Cenos Offshore Windfarm EIA Scoping Report - Volume II: Appendices

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Appendix 5A: Survey Strategy

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1. SURVEY SUMMARY

1.1 Introduction

1.1.1.1 This appendix of the Scoping Report presents a summary of the surveys undertaken for the Cenos Offshore Windfarm ('the Project') and also provides a summary of .2016/2017 geophysical, geotechnical and environmental surveys undertaken by NorthConnect within the inshore area[1]. This appendix should be read in conjunction with **Chapter 7: Marine and Coastal Processes**, **Chapter 8: Marine Water and Sediment Quality**, **Chapter 9: Benthic Ecology**, **Chapter 10: Marine Mammals**, **Chapter 11: Ornithology, Chapter 12: Fish Ecology** and **Chapter 14: Shipping and Navigation**.

1.1.1.2 Between 2021 and 2023, a series of surveys were commissioned by Cenos Offshore Windfarm Limited ('the Applicant') to better understand the Array Area and Export/Import Cable Corridor (ECC) baseline conditions. These surveys included:

- Ornithological;
- Marine megafauna presence (such as marine mammals);
- Shipping and navigation; and
- Geoenvironmental (geophysical and environmental).

1.1.1.3 **Table 1-1, Table 1-2,** and **Table 1-3** present a summary of these survey campaigns. **Table 1-4** presents a summary of the NorthConnect Survey Approach in the UK Territorial Waters out to 12 nautical miles (NM).

1.1.1.4 **Table 1-5** presents a summary of the planned inshore survey (0-12 NM). The Project is undertaking an inshore survey in 2024 to re-validate the existing data supporting baseline characterisation of the inshore ECC, covering landfall to 12 NM within a 500m corridor. The survey will employ hull mounted MBES to assess changes to the seabed, and drop-down video transects to assess changes to key habitats and species. The survey has taken into consideration impacts to the local fishing fleets and was designed to minimise disruption, whilst collecting sufficient data to validate existing data and inform the EIA.

Table 1-1 Array Area survey summary

Survey name	Duration	Date of survey	Location	Sampling strategy
Digital Aerial Survey	2 years	April 2021 – March 2023	Innovation and Targeted Oil and Gas (INTOG) Agreement for Lease Area; plus 4 km buffer. Combined Survey Area of 835.97 km^2 encompassing the 333 km^2 Array Area	Baseline ornithology and marine megafauna survey. 14 x strip transects (2.5 km spacing) flown NW to SW using four HiDef Gen II cameras with sensors set to a resolution of 2 cm Ground Sample Distance (GSD). Each camera sampled a strip of 125 m width, separated from the next camera by ~25 m, thus providing a combined sampled width of 500 m within a 575 m overall strip.
Vessel Traffic Survey (Summer)	3 weeks	22 August – 12 September 2023	Array Area plus 10 NM buffer.	Survey methodology agreed with MCA. MCA approved approach of one three-week summer survey and desktop analysis of 12 months of AIS in lieu of a winter survey.

Table 1-2 Array Area survey summary (Jul 2023 - Sep 2023)

Survey name	Samples	Sample type	Equipment	Sampling strategy	Analysis parameters
Drop down video (300 m transects)	51	DDV transects	BSL MOD4 Camera	• To provide adequate coverage of the Array Area; • To provide benthic characteristics of the Array Area; • To corroborate historic JNCC sampling within the MPA (targeted historic data points); • Fill gap in JNCC database; and • Additional DDV to reduce sampling gap between grab stations.	N/A
Benthic macrofauna	30	Grab sampling	Dual Van Veen grab / mini-Hamon grab	• Video transects first carried out to avoid known or suspected *Sabellaria spinulosa*, Seapen & Quahog habitats with intrusive grab sampling (Previous JNCC data). • To provide benthic characteristics of the OWF array boundaries. • To corroborate historic JNCC sampling within the MPA (targeted historic data points). • Fill gap in JNCC database.	(20/30) macrofauna samples sieved through 0.5 mm mesh. (10/30) MF samples sieved through both 0.5 mm and 1.0 mm mesh to satisfy the Project's EIA, and to mirror mesh sizes featured in historic JNCC sampling campaign.

Survey name	Samples	Sample type	Equipment	Sampling strategy	Analysis parameters
Particle size analysis (PSA)	30	Grab sampling	Dual Van Veen grab / mini-Hamon Grab	• To provide adequate coverage and sediment characteristics within the Array Area. • Co-located with benthic sampling to further inform habitat understanding and minimise habitat disturbance.	N/A
Sediment chemical samples - standard parameters	24	Grab sampling	Dual Van Veen grab / mini-Hamon grab	• To provide adequate coverage of the Array Area. • Stations targeted to provide data in proximity (550 m and 1,000 m) of suspected pollution sources (for example, oil wells). • Stations targeted to provide data in proximity of featured pipeline. • Co-located with PSA and benthic sampling to further inform habitat understanding and minimise habitat disturbance.	Metals (Al, Fe, As, Ba, Cd, Cr, Cu, Hg, Ni, Pb, Zn), Total Organic Carbon (TOC), Total Organic Matter (TOM), Dibutylin (DBT)/ Tributylin (TBT), Total Poly-aromatic Hydrocarbons (PAHs), Total Hydrocarbon Content (THC), Total Petroleum Hydrocarbons)

Survey name	Samples	Sample type	Equipment	Sampling strategy	Analysis parameters
Sediment chemical samples - w/ additional parameters	6	Grab sampling	Dual Van Veen grab / mini-Hamon grab	• To provide adequate coverage of the Array Area. • Stations targeted to provide data in proximity (550 m and 1,000 m) of suspected pollution sources (for example, oil wells). • Co-located with PSA and benthic sampling to further inform habitat understanding and minimise habitat disturbance.	*Standard parameters (above) plus;* Organohalogens, Polychlorinated biphenyls (PCBs) inc. ICES7, alpha-Hexachlorcyclohexane, beta-Hexachlorcyclohexane, gamma-Hexachlorcyclohexane, Dieldrin, Hexachlorobenzene, DDE/ DDT/ TDE/ BDEs
Water sampling station (3 depths; surface, middle, bottom)	10	Water sample	Niskin bottles/ CTD	• To provide adequate representation of water quality within the Array Area.	Total suspended solids, Salinity, pH, Chlorophyll, chlorophyll a, Sodium, Sulfate, Magnesium, Calcium, Total phosphate on unfiltered sample, Potassium, Bicarbonate, Borate, Fluoride, Silicate, Nitrogen, nitrates, nitrites, Dissolved orthophosphates, Total hydrocarbon content (THC),

Survey name	Samples	Sample type	Equipment	Sampling strategy	Analysis parameters
					Total Petroleum Hydrocarbons (TPH), Polycyclic Aromatic Hydrocarbons, Metals (As, Al, Ba, Cd, Cr, Cu, Fe, Hg, Ni, Pb, Sr, Zi)
eDNA (sediment)	6	Grab sampling	Dual Van Veen grab / mini-Hamon grab	• To ensure representation of the habitats found and to provide coverage of the site. • Co-located with PSA sampling to further inform habitat understanding and minimise habitat disturbance.	DNA of species present
Marine geophysical survey	n/a	Geophysical	(1) R2Sonic Dual-Head 2026 MBES (2) Edgetech 4205 Sidescan Sonar (3) G-882 Marine Magnetometer (4) Innomar Medium 100 High-Frequency SBP	(1) Multibeam echo sounder (MBES) - Seabed elevation. (2) Side scan sonar (SSS) - Detection and imaging of seafloor objects. (3) Magnetometer (MAG) - Changes in magnetic field (cultural/geological). (4) Sub-bottom profiler (SBP) - Mapping deposits below seabed. (5) 2D Ultra-high resolution seismic (2D UHR) - Mapping deposits below seabed *in array area only.	(1) >1 m object detection (2) 0.5 m object detection; Dual-frequency SSS (3) Single line magnetometer towfish; corresponding w/ SSS line spacing (4) min. 10 m penetration; Vertical resolution >0.5 m (5) >50 m penetration; Vertical resolution >0.5 m

Survey name	Samples	Sample type	Equipment	Sampling strategy	Analysis parameters
			(5) 2D-UHR multichannel seismic		
Passive acoustic monitoring (PAM) and marine mammal observer (MMO) logs		July 2023 – September 2023	PAM system operated by MMOs. Consisted of a four hydrophone array and depth gauge on a 150 m tow cable connected via a 50 m deck cable, to a signal processing unit with an audio output and computer using PAMGuard software.	Three experienced UK JNCC approved observers were on board for the duration of the survey activities. For full details please refer to **Appendix 10A: MMO PAM logs and DAS**.	Undertook pre-shooting visual watches/acoustic monitoring prior to use of sound sources. Sighting location, species, distinguishing characteristics, number of individuals, behaviour and relevant details about any mitigation required or interactions with operations was recorded.

Table 1-3 Import / Export Cable Corridor (ECC) survey summary (Jul 2023 - Sep 2023)

Survey name	Samples	Sample type	Equipment	Sampling strategy	Analysis parameters
Drop down video (300 m transects)	40	DDV transects	BSL MOD4 camera	• Stations spaced taking account of NatureScot input; • To provide adequate coverage of the ECC; • To corroborate historic JNCC sampling within the MPA (targeted); and • Took into account initial survey data to position where there were '*interesting features*'.	N/A
Benthic macrofauna	20	Grab sampling	Dual Van Veen grab / mini-Hamon Grab	• Video transects first carried out to avoid known or suspected known or suspected *Sabellaria*, Seapen & Quahog habitats with intrusive grab sampling (based of previous JNCC data).	(17/20) Macrofauna samples sieved through 0.5 mm mesh (3/20) MAcrofauna samples sieved through both 0.5 mm and 1.0 mm mesh to satisfy CENOS EIA, and to mirror mesh sizes featured in historic JNCC sampling campaign
Particle size analysis (PSA)	20	Grab sampling	Dual Van Veen grab / mini-Hamon grab	• To provide adequate coverage and sediment characteristics across the ECC; and • Co-located with PSA and benthic sampling to further inform habitat understanding.	N/A

Survey name	Samples	Sample type	Equipment	Sampling strategy	Analysis parameters
Sediment chemical samples - standard parameters	17	Grab sampling	Dual Van Veen grab / mini-Hamon grab	• To provide adequate coverage of the ECC; and • Co-located with PSA and benthic sampling to further inform habitat understanding and minimise habitat disturbance.	Metals (Al, Fe, As, Ba, Cd, Cr, Cu, Hg, Ni, Pb, Zn), Total organic carbon (TOC), Total organic matter (TOM), Dibutylin (DBT)/ tributylin (TBT), Total poly-aromatic hydrocarbons (PAHs), Total hydrocarbon content (THC), Total petroleum hydrocarbons)
Sediment chemical samples - w/ additional parameters	3	Grab sampling	Dual Van Veen grab / mini-Hamon grab	• To provide adequate coverage of the ECC; • Stations targeted to provide data in proximity of featured pipeline; and • Co-located with PSA and benthic sampling to further inform habitat understanding and minimise habitat disturbance.	*Standard Parameters (above) plus;* Organohalogens, Polychlorinated Biphenyls (PCBs)(ICES7), alpha-Hexachlorcyclohexane, beta-Hexachlorcyclohexane, gamma-Hexachlorcyclohexane, Dieldrin, Hexachlorobenzene, DDE/ DDT/ TDE/ BDEs
Water sampling station (3 depths; surface, middle, bottom)	6	Water sample	Niskin bottles/ CTD	• To provide adequate representation of water quality across the ECC.	Total suspended solids, Salinity, pH, Chlorophyll, chlorophyll a, Sodium, Sulfate, Magnesium, Calcium, Total phosphate on unfiltered sample,

Survey name	Samples	Sample type	Equipment	Sampling strategy	Analysis parameters
					Potassium, Bicarbonate, Borate, Fluoride, Silicate, Nitrogen, nitrates, nitrites, Dissolved ortophosphates, Total hydrocarbon content (THC), Total petroleum hydrocrabons (TPH), Polycyclic aromatic hydrocarbons, Metals (As, Al, Ba, Cd, Cr, Cu, Fe, Hg, Ni, Pb, Sr, Zi)
Marine geophysical survey	n/a	Geophysical	(1) R2Sonic Dual-Head 2026 MBES (2) Edgetech 4205 Sidescan Sonar (3) G-882 Marine Magnetometer (4) Innomar Medium 100 High-Frequency SBP	(1) Multibeam Echo Sounder (MBES) - Seabed elevation. (2) Side Scan Sonar (SSS) - Detection and imaging of seafloor objects. (3) Magnetometer (MAG) - Changes in magnetic field (cultural/geological). (4) Sub-bottom Profiler (SBP) - Mapping deposits below seabed.	(1) >1 m object detection (2) 0.5 m object detection; Dual-frequency SSS (3) Single line magnetometer towfish; corresponding w/ SSS line spacing (4) min. 10 m penetration; Vertical resolution >0.5 m

Survey name	Samples	Sample type	Equipment	Sampling strategy	Analysis parameters
Passive acoustic monitoring (PAM) and marine mammal observer (MMO) logs	n/a	Jul 2023 - Sep 2023	PAM system operated by MMOs. Consisted of a four hydrophone array and depth gauge on a 150 m tow cable connected via a 50 m deck cable, to a signal processing unit with an audio output and computer using PAMGuard software.	Three experienced UK JNCC approved observers were on board for the duration of the survey activities. For full details please refer to **Appendix 10A: MMO PAM logs and DAS**.	Undertook pre-shooting visual watches/acoustic monitoring prior to use of sound sources. Sighting location, species, distinguishing characteristics, number of individuals, behaviour and relevant details about any mitigation required or interactions with operations was recorded.

Table 1-4 NorthConnect onshore survey summary

Survey name	Date of survey	Location	Sampling strategy
Geophysical survey including: survey side Scan sonar multibeam echosounder sub-bottom profiler magnetometer	2017	NorthConnect Cable Corridor to 12 NM territorial waters limit	500 m wide survey corridor. MBES conducted as close to shore as possible. Then a geophysical survey with a Work Class Remotely Operated Vehicle) mounted MBES, SSS, SBP and Magnetometer followed 9 survey lines with a separation of 65m for first 4km of cable corridor. Additional cross lines were run close to shore to fill gaps in coverage resulting from complex coastline. North Sea survey work included hull mounted MBES and remotely operated towed vehicle mounted SSS (range set to 100m for High Frequency data and 150m range for low frequency data) and SBP. A magnetometer was towed 10.7 m behind the ROTV. The survey included three survey lines with 125 m line spacing covering a 500 m wide corridor
Geotechnical sampling	2017	NorthConnect Cable Corridor to 12 NM territorial waters limit	Vibro-coring and Cone Penetration Testing Nearshore (within first 4 km) – four sampling sites, two near each of the HDD exit points and two along the survey route. North Sea survey work – Sample sites tested along survey route (within first 12 NM of NorthConnect Cable Corridor).
Chemical analysis (of sediment)	2017	NorthConnect Cable Corridor to 12 NM territorial waters limit	Samples taken for chemical analysis at 5 locations within first 12 NM of North Connect Cable Corridor. Samples were analysed for metals, and hydrocarbons, including polycyclic aromatic hydrocarbons (PAHs), and total petroleum hydrocarbons (TPH). Particle size distribution analysis undertaken of the 5 samples.
Benthic survey	2017	NorthConnect Cable Corridor to 12 NM territorial waters Limit	Benthic survey was performed using a combination of grab samplers, as well as seabed photography and video systems. Sample locations were selected using the information provided from the geophysical survey data. Where grab sampling was not possible due to the presence of hard seabed, coarse substrates, or sensitive habitat types, sampling was undertaken using video/still photo only. Sample sites tested along survey route (within first 12 NM of NorthConnect Cable Corridor). DDV avoided known wrecks to avoid risk of disturbance.

Table 1-5 Planned inshore survey for March 2024

Survey name	Date of survey	Location	Sampling strategy
Hull-mounted multibeam echosounder (MBES) dual swathe bathymetry and backscatter	March 2024	ECC between 0 – 12 NM	The aim is to have a representative sample of the NorthConnect corridor to be able to undertake appropriate comparisons and re-validate the data.
Video transects using drop down video	March 2024	ECC between 0 – 12 NM	Video transects within a 500 m corridor that include previous NorthConnect survey locations and identified areas of environmental interest for habitats and features (e.g. Annex I Habitat, Priority Marine Features)
Ornithological bird trap camera surveys	Spring 2024 - TBC	Cliff location at landfall site.	Time lapse camera/s to be placed on the cliff. Set to auto detect at dawn and dusk taking picture every 10 minutes.

1.2 References

[1] NorthConnect (2018). *NorthConnect HVDC Cable Infrastructure EIAR: Volume 2*. Available at: https://northconnect.no/uploads/downloads/Britain/HVDC-Cable-Infrastructure-UK-EIAR-Volume-2-Main-Document.pdf (Accessed: 15 March 2024).

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Appendix 5B: Approach to Migratory Bats

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Executive Summary

Christopher Formaggia BSc (Joint Hons) CBiol CEnv FRSB PGCert VR has been commissioned to undertake a desk review of bat research and published or grey literature examining bat migration between Norway and the UK to consider the potential for interactions with the Cenos Offshore Windfarm.

Christopher Formaggia is employed by WSP UK Ltd as Technical Director: International Bats and Middle East Biodiversity. He holds a Bachelor of Science Joint Honours degree in Zoology and Environmental Studies and a postgraduate qualification in Management. He is a Fellow of the Royal Society of Biology and is a Royal Chartered Biologist and Chartered Environmentalist. He has been employed as a professional ecologist for 35 years holding senior/director level posts in the regulatory and private sectors. He has worked on bat ecology for the full duration of his career. Within WSP he provides national and international advice on technical, legislative and policy aspects of bat ecology.

There is a current lack of evidence as to the effects of offshore windfarm development upon bat populations in UK Coastal waters. Bats are a relatively poorly understood receptor for marine offshore developments in UK waters. Evidence gaps remain on the occurrence of bats in the offshore environment, including spatial distribution during migration, and their potential interactions with renewable developments. Little is known about bat migration ecology, the number of individuals migrating over sea, and the risk of mortality from interactions with offshore wind turbines. This examination reviews published evidence of a migration route from Scandinavia to the UK and recent work confirming bat migration over the Southern North Sea, including from the Netherlands to UK.

Migration periods are understood to be between late March to June, and from late August until October. For offshore regions, such as the North Sea, the most frequently recorded bats are Nathusius' pipistrelle (*Pipistrellus nathusii)*. However, other bat species have also been recorded offshore, including common pipistrelle (*Pipistrellus pipistrellus)*, common noctule (*Nyctalus noctule)*, Leisler's bat (*Nyctalus leisleri*), particolored bat (*Vespertilio murinus)*, Northern bat (*Eptesicus nilssonii)*, and Serotine bat (*Eptesicus serotinus)*. The particoloured bat and Northern bat are not considered to be resident in the UK but are resident in parts of Scandinavia.

This desk-based review draws upon the latest evidence from international projects, such as WOZEP (the Offshore Wind Ecological Programme) and the national Nathusius' Pipistrelle project, as well as that captured in academic literature. Furthermore, it considers ongoing work being undertaken by WSP Denmark which is monitoring bat migration between Denmark, Sweden and Germany and is soon to be extended to work in Finland. This work is monitoring bat migrations across the Baltic Sea in relation to various offshore wind developments and monitoring systems have been developed that can inform environmental impact assessments and post-construction monitoring. This has included the development of a ruggedised bat detector that can be deployed successfully on temporary and permanent marine structures.

Contained is an evidence review of the publicly available reports, scientific publications and other relevant literature.

The literature/evidence review includes an assessment of:

- Bat migration to and from the UK and European mainland;
- Collision risk for bat spp. from offshore wind infrastructure (including consideration of flight heights and avoidance behaviour); and
- Barrier effects or other possible impacts upon bat populations and migration, resulting from offshore wind infrastructure.

A number of bird observatories on headlands record bats as well as birds and existing opportunistic data sets for bats may be utilised in environmental impact assessments, in general. Additionally, several ringing and tracking studies in relation to bat migration have been completed.

This report addresses each of the evidence gaps identified above, identify species of concern, and impact pressure pathways.

The report identifies that whilst there is now evidence of bat migration in the Southern North Sea, there is no confirmed evidence of migration over the Central North Sea, including the location of the proposed Cenos Offshore Windfarm.

1. APPROACH TO MIGRATORY BATS

1.1 Introduction

1.1.1.1 In February 2023, the Applicant submitted an Environmental Impact Assessment (EIA) Scoping Report (2023 Scoping Report). The 2023 Scoping Report was prepared to support a request for a Scoping Opinion (2023 Scoping Opinion) in relation to the Project from Scottish Ministers.

1.1.1.2 On 28 June 2023 the Applicant received the 2023 Scoping Opinion from NatureScot and the Scottish Ministers. This desk review has arisen as a result of a scoping question raised by the Norwegian Environment Agency:

> *"Nathusius pipistrelle is one of the migratory species in Europe. In Norway, we know that Nathusius pipistrelles congregate in South-West Norway in the spring and autumn. Nathusius pipistrelles have been found on both platforms and vessels in the North Sea. We therefore have good indications that the species migrates between Norway and the UK.*
>
> *We are concerned about the bat populations and the cumulative effects of wind power, both on land and at sea. We expect that appropriate impact assessments are undertaken pre- and post- construction, including mortality rate assessments, and that mitigation measures are being implemented to reduce mortality."*

1.1.1.3 Offshore wind projects are developing at pace as nations move towards Net Zero Targets and, in the UK's case, ambitions to deliver 50 GW by 2030. Potential impacts of offshore windfarms on migrating bat species is, as a consequence, moving up the international agenda.

1.1.1.4 Understanding the evidence base for the effect of offshore wind development and operation upon different environmental receptors is an integral component which underpins the regulation of offshore wind work. Focal receptors are frequently seabirds, marine mammals, benthic receptors (seafloor habitats and species) and designated fish. However, there is a current lack of evidence as to the effects of offshore windfarm development upon bat populations in offshore locations. This represents an evidence gap which is lately beginning to be addressed. Natural England (one of the four UK Statutory Nature Conservation Organisations [SNCOs]), for example, was awarded a contract in 2023 for assessing migration of bat species and interactions with Offshore Windfarms in English Waters[1]. This work is set to be completed in 2024.

1.1.1.5 Bats species are a relatively poorly understood receptor for marine developments in offshore waters. Evidence gaps remain on the occurrence of bats in the offshore environment, including spatial distribution during migration, and their potential interactions with renewable developments. There is very limited literature about bat migration ecology, the number of individuals migrating over sea, and the risk of mortality from interactions with offshore wind turbines (Lagerveld *et al*. 2017[2]).

1.1.1.6 Migration periods are assessed as being between late March to June, and from late August until October. For offshore regions, such as the North Sea, the most frequently recorded bats are Nathusius' pipistrelle. However, other bat species have also been recorded offshore, including common pipistrelle, common noctule, Leisler's bat, particolored bat, Northern bat and Serotine bat *Eptesicus serotinus* (Boshamer *et al*. 2008[3], Lagerveld *et al*. 2014[4], Hüppop *et al*. 2016[5], Hüppop *et al*. 2019[6]).

1.1.1.7 There are pertinent international projects, such as WOZEP[7] and the National Nathusis' Pipistrelle Project[8] that are addressing the knowledge gaps indicated in 1.1.5, above by targeted research and monitoring.

1.1.1.8 Bats are a key focal receptor for the Dutch WOZEP research programme: Wozep ecological programme - Noordzeeloket UK. WOZEP have undertaken monitoring and research specifically targeted at bat populations over Dutch waters and bats are a priority species group for environmental impact assessments. Conditions have been applied to 'curtail' the operation of Dutch onshore windfarms during sensitive times of year, night and in certain environmental conditions (e.g. relating to temperature, wind speed and wind direction).

1.1.1.9 Nonetheless, there are many evidence gaps and areas of uncertainty, including:

- The numbers of bats migrating across offshore locations (including the North Sea, English Channel, and Celtic Sea).
- When each species migrates to/from the UK and migration routes.
- The spatial patterns of migration (e.g. a broad front or spatially distinct patterns (Lagerveld *et al*., 2017[2]).
- Collision risk for bats with offshore windfarms – this includes collision risk parameters, such as flight heights and avoidance rates.
- Possibility of population level effects arising from any collision risk or barrier effects.
- Inter-species variation in behaviour, ecology and migration.
- How bats perceive offshore windfarm turbines and could visual mitigation measures, similar to those identified for birds, be adopted.

1.1.1.10 There is uncertainty regarding the most appropriate monitoring methods for bat species. Evidence gaps include:

- The most appropriate survey methods for bats offshore (e.g. acoustic surveys or tracking[9]).
- Standardisation of bat offshore survey methods is required; as are methods for assessing population level effects upon bat species.
- Brabant *et al*. (2020[10]) present the results of monitoring from bat detectors placed on the nacelle (93 m) and transition piece (16 m) of turbines offshore windfarm in the Belgian North Sea. The research concluded that it is considered likely that including bat detectors within offshore windfarm installations may improve the evidence base.

1.1.2 Review

Nomenclature and definitions

1.1.2.1 The following tables (**Table 1-1** and **Table 1-2** Comparable bat names England) provide common names of bats in Norwegian and English for the purposes of standardisation.

Table 1-1 Comparable bat names Norway

Norwegian	
Afrikagrotteflygehund	1
Alpelangøre	46
Anatolflaggermus	40
Armenerbørsteflaggermus	19
Asorflaggermus	28
Balkanhesteskonese*	7
Blekflaggermus	41
Bøkeflaggermus*	21
Børsteflaggermus	17
Bredøre*	42
Brunlangøre*	45
Damflaggermus	9
Dvergflaggermus	30
Dverghesteskonese*	3
Grålangøre*	48
Grottehesteskonese*	6
Himalayaskjeggflaggermus	16
Hvitrandflaggermus*	33
Iberiabørsteflaggermus	18
Isabellaflaggermus	39
Kanarilangøre	50
Klippeflaggermus*	35
Kyrenaikaflaggermus	31
Langfotflaggermus*	10
Madeiraflaggermus	34
Mahgrebmusøre	24
Middelhavsfrihale*	53
Middelhavshesteskonese	5
Middelhavslangøre	49
Middelhavslangvinge*	51
Nakengumpflaggermus	2
Nordflaggermus	38
Nymfeflaggermus	14
Ørkenlangøre	44
Østbredøre	43
Riseflaggermus	26
Sardinialangøre	47
Sevanskjeggflaggermus	15
Skimmelflaggermus	36
Skjeggflaggermus	12
Skogflaggermus*	11
Småmusøre*	23
Sørflaggermus	37
Steppeflaggermus	13
Steppelangvinge	52
Storflaggermus	25
Storhesteskonese*	4
Stormusøre*	22
Trollflaggermus	32
Tusseflaggermus*	29
Vannflaggermus	8
Vetteflaggermus*	27
Vinkeløreflaggermus*	20

*) Some alternative (=disused) common Norwegian names

Bechsteinflaggermus	21
Blasiushesteskonese	7
Brandtflaggermus	11
Bredøreflaggermus	42
Buldoggflaggermus	53
Capacciniflaggermus	10
Dvergflaggermus**	29
Geoffroyflaggermus	20
Grå langøreflaggermus	48
Kjempeflaggermus	22
Kuhlflaggermus	33
Langøreflaggermus	45
Leislerflaggermus	27
Liten hesteskonese	3
Liten musøre	23
Mehelyhesteskonese	6
Saviflaggermus	35
Schreibersflaggermus	51
Stor hesteskonese	4
Stor musøre	22

**) prior to the recognition of *P. pygmaeus*

Table 1-2 Comparable bat names England

English	
Alcathoe Whiskered Bat	14
Alpine Long-eared Bat	46
Anatolian Bent-winged Bat	52
Anatolian Serotine Bat	40
Armenian Whiskered Bat	15
Asiatic Whiskered Bat	16
Azorean Noctule Bat	28
Balkan Long-eared Bat	49
Bechstein's Bat	21
Blasius's Horseshoe Bat	7
Botta's Serotine Bat	41
Brandt's Bat	11
Brown Long-eared Bat	45
Canary Long-eared Bat	50
Common Pipistrelle Bat	29
Daubenton's Bat	8
Eastern Barbastelle Bat	43
Egyptian Fruit Bat	1
European Free-tailed Bat	53
Geoffroy's Bat	20
Greater Horseshoe Bat	4
Greater Mouse-eared Bat	22
Greater Noctule Bat	26
Grey Long-eared Bat	48
Hanak's Pipistrelle	31
Hemprich's Long-eared Bat	44
Iberian Natterer's Bat	18
Isabelline Serotine Bat	39
Kuhl's Pipistrelle Bat	33
Leisler's Bat	27
Lesser Horseshoe Bat	3
Lesser Mouse-eared Bat	23
Long-fingered Bat	10
Madeiran Pipistrelle Bat	34
Maghrebian Mouse-eared Bat	24
Mediterranean Horseshoe Bat	5
Mehely's Horseshoe Bat	6
Naked-rumped Tomb Bat	2
Nathusius's Pipistrelle Bat	32
Natterer's Bat	17
Noctule Bat	25
Northern Bat	38
Parti-coloured Bat	36
Pond Bat	9
Sardinian Long-eared Bat	47
Savi's Pipistrelle Bat	35
Schaub's Bat	19
Schreibers's Bent-winged Bat	51
Serotine Bat	37
Soprano Pipistrelle Bat	30
Steppe Whiskered Bat	13
Western Barbastelle Bat	42
Whiskered Bat	12

1.1.3 Bat migration: synopsis

1.1.3.1 For more than 100 years it has been speculated that some bats, like many birds and other animals, migrate seasonally. For example, in 1897, Miller[11] noted seasonal occurrences of North American tree bats, which he assessed as being migratory, and drew attention to the paucity of information available on bat migration.

1.1.3.2 Fleming and Eby (2003)[12] produced a review of the advance of understanding in bat ecology in the century proceeding Miller.

1.1.3.3 Scrutiny of the subject has continued to increase, and the years following the Fleming and Eby review have seen a significant number of important publications on bat migration.

1.1.3.4 Spurred by concern generated by current ecological challenges such as climate change and the switch to greener energy sources, led to the 1st International Symposium on Bat Migration in Berlin, Germany, 16 – 18 January 2009, involving over 300 scientists and conservationists from around the world.

1.1.3.5 However, bat migration understanding, and its study is still considerably less than the large volume of literature on, for example, bird migration.

1.1.4 Ecological and evolutionary drivers of bat migration

1.1.4.1 To understand why bats migrate, it is necessary to consider what ecological and evolutionary factors drive migration, and what characteristics migratory bat species around the world have in common.

1.1.4.2 Temperate bat species that migrate most likely do so in response to unfavourable climatic conditions during the colder part of the year. Many temperate zone bats "*avoid*" the cold (and its associated drop in available prey items) by hibernating/overwintering in caves or buildings with relatively constant microclimates. For this reason, migration is less common in bats than in birds. Most bird species cannot hibernate and so are forced to either adapt to adverse conditions in winter or move seasonally to warmer regions.

1.1.4.3 Hibernation alone, though, may not be sufficient to allow naturally tree-roosting bats to cope with cold winters, because trees, in general offer limited protection against extreme ambient temperatures. As a consequence, it is found that some bats travel hundreds or even thousands of kilometres seasonally from breeding areas to wintering areas at lower latitudes where the climate is ameliorated and hibernation in trees less risky to survival.

1.1.4.4 Seasonal movements of temperate natural cave-roosting bats between summer and winter roosts are sometimes categorised as regional migrations, and it has been suggested that the driver of movements that do not follow a clear geographic trend is roost temperature[13] rather than seasonal climate differences.

1.1.4.5 Tropical or subtropical migratory bats, on the other hand, may be forced to migrate because the availability and geographical distribution of their food resources shift seasonally.

1.1.4.6 Several studies suggest that in the absence of seasonal factors favouring migration, bats cease to migrate. Partial migration and migratory flexibility are in fact common in bats[12]. Sex-biased migration is also a form of partial migration. Females of most migratory bat species migrate longer distances than males[12].

1.1.4.7 Migratory behaviour can nonetheless still evolve/adapt rapidly and it can appear or disappear within a few generations (Berthold,1999[14]). Most bat families originated in the tropics where there is little or no selection pressure for migratory behaviour, and because these areas still have by far the highest bat species richness, it is assumed that ancestors of bats were non-migratory[12], and is an adaption to population dispersal away from the tropics.

1.1.4.8 Even so, migration is displayed at least 15 bat genera containing species that are known to be long-distance migrants and nearly nothing is known about the migratory status of most African and Asian bats. The Convention on Migratory Species lists African bats for which migration is suspected. The list includes 34 species belonging to the families Pteropodidae (14 species), Rhinopomatidae (2 species), Emballonuridae (3 species), Nycteridae (1 species), Rhinolophidae (1 species), Hipposideridae (2species), Vespertilionidae (10 species), and Molossidae (1 species—Hutson 2005[15]).

1.1.4.9 Additionally, the numerous cases of partial migration in bats show that bat migratory behaviour is quite flexible.

Preparation for and performance during migration

1.1.4.10 Migration in birds and other animals requires a series of physiological adaptations such as fat deposition, increase in muscle capacity, and even important modifications in the digestive system[16]. It is uncertain whether physiological adjustments occur in migrating bats, but this has not seen any evaluation[12].

1.1.4.11 Some more recent research has focused on places that bats select for migration, such as river valleys as corridors[17] and offshore[18]. Ahle'n *et al*[18] studied bats migrating and foraging over the [Redacted] by direct observations and automatic static acoustic recording. They recorded 11 species (from a potential community of 18 species) flying over the ocean up to 14 km from the shore. All bats used ultrasound during migration flights at sea, often with slightly lower frequencies and longer pulse intervals compared to those used over land. The altitude used for migration flight was most often < 10 m above sea level. They considered that bats must use other sensory systems for long-distance navigation, but it is assumed they probably used echoes from the water surface to orient to the immediate surroundings. Both migrant and resident bats foraged over the sea in areas with an abundance of insects in the air and crustaceans in the surface waters. When hunting insects near vertical objects such as lighthouses and wind turbines, bats rapidly changed altitude, for example, to forage around turbine blades. They considered their findings illustrate why and how bats might be exposed to additional mortality by offshore wind power.

1.1.4.12 Understanding geographical preferences for bats in migration could help reduce the impact of wind energy facilities on migratory bats[19].

1.1.4.13 Cryan and Barclay[20] consider timing of arrival and departure of migrating bats at a stopover site in relation to environmental factors, such as wind speed, moonlight, and weather, and suggest that this information could be used to predict bat fatalities at wind turbines. The WSP Denmark team find that wind speed, direction and temperature are important abiotic factors shaping migration and that their data can be refined into a predictive algorithm to guide turbine shut-off in offshore environments[21].

Methods for studying bat migration

1.1.4.14 The earliest reports on bat migration were based on observations of the seasonal occurrence of some species in a given area[11] and along a geographical gradient. The phenology of bat migration (e.g., timing of arrivals and departures) can therefore provide important information on migratory routes and it continues to be a method of study today.

1.1.4.15 Seasonal variation of sex ratios of Nyctalus species in Hungary[22] and in Iberia[23] provides valuable information on migratory strategies of European bats.

1.1.4.16 Hutterer *et al*.[24] compiled the results of 70 years of bat ringing in Europe and present the then most comprehensive review on migration of European bats. The authors demonstrated that European migratory bats typically follow a northeast–southwest direction from their breeding to their wintering grounds.

1.1.4.17 Hutterer *et al*. classified European bats as long-distance migrants, regional migrants, or sedentary species, although acknowledging there is not a clear distinction between the three groups[24].

1.1.4.18 Even though ringing provides accurate information on individual routes of migrating bats, there are limitations to the methodology. This arises from regional biases in ringing effort, with large geographical areas existing for which no information on migratory routes is available.

1.1.4.19 The authors considered that only sufficient data had been compiled only for central European bat populations.

1.1.4.20 In the Ahle´n *et al*.[18] study, the authors describe their studies of bat migration over open water. The authors observed bats from coastal areas where bats depart land and also from ships. They combined traditional observational methods, watching bats (including by searchlight) and listening to their vocalisations via bat detectors, with modern techniques, using infrared thermal cameras and tracking radar.

1.1.4.21 Modern techniques such as radiotelemetry, stable isotope analysis, and use of genetic markers, have recently advanced the field of bat migration substantially. Stable isotopes have been used successfully to track movements of migratory nectar-feeding bats in America.

1.1.4.22 Population genetic approaches are proving to be of value in identifying migration corridors and to deduce general migratory directions.

1.1.4.23 Technological progress made in the field of satellite telemetry has allowed the movements of a few large pteropodids to be followed directly[25;26]). However, satellite telemetry was then impracticable for all but a few large species because of size constraints[27]. Technological advances are allowing the technique to become more viable for a greater range of species.

1.1.4.24 High altitude movements of bats also can be observed with radar, such as tracking radar, marine surveillance radar and Doppler radar.

1.1.5 Bats on offshore structures

1.1.5.1 [Reda

1.1.5.3 They were able to determine 12 species but the majority of records could not be speciated so more species may have been present. Eight species were European bats and four were “*New World*” bats.

1.1.5.4 The greatest species diversity (8 species) was found in Iceland whereas the greatest abundance (180 records) was in Orkney. They noted a pronounced concentration of bats in the Faroes in 2010 with more than 70 observations of 45+ individual bats).

1.1.5.5 Most observations were in the autumn with a smaller amount in the spring – this may correlate with a larger autumn migration and a more modest spring migration which is starting to appear to be the European pattern.

1.1.5.6 Thirty bat records were from offshore installations in the North Sea and all of these bats were identified to species level. They were:

- Northern bat*;*
- Leisler’s bat;
- Common noctule;
- Nathusius’ pipistrelle (20 records – 67%); and
- Particoloured bat*.*

1.1.6 EUROBAT position

1.1.6.1 EUROBAT considers that the Nathusius' pipistrelles have adapted to seasonal climatic changes and performs large scale movements to escape harsh environmental conditions and low levels of food resources[29] (**Figure** . The autumn migration period spans approximately two months.

1.1.6.2 Recovery data of ringed bats highlight travel distances of up to 2,000 km and show that Central European and northern populations of Scandinavia, Baltics and Russia leave breeding grounds moving in a northeast to west/southwest direction for wintering in the Netherlands, France, Switzerland and Italy.

1.1.6.3 Even the Baltic and North Sea are crossed regularly which has been demonstrated by bats found on oil-platforms and ships. As evidenced by recent findings a connection of populations on the British Isles and the Continent exists.

1.1.6.4 Central European summer habitats are used as stopover sites during migration. Females leaving stopovers earlier than males is a common phenomenon, resulting in territorial males being the last recorded animals in summer habitats.

1.1.6.5 The minimum migratory speed has been estimated at ca. 50 – 60 km/day and energetic demands of continuous flights are fulfilled using a 'mixed-fuel strategy’, based on a combination of directly metabolised dietary proteins from insects preyed while flying and fatty acids from body reserves.

1.1.6.6 Acoustic surveys on ultrasound calls indicates that Nathusius' pipistrelles are crossing even the highest altitudes in the Alps (1100 – 3100 m above sea level) and thus, do not depend on rivers as necessary leading landscape structures. Parts of the migrating populations are hibernating at the foothills of the Alps. Individuals are regularly found in piles of wood, trees or cellars, typically in larger cities and along rivers. However, with increasing frequency hibernating bats are found at more northern latitudes.

1.1.6.7 After hibernation, spring migration in Central Europe appears to be a rapid large-scale (2 – 3 weeks) movement with a mostly north-eastern direction towards summer habitats.

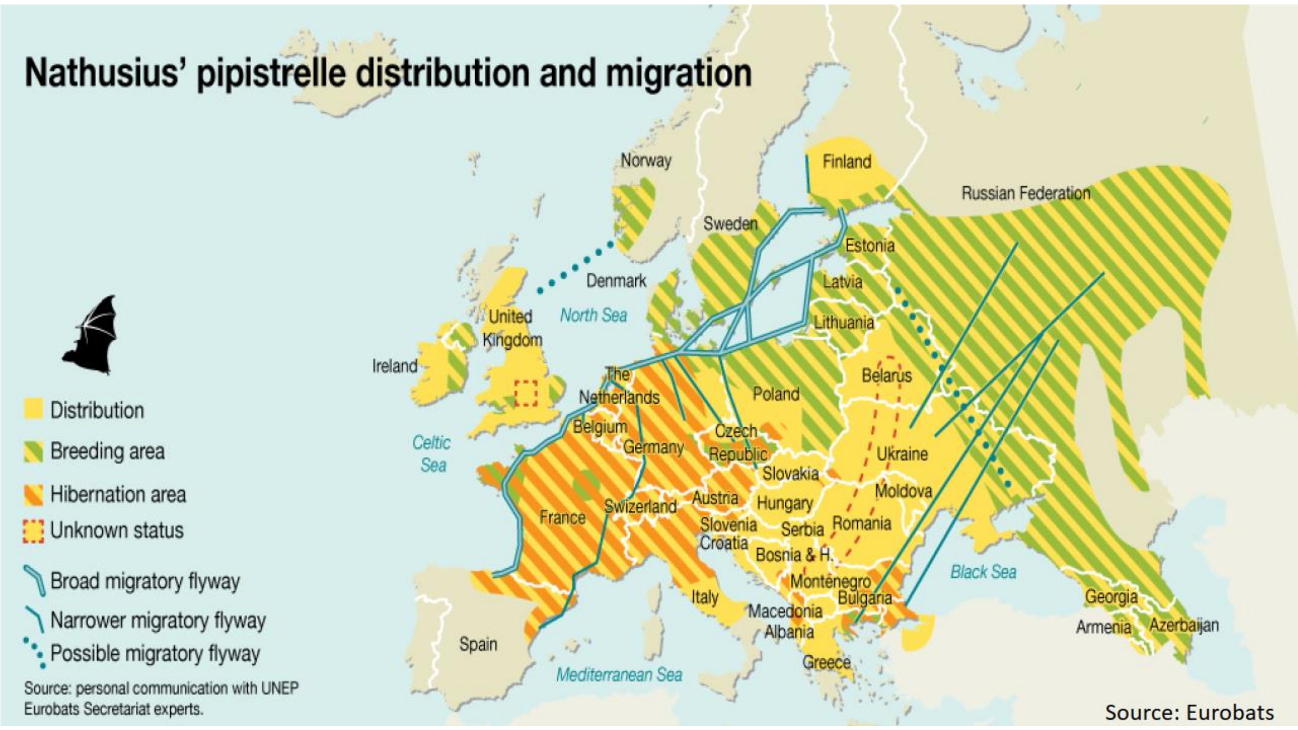

Figure 1-1 Nathusius' Pipistrelle distribution and migration

1.1.6.8 Note Eurobats identification of possible migratory flyway between Norway and UK in **Figure 1-1** above.

1.1.7 National *Nathusius' Pipistrelle* Project (NNPP)

1.1.7.1 The UK's National Nathusius' Pipistrelle Project was launched in 2014 with a grant from the People's Trust for Endangered Species, with the aim of improving understanding of the ecology, current status and conservation threats for Nathusius' pipistrelles in Great Britain.

1.1.7.2 The project's original aims are considered to have been met in England. These were:

- To determine the resident and breeding status of Nathusius' pipistrelle in Great Britain;
- To determine the migratory origins of Nathusius' pipistrelles in Great Britain; and
- To gather further information on the distribution of Nathusius' pipistrelle in Great Britain and the Channel Islands.

1.1.7.3 There are still knowledge gaps for Scotland and Wales but the project is on hold as of 2023[8].

1.1.7.4 The strategy of the NNPP was to:

- Identify "*hotspots*" of Nathusius' pipistrelle activity using acoustic bat detector surveys. Many Nathusius' pipistrelle hotspots had already been identified by BCT's earlier Nathusius' Pipistrelle Survey which ran from 2009 – 2014.
- Utilise harp traps and acoustic lures in activity hotspots, trap individuals under licence and ascertain their breeding status, and, where possible, ring each individual.
- If females were captured in the pre-breeding period, to undertake radio tracking to locate potential maternity roosts.

1.1.7.5 The key results from the NNP are shown in **Figure 1-2**.

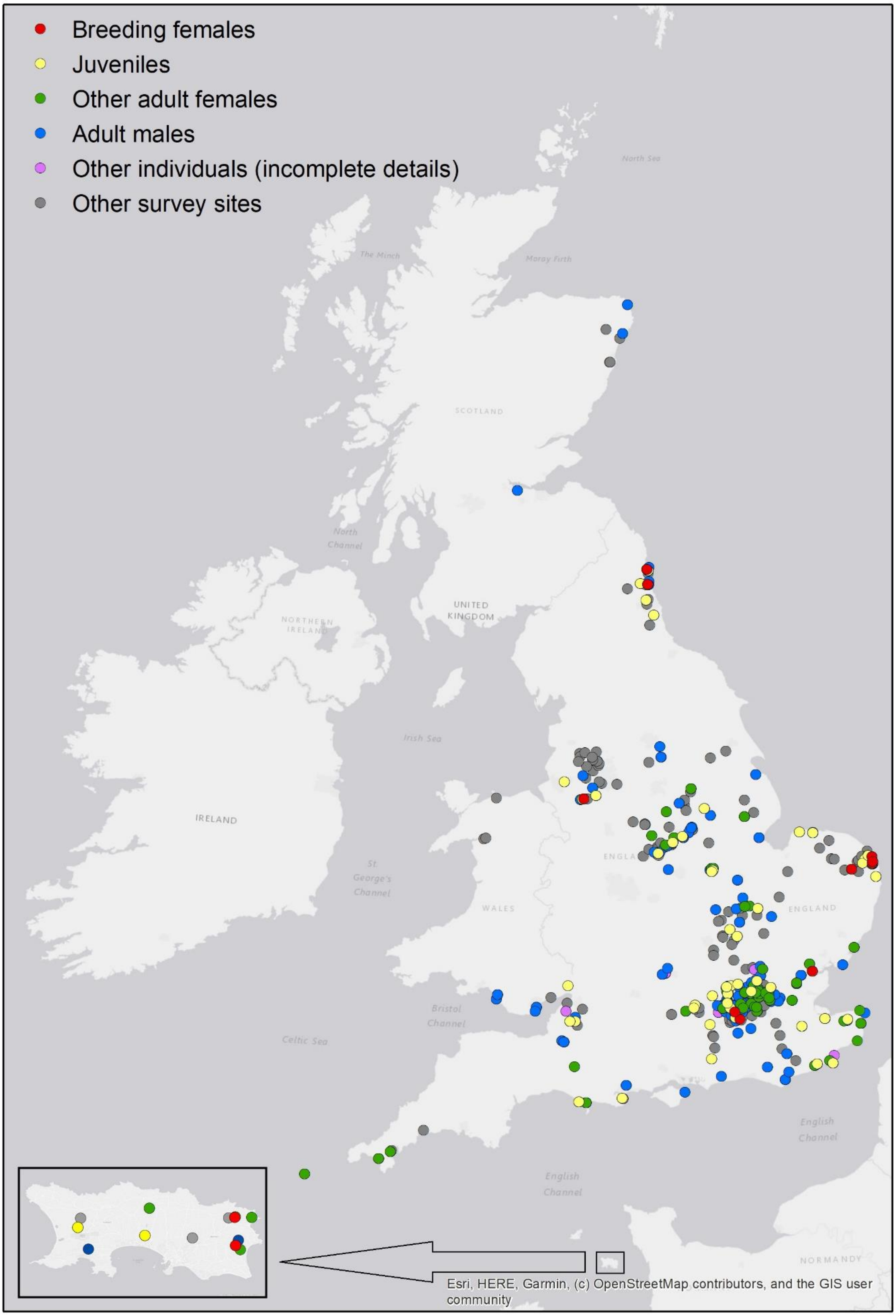

Figure 1-2 Key results map from NNPP.

1.1.7.6 Based on data received, from April 2011 to October 2022, there were 2,761 Nathusius' pipistrelles records (including some recaptures of individuals). Twenty-three were breeding females, 471 were adult females who showed no evidence of breeding that year (101 had bred previously though whether at that particular site or even in the UK is not known), 1,924 were adult males, 305 were juveniles, and 38 didn't have the sex and/or age recorded.

1.1.7.7 Work carried out by the University of Exeter on stable isotopes in the fur samples of Nathusius pipistrelles caught during this project suggests that these bats have a migratory origin further northeast than the UK, and that the Nathusius' pipistrelles originated from more northerly latitudes than comparable soprano pipistrelles.

1.1.7.8 Maternity colonies were discovered in [Redacted]

1.1.7.9 Ten long distance migratory records (see) were found:

- A bat ringed in North Somerset was rediscovered in the Netherlands in December 2013;
- A bat ringed in Latvia was recaptured in East Sussex in October 2015;
- Two bats ringed in Lithuania were recaptured in Kent in August and October 2016;
- Two bats ringed in Latvia were recorded in Greater London in August and September 2017;
- A bat ringed in Latvia was recorded in Essex in September 2017;
- A bat ringed in East Sussex was found in Belgium in September 2018;
- A bat ringed in Northumberland was found in Poland in May 2019; and
- A bat ringed in Greater London was found in Russia in August 2021.

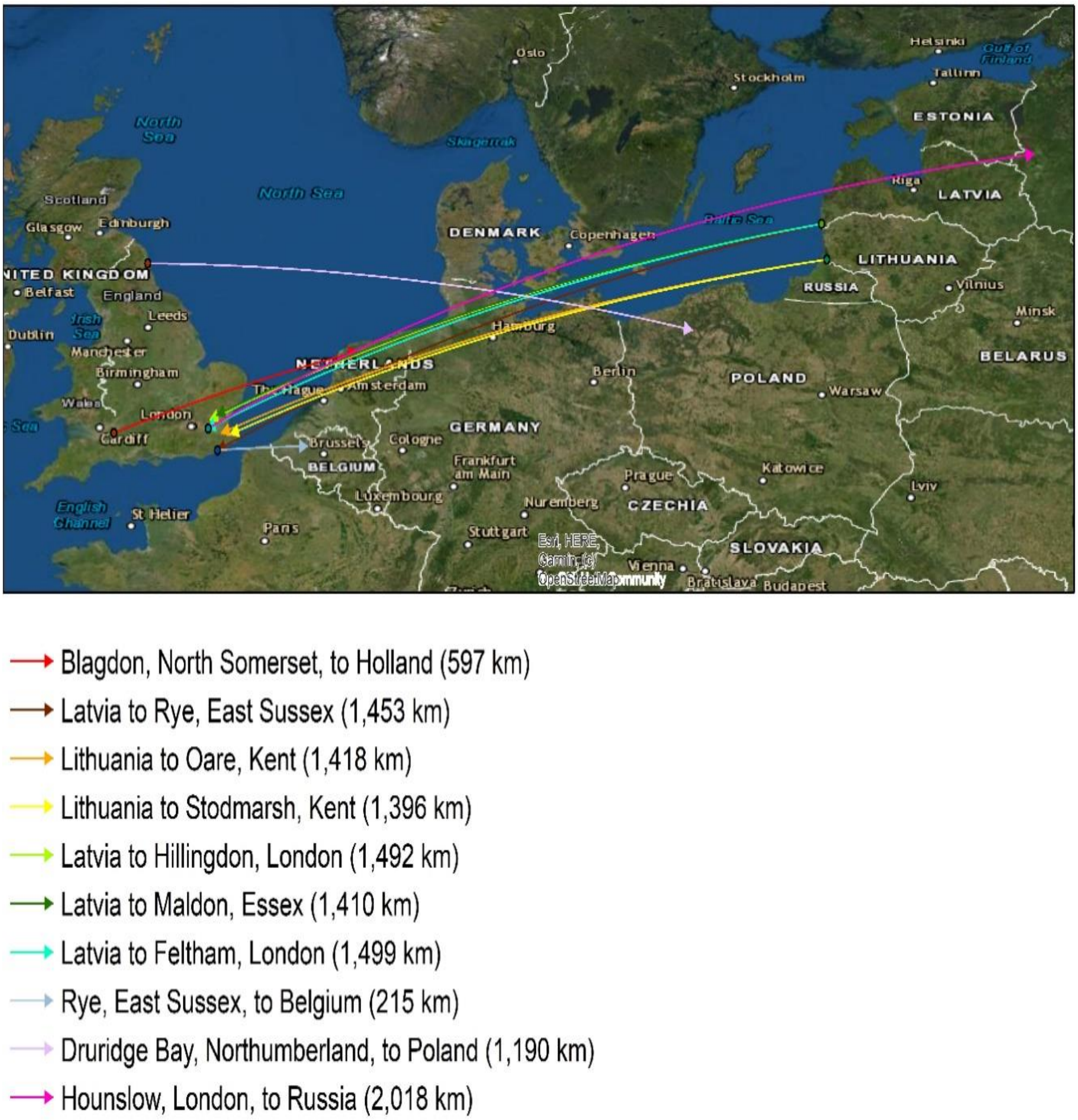

Figure 1-3 NNPP migratory movements.

1.1.7.10 Of note to the Cenos evaluation are the adult male Nathusius' pipistrelles records around Aberdeen (**Figure 1-2**).

1.1.7.11 The distance between Aberdeen, Scotland and Stavanger, Norway is 506 km. Therefore, the known migratory distances for this species are entirely compatible with migration between the two nations.

1.1.8 WOZEP

1.1.8.1 WOZEP[30] is The Netherlands Government's Offshore Wind Ecological Programme. The aim of the study is to map out the ecological effects of offshore wind, looking at the species protected by the Netherlands Nature Conservation Act. The intention of the programme is that by expanding the knowledge base it will make it possible to predict the ecological effects with greater certainty during the preparatory phases for each new offshore windfarm.

1.1.8.2 The primary focus of the WOZEP research is to acquire knowledge about the specific conditions in which bats fly out to sea, why they do so, and how bats behave spatially around offshore windfarms. To see how bats move along the coast and over the sea, Wozep is conducting studies with telemetry stations and tagged *Nathusius' pipistrelles* (NPs). The tags broadcast a radio signal which is picked up by the stations. In addition, there is research using acoustic records captured by bat detectors.

1.1.8.3 The reports[31] generated by the WOZEP programme to date are:

- 2023: Spatiotemporal occurrence of bats at the Southern North Sea 2017 – 2020 (pdf, 4.6 MB). See also the article: Acoustic monitoring reveals spatiotemporal occurrence of Nathusius’ pipistrelle at the Southern North Sea during autumn migration.
- 2022: Home range and habitat use of common noctules in the Dutch coastal zone (pdf, 30 MB). See also the open access article: Offshore Occurrence of a Migratory Bat, *Pipistrellus nathusii*, Depends on Seasonality and Weather Conditions (pdf, 1.2 MB).
- 2020: Methods for assessing fatality risk of bats at offshore wind turbines (pdf, 821 kB).
- 2018: Stilstandvoorziening als mitigatie voor Vleermuizen in OWFs (pdf, 4.7 MB).
- 2017:
  - Lagerveld, S., Janssen, R., Manshanden, J., Haarsma, A.-J., de Vries, S., Brabant, R. & Scholl, M. (2017) Telemetry for migratory bats – a feasibility study (Nr. C011/17) Wageningen University & Research, 58 pp.
  - Limpens, H.J.G.A., Lagerveld, S., Ahlén, I., Anxionnat, D., Aughney, T., Baagøe, H.J., ... Schillemans, M.J. (2017). Migrating bats at the southern North Sea - Approach to an estimation of migration populations of bats at southern North Sea (Nr. 2016.031), Zoogdiervereniging (Dutch Mammal Society), Nijmegen/ Wageningen Marine Research, 76 pp.
  - Lagerveld, S., Limpens, H.J.G.A., Schillemans, M.J. & Scholl, M., Bat 1: Estimate of bat populations at the southern North Sea (WU& Research Nr. C014/17, DMS Nr. 2017.08) Supporting note to ZDV (Nr. 2016.031, Migration bats at the southern North Sea), Wageningen University & Research and DMS, 15 pp.
  - Lagerveld, S., Kooistra , G., Otten, G., Meesters, L., Manshanden, J., de Haan, D., ... Scholl, M. (2017), Bat flight analysis around wind turbines –a feasibility study (Nr. C026/17), Wageningen Marine Research, 41 pp.
  - Lagerveld, S., Gerla, D., van der Wal, J.T., de Vries, P., Brabant, R., Stienen, ... Scholl, M. (2017) Spatial and temporal occurrence of bats in the southern North Sea area (Nr. C090/17), Wageningen Marine Research, 54 pp.

1.1.8.4 The programme has analysed data from 2017 to 2020 at 14 southern North Sea locations and the summary conclusions of that analysis are:

1.1.8.5 Nathusius’ pipistrelle is the most commonly recorded bat species in the southern North Sea. Its offshore activity extends later than was previously considered with late season movement of adult males captured in the end of October.

1.1.8.6 Migration occurs regularly during consecutive nights and existing offshore structures are utilised as day roosts. There is considerable variability in offshore activity and this increases with distance from shore.

1.1.8.7 Average bat movement speed is 25.1km/h (extrapolates as ~20 hours between Norway and UK).

1.1.8.8 They found an increased distribution of bats off the northern Netherlands coast which may well be a reflection of terrestrial abundance and distribution in the Netherlands.

1.1.8.9 They note the interaction between the abiotic factors of wind speed and direction and comment that both must be considered working together. While migration appears to correlate with lower windspeeds it is noted that higher windspeeds could result in bats flying higher (and therefore beyond the range of the monitoring microphones). The studies undertaken by WSP Denmark have found that windspeed/direction actually determines the departure/landfall of the bat migrations (Morten Christensen, 2024, *pers comm*).

1.1.8.10 They found correlation between moon phase bat movement with lower levels of bat movement in brighter moon phases – this may be bats seeking to reduce exploitation, or seeking to exploit greater insect numbers, or a combination of both factors.

1.1.8.11 The programme found a reduced occurrence in 2020 which suggests inter-year variability in migration or might be the first observation of an actual decline.

1.1.9 Minsmere, England to Wijk aan Zee, (Netherlands)

1.1.9.1 During the night of Sunday 2 to Monday 3 May 2021, a Nathusius' pipistrelle flew from Minsmere in England directly to Wijk aan Zee (Netherlands) (see **Figure 1-4**). This is the first detection of such a crossing from England to the Netherlands through the telemetry study of the migration of *Nathusius' pipistrelles*. The bat, an adult female, was tagged on 29 March 2021 by the Norwich Bat Group, who are WUR research partners[32].

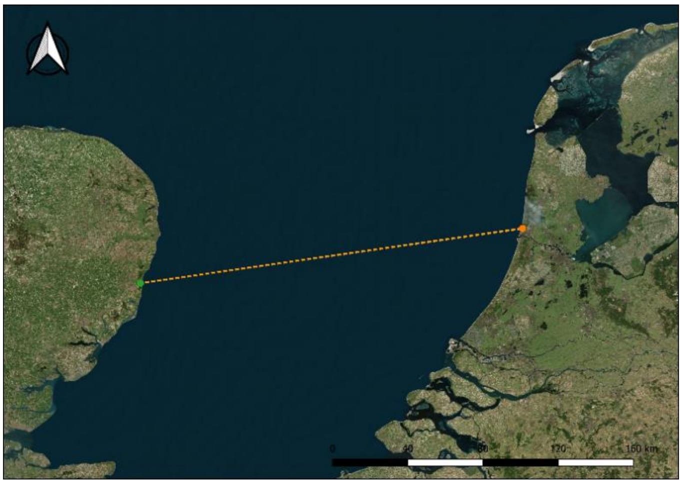

Figure 1-4 Track of the tagged Spring Nathusius crossing Southern North Sea between Minsmere in England (green circle) and Wijk An Zee in The Netherlands (orange circle).

1.1.9.2 This was the first micro-tagged confirmation of a spring migratory movement by Nathusius' pipistrelles from UK to the European continent.

1.1.10 Conclusion

1.1.10.1 Whilst there is now evidence of bat migration in the southern North Sea between the UK and The Netherlands and Belgium and between Denmark, Germany and Sweden over the Baltic Sea there is no confirmed evidence of a more northern migration over the North Sea. Eurobats have published a possible migratory route between Norway and Scotland for Nathusius' Pipistrelles but this is speculative – based on the migratory capability of the species and land-based distributions. Therefore, it is anticipated that an evaluation of migratory bat impact should be scoped out from the CENOS EIA as a consequence of there being no confirmed evidence of a migratory route between Norway and Scotland and significant effects being unlikely.

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Appendix 5C: Cumulative Effects Assessment Long List of Projects

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List of Tables

5C. CUMULATIVE EFFECTS ASSESSMENT LONG LIST

5C.1 Introduction

5C.1.1.1 A Cumulative Effect Assessment (CEA) is a legal requirement under the EIA Regulations. A CEA provides consideration of the potential significant effects as used in the EIA Regulations, arising from the Project alone and cumulatively with other relevant plans, projects and activities. Cumulative effects are the combined effect of the Project in combination with the effects from a number of different projects and/or plans, on the same receptor or resource.

5C.1.1.2 To support undertaking the CEA it is necessary to first to identify those foreseeable developments or activities with which the Project may interact and have the potential to result in a potential significant cumulative effect. All phases (construction, operation and maintenance, and decommissioning) of the Project have the potential to lead to potential significant cumulative effects.

5C.1.1.3 This CEA long list aims to identify in a systematic and transparent way the other projects, plans and activities within an area of search. This long list will then be subject to further assessment and screening to identify which projects/plans may interact to produce a cumulative effect.

5C.2 Methodology

5C.2.1.1 The CEA methodology has been provided in detail in **Chapter 5: Approach to EIA and Scoping** therefore a brief summary is provided within this appendix to provide the justification for the long list search areas, types of projects considered and next steps.

5C.2.1.2 The EIA Regulations require only the assessment of other existing developments and / or approved developments (i.e. projects with the necessary consents to enable construction). This requirement has been extended to fulfil the requirements of the guidance referred to in **Chapter 5: Approach to Scoping and EIA** to provide a comprehensive assessment of potential cumulative effects.

5C.2.1.3 For the purposes of the CEA, the criteria of other plans or projects that are proposed for consideration include those:

- Already constructed;
- Under construction;
- Permitted application (s) but not yet implemented;
- Submitted application(s) but not yet determined, and
- Plans and projects which are ‘reasonably foreseeable’ including offshore renewable energy projects that have a Crown Estate Area for Lease (AfL).

5C.2.1.4 The CEA will focus on developments in proximity to the Project that may have effects on the same receptors. Generally, only other developments where an EIA is required are considered appropriate for inclusion in the CEA. This is because these developments are most likely to result in effects of a magnitude sufficient to lead to potential significant effect either on their own or in combination with the Project, and they are also most likely to have sufficient information in order to undertake a meaningful assessment. The CEA will include other developments that may begin construction, operation or be decommissioned within the same period as the Project's construction, operation and maintenance or decommissioning timelines.

5C.2.1.5 In relation to future protects, the Project will consider other plans / projects that have submitted a scoping report up to four months prior to application submission.

5C.3 Stage 1: Identify a Long List of 'Other Developments'

5C.3.1 Approach to the Long List

5C.3.1.1 The first stage of the CEA is to produce a 'long list' of other relevant projects, plans and activities ('other developments') happening within a large study area around the Project Area. The long list includes those in the UK and adjoining international jurisdictions and is based on publicly available information available at the time of preparation. It considers the scale of the other developments, and the potential for these to produce cumulative effects with the Project.

5C.3.1.2 The search area defined in **Table 5C-1** has been applied in developing the long list. This long list was discussed at a Scoping Workshop on 29th February 2024 with MD-LOT and its advisors. It should be noted that these initial screening ranges are based on what are considered to be the maximum extents of potential impacts (based on guidance and professional experience) from those activities and are therefore considered to be highly precautionary.

5C.3.1.3 Where other developments are expected to be completed before the construction of the Project and the effects of those projects are fully determined, effects arising from them will be considered as part of the baseline and may be considered as part of specific impact assessment in the construction and operational phases (noting that the assessment should clearly distinguish between other developments forming part of the baseline and those in the CEA) and therefore not considered within the cumulative impact assessment.

Table 5C-1: Search area for long list

Offshore Elements	Search area extent	Rationale
Aggregate, dredging and disposal	Up to 50 km from the Site	This range represents a precautionary maximum distance at which effects from aggregate dredging and disposal could occur (e.g. changes to hydrodynamic regime/coastal processes).
Cables and Pipelines	Up to 50 km from the Site	This range represents a precautionary distance at which effects from cables and pipelines (e.g. increases to Suspended Sediment Concentrations (SSCs) from installation could occur).

Offshore Elements	Search area extent	Rationale
Commercial fisheries	Up to 200 km from the Site	This range represents a precautionary maximum distance at which effects from commercial fisheries could occur and is wide enough to cover fishing grounds off the East Coast of Scotland and off North East England.
Port and Harbour Development	Up to 200 km from the Site	This range represents a precautionary maximum distance at which effects from Port and Harbour Development could occur (numerous receptor types (marine mammals, socio-economic impacts, shipping and navigation impacts etc) therefore the search area is wide enough to cover noise impacts from the movement of vessels and construction or development activities as part of the port/harbour).
Military, aviation and radar	Up to 200 km from the Site	This range represents a precautionary maximum distance at which effects from Military and Civil Aviation could occur (e.g. impacts to other helicopter and platform operators, impacts on civil aviation radar).
Offshore energy	Up to 510 km from the Site	This range represents a precautionary maximum distance at which effects from offshore energy (e.g. collision risk to bird species with large foraging ranges) could occur.
Oil and Gas Field Developments	Up to 500 km from the Site	This range represents a precautionary maximum distance at which effects from oil and gas activities (e.g. underwater noise from piling) could occur.
Shipping	Up to 200 km from the Site	This range represents a precautionary maximum distance at which effects from shipping could occur. This range comfortably allows for a UK Chamber of Shipping routing study area of 50 NM for impacts from the Project with a 50 NM buffer for impacts from other projects.
Carbon Capture and Storage (CCS)	Up to 500 km from the Site	This range represents a precautionary maximum distance at which effects from CCS could occur (e.g. underwater noise from piling activities). This distance will be considerably reduced if existing wells and platforms are used.

5C.3.1.4 The long list shown in **Table 5C-2** provides a list of projects identified during this search process.

5C.3.1.5 The long list will be further developed and populated with plan/project types and as far as possible the timing and nature of planned activities (including the duration of phases) based on a search of publicly available information using planning databases and internet searches. The database will be supplemented with additional sources of information until 4 months prior to EIAR submission.

5C.3.1.6 The long list will be made available to topic authors as a tool to identify potential cumulative effects consistently across the Project, serving as a reference sheet to extract or discount significant interactions on the basis of topic specific qualifying criteria. Following creation of the long list, all developments will be screened based on the potential for each potential impact-receptor pathway interaction (shown in **Table 5-6** of **Chapter 5: Approach to Scoping and EIA**) with the Project and on the level of detail available (tiered approach). This screening will produce EIA topic-specific shortlists of other developments which will be considered further within the CEA section of the topic chapters. The methodology and topic specific Zone of Influences for this stage is contained in **Chapter 5: Approach to EIA and Scoping.**

5C.4 Next Steps

5C.4.1.1 The Applicant welcomes MD-LOT feedback on this long list of projects and the CEA approach. Once the topic specific shortlists have been finalised the Applicant will engage further with MD-LOT on the projects identified to ensure that effective engagement has taken place.

Table 5C-2: CEA long list

Project
Aggregate, Dredging and Disposal
MIDDLE BUCHAN NESS
PETERHEAD
NORTH BUCHAN NESS
MIDDLE BUCHAN NESS B
SOUTH BUCHAN NESS B
SOUTH BUCHAN NESS
ABERDEEN
FRASERBURGH
MACDUFF
Cables and Pipelines
Culzean - Natural Gas
CATS - Natural Gas
CULZEAN 22 INCH GAS EXPORT FLOWLINE
CATS PIPELINE

Project
GREATER STELLA 10 INCH GAS EXPORT
MADOES PRODUCTION PIPELINE
MADOES MANIFOLD TO CPF
Banff Oil Export
Banff Oil Export SAL
BANFF FPSO TO CATS
BANFF GAS EXPORT PIPELINE (PL1549A)
BANFF OIL EXPORT PIPELINE (PL5073)
BANFF STATIC UMBILICAL (PLU3106)
BANFF TO KYLE UMBILICAL
STATIC UMBILICAL TO N KYLE
ELGIN TO ETAP
KYLE TO BANFF PRODUCTION PIPELINE
BANFF MANIFOLD TO FPSO (PL1547)
KYLE TO BANFF PRODUCTION CUT SECTION
BANFF FPSO TO MANIFOLD
Banff Gas Lift/Injection SSIV Umbilical PLU5076
Banff Gas Lift/Injection SSIV Umbilical PL5074
Banff Gas Lift/Injection SSIV Umbilical PL5075
BANFF WATER INJECTION PIPELINE (PL1548)
BANFF MANIFOLD TO FPSO (PL1546)
BANFF POWER UMBILICAL (PLU4522)
Banff Chemical Injection Umbilical
BANFF EHC UMBILICAL (PLU1552.1 - 1554.7)
WELL B5 TO BANFF MANIFOLD PRODUCTION JUMPER
Banff Gas Lift/Injection PL2052JB1
Banff B1 Control Umbilical
BANFF PRODUCTION
Banff Gas Lift/Injection PL2052JB4
Banff Production PL2053
Banff Gas Lift/Injection PL2052JB3
Banff Production PL2054
BANFF TO KYLE NORTH GAS LIFT
BANFF CONTROL UMBILICAL
SHAW WATER INJECTION UMBILICAL

Project
SHAW 8 INCH WATER INJECTION
SEAGULL WASHWATER SPOOLS
SEAGULL PRODUCTION SPOOLS
SEAGULL PRODUCTION PIPELINE
SEAGULL WASH WATER PIPELINE
SHAW 4 INCH GAS LIFT
SHAW 10 INCH PRODUCTION
LANGELED PIPELINE
SKUA TO EGRET MAN WI
WEST SKUA TO EGRET
EAST SKUA TO EGRET
12/20"" P.I.P. SHEARWATER A TO STARLING MANIFOLD
20"" GAS FULMAR A - ST. FERGUS
16"" OIL GANNET A - FULAMR A (CUT AND DISUSED)
16"" OIL GANNET A - FULMAR A
ETAP TO SKUA WI
ETAP WEST TO SKUA
UMBILICAL SKUA UTA - SKUA MANIFOLD
ETAP EAST TO SKUA
UMBILICAL STARLING MANIFOLD - STARLING WELL PE
6"" GAS STARLING MANIFOLD - WELL PE
6"" GAS STARLING MANIFOLD - WELL PW
10""/16"" PIP GAS FRAM MANIFOLD - STARLING MANIFOLD
6"" WET GAS STARLING MANIFOLD - WELL P3
UMBILICAL ARBROATH TO ARKWRIGHT
ARBROATH TO ARKWRIGHT GAS LIFT
ARBROATH TO ARKWRIGHT
ARBROATH TO ARKWRIGHT METHANOL
ARKWRIGHT TO ARBROATH
UMBILICAL EGRET UTA - EGRET MANIFOLD
EGRET SPOOLS
EAST EGRET TO HERON
WEST EGRET TO HERON
EGRET TO HERON WATER LINE
EGRET WASHWATER SPOOLS

Project
EGRET TO HERON MAN UMB
BRECHIN TREE TO ARKWRIGHT MAN
UMBILICAL HERON UTA - HERON MANIFOLD
WOOD PRODUCTION
WOOD GAS LIFT
ETAP/CATS START-UP
MACHAR 12 INCH WATER INJECTION
ETAP/MACHAR START-UP
6 INCH GAS EXPORT / IMPORT PIPELINE
MACHAR PRODUCTION UMBILICAL
ETAP TO MACHAR
MONTROSE TO ARBROATH WATER INJECTION
ARBROATH TO MONTROSE (PL629)
ARBROATH TO MONTROSE (PL626)
ARBROATH TO MONTROSE (PL627)
Kyle North K13 Control Umbilical
KYLE K13 UMBILICAL
KYLE NORTH GAS LIFT K13
REDUNDANT KYLE WELL K13 UMBILICAL
KYLE WELL K13 PRODUCTION
REDUNDANT KYLE WELL K14 UMBILICAL
KYLE NORTH K14A CONTROL UMBILICAL
KYLE NORTH CHEMICAL UMBILICAL
KYLE WELL K14 PRODUCTION
KYLE NORTH/KYLE SOUTH GAS LIFT
KYLE NORTH GAS LIFT K14A
KYLE NORTH CONTROL UMBILICAL
ETAP TO FORTIES UNITY
MIRREN PRODUCTION PIPELINE (PL1950B)
MUNGO TO ETAP GAS INJ LINE
MUNGO TO ETAP WATER
MUNGO TO ETAP LIQUIDS
ETAP/MUNGO START-UP
MONTROSE TO ARBROATH WATER INJ
24"" OIL SHEARWATER - SHEARWATER WYE

Project
ELGIN TO FRANKLIN BUNDLE
WEST FRANKLIN TO ELGIN B PRODUCTION 2
WEST FRANKLIN TO ELGIN B PRODUCTION 1
34 INCH GAS SHEARWATER - BACTON SEAL LINE
KYLE SOUTH K15 CONTROL UMBILICAL
KYLE SOUTH GAS LIFT K15
KYLE WELL K15 PRODUCTION
KYLE SOUTH CONTROL UMBILICAL
KYLE SOUTH K12Z CONTROL UMBILICAL
KYLE SOUTH GAS LIFT K12Z
KYLE WELL K15 UMBILICAL
KYLE WELL K12 PRODUCTION
KYLE WELL K12 UMBILICAL
KYLE SOUTH UMBILICAL
KYLE 12 PRODUCTION
4"" GAS LIFT GANNET A - GANNET D
4"" OIL TESTLINE GANNET A - GANNET D
6"" OIL GANNET D P2 - GANNET A
6"" OIL GANNET D - GANNET A
3"" GAS LIFT GANNET A - GANNET G MANIFOLD
6"" OIL GANNET A ISOLATION VALVE - GANNET G MANIFOLD
PROPOSED PRODUCTION 2 GANNET D LINEAR BLOCK MANIFOLD - GANNET A
PROPOSED PRODUCTION 1 GANNET D LINEAR BLOCK MANIFOLD - GANNET A
6"" OIL GANNET G MANIFOLD - GANNET A WYE
3"" GAS LIFT GANNET A - GANNET E
8"" OIL GANNET E - GANNET A
6"" OIL GANNET A - GANNET A VALVE SKID
6"" GAS GANNET A - C1 MANIFOLD
6"" GAS GANNET B1 - GANNET A
4.5"" GAS LIFT GANNET A - GANNET F VALVE SKID
6"" GAS GANNET B2 - GANNET A
36"" OIL / COMPOSITE BUNDLE GC2 AND GC4 - GANNET A
6"" OIL GANNET A PLATFORM - GANNET A VALVE SKID
20"" GAS GANNET A - GANNET DIVERTER
36"" OIL/COMPOSITE BUNDLE GC1 AND GC3 - GANNET A

Project
10"" OIL GANNET A VALVE SKID - GANNET F VALVE SKID
2"" GAS LIFT GANNET C2 MANIFOLD - WELL GC2-02
4"" OIL JUMPER GANNET GC2-02 - TOWHEAD
CONTROL JUMPER GANNET GC2 TOWHEAD-WELL 02(NOTINUSE
4"" OIL GANNET GC2 TOWHEAD - GC2-04G
CONTROL JUMPER GANNET GC2 TOWHEAD - WELL 04
3"" GAS LIFT GANNET G MANIFOLD - WELL GG01
6"" OIL GANNET G MANIFOLD - WELL GG01
OIL JUMPER GANNET G ISOLATION VALVE - GG-02
3"" GAS LIFT GANNET G MANIFOLD - GANNET GG02
4"" OIL GANNET D LBM - GANNET GD03/04
4"" GANNET D LBM TO GD03/04 GAS LIFT
4"" PRODUCTION TEST GANNET GD03/04 - GANNET D LBM
4"" OIL PRODUCTION TEST GANNET GD03/04-GANNET D LBM
2"" HYDRAULIC UMBILICAL GANNET D LBM - GD04
2"" CHEMICAL UMBILICAL GANNET D JUNCTION BOX - GD04
4"" TEST LINE GANNET D LBM - GANNET GD-06
2"" GASLIFT GANNET D LBM - GANNET GD-06
4"" OIL GANNET D LBM - GANNET GD-06
4"" OIL GANNET D LBM - GANNET GD06
4"" OIL GANNET D LBM - GD01/02 PRODUCTION TEST
4"" OIL GANNET D LBM - GANNET GD01/02
4"" GAS LIFT GANNET D LBM TO GD01/02
4"" OIL GANNET D GD01/02 - LBM
UMBILICAL GANNET D JSBS - GANNET GD-06
CULZEAN 4 INCH FUEL GAS FLOWLINE
CULZEAN 6 10 CONDENSATE PIPE-IN-PIPE
6"" OIL GANNET VALVE SKID - GF03
2.5"" GAS LIFT GANNET F VALVE SKID - GF03
UMBILICAL GANNET F UTA - GANNET F MANIFOLD
3"" GAS LIFT GANNET INTERSECTION - GANNET F
8"" OIL GANNET INTERSECTION - GANNET F
CONTROL UMBILICAL INTERSECTION - GANNET F
24"" COMPOSITE BUNDLE INTERSECTION
6"" OIL GANNET F VALVE SKID - GANNET F WELL 2

Project
3"" GAS LIFT GANNET F VALVE SKID - GANNET F WELL 2
UMBILICAL GANNET F MANIFOLD - WELL 2
UMBILICAL GANNET F VALVE SKID - GANNET F WELL 1
6"" OIL GANNET F VALVE SKID - GANNET F WEL 1
3"" GAS LIFT GANNET F VALVE SKID - GANNET F WELL 1
8"" GAS GANNET DIVERTER TIE-IN - GANNET ALTERNATIVE DIVERTER
TRITON FPSO TO GANNET DIVERTER
ANASURIA FPSO TO FULMAR
UMBILICAL MERGANSER MANIFOLD - WELL WEST
6"" GAS MERGANSER MANIFOLD - WELL WEST
4"" OIL GANNET C4 MANIFOLD - WELL GC4-01
4"" OIL GANNET WELL GC4-01 - WELL GC4-03
CONTROL JUMPER GANNET GC4 TOWHEAD - GC4-03 WELL
2"" GAS LIFT GANNET C4 MANIFOLD - WELL GC4-03
4"" OIL GANNET C4 MANIFOLD - WELL GC4-03
2"" GAS LIFT GANNET C4 MANIFOLD - WELL GC4-01
CONTROL JUMPER GANNET GC4 TOWHEAD - GC4-01 WELL
CONTROL JUMPER GANNET GC4 TOWHEAD - WELL 01
UMBILICAL MERGANSER MANIFOLD - WELL EAST
UMBILICAL SCOTER MANIFOLD - MERGANSER MANIFOLD
8"" GAS SCOTER SMES - MERGANSER MANIFOLD
6"" GAS - MERGANSER MANIFOLD - WELL EAST
6"" OIL GANNET C4 TOWHEAD - GC4-04 WELL
2"" GAS LIFT GANNET C4 TOWHEAD - GC4-04 WELL
6"" GAS GANNET GC1-04 - GC4-04
TRITON FPSO TO BITTERN DCB OIL TEST LINE
TRITON FPSO TO BITTERN DCB OIL LINE 1
TRITON FPSO TO BITTERN DCB OIL LINE 2
TRITON FPSO TO BITTERN DCB GAS LIFT
TRITON FPSO TO BITTERN DCB WATER LINE
2"" GAS LIFT GANNET GC1 TOWHEAD - GC1-04
6"" OIL GANNET GC1 TOWHEAD - GC1-04
UMBILICAL GANNET C1 MANIFOLD - WELL 4
2"" GAS LIFT GANNET C1 MANIFOLD - WELL GC1-02
CONTROL JUMPER GANNET GC1 TOWHEAD - GC1-01

Project
UMBILICAL GANNET GC1 TOWHEAD - WELL GC1-01
UMBILICAL GANNET C1 TOWEAD - WELL GC1-01
CONTROL JUMPER GANNET GC1 TOWHEAD - GC1-02 WELL
CONTROL JUMPER GANNET GC1 TOWHEAD - GC1-01 WELL
2"" GAS LIFT GANNET C1 MANIFOLD - WELL GC1-01
4"" OIL GANNET C1 MANIFOLD - WELL GC1-01
4"" OIL GANNET C1 MANIFOLD - WELL GC1-02
4"" OIL JUMPER GANNET GC1-03 - TOWHEAD
CAYLEY 3 INCH GAS LIFT PIPELINE
CAYLEY 8 INCH PRODUCTION
CAYLEY BUNDLE
CAYLEY 4 INCH UTILITY PIPELINE
MONTROSE TO SBM
BITTERN DCB TO BITTERN DCA OIL TEST LINE
BITTERN DCB TO BITTERN DCA OIL LINE 1
BITTERN DCB TO BITTERN DCA OIL LINE 2
BITTERN DCB TO BITTERN DCA GAS LIFT
BITTERN DCB TO BITTERN DCA WATER LINE
BITTERN DCB TO TREE WA WATER INJ
CONTROL UMBILICAL GANNET GC3 TOWHEAD - GC3-01B
CONTROL UMBILICAL GANNET C3 TOWHEAD - GC3-03
2"" CONTROL JUMPER GANNET GC3 TOWHEAD - GC3 WELL
2"" GAS LIFT GANNET C3 MANIFOLD - WELL GC3-01
4"" OIL GANNET C3 MANIFOLD - WELL GC3-01
2"" GAS LIFT GANNET C3 MANIFOLD - WELL GC3-03
4"" OIL GANNET C3 MANIFOLD - WELL GC3-03
MONTROSE OIL TRUNKLINE 22/17-AD TO 21/10
24"" GAS SWC-FGL SSIV - SHEARWATER FGL GAS EXPORT PLEM
12"" GAS SCOTER - SHEARWATER A
CONTROL UMBILICAL SHEARWATER C - SCOTER
MONTROSE OIL OFFLOADING LINE
WAGE 6 INCH GE FLEXIBLE PIPELINE
12"" GAS SHEARWATER - COLUMBUS TIE IN STRUCTURE (CTIS)
34 INCH GAS SHEARWATER - SHEARWATER C SSIV (GAS) SEAL LINE
6"" GAS GANNET B T-PIECE - GANNET B3

Project
6"" GAS GANNET B1 - GANNET B2
14"" GAS SHEARWATER C - SWC-FGL SSIV
18"" PIP PRODUCTION JACKDAW WHP - SHEARWATER A
GAS PIERCE FPSO - SHEARWATER SSIV
6"" GAS FRAM G3 WELL - FRAM MANIFOLD
6"" GAS FRAM G5 WELL - FRAM MANIFOLD
6"" GAS FLEXIBLE GANNET B N1102 - N1104 (WELL 1 BYPASS)
UMBILICAL SCOTER MANIFOLD - WELL AD (P3)
SCOTER WELL AD (P3) - SCOTER SMES UMBILICAL
6"" GAS SCOTER MANIFOLD - WELL AD (P3)
6"" GAS SCOTER MANIFOLD - SCOTER SMES
UMBILICAL SCOTER MANIFOLD TO WELL AC (P1)
UMBILICAL SCOTER MANIFOLD TO WELL AB (P2)
6"" GAS WELL AC (P1) - SCOTER MANIFOLD
6"" GAS WELL AB (P2) - SCOTER MANIFOLD
GE 9"" PROD FLEXIBLE 2
GE 9"" PROD FLEXIBLE 1
TRITON FPSO TO GUILLEMOT DC1 UMB SECT B
EV01 to GEEBB Manifold PRODCUTION PIPELINE
EV01 to GEEBB Manifold GAS LIFT Flowline
GE 3"" Gas lift flexible
PL6019 GANNET E 04 Production Flowline
TRITON FPSO GLTS TO DC6 GAS LIFT LINE
GW PROD LINE 2 DC2 TO TRITON
CLAPHAM WATER INJ FROM TRITON
GW PROD LINE 1 DC2 TO TRITON
GANNET E GAS LIFT PIPEPLINE
GANNET E PRODUCTION PIPELINE
MIRREN PRODUCTION PIPELINE (PL1950A)
CLAPHAM WATER INJ FROM TRITON DISUSED
PL4417 6"" Production Jumper GE03
PL4421 3"" Gas Lift Jumper GE03
GANNET E 04 Production Jumper
GE04 PLANNED GAS LIFT JUMPER
PL4421 GEM 3"" Gas Lift Jumper

Project
GANNET E Expansion production jumper
EV01 to EV VALVE SKID Production Jumper
EV01 to EV VALVE SKID Gas Lift Jumper
PL3596 MONAN SE 6INCH PRODUCTION
GUILLEMOT A-WELL GUA-W1 5"" WATER
PL3144 GUILLEMOT WELL P1 TO WELL GUA-P5
GUILLEMOT TO ANASURIA
PL4309 GUILLEMOT GLVS TO GUA-P4 GAS LIFT
GUILLEMOT P4 TO MANIFOLD
GUILLEMOT MANIFOLD TO P2
GUILLEMOT MANIFOLD TO P1
PL1954JP2 GUILLEMOT GLVS TO WELL GUA-P2
GUILLEMOT P2 TO MANIFOLD
PL1238.1 GUILLEMOT P1 TO MANIFOLD
PL4726 GUILLEMOT GLVS TO GUA-P1 GAS LIFT
ANASURIA TO GUILLEMOT A MANIFOLD
PL3145 GUILLEMOT TO WELL GUA-P5
GUILLEMOT A TO ANASURIA
GUILLEMOT GUA-WI TO MANIFOLD
GUILLEMOT P3 TO GUILLEMOT MANIFOLD
GUILLEMOT TO WELL GUA-P3
GUILLEMOT MANIFOLD TO W2 WI
ANASURIA TO GUILLEMOT MANIFOLD
GUILLEMOT MANIFOLD TO GUAW1
CTRL UMB TO FSM SPOOL (DISUSED)
ERSKINE TO LOMOND GAS CONDENSATE LINE
TRITON FPSO TO GUILLEMOT DC1 UMB SECT D
MACHAR EAST WELL TO SUBSEA GAS LIFT
MACHAR EAST WELL TO SUBSEA WI
MACHAR EAST WELL TO SUBSEA PIPELINE
PL1247 TEAL SOUTH TEE TO TLS-W1
TEAL SOUTH TEE TO TLS W1 JUMP WI
TEAL SOUTH P1 TO TEE
TEAL PRODUCTION WELL TO ANASURIA FPSO
PL1235 TEAL COOL SPOOL TO VALVE SKID

Project
TEAL P1/P2 VALVE SKID TO WELL P2
TEAL WI UTA TO TEAL PRODUCTION WELL
GW TREE 21/24-E2Y (TA) GAS LIFT
GW TREE 21/24-E2Y (TA) PROD LINE
GW TREE 21/24-E1 (TB) GAS LIFT
GW TREE 21/24-E1 (TB) PROD LINE
GW PROD LINE 2 DC1 TO DC2 2015
GW PROD LINE 2 DC1 TO DC2
GW PROD LINE 1 DC1 TO DC2 2020
GW PROD LINE 1 DC1 TO DC2
ANASURIA TO TEAL INJECTION TEE
COOK WATER INJECTION PIPELINE
COOK METHANOL PIPELINE
COOK PRODUCTION PIPELINE
TEAL TEE PIECE TO W1
TEAL TEE PIECE TO W2
UMBILICAL CURLEW FPSO - CURLEW C UTA
8"" OIL CURLEW FPSO - CURLEW C WELL P1
3"" GAS LIFT CURLEW FPSO - CURLEW C WELL P1S
5.5"" OIL CURLEW FPSO - CURLEW B WELL P1
CONTROL UMBILICAL CURLEW - CURLEW D SDU
8"" GAS CURLEW - CURLEW D PRODUCTION MANIFOLD
GNW TREE 21/24-W6Y (W6) GAS JUMPER
GNW TREE 21/24-W6Y (W6) PROD JUMPER
PICT PRODUCTION FLOWLINE DC7 TO DC6 SOVS
PICT GAS LIFT FLOWLINE DC6 TO DC7
GNW TREE 21/24-W5Z (TF) PROD LINE
GNW TREE 21/24-W5Z (TF) GAS LIFT
GW TREE 21/24-W1Z (TD) UMBILICAL
GW TREE 21/24-W1Z (TD) GAS LIFT
GW TREE 21/24-W1Z (TD) PROD LINE
GW TREE 21/24-W2Y (TE) UMBILICAL
GW TREE 21/24-W2Y (TE) GAS LIFT
GW TREE 21/24-W2Y (TE) PROD LINE
GNW TREE 21/24-W4Z (TFR) GAS LIFT JUMPER

Project
PICT PRODUCTION FLOWLINE DC6 SOVS TO DC6
GNW TREE 21/24-W4Z (TFR) PROD JUMPER
GNW TREE 21/24-W4Z (TFR) UMBILICAL
CLAPHAM GAS LIFT FLOWINE DC6 TO DC5
CLAPHAM GAS LIFT FLOWINE DC6 TO DC5 INDENT 2
WEST EXT GAS LIFT FLOWINE DC6 - DC3 2015
WEST EXT PROD FLOWLINE DC3 TO DC6
WEST EXT GAS LIFT FLOWINE DC6 - DC3
WELL P2 TO ABIGAIL MANIFOLD
WELL P2 TO STELLA MANIFOLD
ABIGAIL MANIFOLD TO STELLA MANIFOLD
CATCHER GAS EXPORT PIPELINE
COOK MANIFOLD TO WELL P1 GAS METH
COOK MANIFOLD TO WELL P1 OIL LINE
WEST EXT TREE 21/24-T3Y (TU) PROD JUMPER
WEST EXT TREE 21/24-T3Y (TU) GAS LIFT JUMPER 2022
WEST EXT TREE 21/24-T3Y (TU) GAS LIFT JUMPER
WEST EXT TREE 21/24-T2Y (T2) CONTROL JUMPER
WEST EXT TREE 21/24-T2Y (T2) PROD JUMPER
WEST EXT TREE 21/24-T2Y (T2) GAS LIFT JUMPER
WEST EXT TREE 21/24-T2Y) (T2) GAS LIFT JUMPER 2022
WEST EXT TREE 21/23-T1Z (T1) GAS LIFT JUMPER 2022
WEST EXT TREE 21/23-T1Z (T1) GAS LIFT JUMPER
WEST EXT TREE 21/23-T1Z (T1) PROD JUMPER
VORLICH PRODUCTION PIPELINE
12"" GAS COLUMBUS TIE IN STRUCTURE (CTIS) - ARRAN SOUTH TIE IN STRUCTURE (ASTIS)
6"" GAS COLUMBUS TIE IN STRUCTURE (CTIS) - COLUMBUS WELL 1 (C1)
6"" OIL PIERCE GDM - PIERCE WELL C1
12"" GAS CURLEW PIG SKID - DEEP GAS DIVERTER
12"" GAS CURLEW SSIV - DEEP GAS DIVERTER
10"" GAS CATCHER PLEM - CURLEW DEEP GAS DIVERTER
14"" GAS SHEARWATER FGL GAS EXPORT PLEM - CATCHER PLEM
N0214-LOMOND TO CATS RISER PLATFORM GAS
PL781 LOMOND CONDENSATE EXPORT BYPASS

Project
LOMOND TO CATS RISER PLATFORM CONDENSATE
BRYNHILD TO PIERCE WATER INHECTION
BRYNHILD TO PIERCE WATER INJECTION
STELLA NDC MANIFOLD TO WELL B3
STELLA NDC MANIFOLD TO WELL B1
STELLA NDC MANIFOLD TO WELL B2
GREATER STELLA 4 INCH GL MDC-NDC
GREATER STELLA 8 INCH PROD MDC-NDC
2.5""GAS LIFT PIERCE A11 GDM - PIERCE B5 WELL
2.5"" GAS LIFT PIERCE A11 GDM - WELL D4 (SAOP)
6"" OIL PIERCE MDS - WELL D4 (SAOP)
UMBILICAL PIERCE MDS - WELL A9 (MP3)
6"" OIL PIERCE MDS VALVE SKID - WELL A9 (NP3)
2.5"" GAS LIFT PIERCE MDS - PIERCE A11 GDM
6"" OIL PIERCE MDS - PIERCE A11 GDM
6"" WI Pierce MDS WI Manifold - LUNDIN PIPLELINE
2.5"" GAS LIFT PIERCE A11 GDM - WELL A11
2"" GAS LIFT PIERCE GDM - WELL A12
6"" OIL PIERCE A11 GDM - WELL A11
UMBILICAL PIERCE MAIN MANIFOLD - WELL A5 (SP2)
6"" OIL PIERCE WELL A5 (SP2) - MAIN MANIFOLD
6"" OIL PIERCE MAIN MANIFOLD - WELL A5 (SP2)
UMBILICAL PIERCE MDS - WELL A10 (PC1)
6"" GAS INJECTION PIERCE MDS - WELL A10 (PC1)
6"" OIL PIERCE WELL A3X (NP1) - MAIN MANIFOLD
6"" OIL PIERCE MDS VALVE SKID - N2793 TEE
UMBILICAL PIERCE MAIN MANIFOLD - WELL A4 (NG1)
6"" OIL PIERCE MDS VALVE SKID - WELL A6 (NP2)
UMBILICAL PIERCE MDS - WELL A4 (NG1)
6"" OIL PIERCE MDS - VALVE SKID
6"" GAS PIERCE MAIN MANIFOLD - WELLA4 (NG1)
UMBILICAL PIERCE MAIN MANIFOLD - WELL A6 (NP2)
5"" WATER PIERCE WI MANIFOLD - WELL MWI-2
UMBILICAL PIERCE MDS - WELL NP2 (REPLACEMENT)
UMBILICAL (ELEC.) PIERCE MDS - WELL NP2

Project
6"" OIL PIERCE MDS - WELL MWI-1 (A7 SG2)
6"" GAS PIERCE MAIN MANIFOLD - WELL A2Y (SG1)
UMBILICAL PIERCE MDS - WELL MWI-1 (A7 SG2)
6"" OIL PIERCE WELL A1 (SP3) - MAIN MANIFOLD
UMBILICAL PIERCE MDS - WELL A7 (SG2)
6"" OIL PIERCE MDS - WELL A12
UMBILICAL (ELEC.) PIERCE MDS - WELL MWI-1 (A7 SG2)
5"" WATER MDS WI MANIFOLD - MWI-1
I0"" OIL/TEST PIERCE MAIN MANIFOLD - FPSO
8"" GAS INJECTION PIERCE FPSO - PIERCE MDS
10"" OIL PIERCE FPSO - MAIN MANIFOLD
6"" OIL PIERCE N2758 TEE - WELL A1
10"" WATER PIERCE FPSO - MDS WI MANIFOLD
CLAPHAM GAS LIFT FLOWINE DC6 TO DC5 INDENT 4
8"" GAS RE-INJECTION PIERCE FPSO - MAIN MANIFOLD
CLAPHAM DC5 MANIFOLD TO PIPELINE PL2084
CLAPHAM DC5 MANIFOLD TO PIPELINE PL2086
CLAPHAM TREE CC GAS LIFT JUMPER 2003
JUDY EXPORT PIPELINE
CLAPHAM TREE CC GAS LIFT JUMPER 2008
CLAPHAM GAS LIFT TREE CD TO TREE CC
UMBILICAL (HYD/CHEM) PIERCE SDS - WELL B5
6"" OIL PIERCE SDS - WELL B5
BRYNHILD TO PIERCE PRODUCTION
BRYNHILD TO PIERCE CONTROL UMBILICAL
UMBILICAL (ELECTRICAL) PIERCE SDS - WELL B5
HUNTINGTON WATER INJECTION
HUNTINGTON PRODUCTION FLOWLINE
HUNTINGTON GAS LIFT
HUNTINGTON UMBILICAL
6"" OIL PIERCE WELL B1 (SP1) - SATELLITE MANIFOLD
UMBILICAL (ELEC.) PIERCE SDS - WELL SWI-2 (B3) LB2
UMBILICAL (ELEC.) PIERCE SDS - WELL SWI-1 (B4A) 1A
UMBILICAL PIERCE SATELLITE MANIFOLD - WELL B2 (SP5
10"" OIL PIERCE SATELLITE MANIFOLD - FPSO

Project
6"" OIL PIERCE WELL B2 (SP5) - SATELLITE MANIFOLD
5"" WATER PIERCE SDS WI MANIFOLD - SWI-1 (B4A) LB1A
5"" WATER PIERCE SDS WI MANIFOLD - SWI-2 (B3) LB2
10"" WATER INJECTION PIERCE FPSO - SDS WI MANIFOLD
STELLA FPF 1 TO SAL OIL EXPORT .1
MALLARD TO KITTIWAKE OIL BNDLE
MALLARD TO KITTIWAKE WI
CATCHER NORTH PRODUCTION PIPELINE
CATCHER NORTH GAS LIFT PIPELINE
PL4226
2"" GAS LIFT BARDOLINO MANIFOLD - WELL P1
6"" OIL BARDOLINO MANIFOLD - WELL P1
16"" OIL GANNET A - FULMAR A REMOVED SECTION
2"" GAS LIFT NELSON S. MANIFOLD - WELL A2
6"" OIL NELSON S. WELL A4 - S. SAT. MANIFOLD
6"" OIL NELSON S. SAT. WELL A2 - S. SAT. MANIFOLD
2"" GAS LIFT NELSON S. SAT. MANIFOLD - S. WELL A4
UMBILICAL NELSON S. SAT. MANIFOLD - S. SAT. WELL A
3"" GAS LIFT - BARDOLINO VPS - BARDOLINO MANIFOLD
6"" OIL BARDOLINO VPS - BARDOLINO MANIFOLD
2"" GAS LIFT NELSON S. MANIFOLD - WELL A1
6"" OIL NELSON S. SATELLITE MANIFOLD - WELL A1
6"" OIL NELSON S. WELL A3Z - S. SAT. MANIFOLD
2"" GAS LIFT NELSON S. SAT. MANIFOLD - S. WELL A3
8"" OIL/TEST NELSON S. SAT. MANIFOLD - NELSON (R7)
6"" GAS LIFT NELSON - S. SAT. MANIFOLD (R22)
8"" OIL NELSON S. SAT. MANIFOLD - NELSON (R5A)
10"" OIL NELSON S. SAT. MANIFOLD (R5) NOT IN USE
6"" Well A2 Tie-in Spool
6"" Well W1 (SCP1) Tie-in Spool
6"" Well A3Z Tie-in Spool
6"" Well W3 (SPC3) Tie-in Spool
6"" Well W2 (SPC2) Tie-in Spool
6"" Well A1Z Tie-in Spool
HARRIER PRODUCTION PIPELINE

Project
GREATER STELLA 10 INCH PROD FPF-MDC
GREATER STELLA 4 INCH GL FPF-MDC
HUNTINGTON GAS TO FPSO
STELLA OIL EXPORT PIPELINE
STELLA FPF 1 TO SOUTHERN WYE .2
3"" GAS LIFT NELSON - HOWE MANIFOLD
8"" OIL NELSON - HOWE MANIFOLD
3"" GAS LIFT HOWE MANIFOLD - BARDOLINO VPS
8"" OIL HOWE MANIFOLD - BARDOLINO VPS
2"" GAS LIFT HOWE MANIFOLD - WELL P1
UMBILCAL HOWE MANIFOLD - WELL P1
6"" OIL HOWE MANIFOLD - WELL P1
UMBILICAL HOWE MANIFOLD - WELL P1
CATCHER BUNDLE
10"" GAS NELSON - KITTIWAKE RECEIVER TEE
GTR STELLA UMB. RISER BASE - GTR STELLA EXPORT RISER BASE
STELLA 10"" PRODUCTION FLEXIBLE RISER
STELLA 10"" GAS EXPORT FLEXIBLE RISER
FPF1 TO VORLICH MWA
VARADERO BUNDLE
PL4227
12"" GAS ARRAN SOUTH TIE IN STRUCTURE (ASTIS) - ARRAN NORTH TIE IN STRUCTURE (AN
6"" GAS ARRAN NORTH TIE IN STRUCTURE (ANTIS) - ARRAN NORTH WELL 1 (AN1)
6"" GAS ARRAN NORTH TIE IN STRUCTURE (ANTIS) - ARRAN NORTH WELL 2 (AN2)
BURGMAN BUNDLE
JADE TO JUDY
6"" GAS ARRAN SOUTH TIE IN STRUCTURE (ASTIS) - ARRAN SOUTH WELL 3 (AS3)
6"" GAS ARRAN SOUTH TIE IN STRUCTURE (ASTIS) - ARRAN SOUTH WELL 2 (AS2)
Franpipe
Zeepipe I
HARRIER MANIFOLD TO HARRIER WELLHEAD 10
9"" WATER INJECTION F/LINE NELSON - S. SAT. (R15)
10"" OIL PROD. F/LINE TAIL S. SAT - NELSON (R6)
20"" OIL NELSON - B.P. UNITY

Project
SAXON TREE SB GAS LIFT JUMPER
SAXON TREE SB PRODUCTION JUMPER
SAXON TREE SA PRODUCTION JUMPER
SAXON TREE SA GAS LIFT JUMPER
SAXON GAS LIFT FLOWLINE
SAXON PRODUCTION FLOWLINE
PICT TREE GB GAS LIFT JUMPER
PICT TREE GB PRODUCTION JUMPER
PICT TREE GC GAS LIFT JUMPER
PICT TREE GC PRODUCTION JUMPER
PICT TREE GA GAS LIFT JUMPER
PICT TREE GA PRODUCTION JUMPER
PL3790
PL3790JWS62A
GROUSE 3IN PRODUCTION
GROUSE 6IN PRODUCTION
KITTIWAKE TO KITTIWAKE LOADING BUOY
FORTIES E TO FORTIES A OIL EXPORT
FORTIES E TO FORTIES A OIL TEST
WATER INJ LINE KITTIWAKE TO WELL GO-P1
GAS LIFT LINE KITTIWAKE TO WELL GO-P1
PROD FLOWLINE KITTIWAKE TO WELL GO-P1
4"" GAS KITTIWAKE - KITTIWAKE RECEIVER TEE
KITTIWAKE TO FULMAR GAS EXPORT LINE
KITTIWAKE TO OIL STORAGE TANKS OIL LINE
KITTIWAKE TO OIL STORAGE TANKS WI
KITTIWAKE OIL EXPORT
CRATHES TO KITTIWAKE PRODUCTION PIPELINE
PL3989
PL3990
BACCHUS MANIFOLD TO FORTIE ALPHA 5
BACCHUS MANIFOLD TO FORTIE ALPHA 2
BACCHUS MANIFOLD TO FORTIE ALPHA 7
BACCHUS MANIFOLD TO FORTIE ALPHA 1
BACCHUS MANIFOLD TO FORTIE ALPHA 4

Project
BACCHUS MANIFOLD TO FORTIE ALPHA 3
BACCHUS MANIFOLD TO FORTIE ALPHA 6
EVEREST TO FORTIES
FORTIES A TO FORTIES D FUEL GAS
PL3792
FORTIES A TO FORTIES C (DECOMM)
FORTIES A TO FORTIES C OIL EXPORT
FLEXIBLE PIPELINE 8IN OIL
FORTIES C TO FORTIES D FUEL GAS
FORTIES D TO FORTIES C
FORTIES C TO A EXPORT
FORTIES B TO FORTIES C
FORTIES B TO FORTIES C PROD PIPELINE
PL209
FORTIES BRAVO TO FORTIES CHARLIE
PL8
PL64
FORTIES C TO FORTIES B WI
PL721
FORTIES C TO CRUDEN BAY SPOOL
FORTIES C TO CRUDEN BAY (PL8)
BRAE A TO FORTIES C
FORTIES C TO CRUDEN BAY (PL721)
PL401
BUCHAN OIL EXPORT
BRUCE TO FORTIES UNITY
BRITANNIA TO FORTIES UNITY
SCOTT TO FORTIES UNITY
GOOSANDER P2 GAS LIFT LINE
GOOSANDER P2 PRODUCTION FLOWLINE
SCOLTY TO CRATES PRODUCTION PIPELINE
PL3993
PL3992
DURWARD 1 WELLHEADS TO 2 WELLHEADS UMB
DURWARD 1 WELLHEADS TO 2 WELLHEADS WATER

Project
DURWARD MANIFOLD TO 1 WELLHEADS (PL1289)
DURWARD MANIFOLD TO 1 WELLHEADS WATER
DURWARD MANIFOLD TO 1 WELLHEADS (PL1285)
DURWARD MANIFOLD TO 1 WELLHEADS GAS
DURWARD MANIFOLD TO 1 WELLHEADS OIL LINE
DURWARD MANIFOLD TO DAUNTLESS GAS
DURWARD MANIFOLD TO DAUNTLESS OIL LINE
DURWARD MANIFOLD TO DAUNTLESS WATER
DURWARD MANIFOLD TO DAUNTLESS
BRITANNIA TO ST FERGUS
TWEEDSMUIR 4IN GL TO SOUTH MAN
TWEEDSMUIR SOUTH PROD TO MAIN MAN
HANNAY CONTROL UMBILICAL
8IN PROD BUCHAN A TO HANNAY WELL 20/5C-G
HANNAY PRODUCTION
HANNAY GAS LIFT
MILLER TO ST. FERGUS
SAGE PIPELINE
SERVICE ST. FERGUS - GOLDENEYE
20"" GAS GOLDENEYE - ST. FERGUS
STATIC UMBILICAL -RISER TO BLACKBIRD
CONTROL UMBILICAL IB1 TO BLACKBIRD MAN
GAS LIFT FLOWLINE ETTRICK- BLACKBIRD
FLEX PRODUCTION FLOWLINE BLACKBIRD
BLACKBIRD INJECTION ETTRICK TO IB1
INFIELD PRODUCTION LINE 2
COMBINED MAIN CONTROL UMBILICAL
INFIELD PRODUCTION LINE 1
INFIELD GAS LIFT PIPELINE AND RISER
INFIELD WATER INJECTION PIPELINE
ETTRICK GAS EXPORT TO SSIV JUMPER
SSIV CONTROL UMBILICAL
ETTRICK GAS EXPORT PIPELINE AND RISER
WATER INJECTION STEP OUT PIPELINE
STEP OUT CONTROL UMBILICAL

Project
FHT SPOOL
BUZZARD (P) TO FORTIES HOT TAP
GOLDEN EAGLE TO ETTRICK GAS IMPORT/EXPOR
ETTRICK GAS EXPORT JUMPER AT SAGE
BUZZARD (P) TO SOUTHERN WI MANIFOLD
NTM TOWHEAD TO IN2 WELL
NTM TOWHEAD TO PN3 WELL
PN3 WELL TO NTM TOWHEAD
BUZZARD PLATFORM TO NTM TOWHEAD
NTM TOWHEAD TO BUZZARD PLATFORM
SSIV TOWHEAD SIDE TO NTM TOWHEAD
NTM TOWHEAD TO IN1 WELL
PN7 WELL TO NTM TOWHEAD
NTM TOWHEAD TO PN7 WELL
BUZZARD (P) TO CENTRAL WI MANIFOLD
BUZZARD (P) TO CAPTAIN TEE
PUQ PLATFORM TO SDC
SDC TO GOLDEN EAGLE INFIELD GAS LIFT
SDC TO GOLDEN EAGLE INFIELD PRODUCTION
GOLDEN EAGLE TO CLAYMORE OIL EXPORT
NDC TO GOLDEN EAGLE INFIELD GL
NDC TO GOLDEN EAGLE INFIELD PRODUCTION
NDC TO GOLDEN EAGLE INFIELD WATER INJ
PUQ PLATFORM TO NDC
4"" MEG ST. FERGUS - ATLANTIC MANIFOLD
16"" GAS ATLANTIC MANIFOLD - ST. FERGUS
Vesterled
HFC TO ST. FERGUS SOUTH
36"" GAS BRENT A - ST. FERGUS (FLAGS)
Tampnet Offshore FOC Network
SHEFA-2
Aspen
Green Volt
Salamander
Hywind

Project
Kincardine
Aberdeen Cable
North Sea Link
Eastern Greenlink 1
Eastern Greenlink 2
Spittal to Peterhead sub sea cable
Scottish Hydro electric Transmission SHET - L caithness to orkney
Neu Connect
Carbon Capture and Storage
Acorn Hydrogen
Acorn
Endurance
CS001 Licence Area
CS005 Licence Area
CS006 Licence Area
CS007 Licence Area
CS025 Licence Area
CS023 Licence Area
CS024 Licence Area
CS008 Licence Area
CS013 Licence Area
CS014 Licence Area
CS015 Licence Area
CS016 Licence Area
CS021 Licence Area
CS020 Licence Area
CS022 Licence Area
CS012 Licence Area
CS009 Licence Area
CS017 Licence Area
CS018 Licence Area
CS027 Licence Area
CS026 Licence Area
CS028 Licence Area
CS019 Licence Area

Project
Offshore Energy
Huntington Oil Field
Bolt 1
SEEWEC-FO3 B1
SEEWEC-FO3 B22
Mocean Energy Ltd
SeaGen Brough Ness
Ness of Duncansby
Ness of Duncansby phase 1
Ness of Duncansby phase 2
MeyGen Limited
Meygen Pentland Firth Phase 1a
Meygen Pentland Firth Phase 1c
Meygen Pentland Phase 2 & 3
Churchill Barrier No.2
Churchill Barrier No.1
Orbital Marine Power (Orkney)
EMEC Stronsay Firth Demonstration Site
EMEC Scapa Flow Scale Wave Test Site
Archimedes Wave Swing (AWS-Mk1)
EMEC Blue Horizon
EMEC Shapinsay Sound
EMEC Aquantis
EMEC Fall of Warness Tidal Energy Test Site
EMEC Bluewater TEC
Orbital Marine Eday Project
EMEC Magallanes 2
EMEC Magallanes 3
Lashy Sound Phase (Rest)
Lashy Sound Phase 1
Lashy Sound Phase 2
Orbital Marine Power Westray Firth
PowerBuoy Mark 3 ocean trials
EMEC Billia Croo
The European Marine Energy

Project
EMEC Ocean Energy
LAMWEC project
CorPower
EMEC Orbital O2
EMEC Orbital O2 - Phase II
AWS Ocean
Pulse Stream 100 Demonstration Project
Yell Sound Array
Stingray project-Phase 2
MAWEC/Leancon
Shetland Tidal Array (2) (EnFAIT))
Shetland Tidal Array Phase 1
Shetland Tidal Array Phase 2
Nova Innovation Ltd
Nova 30 Demonstrator
Folkecenter Wave Test Station (Nissum Bredning Test Station for Wave energy)
Sustainable Marine Energy Ltd
Dexawave (1/5 scale)
Wave Star (1/10 scale)
WaveDragon (1/10 scale Phase 1)
WaveDragon (1/10 scale Phase 2)
NEMOS (1/10 scale)
Danish Wave Energy Center (DanWEC)
Wavepiston
WavePlane
NEMOS sea test
Wave Net Array
Oran na Mara
Sound of Islay - QED Navel
Sound of Islay
Tidal test site Ameland
Argyll Tidal Demonstrator Project-Mull of Kintyre (Phase 2)
Mull of Kintyre (Phase 1)
Plat-O
Wave test site Texel

Project
Texel Pilot
Slow Mill
BlueTec ?oating platform
REDstack
Fair Head Tidal Array - Phase 2
Fair Head Phase 1
EMEC Islay Demonstration Zone
Bernera
West Islay Tidal Energy Farm
Harris Demonstration Zone
QUB Wave Test Site
Strangford Lough
Evopod E1 demonstration
DeepGreen 1/10
Avalon - INTOG
Cedar - INTOG
CampionWind Limited
Beech - INTOG
Bellrock Wind Farm Limited
Harbour Energy - INTOG
Ossian Offshore Windfarm
Aspen - INTOG
Muir Mhor Offshore Wind Farm
Morven Offshore Wind Limited
Avalon
Green Volt - INTOG
MarramWind
Bowdun Offshore Wind Farm
Flora - INTOG
Salamander - INTOG
Hywind (Scotland) Ltd - Buchan Deep
EN19
Seagreen Wind Energy Limited
Berwick OFTO
Berwick Bank

Project
Kincardine Offshore WF Ltd
Buchan Offshore Wind Ltd
Marr Bank
Seagreen OFTO
Seagreen 1A OFTO
Seagreen 1A Limited
Aberdeen Offshore WindFarm Ltd
Scaraben - INTOG
Broadshore Offshore Wind Farm
Inch Cape
Dogger Bank B
Sinclair - INTOG
Sofia
Inch Cape OFTO
Dogger Bank C
Neart Na Gaoithe Offshore Wind
Neart Na Gaoithe OFTO
Moray OFTO
Stromar Offshore Wind Farm
Caledonia Offshore Wind Farm
Nordsren III vest
Dogger Bank A
EN17
Dogger Bank South West
Moray Offshore Wind Farm
Blyth Demonstration Phases 2&3
Ayre Offshore Wind Farm
Dogger Bank South East
Blyth Demonstration Phase 1
Moray Offshore Windfarm (West)
EN18
Beatrice Offshore Wind Farm Li
EN20
ForthWind Offshore Wind Demonstration Project - phase 1
Jyske Banke

Project
Nordsren III
EN15
Teesside
EN16
Hornsea Project Four (HOW04)
Nordsren II vest
Nordsren II
Westray South
EN14
ARVEN Area 2
Hornsea Project 2 - Phase 2 (Soundmark)
Hornsea Project 2 (HOW02) Wind Farm
Hornsea Project 2 - Phase 1 (Breesea)
ARVEN Area 3
Hornsea Project 1 (Heron West) Wind Farm
Hornsea Project Three (HOW03)
Hornsea Project 2 - Phase 3 (Sonningmay)
Hornsea Project 1 (Heron East) Wind Farm
Hornsea Project 1 (Njord) Wind Farm
Pentland Floating Offshore Wind Demonstrator
Nordsren I
EN13-Nord
West of Orkney
ARVEN Area 1
EN13
Westermost Rough
EN12
Thor
EN10
N-10.2
EN11
Outer Dowsing
N-9.4
EN9
Humber Gateway

Project
Sandbank
Containing Cluster Boundary - EN5
N-9.3
N-9.2
Doordewind II
N-9.1
N-10.1
Triton Knoll
Vesterhav Nord
Horns Rev III
N-6.7
Containing Cluster Boundary - EN6
Nederwiek Noord II/III
Dan Tysk
Horns Rev II
Deutsche Bucht
Robin Rigg
Veja Mate
Vesterhav Syd
Bard Offshore 1
Containing Cluster Boundary - EN8
RÃ¸nland
EnBW Albatros
Nissum Bredning
Containing Cluster Boundary - EN7
Dudgeon Extension
Global Tech I
EnBW He Dreiht
N-6.6
Ten Noorden van de Wadden
EnBW Hohe See
Race Bank
Dudgeon
N-7.2
Part of EnBW He Dreiht - Merge

Project
Sheringham Shoal Extension
Horns Rev I
Lincs
ZeeEnergie / Gemini II
Lagelander Noord (2-n)
Inner Dowsing
Sheringham Shoal
Nederwiek Zuid I
Buitengaats / Gemini I
East Anglia North Tranche 2 (Norfolk Boreas)
Lynn
Borkum Riffgrund 3
FanÃ¸ Bugt
Butendiek
Jammerbugt
Walney 2
Walney 1
West of Duddon Sands
Trianel Windpark Borkum Phase 1
Containing Cluster Boundary - EN2
East Anglia North Tranche One West (Norfolk Vanguard West)
Trianel Windpark Borkum Phase 2
Walney Extension 4
IJmuiden Ver
Walney Extension 3
Merkur Offshore (MEG Offshore I)
IJmuiden Ver Noord (IJ-Ver-n)
Borkum Riffgrund 2
Borkum Riffgrund 1
Alpha Ventus
N-3.6
Containing Cluster Boundary - EN3
Lagelander Zuid (2-z)
IJmuiden Ver 2021 - Y-VER
Same as OE_WindFarm_283

Project
Nordsee Two
Morgan
N-3.5
Morecambe
East Anglia North Tranche One East (Norfolk Vanguard East)
Nordsee One
Containing Cluster Boundary - EN4
Amrumbank West
Gode Wind 02
Gode Wind 01
Kaskasi II
Nordsee Ost
Hollandse Kust E
Hollande Kust (Noord)
Gode Wind 3
N-3.7
Meerwind Sued/Ost
Mona
Talisk
East Anglia Three
Riffgat
Burbo Bank
Scroby Sands
Burbo Bank Extension
Hollandse Kust D
Hollandse Kust West - N
Hollandse Kust West VI
Gwynt y Mor
North Hoyle
Awel y Mor
Rhyl Flats
Yell Tidal Energy Ltd
EMEC Fall of Warness Tidal test Site
EMEC Billia Croo Wave Test Site
Sound of Islay Community Turbine

Project
MeyGen Tida Energy Project Phase 2 and 3
Shetland Tidal Array
West Islay Tidal Energy Park
Galatea - galene
Stora middelgrund
Oil and Gas
Rosebank development
Teal west Development
Avalon Field development
Oil and Gas Field Developments
ARBROATH
ETAP QU
ETAP PDR
ELGIN PUQ
ELGIN A WHP
ELGIN B WHP
WEST FRANKLIN WHP
GANNET A
CULZEAN LIVING QTRS AND UTILITY (ULQ)
CULZEAN PROCESSING PLATFORM (CPF)
CULZEAN WHP JACKET
FRANKLIN WHP
MONTROSE A
MONTROSE BLP PLATFORM
SHEARWATER A
SHEARWATER C
CULZEAN FSO - AILSA
TRITON
ERSKINE
ANASURIA
MUNGO
LOMOND
PIERCE WAVERIDER
PIERCE FPSO HAEWENE BRIM
FPF1

Project
CATCHER
JADE
NELSON A
JACKDAW
JASMINE JLQ
JASMINE WELLHEAD PLATFORM
FORTIES ECHO
KITTIWAKE
FORTIES ALPHA
FASP
FORTIES DELTA
JUDY JRP
JUDY
CATS RISER
NORTH EVEREST
FORTIES CHARLIE
FORTIES BRAVO
FORTIES UNITY
FULMAR A
FULMAR AD
ULA QP
ULA DP
ULA PP
GYDA-Y
ULA-Y
AUK A
CLYDE
HUMMINGBIRD FPSO
ARMADA
TAMBAR
ANDREW
ODA
BRITANNIA BLP
BRITANNIA
ALBA

Project
ALBA NORTH
EKOFISK B
EKOFISK K
TOR 2/4 YA
EKOFISK BS3
EKOFISK C
EKOFISK X-BS
EKOFISK X
TOR 2/4 YB
TEESSIDE SSIV
EKOFISK J
EKOFISK VA
EKOFISK M
EKOFISK M-BS
EMDEN SSIV
EKOFISK L-BS
EKOFISK L
EKOFISK Z
EKOFISK VB-T
EKOFISK VB
EKOFISK VC
SIGYN
DRAUPNER S
DRAUPNER E
ELDFISK B
ELDFISK B-FL
VALHALL SSPR
VALHALL VTS
NORPIPE Y
UTGARD
37/4-BP
BOOSTER PLATFORM 37/4A NORPIPE A.S
FPSO GLOBAL PRODUCER III
SLEIPNER A
ELDFISK A

Project
ELDFISK S
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ELDFISK E
SLEIPNER T
SLEIPNER R
SLEIPNER FL
EMBLA
SLEIPNER D
SLEIPNER B
SLEIPNER C
VALHALL FLANKE NORD
SCOTT JD
SCOTT JU
TIFFANY
GINA KROG T
15/9-E
VALHALL FLANKE VEST
VALHALL WP
VALHALL IP
VALHALL BVS
VALHALL PH
VALHALL FLANKE SUR
GINA KROG
GINA KROG FSO
PIPER B
HOD B
WELLHEAD (W)
PRODUCTION (P) JACKET
QUARTERS UTILITIES (QU) JACKET
GOLDEN EAGLE PUQ PLATFORM
GOLDEN EAGLE WELLHEAD PLATFORM
BRAE A
CLAYMORE CPP
16/4 SOLVEIG BC
16/4 SOLVEIG BE

Project
CLAYMORE CAP
16/4 SOLVEIG BD
16/4 SOLVEIG BB
16/4 SOLVEIG BA
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GUDRUN
TRYM
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JOHAN SVERDRUP E
JOHAN SVERDRUP H
YME SLS
ROSS
CRUDEN BAY TANKS
ST FERGUS GAS TERMINAL
Syd Arne - wellhead platform N

Project
Syd Arne
Syd Arne - wellhead platform E
Syd Arne - offloading facility
Ravn A
25/11 M4W BALDER
CAPTAIN
CAPTAIN WPPA
CAPTAIN BLPA
25/11 BALDER B
25/11 BALDER D
GRANE-Y
25/11 BALDER FT
25/10 WI BALDER
25/11 BALDER GT
25/8 BALDER H
KRAKEN FPSO
KATY KT
44/23A KELVIN TM
FLOTTA MARINE OIL TERMINAL
NIGG BAY
TOLMOUNT
BRASSE
48/9A MIMAS
49/11B TETHYS
31/5-7 EOS
KOLLSNES T
31/2-D-3 H TROLL D-3
TROLL R
VISUND T
35/11-B-31 H
VIGDIS-Y
34/4-I-1 H SNORRE
FRANPIPE T
34/8-A-18 AH/H
34/8-A-20 H

Project
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NOVA X
NOVA W
PENGUINS FPSO
FLORr T
Port and Harbour Development
Peterhead
Aberdeen
Dundee
Forth
Kirkwall
Cromarty Firth
Ports and Harbours
Aberdeen Harbour Expansion
Peterhead Sea Wall repair
Port of Cromarty Firth - Phase 4
Port of Dundee expansion
Port of Leith
Port of Leith - outer berth
Quay improvement works Ardrossan Harbour
Redevelopment of Dundee East
Rosyth International Container Terminal
Scapa deep water quay
Scapa pier enhancements
Scotstoun deep water berth project
St ola pier redevelopment, Scrabster

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Appendix 5D: Transboundary Screening Matrix

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1. TRANSBOUNDARY SCREENING MATRIX

1.1 Introduction

1.1.1.1 This Appendix identifies the transboundary receptors of relevance to Cenos Offshore Windfarm (the Project) and considers the potential significant effects from the construction, operation and maintenance and decommissioning of the offshore aspects of the Project on those transboundary receptors.

1.1.1.2 Transboundary effects may occur when impacts from a development within Member States (European Economic Area (EEA) States) affects the environment of another EEA State(s).

1.1.1.3 The primary purpose of this appendix is to provide a screening assessment of potential transboundary impact that have the potential to affect Member States.

1.2 Legislative context

1.2.1.1 The United Nations Economic Commission for Europe Convention on Environmental Impact Assessment (EIA) in a transboundary context (adopted in 1991 as the 'Espoo Convention') was negotiated to enhance the cooperation between EEA States in assessing environmental effects. The Espoo Convention has been transposed into Scottish EIA law by way of Regulation 29 of the Electricity Works (EIA) (Scotland) Regulations 2017[1], Regulation 30 of the Marine Works (EIA) (Scotland) Regulations 2017[2]. These Regulations set out the processes for consultation and notification. In the event that a project is considered to cause significant transboundary effects, the EIA Regulations 2017 require Scottish Ministers to engage with the affected EEA State and invite them to participate in consultation. **Chapter 5: Approach to Scoping and EIA** provides full details on the approach to the transboundary effects assessment.

1.2.1.2 Following the exit of the UK from the European Union (EU) in December 2020, the UK is no longer an EU Member State. However, for the purposes of assessing potential transboundary effects, the approach outlined above has been followed by the Project.

1.2.1.3 **Table 1-1** sets out the Regulations of relevance to the assessment of transboundary effects. **Chapter 2: Legislative and Policy Context** provides an overview of the relevant legislation and policy for the Project.

1.2.1.4 The screening for potential significant effects on the environment of another EEA State may take place at any time when new relevant information becomes available. Where a potential significant effects on the environment of any other EEA State(s) is identified, the role of the Scottish Ministers includes the identification of EEA State(s) to be notified, notification of the State(s) that an effect is likely, consultation with the EEA State(s), and notification to the EEA State(s) of the outcome of the application for the EIA project.

Table 1-1 EIA Regulations 2017 relevant to transboundary effects

EIA Regulations	Relevance to transboundary
Regulation 5 of The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 Regulation 6 of The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017	Require that an application for an 'EIA project' must be accompanied by an Environmental Impact Assessment Report (EIAR). The EIAR must include information stipulated by the Regulations 5 and 6.
Schedule 4 of The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017	Requires that description of likely significant effect should include those that are of transboundary nature.
Regulation 29 of The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 Regulation 30 of The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017	Establish the procedural duties necessary where the Scottish Ministers are of the view that an EIA project is likely to have significant effects on the environment in another EEA State; or where another EEA state is of the view that its environment is likely to be affected by an EIA Project.
Regulation 19 of The Marine Works (Environmental Impact Assessment) Regulation 2007 (as amended)	The appropriate authority must supply a copy of the environmental statement, and any additional information provided by the Applicant.

1.3 Screening considerations

1.3.1 Characteristics of the development

1.3.1.1 The Project is a new floating offshore windfarm located in the North Sea, with a generating capacity of up to 1,350 megawatts (MW). The Project will help with the decarbonisation of the oil and gas industry through the electrification of offshore oil and gas installations, while also providing surplus power to the UK grid.

1.3.1.2 The Project comprises of an Array Area and Import/Export Cable Corridor (ECC) (from (from Mean High Water Springs (MHWS) to the Array Area).

1.3.1.3 The Array Area comprises an area of approximately 333 km^2 and includes Wind Turbine Generators (WTGs), Floating Substructures, Moorings and Anchors, Inter-Array Cables and an Offshore Substation and Converter Platform. Full Project details can be found in **Chapter 3: Project Description**.

1.3.1.4 The construction of the Project will also include associated seabed preparation and, where necessary, scour protection.

1.3.1.5 Any effects and risks associated with pollution, nuisances and accidents have been considered (if required) within the relevant technical chapters (see **Chapter 7** to **Chapter 23** inclusive).

1.4 Location of Project and geographical area

1.4.1.1 The Project's generating infrastructure will be located in the Central North Sea, within the 'Scottish Zone' of the UK Exclusive Economic Zone (EEZ). It is part of the Innovation and Targeted Oil and Gas (INTOG) leasing process currently being undertaken by Crown Estate Scotland (CES) (see **Chapter 2: Legislative and Policy Context** for further detail).

1.4.1.2 The Project will be located within the INTOG 'E-a' Project Area (illustrated in **Figure 3–1, Chapter 3: Project Description**).

1.4.1.3 The 'Project Area' (illustrated in **Figure 1-1),** is defined as the term used to describe the consenting red line boundary within which the Project and associated infrastructure will be located.

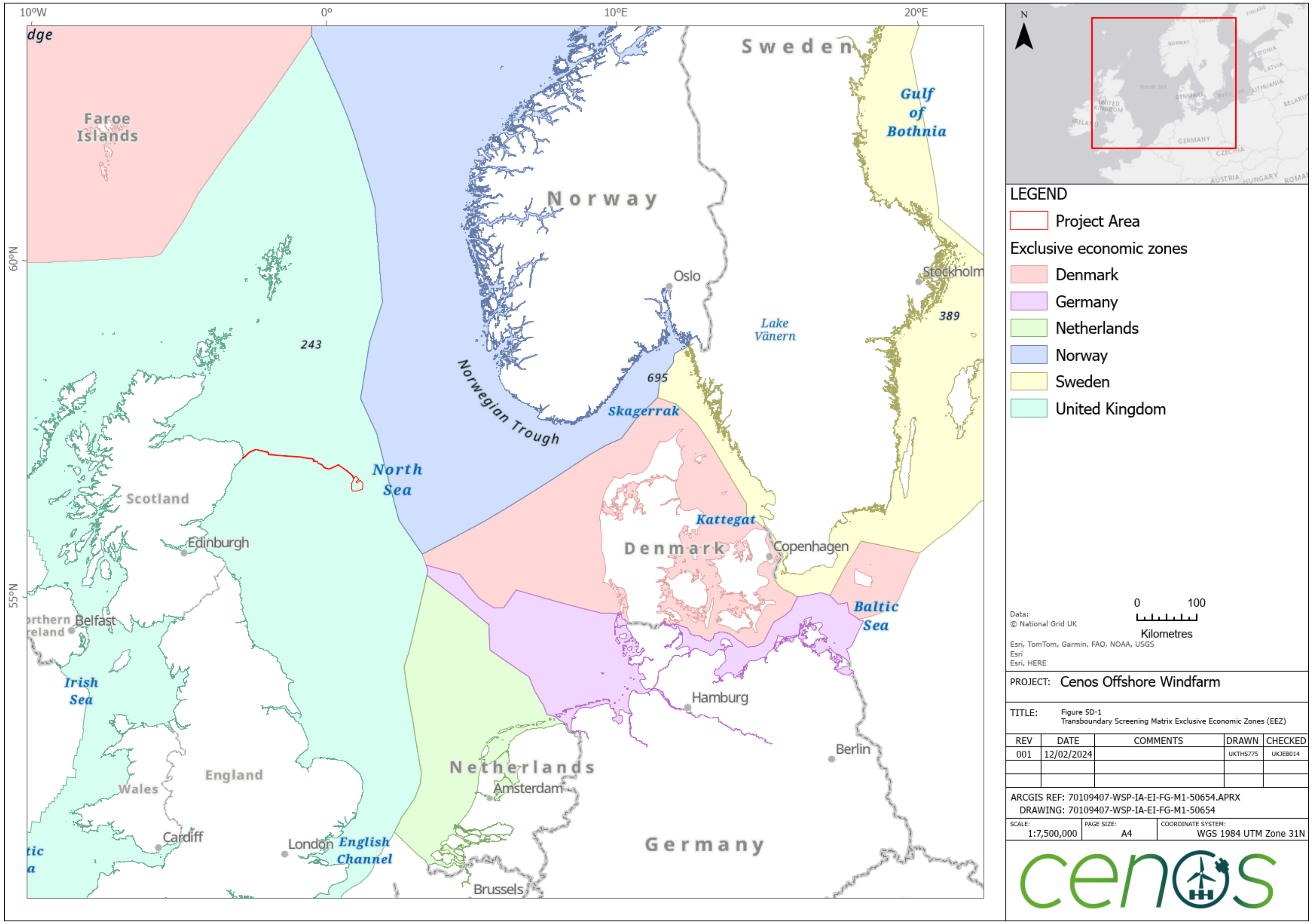
Distance to other EEA states

1.4.1.4 The Project Area includes areas that are outside of the 12 NM UK limit. Given the nature of the Project, it has been considered that the project may potentially have transboundary interactions with other EEA States. These, and their respective distances from the Project area, are outlined in **Figure 1-1** and **Table** Table below.

Table 1-2 Distance from EEZ

EEZ	Approximate Distance from the Scoping Boundary (km)
Denmark	149
Norway	43
Netherlands	181
Sweden	517
Germany	167

Figure 1-1 Transboundary screening matrix Exclusive Economic Zones (EEZ)



1.5 Screening matrix

1.5.1.1 A transboundary screening matrix has been completed for potential effects for the physical, biological and human environments that could arise from the Project. The conclusions presented have been drawn from the assessment undertaken to date through the scoping process. Any potential significant transboundary effects identified at this stage will be accounted for in the EIA Report (EIAR) and Habitats Regulation Appraisal (HRA) Report to Inform Appropriate Assessment.

1.5.1.2 The extent of the area likely to affect a jurisdiction of another EEA state is considered in:

- **Table 1-3**;
- **Table 1-4**; and
- **Table 1-5**.

1.5.1.3 Additional justification has been provided below each table where transboundary impacts are predicted.

Table 1-3 Offshore transboundary screening matrix: Physical and biological environment

Screening Criteria	Marine and Coastal Processes	Marine Water and Sediment Quality	Benthic Ecology	Marine Mammals	Ornithology	Fish Ecology
Characteristics of the development	The Project comprises of an Array Area and the ECC (from MHWS to the Array Area). The Array Area comprises an area of approximately 333 km^2 and includes WTGs, Floating Substructures, Moorings and Anchors, Inter-Array Cables and an Offshore Substation and Converter Platform. The Project will provide onward connection to five oil and gas assets located in the waters to the northeast and southeast of the Array Area for the purposes of electrification. For full project details, refer to **Chapter 3: Project Description.**					
Location of development and geographical area	The Project is located in the Central North Sea. The Array Area is located 185 km at its closest point from the coast / Scottish Mainland, offshore northeast of Aberdeen with broadly uniform water depths of approximately 90-100 m across the area. See **Chapter 3: Project Description.**					
Cumulative impacts	For potential cumulative effects see the 'Cumulative effects' subsection of each chapter.					
Potential Impacts and carrier **Environmental Importance** **Extent**	No significant transboundary effects are predicted. See marine and coastal processes section below (**section 1.5.2**).	No significant transboundary effects are predicted. See marine water and sediment quality section below (**section 1.5.2**).	No significant transboundary effects are predicted. See benthic ecology section below (**section 1.5.2**).	There is the potential for transboundary effects on marine mammals. See marine mammals section below (**section 1.5.2**).	There is potential for transboundary effects to occur to ornithology receptors. See ornithology section below (**section 1.5.2**).	There is potential for transboundary effects on fish ecology. See fish ecology section below (**section 1.5.2**).
Magnitude	To be determined in the EIA process.					

Screening Criteria	Marine and Coastal Processes	Marine Water and Sediment Quality	Benthic Ecology	Marine Mammals	Ornithology	Fish Ecology
Probability **Duration** **Frequency** **Reversibility**	No significant transboundary effects are predicted. See marine and coastal processes section below (**section 1.5.2**).	No significant transboundary effects are predicted. See marine water and sediment quality section below (**section 1.5.2**).	No significant transboundary effects are predicted. See benthic ecology section below (**section 1.5.2**).	There is the potential for transboundary effects on marine mammals. See marine mammals section below (**section 1.5.2**).	There is potential for transboundary effects to occur to ornithology receptors. See ornithology section below (**section 1.5.2**).	There is potential for transboundary effects on fish ecology. See fish ecology section below (**section 1.5.2**).
Screened in / out	Screened out	Screened out	Screened out	Screened in	Screened in	Screened in

1.5.2 Offshore physical and biological baseline environment

Marine and Coastal Processes

1.5.2.1 The closest transboundary is approximately 43 km to the East of the Array Area. In the Array Area tidal ellipses are capable of travelling approximately 5 km. As such, any mobilised sediments remain localised. No transboundary effects are therefore expected due to weak flows and sufficient distance from international boundary.

Marine Water and Sediment Quality

1.5.2.2 In the vicinity of the Array Area, the length of the spring tidal ellipse major axis is only about 5 km. This means that sediment and contaminant transport will be limited in extent, compared with a distance of approximately 43 km to the nearest international boundary (with Norway). On this basis, no significant transboundary impacts are unlikely.

Benthic Ecology

1.5.2.3 Any impacts on benthic subtidal and intertidal ecology will be confined to a localised area within the footprint of the Project's Array Area and ECC plus one tidal ellipse which is 5 km at the Array Area.

1.5.2.4 In conclusion, any impacts upon benthic subtidal and intertidal ecology will be limited to the UK EEZ, based on the current understanding of the baseline environment. Therefore, it is proposed that transboundary impacts upon benthic ecology are screened out of the EIA process.

Marine Mammals

1.5.2.5 The marine mammals baseline for the Project is outlined in **Chapter 10: Marine Mammals.**

1.5.2.6 There is the potential for transboundary underwater noise (UWN) effects on marine mammals during both construction and decommissioning phases. Although the Project lies within Scottish waters, marine mammals' range widely and may migrate over large distances.

1.5.2.7 Operational impacts may arise if the Project results in aggregation of prey species and a consequent change in foraging patterns and movements of marine mammals over a wider area. Marine mammals are keystone species and features of Qualifying Interest for numerous European conservation sites.

1.5.2.8 Generation of UWN is inevitable; the extent to which it may extend beyond UK waters will be determined following noise modelling. The periods of loud UWN will be restricted. Other effects with possible transboundary implications, e.g. fish aggregation, will be continuous. Given the transient nature of the impact, effects of UWN will be temporary. If impacts relating to prey distribution occur, these will last throughout the lifetime of the Project, though are likely to be reversible.

Ornithology

1.5.2.9 Transboundary impacts upon ornithological receptors are possible due to the wide foraging and migratory ranges of typical bird species in the North Sea.

1.5.2.10 The bird species likely to be present in the Project's Array Area, based upon the Project's aerial survey data gathered to date, are outlined in full in **Chapter 11: Ornithology.** These species include, but are not limited to, Guillemot, Fulmar, Kittiwake and Gannet.

1.5.2.11 Due to the proximity of the Project to the eastern boundary of the UK EEZ, and therefore seabird colonies in the eastern North Sea, and the wide-ranging distribution of seabirds, there is potential for transboundary effects to occur to ornithological receptors. The area of search for Transboundary Effects is the North Sea, with potential connectivity between the Project and seabird colonies at designated sites outside of Scotland.

1.5.2.12 During the breeding season, Woodward *et al.*[3] foraging ranges will be used to determine transboundary connectivity.

Fish Ecology

1.5.2.13 The fish ecology baseline for the Project is outlined in **Chapter 12: Fish Ecology.**

1.5.2.14 Important Atlantic mackerel and sandeel spawning grounds are found east of the Array Area in Norwegian waters. Transboundary impacts may arise if long range acoustic effects on fish are identified during the spawning period. Mackerel spawn typical between May and June and sand eel between January and February.

Table 1-4 Offshore transboundary screening matrix: Human environment

Screening criteria	Commercial Fisheries	Shipping and Navigation	Marine Archaeology	Seascape, Landscape and Visual (SLVIA)	Marine Infrastructure and Other Users	Military and Civil Aviation
Characteristics of the development	See **Table 1-3** for details.					
Location of development and geographical area	See **Table 1-3** for details.					
Cumulative impacts	For potential cumulative effects see the 'Cumulative effects' subsection of each chapter.					
Potential Impacts and carrier **Environmental Importance** **Extent**	No significant transboundary effects are predicted. See commercial fisheries section below (**section 1.5.3**).	There is potential for transboundary effects to occur on Shipping and Navigation. See Shipping and Navigation section below (**section 1.5.3**).	No significant transboundary effects are predicted. See marine archaeology section below (**section 1.5.3**).	No significant transboundary effects are predicted for SLVIA. See SLVIA section below (**section 1.5.3**).	There is potential for transboundary effects to occur on Marine Infrastructure and other users. See section below (**section 1.5.3**).	No significant transboundary effects are predicted. See Military and Civil Aviation section below (**section 1.5.3**).
Magnitude	To be determined in the EIA process.					

Screening criteria	Commercial Fisheries	Shipping and Navigation	Marine Archaeology	Seascape, Landscape and Visual (SLVIA)	Marine Infrastructure and Other Users	Military and Civil Aviation
Probability **Duration** **Frequency** **Reversibility**	No significant transboundary effects are predicted. See commercial fisheries section below (**section 1.5.3**).	There is potential for transboundary effects to occur on Shipping and Navigation. See Shipping and Navigation section below (**section 1.5.3**).	No significant transboundary effects are predicted on marine archaeology. See marine archaeology section below (**section 1.5.3**).	No significant transboundary effects are predicted for SLVIA. See SLVIA section below (**section 1.5.3**).	There is potential for transboundary effects to occur on Infrastructure and other users. See section below (**section 1.5.3**).	No significant transboundary effects are predicted. See Military and Civil Aviation section below (**section 1.5.3**).
Screened in/ out	Screened out	Screened in	Screened out	Screened out	Screened in	Screened out

1.5.3 Offshore human environment

Commercial Fisheries

1.5.3.1 As described in **Chapter 13: Commercial Fisheries**, non-UK fishing vessels may target fishing grounds within the commercial fisheries study area at times, however, activity by these vessels concentrates to the south of the ECC and the overlap with the Project is expected to be negligible. As such, no transboundary impacts associated with commercial fishing are expected as a result of the Project and these are screened out from the assessment.

Shipping and Navigation

1.5.3.2 The shipping and navigation baseline for the Project's Array Area and the ECC are outlined in **Chapter 14: Shipping and Navigation.**

1.5.3.3 There is the potential for transboundary impacts upon shipping routes which transit to/from other EEA countries including routes to/from Norway, Denmark, Germany and Netherlands. Transboundary issues could also arise from impacts upon international ports, other international shipping routes and/or routes affected by other international offshore renewable energy developments.

1.5.3.4 Due to the international nature of shipping, and that since commercial (international) routeing is captured in the existing baseline environment, the environmental assessment for any project in isolation and cumulatively with other projects will already suitably consider any effect on shipping and navigation receptors in transboundary terms. Therefore, an assessment of transboundary impacts will be undertaken as part of the EIA in isolation and as part of the cumulative assessment. Accordingly, transboundary impacts upon shipping and navigation are not screened out at this time.

Marine Archaeology

1.5.3.5 Due to the localised nature (limited entirely to within the UK EEZ) of any potential impacts on known marine archaeological and cultural heritage receptors, transboundary impacts are unlikely to occur and therefore it is proposed that this impact will be screened out from further consideration within the EIA.

1.5.3.6 There is a potential for paleochannels and palaeolandscapes within the North Sea to stretch beyond international boundaries. The impact on submerged landscapes in those cases is expected to be local within the Project and will be mitigated and offset by archaeological assessments of geophysical and geotechnical data.

Seascape, Landscape and Visual (SLVIA)

1.5.3.7 No transboundary effects have been identified and there is no potential for offshore elements of the Project to have a significant effect on the SLVIA receptors of an adjacent state.

Marine Infrastructure and Other Users

1.5.3.8 The baseline for marine infrastructure and other users is outlined in **Chapter 17: Marine Infrastructure and Other Users**.

1.5.3.9 Potential impacts upon infrastructure and other users are limited to activities surrounding oil and gas operations, cables, pipelines, as well as the potential for disruption to assets which provide products and services consumed or delivered outside the UK national borders. Engagement with stakeholders operating or owning assets will be undertaken to confirm the extent of potential transboundary effects.

1.5.3.10 Therefore, it is proposed that transboundary impacts upon marine infrastructure and other users are assessed further within the EIA and are not screened out at this time.

Military and Civil Aviation

1.5.3.11 Potential effects upon aviation during the operation and maintenance phase include potential disturbance to commercial helicopter transiting to oil and gas installations in the Central North Sea from UK airports. The Project is entirely within the UK Flight Information Region and therefore no transboundary effects are predicted in relation to aviation airspace.

1.5.3.12 Therefore, due to the localised nature of potential impacts, transboundary impacts are considered unlikely to occur and therefore it is proposed that military and civil aviation is considered screened out from further consideration within the EIA, with regard to transboundary effects.

Table 1-5 Other environmental aspects

Screening criteria	Carbon and Greenhouse Gases	Climate Change Resilience	Socio-Economics	Materials and Waste	Major Accidents and Disasters
Characteristics of the development	See **Table 1-3** for details.				
Location of development and geographical area	See **Table 1-3** for details.				
Cumulative Impacts	For potential cumulative effects see the 'Cumulative effects' subsection of each chapter.				
Potential Impacts and carrier **Environmental Importance** **Extent**	No significant transboundary effects are predicted. See carbon and greenhouse gases section below (**section 1.5.4**).	No significant transboundary effects are predicted. See climate change resilience section below (**section 1.5.4**).	No significant transboundary effects are predicted. See socio-economics section below (**section 1.5.4**).	No significant transboundary effects are predicted. See materials and waste section below (**section 1.5.4**).	There is potential for transboundary effects to occur from major accidents and disasters. See Major Accidents and Disasters section below (**section 1.5.4**).
Magnitude	To be determined in the EIA process.				
Probability **Duration** **Frequency**	No significant transboundary effects are predicted. See carbon and Greenhouse Gases	No significant transboundary effects are predicted. See climate change	No significant transboundary effects are predicted. See socio-economics	No significant transboundary effects are predicted. See materials and	There is potential for transboundary effects to occur from major accidents and disasters. See Major Accidents and Disasters

Screening criteria	Carbon and Greenhouse Gases	Climate Change Resilience	Socio-Economics	Materials and Waste	Major Accidents and Disasters
Reversibility	section below (**section 1.5.4**).	resilience section below (**section 1.5.4**).	section below (**section 1.5.4**).	waste section below (**section 1.5.4**).	section below (**section 1.5.4**).
Screened in/ out	Screened out	Screened out	Screened out	Screened out	Screened in

1.5.4 Other environmental aspects

Carbon and Greenhouse Gases (GHG)

1.5.4.1 The contextualisation of GHG emissions, by its nature, incorporates potential transboundary impacts.

1.5.4.2 Potential transboundary impacts to GHG arising from the construction, operation and maintenance and decommissioning of the Project will be assessed in the future baseline against the UK and Scottish carbon budgets and net zero targets, set under international commitments to the Paris Agreement.

1.5.4.3 A separate transboundary assessment is not required and is hence screened out.

Climate Change Resilience

1.5.4.4 The Climate Change Resilience assessment is an assessment of the effect of climate change on the Project, and not the effect of the Project on the environment, in the UK or with any transboundary effects. No transboundary effects are anticipated on the basis that climate change adaptation effects and impacts are specific to the development and will not result in impacts to an adjacent state. Therefore, a transboundary assessment is not required.

Socio-Economics

1.5.4.5 An extended supply chain for labour, services, equipment or materials may lead to transboundary socio-economic impacts outside the UK. However, the level of purchases arising from the Project is considered to be relatively small compared to the size of the well-developed international markets in which they take place, and the assessment of transboundary effects is proposed to be screened out.

Materials and Waste

1.5.4.6 The materials and waste assessment considers the material resources required form the scheme which will be from regional / national sources. The manufacturers delivering the commodities and pre-fabricated component parts will be subject to country specific controls to operate. The sector is a growth sector, and manufacturers will inherently be aware of the supply requirements necessary to deliver future developments. The assessment also considers remaining landfill capacity which is local / regional to the scheme. Therefore, the assessment of transboundary effects is proposed to be screened out.

Major Accidents and Disasters (MA&D)

1.5.4.7 By definition, a MA&D event could result in a significant environmental effect and may result in transboundary effects. The EIAR will consider potential transboundary effects for those MA&D types which have been scoped in for further assessment.

1.6 Consultation

1.6.1.1 Where there is potential for a proposed development to have significant effects on the environment of another EEA State(s) (or where the Scottish Ministers receive a request for the involvement from an EEA State), the Scottish Ministers are required to undertake a consultation and notification process under:

- Regulation 29, for The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017;
- Regulation 30 of The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017; and
- Regulation 20 of The Marine Works (Environmental Impact Assessment) Regulations 2007.

1.7 Summary

1.7.1.1 Based on current information available, there is the potential for significant effects arising from the Project on the interests of EEA States and as such transboundary effects may arise. Those impacts for which transboundary effects may arise, and which are therefore screened into the EIA, are listed below:

- Marine Mammals;
- Ornithology;
- Fish Ecology;
- Shipping and Navigation;
- Marine Infrastructure and Other Users; and
- Major Accidents and Disasters.

1.8 References

[1] *The Electricity Works (Environmental Impact Assessment) (Scotland) regulations 2017. (SI 2017 101)*. Available at: https://www.legislation.gov.uk/ssi/2017/101/contents/made (Accessed: 25 January 2024).

[2] *The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017. (SI 2017 115).* Available at: https://www.legislation.gov.uk/ssi/2017/115/contents/made (Accessed: 25 January 2024).

[3] Woodward, I., Thaxter, C. B., Owen, E. and Cook, A.S.C.P. (2019). *Desk-based revision of seabird foraging ranges used for HRA screening*. BTO research report number 724.

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Appendix 5E: Marine Protected Area Screening Assessment

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1. MARINE PROTECTED AREA SCREENING ASSESSMENT

1.1 Introduction

1.1.1 Project background

1.1.1.1 Cenos Offshore Windfarm ("the Project") has been created as a 50/50 Joint Venture (JV) between Flotation Energy (FE) and Vårgrønn As (Vårgrønn) hereafter referred to as 'the Applicant'. The Project is planned to deliver 1350 megawatts (MWs) of floating offshore wind energy in the United Kingdom (UK) Central North Sea in Scottish waters.

1.1.1.2 In November 2023, the Applicant signed the exclusivity agreement for the Project under Crown Estate Scotland's (CES) Innovation and Targeted Oil and Gas (INTOG) leasing round. When completed, the windfarm will provide de-carbonised power to offshore oil and gas assets and provide a shore link to export excess power to the UK grid and import as required.

1.1.1.3 The Project is located approximately 185 km at its closest point from the coast / Scottish Mainland, off the east coast of Scotland in water depths ranging from 90 m – 100 m, with Project area of approximately 333 square kilometres (km^2). It is currently envisaged that the Project area will comprise up to 95 floating Wind Turbine Generators (WTGs), mooring lines, anchor systems, inter-array cables, and a fixed foundation substation. The proposed Export/Import Cable Corridor (ECC) extends approximately 230 km from the western side of the array and proceeds westerly to mean high water springs (MHWS).The ECC is 1,000 m wide (500 m either side of the survey line).

1.1.1.4 The section of the ECC from MHWS to 12 nautical miles (NM) is the same as the NorthConnect Cable Corridor. The Applicant is coordinating with NorthConnect Limited. NorthConnect Interconnector and the Project will only require one set of infrastructure, within the overlapping marine licence Project Area from MHWS to 12 NM.

1.1.1.5 The section of the ECC from MHWS to 12 NM has previously been assessed within the EIA Report submitted for NorthConnect Limited (application reference number 06771 & 06870) and judged acceptable through the consenting of NorthConnect. The previous EIA work for NorthConnect will be considered in assessing the ECC from MHWS to 12 NM, updated by any other readily available information and surveys undertaken.

1.1.2 Purpose of the document

1.1.2.1 The purpose of this document is to outline the approach for a Marine Protected Area (MPA) assessment for the Project, and present the findings of the initial screening assessment. For the purposes of the MPA Screening Assessment the Project is defined as the ECC (MHWS – Array Area) and the Array Area as illustrated in **Figure 5E-1**.

1.1.2.2 An MPA Screening Assessment is required for the Project to accompany the marine licence application. Specific consideration of MPA is required for consent applications in UK waters. The Marine (Scotland) Act 2010 and the Marine and Coastal Access Act 2009 introduced provisions to support the management of MPA under section 83 and section 126, respectively. The Marine Directorate Licensing Operations Team (MD-LOT), as the Competent Authority, are required to consider whether the licensable activity applied for is capable of affecting (other than insignificantly) a protected feature in an MPA or any ecological or geomorphological process on which the conservation of any protected feature in an MPA is dependent. The methodology of this assessment, therefore, deviates slightly from the overarching Environmental Impact Assessment (EIA) methodology found in **Chapter 5: Approach to Scoping and EIA** of this 2024 Scoping Report, so as to consider the conservation objectives of each MPA and the methodology adopted is set out in Section 1.4 of this report.

1.1.2.3 This document has been prepared in line with the relevant guidance published in "*Marine Conservation Zones and Marine Licensing*"[1]. No formal guidance on the MPA Screening Assessment process has been issued by the Scottish Government's Marine Directorate; however, the archived "*Nature Conservation Marine Protected Areas: Draft Management Handbook*"[2] published in 2013, which follows a similar approach to the Marine Management Organisation (MMO) guidance, is referred to in the context of regional applicability.

1.1.2.4 The full MPA Screening Assessment will be submitted with the Environmental Impact Assessment Report (EIAR) and will consider any advice received through consultation. The consultation responses relevant to this document are presented in Section 1.2 of this report.

1.1.3 Legislative context

1.1.3.1 The Marine (Scotland) Act 2010 and the Marine and Coastal Access Act 2009 introduced provisions to support the management of MPA. Respectively, the Marine (Scotland) Act 2010 affords protection to Nature Conservation Marine Protected Areas (NCMPA) within Scottish territorial waters (out to 12 NM), and the Marine and Coastal Access Act 2009 affords protection to Marine Conservation Zones (MCZs) within English territorial and offshore waters, and NCMPA within Scottish offshore waters (for instance, beyond 12 NM).

1.1.3.2 Under section 83 of the Marine (Scotland) Act 2010 and section 126 of the Marine and Coastal Access Act 2009, MD-LOT "*is required to consider whether a licensable activity is capable of affecting, other than insignificantly, a protected feature of an NCMPA or any ecological or geomorphological process on which the conservation of any protected feature in an NCMPA is dependent*".

1.1.3.3 Under Section 116(7) of the Marine and Coastal Access Act 2009, an MCZ designated by Scottish Ministers under Section 116 is to be known as an NCMPA, and any reference to an MCZ within the Marine and Coastal Access Act 2009 is to be read as a reference to an NCMPA.

1.1.3.4 MD-LOT must not grant authorisation of an activity unless the Applicant satisfies them that there is no significant risk of the activity hindering the achievement of the conservation objectives for the NCMPA. If MD-LOT believes that there is or may be a significant risk of a proposal hindering the achievement of the conservation objectives, then they must notify the conservation bodies (NatureScot for MPA within

12 NM or the Joint Nature Conservation Committee (JNCC) for MPA seaward of 12 NM) of that fact.

1.1.3.5 In summary, the introduction of the Marine (Scotland) Act 2010 and the Marine and Coastal Access Act 2009 means the Scottish Government has the authority to introduce statutory marine planning for Scotland's seas. The Marine (Scotland) Act 2010 provides powers to designate MPA within the Scottish territorial waters, and the Marine and Coastal Access Act 2009 provides powers to designate sites in the rest of Scottish waters. Therefore, section 83 of the Marine (Scotland) Act 2010 and section 126 of the Marine and Coastal Access Act 2009, place specific duties on MD-LOT with regard to MPA and decision-making through the marine licence function.

1.1.3.6 If the Applicant is not able to satisfy MD-LOT that there is no significant risk of the licensable activity hindering the achievement of the conservation objectives, then a licence will only be granted if:

- MD-LOT is satisfied that there are no other means of proceeding with the licensable activity that will create a substantially lower risk of hindering the achievement of those objectives (to include proceeding in another manner or at another location).
- MD-LOT is satisfied that the benefit to the public of proceeding with the licensable activity clearly outweighs the risk of damage to the environment that will be created by proceeding with it.
- MD-LOT is satisfied that the Applicant will undertake, or make arrangements for the undertaking of, measures of environmental benefit equivalent to the damage that the activity will or is likely to have in or on the MPA concerned.

1.1.3.7 The necessary stages of an MPA Screening Assessment[a] are described in Section 1.4. This document presents the initial screening findings. The main assessment of the designated MPA will then be submitted with the EIAR as part of a complete environmental assessment in support of the licence application.

1.2 Consultation

1.2.1.1 No specific consultation directly related to the MPA Screening Assessment has been undertaken to date. However, the 2023 Scoping Opinion, received in June 2023, from MD-LOT included a number of comments regarding the requirement of a standalone MPA Screening Assessment. A stakeholder workshop was held in February 2024 where the Applicant discussed the scope, approach, evidence base, and potential effects/receptors considered in the MPA Screening Assessment. The relevant stakeholders included in the discussion were:

- MD-LOT (including the Marine Directorate’s MPA policy division);
- JNCC; and
- NatureScot.

[a] For the purpose of this report, MCZ and MPA will be collectively referred to as MPA(s) and MPA Screening Assessment, expect for when making direct reference to the guidance and then use the respective terminology (for example, English guidance – MCZ; Scottish guidance – NCMPA).

1.2.1.2 The comments received on the 2023 Scoping Report, and which are considered relevant to the MPA Screening Assessment are presented in **Table 1-1**. However, it is important to note that a new Scoping Opinion is expected in 2024 (2024 Scoping Opinion) and the consultation responses will also be included in the EIAR.

Table 1-1 :Summary of stakeholder consultation on the 2023 EIA Scoping Report

Consultee	Issue(s) raised	Response
Consultation on the project: Scoping Opinion		
NatureScot	"*In terms of methods to undertake the assessments, the information provided is either not sufficient, deviates from our guidance or is missing. We are therefore unable to understand what will be included in the application and supporting EIAR, HRA and the nature conservation MPA assessment or know if it will be sufficient to inform our assessment.*"	The MPA Screening Assessment will be included as an appendix to the EIAR. This report includes a MPA initial screening assessment only and is appended to the 2024 Scoping Report.
NatureScot	"*As you will also be aware the CENOS project lies wholly within the East of Gannet and Montrose nature conservation MPA and under the delegated authority between JNCC and ourselves, whilst we will take the lead on providing advice on this proposal to Marine Directorate-LOT, we will be relying on advice from JNCC on the assessment requirements for this NCMPA-as it is in offshore waters and they oversee the management of NCMPAs beyond 12 nautical miles. As such we have been in touch with JNCC and incorporate their advice at this stage in the comments below on the NCMPA.*"	The Applicant will take into consideration the advice from JNCC, as recommended by NatureScot, and incorporate it into the MPA Screening Assessment.
NatureScot	"*As the proposed development is entirely within the East of Gannet and Montrose Fields NCMPA, a comprehensive, standalone assessment will be needed, which considers the features of the site and their conservation objectives.*"	The MPA Screening Assessment will include the East of Gannet and Montrose Fields NCMPA, as well as other designated sites with the potential to be impacted by the Project. Section 1.4 of this MPA screening report present the screening approach to the MPA Screening Assessment.
NatureScot	"*The standalone NCMPA assessment against the conservation objectives for the site needs to consider all relevant activities (for example, turbines, anchors, cables and export cables etc) and should ensure all relevant*	The EIAR will assess impacts from all Project activities from construction to decommissioning on all the designated sites that could potentially be impact by the Project. Site specific survey data and data from literature review will be

Consultee	Issue(s) raised	Response
	ecological information is included in that assessment. Cross referencing between chapters should be limited or, if used exceptionally, clearly stated. It also must consider cumulative aspects for the site.”	used to establish the baseline and assess impacts against. The MPA Screening Assessment will be done concomitantly with the EIA. Cumulative impacts will also be assessed for the MPA Screening Assessment. Section 1.6 of this MPA screening report explains the approach to in-combination and cumulative effects for this type of assessment. Cross referencing will only be used where necessary to avoid repetitions within the same chapter or to refer to assessment undertaken in another chapter.
NatureScot	“*JNCC provide formal Conservation Advice on NCMPAs which provide background information on the site, features for which the site is designated and conservation objectives for those features.*”	The Applicant will include the background information on the designated sites and make use of the Conservation Advice published by JNCC.
NatureScot	“*This document provides useful information on conservation advice packages and how to use them: East of Gannet and Montrose Fields MPA Background Document.*”	The Applicant will include the conservation advice packages for all the designated sites with potential impact within the MPA Screening Assessment.
NatureScot	“*The Supplementary Advice on Conservation Objectives (SACO) provides detailed information for each of the attributes of the features for which the site is designated and should be used to consider the potential effects of the proposal.*”	The Applicant will use the Supplementary Advice on Conservation Objectives (SACO) in order to assess impacts against the features and conservation objectives of all the sites that could potentially be impacted.
NatureScot	“*The Advice on Operations provides details on human activities that could impact the site and hinder achievement of the Conservation Objectives. This is presented in the form of activities and pressures and we will expect all pressures related to the proposed activities to be scoped in, and justification provided where a pressure will be scoped out. The Advice on operations provides justification as to why a pressure is listed for a particular*	The Applicant will use the Advice on Operations to assess impacts against the features and conservation objectives of all the site that could potentially be impacted. Section 1.5.3 of this MPA screening report presents the potential impacts screened into the assessment.

Consultee	Issue(s) raised	Response
	feature and activity, with related references."	
JNCC	"*The project is located within the East of Gannet and Montrose NCMPA. Which is designated for 'Offshore deep-sea muds' and 'Ocean quahog aggregations (including sands and gravels as their supporting habitat)' and has a Conservation Objective of:* *− so far as already in favourable condition, remain in such condition.* *− so far as not already in favourable condition, be brought into such condition, and remain in such condition.* *The evidence presented in the application suggests that there may be other species or habitats of nature conservation interest affected by the proposed operations.* *− The Priority Marine Feature (PMF) 'Offshore deep-sea mud' is known to occur in the area.* *− The OSPAR T&D Species, Arctica islandica (ocean quahog) are known to occur in the area.* *• Operations include the collection of up to 50 sediment samples using either a dual van Veen grab (2×0.1m2) or a mini-Hamon grab (0.1m2). Samples will be directed via underwater video footage and geophysical surveys (multibeam and side scan sonar).* *The proposed operations are likely to impact upon 10m2 of the site.* *JNCC considers that the proposed operations are unlikely to affect, other than insignificantly, the protected features of the East of Gannet and Montrose NCMPA and therefore we do not object on marine nature conservation grounds.*"	Advice from JNCC suggests that collection of the sediment samples as part of the geophysical surveys for the Project will not have a significant effect on the East of Gannet and Montrose Fields NCMPA from a marine nature conservation perspective. The EIAR will assess impacts from all Project activities from construction to decommissioning on all of the designated sites that could potentially be impacted by the Project. Impacts against the designated features and conservation objectives of the sites will be assessed. Other species and habitats present in the MPA, but not as designated features, will also be assessed in the EIAR. The seabed footprint of the activities arising from the Project will be assessed fully in the EIAR, on the basis of the maximum design scenario. This will be replicated in the MPA Screening Assessment. The Applicant will be looking to understand the threshold for significant impacts of the MPA that could hinder the marine nature conservation objectives. Through the iterative process for refining the design parameters of the Project, the Applicant seeks to reduce the impacts on the MPA as much as is realistically possible.
Scottish Fisherman's Federation	"*Looking closer at the East of Gannet and Montrose Fields NCMPA, it is the only MPA designated in the northern North Sea region for the protection of offshore deep sea muds. The deep sea muds occur across the south-east half*	The Applicant welcomes the opinion from the Scottish Fisherman's Federation. The JNCC's Conservation Advice on the NCMPA will be used to assess impacts against the conservation objectives of the site. The

Consultee	Issue(s) raised	Response
	of the MPA, approximately 100 m deep. Not only that but the enormously rare Ocean quahog are distributed across the entire site, with the supporting habitat for this feature occurring across the north-west, which should mean the only activity allowed in the area will by default the North East section? The SFF will insist on this being scoped in, in order to verify that the development is not interfering negatively with the MPA."	MPA Screening Assessment will assess all potential sites that may be impacted by the Project.

1.3 Project description

1.3.1.1 As part of the scoping exercise, an updated version of the Project design has been provided. Throughout the development of the engineering design, environmental constraints have been considered and the design has been developed to reduce impacts on the environment where possible. The Project characteristics and construction methods are described in **Chapter 3: Project Description** of this 2024 Scoping Report.

1.3.1.2 A full description of the Project activity is provided in **Chapter 3: Project Description** and **Chapter 4: Site Selection and Consideration of Alternatives** of this 2024 Scoping Report. This chapter provided details on the key aspects of the Project relevant to the MPA Screening Assessment. Key parameters of the Project description relevant to this assessment include:

- Site selection of the Project (**Chapter 4: Site Selection and Consideration of Alternatives**).
- Windfarm area: any site preparation works, turbines layout and anchoring type, offshore substation location and foundation type (**Chapter 3: Project Description**).
- Cable corridor (if methods differ from one end to another – windfarm area, offshore and nearshore): any route preparation works, cable installation method, burial and protection measure (**Chapter 3: Project Description**).

1.3.1.3 The operation and maintenance (O&M), and decommissioning activities will also be considered in this assessment.

1.3.1.4 The screening assumptions in this report were made with consideration to industry specific activities and that Project specific environmental effects will not be exceeded after the finalisation of the design parameters.

1.4 MPA Screening Assessment methodology

1.4.1.1 The Project is confined to Scottish waters and will interact with MPA both inshore and offshore of the 12 (NM) boundary.

1.4.1.2 It is expected that at the time of submission for the application for the marine licence(s) to MD-LOT, MD-LOT's Nature Conservation Marine Protected Areas: Draft Management Handbook[2] will remain archived and replacement or updated guidance will not have been issued. Although this document remains archived, it contains guidance which is still considered to be relevant to the completion of an MPA Screening Assessment and follows a similar approach to the MMO guidance[1].

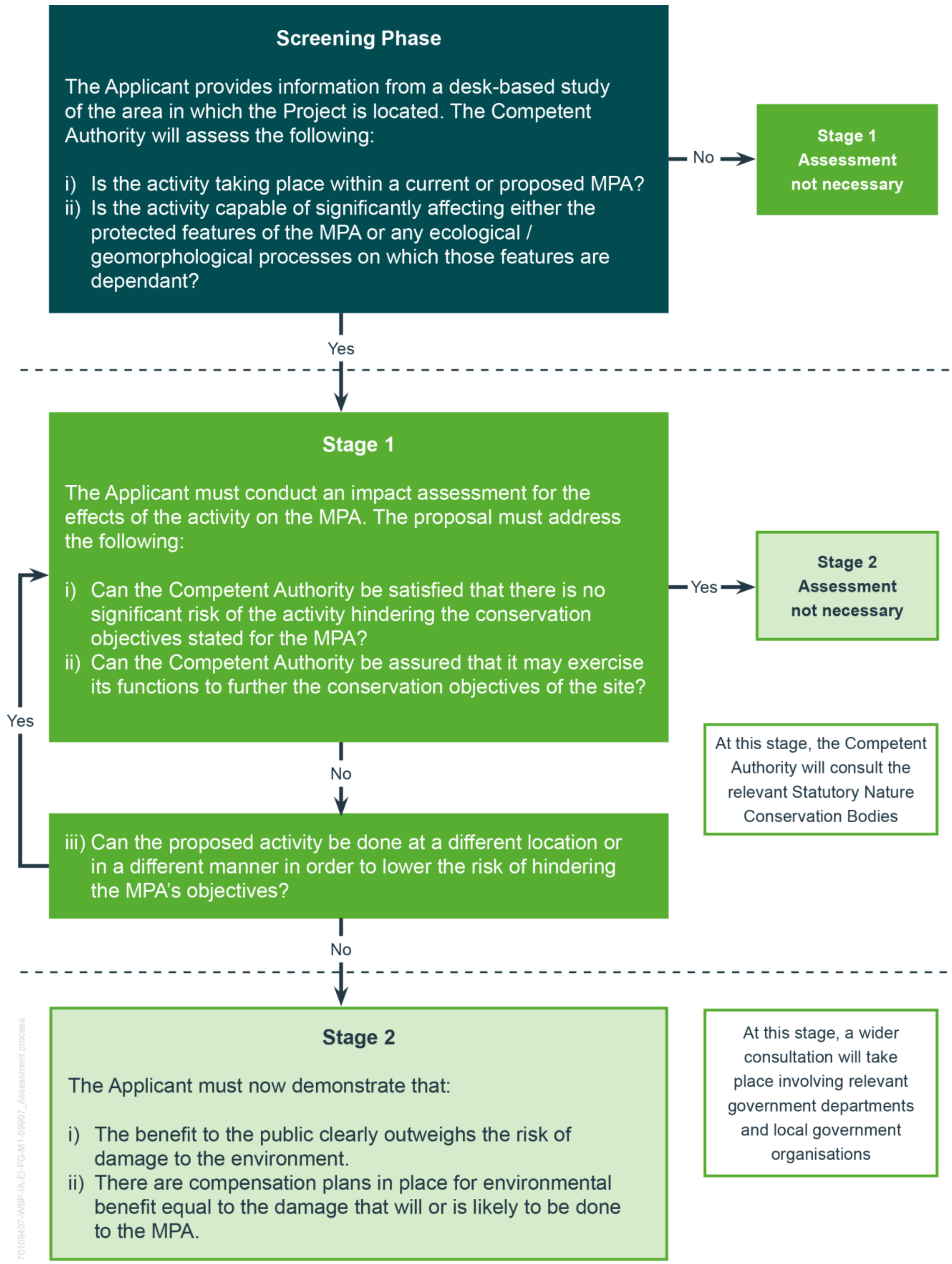
1.4.1.3 As the Project has the potential to interact with MPA in both inshore and offshore waters, and MPA in Scotland (beyond 12 NM) are designated under the Marine and Coastal Access Act 2009, it is considered appropriate that the MPA Screening Assessment process followed and applied within this report is in line with the published guidance.

1.4.2 The MPA Screening Assessment process

1.4.2.1 A marine licence(s) is being applied for in relation to construction of an offshore windfarm. The purpose of an MPA Screening Assessment is to provide sufficient information to establish whether there is potential for this proposed activity to significantly affect the protected features of any MPA.

1.4.2.2 **Plate 1-1** provides a summary of the MPA Screening Assessment process as recommended by the MMO. The guidance recommends a sequential and staged approach to the MPA Screening Assessment, as described below:

Plate 1-1: Summary of the MPA Screening Assessment process as adapted from the MMO in the marine licence decision making1



Screening

1.4.2.3 This stage is carried out to determine whether the licensable activity is taking place within, or within the vicinity of, an area designated as an MCZ (and MPA) or recommended for designation. The screening stage also considers whether the licensable activity is capable of affecting (other than insignificantly) either:

- The protected features of an MCZ (and MPA) or;
- Any ecological or geomorphological process on which the conservation of any protected feature of an MCZ (and MPA) is (wholly or in part) dependent. Should the answer to either question be 'yes', a Stage 1 Assessment must follow.

1.4.2.4 At the screening stage, the MMO guidance encourages a risk-based approach when determining the geographical proximity of an activity to an MCZ (or MPA). The application of appropriate buffer zones to the protected features of an MPA under consideration, as well as consideration of the risk of impacts from activities at greater distances from the MPA is necessary.

1.4.2.5 If certain activities, sites or impacts are screened into the MPA Screening Assessment process, these will then be considered within the main assessment if there is significant risk to achieve the MPA conservation objectives identified in the initial screening.

Stage 1 Assessment (main assessment)

1.4.2.6 This stage is carried out to ensure that the Competent Authority is satisfied that there is no significant risk of the licensable activity hindering the conservation objectives for the MCZ (and MPA), and to ensure that the Competent Authority can exercise its functions to further the conservation objectives of the MCZ (or MPA).

1.4.2.7 If the Competent Authority is not satisfied regarding environmental risk to the MCZ (and MPA) and the fulfilment of their functions, they must consider whether there are other means of delivering the licensable activity with a lesser environmental impact and therefore a lower risk of hindering the conservation objectives of an MCZ (and MPA). If the answer is still 'no', a Stage 2 Assessment must follow.

Stage 2 Assessment

1.4.2.8 This stage considers whether the benefit to the public clearly outweighs the environmental risk associated with the licensable activity. This stage may also involve the agreement of commitments by the Applicant to undertake measures of 'equivalent environmental benefit' to the damage which the licensable activity may have on the MCZ (and MPA).

1.4.2.9 As well as liaising with the SNCBs, wider consultation may be undertaken at this point, taking into account additional and specific advice on socio-economic matters, discussing the case with, for example, local authorities, local enterprise partnerships and other relevant government departments.

1.4.2.10 'Public benefit' must be considered at a national, regional and local level, and in determining 'measures of equivalent environmental benefit', types of compensatory measures which may be considered under the European Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the

Habitats Directive) will also be appropriate, although consideration does not necessarily need to be confined only to these.

1.4.3 Study Area

1.4.3.1 The MPA Screening Assessment study area is defined as the footprint of the Project, the maximum Zone of Impact (ZoI)[b] that may arise from the construction, O&M, and decommissioning of the Project, and the mobility ranges of the different ecological receptors designated under the MPA in the wider area.

1.4.3.2 At this stage, in the absence of a maximum defined Project ZoI which will be determined during the assessment, an initial precautionary search area of 100 km of the Project[c,3] has been used to identify the MPA and MCZs with potential to be affected by activities associated with the Project. However, the 100 km study area is considered appropriate for this Screening process, based on the typical features on MPA (generally not mobile in nature, as is the case with European designated sites' qualifying features).

1.4.3.3 There are 37 Scottish MPA and 91 English MCZs, where a wide range of ecological groups are designated for protection (from geological features, benthic habitats and species to non-migratory fish, auks and marine megafauna, such as minke whale, basking sharks and Risso's dolphin). From these, none are designated for migratory or long-distance foraging seabirds, or migratory fish. However, there are MPA designated for the protection of marine mammal (cetaceans) species which have large foraging ranges, and therefore the marine mammal management units (MMMUs)[4] as defined by the Inter-Agency Marine Mammal Working Group (IAMMWG) have been used for the screening of sites with marine mammal species as a designated feature instead of the 100 km buffer. The MPA and MCZs within the search area are presented in Section 1.4.3.

1.4.3.4 The impact pathways and associated ZoIs that are considered within this assessment include those that specifically relate to the receptor groups designated under the screened in MPA. For this screening exercise, a summary of impact pathways and associated ZoIs which have been established for the proposed Habitats Regulations Appraisal (HRA) screening, which is currently under development and will be submitted separately to MD-LOT in 2024, have been adopted for the MPA Screening Assessment. These are presented in **Table 1-2**.

1.4.3.5 The ZoIs of the activities associated with the Project will be determined by the final design envelope which will provide a realistic maximum design scenario, unless stated otherwise, and allow for the relevant modelling analysis to be undertaken (for example, underwater noise). The maximum ZoI will then be calculated and included in the main assessment. This together with any further consultation advice received from MD-Lot, will help refine/verify whether the list of sites screened into the assessment is appropriate.

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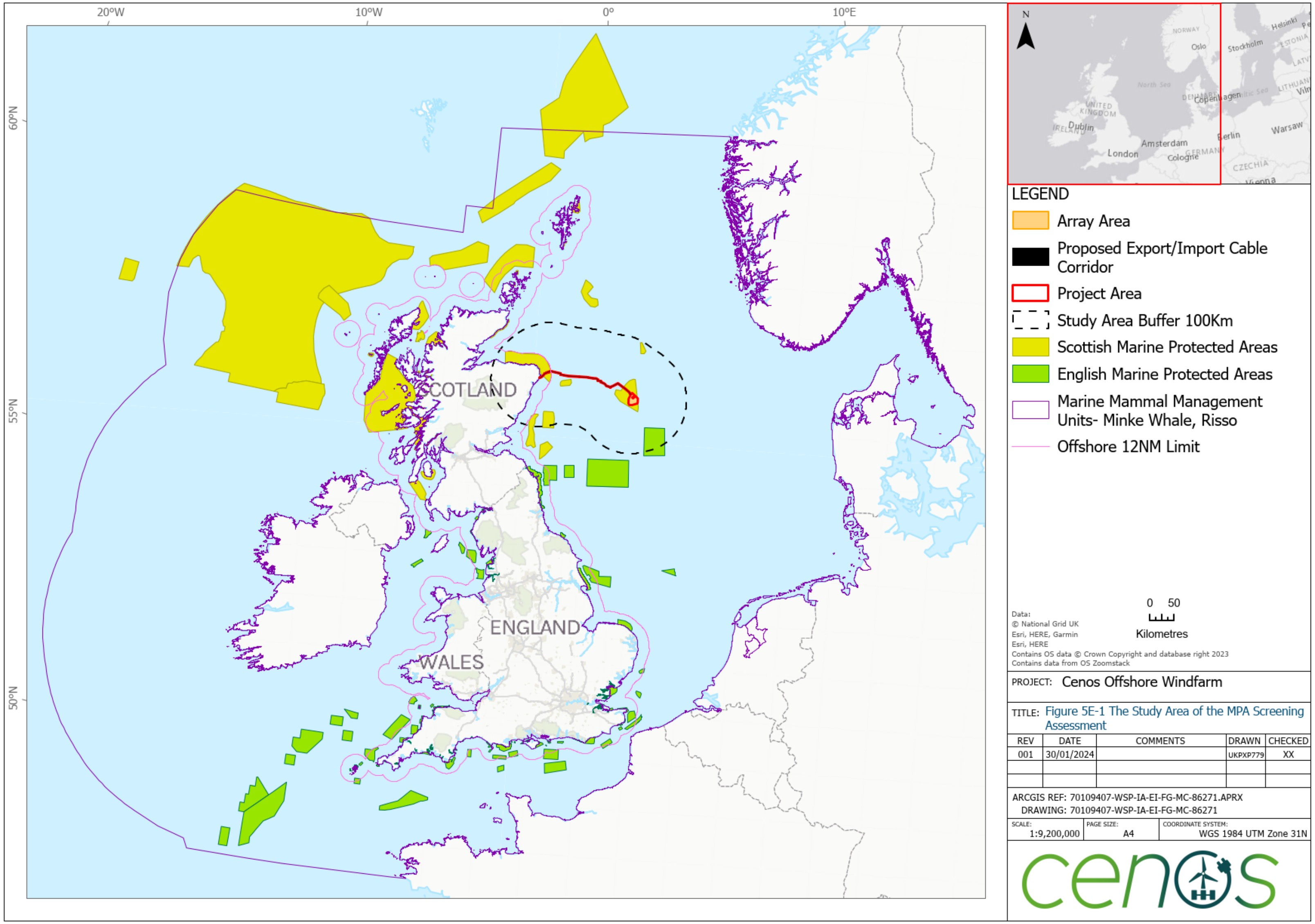
[b] The total range of impact from all the potential impacts arising from the activities associated with the Project, in line with the precautionary approach recommended by the MMO guidance[1].

[c] A 100km search area has been applied, as this is a distance that has been previously used as a screening boundary by UK regulatory agencies for plan-level HRAs. It is used because it defines a quantifiable and objective area that is likely to encompass many of the mobile species interest features (fish, seabirds, and mammals) within European/Ramsar sites, which could be indirectly affected by the development proposals.

1.4.3.6 It is proposed that the MPA Screening Assessment is completed concomitantly with the EIA. Thus, the 'insignificance' will be determined for the Project through the assessments made in the EIAR.

1.4.3.7 **Figure 5E-1** depicts the study area for the MPA Screening assessment.

Figure 5E-1: The Study Area of the MPA Screening Assessment



1.5 MPA Screening

1.5.1 Introduction

1.5.1.1 This section presents the screening stage of the MPA Screening Assessment as described in Section 1.4.

1.5.1.2 Although the Project is located in Scottish offshore waters only, based on a precautionary search area, the Project is capable to potentially impact MCZs in English waters. On this basis, this section provides a screening assessment only for relevant NCMPA and MCZ sites.

1.5.1.3 The main assessment for each site (in terms of Scottish NCMPA assessment terminology) which is considered one-and-the-same as the ‘Stage 1’ assessment (in terms of English MCZ assessment terminology) will be provided at the time of submission of the EIAR to allow for the chapters relevant here to complete their assessments.

1.5.1.4 Based on the application of the MMO guidance to the identified Scottish MPA, it is considered that Section 83 of the Marine (Scotland) Act 2010 and Section 126 of the Marine and Coastal Act 2009 will apply when determining whether it is required to proceed to the next stage, Stage 1 assessment. For the MCZs, Section 126 will apply to determine the requirement for the next assessment stage.

1.5.2 Site details and protected features

1.5.2.1 The sites requiring consideration in this MPA Screening Assessment, and their protected features, are listed in **Table 1-2**. The sites screened into the assessment are based on an initial precautionary search area of 100 km and using the MMMUs for sites with marine mammal species as designated features. The locations of these sites relative to the Project are illustrated in **Figure 5E-1.**

Table 1-2: Summary of initial screening of MPA sites based on the 100 km buffer and the MMMUs

Site name	Distance from Project (distance at sea)		Location relative to the Project	Protected features	Conservation objectives	Condition status
	Array Area (km)	ECC (MHWS-seawards) (km)				
East of Gannet and Montrose Fields NCMPA	0	0	In Scottish offshore waters. The Array Area directly overlaps the MPA.	**Species:** Ocean quahog aggregations (*Arctica islandica*) **Habitats:** Offshore deep sea muds Offshore subtidal sands and gravels (as supporting habitat for ocean quahog)	The conservation objectives for the East of Gannet and Montrose Fields NCMPA are that the protected features: • So far as already in favourable condition, remain in such condition; and • So far as not already in favourable condition, be brought into such condition, and remain in such condition. With respect to the ocean quahog aggregations (including supporting sedimentary habitats) within the NCMPA, this means that the quality and quantity of its habitat and the composition of its population in terms of number, age and sex ratio are such as to ensure that the population is maintained in numbers which enable it to thrive. Any temporary reduction of numbers is to be disregarded if the population is sufficiently thriving and resilient to	***Unfavourable*** for all designated features as of 2018[6]

Site name	Distance from Project (distance at sea)		Location relative to the Project	Protected features	Conservation objectives	Condition status
	Array Area (km)	ECC (MHWS-seawards) (km)				
					enable its recovery. Any alteration to that feature brought about entirely by natural processes is to be disregarded. With respect to the offshore deep-sea muds within the NCMPA, this means that: • Extent is stable or increasing. • Structures and functions, quality, and the composition of characteristic biological communities (which includes a reference to the diversity and abundance of species forming part of or living within the habitat) are such as to ensure that they remain in a condition which is healthy and not deteriorating. • Any temporary deterioration in condition is to be disregarded if the habitat is sufficiently healthy and resilient to enable its	

Site name	Distance from Project (distance at sea)		Location relative to the Project	Protected features	Conservation objectives	Condition status
	Array Area (km)	ECC (MHWS-seawards) (km)				
					recovery from such deterioration. Any alteration to that feature brought about entirely by natural processes is to be disregarded.[5]	
Southern Trench NCMPA	166	0	In Scottish inshore waters. The ECC directly overlaps the MPA.	**Species:** Minke whale (*Balaenoptera acutorostrata*) **Habitats:** Burrowed mud Fronts Shelf deeps **Geology:** Quaternary of Scotland: Moraines Quaternary of Scotland: Sub-glacial tunnel valleys Submarine Mass Movement: Slide scars	The Conservation Objectives seek to conserve protected feature(s) of a MPA where evidence exists that it is in favourable condition in the site, or where there is uncertainty concerning the assessed condition of a feature but no reason to suspect deterioration in condition since designation. Where evidence exists that a feature is declining and/or damaged and therefore is in unfavourable condition in the site, the Conservation Objectives will seek to recover the protected feature. All of the biodiversity and geodiversity features are in favourable condition at Southern Trench MPA and therefore the Conservation Objectives seek to conserve this condition.	***Favourable*** for all designated features as of 2019[7]

Site name	Distance from Project (distance at sea)		Location relative to the Project	Protected features	Conservation objectives	Condition status
	Array Area (km)	ECC (MHWS-seawards) (km)				
					The aim is to conserve all the protected features in order to make a long-lasting contribution to the MPA network.[7]	
Turbot Bank NCMPA	122	6	In Scottish offshore waters. The ECC is located to the north of the MPA.	**Species:** Sandeels (*Ammodytes marinus*/ and *Ammodytes tobianus*)	The Conservation Objective for the Turbot Bank NCMPA is that the protected feature (sandeels) is: • So far as already in favourable condition, remain in such condition; and • So far as not already in favourable condition, be brought into such condition, and remain in such condition. With respect to the sandeels, this means that the quality and quantity of its habitat and the composition of its population are such that they ensure that the population is maintained in numbers which enable it to thrive. Any temporary reduction of numbers is to be disregarded if the population of sandeels is thriving and sufficiently resilient to enable its recovery from such reduction. Any alteration to that feature brought	***Favourable*** as of 2018[9]

Site name	Distance from Project (distance at sea)		Location relative to the Project	Protected features	Conservation objectives	Condition status
	Array Area (km)	ECC (MHWS-seawards) (km)				
					about entirely by natural processes is to be disregarded.[8]	
Norwegian Boundary Sediment Plain NCMPA	84	78	In Scottish offshore waters. The Array Area is located to the south of the MPA.	**Species:** Ocean quahog **Habitats:** Offshore subtidal sands and gravels (as supporting habitat for ocean quahog)	The conservation objectives for the Norwegian Boundary Sediment Plain NCMPA are that the protected features: • Do far as already in favourable condition, remain in such condition; and • Do far as not already in favourable condition, be brought into such condition, and remain in such condition. With respect to the ocean quahog aggregations (including supporting sedimentary habitats) within the NCMPA, this means that the quality and quantity of its habitat and the composition of its population in terms of number, age and sex ratio are such as to ensure that the population is maintained in numbers which enable it to thrive. Any temporary reduction of numbers is to be disregarded if the population is	***Unfavourable*** as of 2018[11]

Site name	Distance from Project (distance at sea)		Location relative to the Project	Protected features	Conservation objectives	Condition status
	Array Area (km)	ECC (MHWS-seawards) (km)				
					sufficiently thriving and resilient to enable its recovery. Any alteration to that feature brought about entirely by natural processes is to be disregarded.[10]	
Firth of Forth Banks Complex NCMPA	Montrose Bank: 155 Scalp Bank and Wee Bankie: 188 Berwick Bank: 180	Montrose Bank: 69 Scalp Bank and Wee Bankie: 74 Berwick Bank: 132	In Scottish offshore waters. The ECC is located to the north of the MPA.	<u>Montrose Bank</u> **Species:** Ocean quahog **Habitats:** Offshore subtidal sands and gravels Shelf banks and mounds <u>Scalp Bank and Wee Bankie</u> **Species:** Ocean quahog **Habitats:** Offshore subtidal sands and gravels Shelf banks and mounds **Geology:** Quaternary of Scotland: Moraines	The conservation objectives for the Firth of Forth Banks Complex NCMPA are that the protected features: • Do far as already in favourable condition, remain in such condition. • So far as not already in favourable condition, be brought into such condition, and remain in such condition. With respect to the ocean quahog aggregations within the NCMPA, this means that: • the quality and quantity of its habitat and the composition of its population in terms of number, age and sex ratio are such as to ensure that the population is maintained in numbers which enable it to thrive.	• ***Unfavourable*** for offshore subtidal sands and gravels and ocean quahog aggregations as of 2018[13] • ***Favourable*** for shelf banks and mounds large-scale feature and Wee Bankie key geodiversity area as of 2018[13]

<table>
<tr><th rowspan="2">Site name</th><th colspan="2">Distance from Project (distance at sea)</th><th rowspan="2">Location relative to the Project</th><th rowspan="2">Protected features</th><th rowspan="2">Conservation objectives</th><th rowspan="2">Condition status</th></tr>
<tr><th>Array Area (km)</th><th>ECC (MHWS-seawards) (km)</th></tr>
<tr><td></td><td></td><td></td><td></td><td><u>Berwick Bank</u>
Species:
Ocean quahog
Habitats:
Offshore subtidal sands and gravels
Shelf banks and mounds
Geology:
Quaternary of Scotland: Moraines</td><td>Any temporary reduction of numbers is to be disregarded if the population of ocean quahog aggregations is sufficiently thriving and resilient to enable its recovery. Any alteration to that feature brought about entirely by natural processes is to be disregarded.

With respect to the offshore subtidal sands and gravels within the NCMPA, this means that:
Extent is stable or increasing.
Structures and functions, quality, and the composition of characteristic biological communities (which includes a reference to the diversity and abundance of species forming part of or living within the habitat) are such as to ensure that they remain in a condition which is healthy and not deteriorating.</td><td></td></tr>
</table>

Site name	Distance from Project (distance at sea)		Location relative to the Project	Protected features	Conservation objectives	Condition status
	Array Area (km)	ECC (MHWS-seawards) (km)				
					• Any temporary deterioration in condition is to be disregarded if the habitat is sufficiently healthy and resilient to enable its recovery from such deterioration. Any alteration to that feature brought about entirely by natural processes is to be disregarded. With respect to the shelf banks and mounds large-scale feature within the NCMPA, this means that: • The extent, distribution and structure are maintained. • The function is maintained so as to ensure that it continues to support its characteristic biological communities (which includes a reference to the diversity of any species associated with the large-scale feature) and their use of the site for, but not restricted to, feeding,	

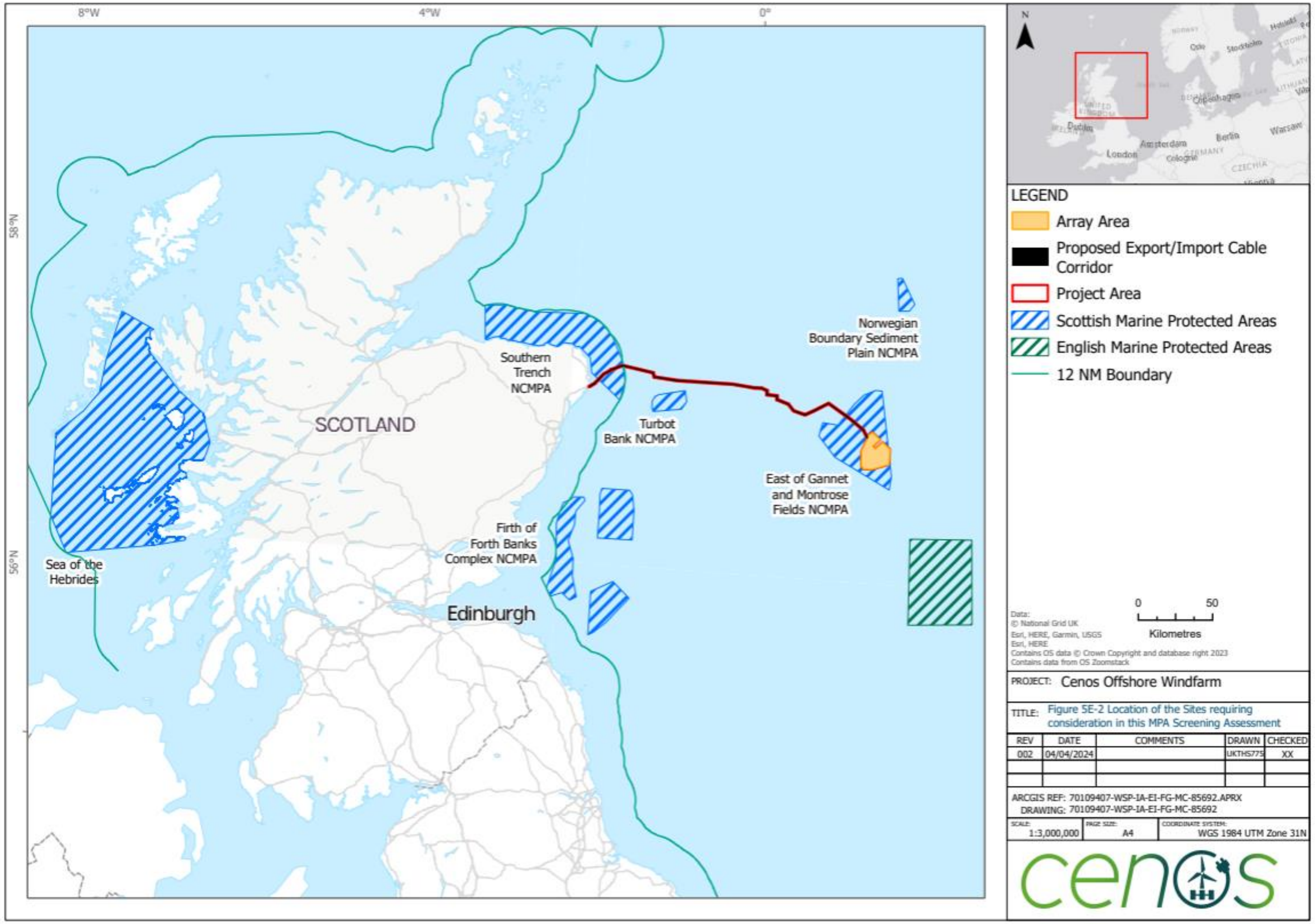
Site name	Distance from Project (distance at sea)		Location relative to the Project	Protected features	Conservation objectives	Condition status
	Array Area (km)	ECC (MHWS-seawards) (km)				
					courtship, spawning, or use as nursery grounds. • The processes supporting that feature are maintained. Any alteration to that feature brought about entirely by natural processes is to be disregarded. With respect to the Wee Bankie key geodiversity area within the NCMPA, this means that: • Its extent, component elements and integrity are maintained. • Its structure and functioning are unimpaired. • Its surface remains sufficiently unobscured for the purposes of determining whether the above criteria are satisfied. Any obscuring of that feature entirely by natural processes is to be disregarded. Any alteration to that feature brought about entirely by	

Site name	Distance from Project (distance at sea)		Location relative to the Project	Protected features	Conservation objectives	Condition status
	Array Area (km)	ECC (MHWS-seawards) (km)				
					natural processes is to be disregarded.[12]	
Fulmar MCZ	52	73	In English offshore waters. The Array Area is located to the north of the MPA.	**Species:** Ocean quahog **Habitats:** Subtidal mixed sediments Subtidal mud Subtidal sand	The conservation objectives for the Fulmar MCZ are that the protected features: • So far as already in favourable condition, remain in such condition; and • So far as not already in favourable condition, be brought into such condition, and remain in such condition. With respect to the ocean quahog within the zone, this means that the quality and quantity of its habitat and the composition of its population in terms of number, age and sex ratio are such as to ensure that the population is maintained in numbers which enable it to thrive. Any temporary reduction of numbers is to be disregarded if the population is sufficiently thriving and resilient to enable its recovery. Any alteration to that feature brought about entirely	***Favourable*** for all designated features as of 2018[15]

Site name	Distance from Project (distance at sea)		Location relative to the Project	Protected features	Conservation objectives	Condition status
	Array Area (km)	ECC (MHWS-seawards) (km)				
					by natural processes is to be disregarded. With respect to subtidal mixed sediments, subtidal mud and subtidal sand within the zone, this means that: • Extent is stable or increasing. • Structures and functions, quality, and the composition of characteristic biological communities (which includes a reference to the diversity and abundance of species forming part of or living within the habitat) are such as to ensure that they remain in a condition which is healthy and not deteriorating. • Any temporary deterioration in condition is to be disregarded if the habitat is sufficiently healthy and resilient to enable its recovery. Any alteration to that feature brought about	

Site name	Distance from Project (distance at sea)		Location relative to the Project	Protected features	Conservation objectives	Condition status
	Array Area (km)	ECC (MHWS-seawards) (km)				
					entirely by natural processes is to be disregarded.[14]	
Sea of the Hebrides NCMPA	439	258	In Scottish inshore waters. The Project is located on the opposite side of the country (eastern offshore waters) being separated by land from the MPA.	**Species:** Basking shark (*Cetorhinus maximus*) Minke whale **Habitats:** Fronts **Geology:** Marine Geomorphology of the Scottish Shelf Seabed: Inner Hebrides Carbonate Production Area	The Conservation Objectives seek to conserve protected feature(s) of a MPA where evidence exists that it is in favourable condition in the site, or where there is uncertainty concerning the assessed condition of a feature but no reason to suspect deterioration in condition since designation. Where evidence exists that a feature is declining and/or damaged and therefore is in unfavourable condition in the site, the Conservation Objectives will seek to recover the protected feature. All of the biodiversity and geodiversity features are in favourable condition at Sea of the Hebrides MPA and therefore the Conservation Objectives seek to conserve this condition. The aim is to conserve these features in order to make a long-lasting contribution to the MPA network.[16]	***Favourable*** for all designated features as of 2019[16]

Figure 5E-2: Location of the Sites requiring consideration in this MPA Screening Assessment



1.5.3 Potential impacts

1.5.3.1 This section identifies the potential impacts arising from the Project, during construction, O&M, and decommissioning, and requiring assessment for each screened in MPA. **Table 1-3** presents the potential impacts and their ZoIs and **Table 1-4** presents those impacts screened in requiring further assessment based on the MPA and their protected features.

1.5.3.2 The potential impacts for Marine and Coastal Processes (MCP) are separated from a specific receptor group and rather considered as a pathway to a receptor. The assessment methodology for the MCP section presented in the **2024 Scoping Report** will evaluate geomorphological seabed and coastal features that form the basis of designated areas (MCP receptors), direct impacts on hydrodynamics and sediment dynamics, and the pathways that have the potential to develop indirect impacts on other types of receptors, for example fronts or geological features.

Table 1-3: Summary of potential impacts screened in (✓) or screened out (x) of the assessment during construction (C), operation and maintenance (O&M) and decommissioning (D)

Ecological group/pathway receptor	Potential impact	C	O&M	D	Zone of impact
Benthic features	Direct impact/disturbance leading to temporary or long-term habitat loss	✓	X	X	Within footprint of the Project
	Long-term or short-term disturbance resulting in displacement due to landfall works	X	X	X	Within footprint of the Project
	Temporary increases in suspended sediments and contaminants	✓	X	✓	Within 15 km (encompasses tidal excursion) of Project footprint
	Smothering resulting from resettlement of suspended material	✓	X	✓	Within 15 km (encompasses tidal excursion) of Project footprint
	Increased turbidity	✓	X	✓	Within 15 km (encompasses tidal excursion) of Project footprint
	Accidental pollution from vessels	X	X	X	Within 15 km (encompasses tidal excursion) of Project footprint
	Introduction of Invasive Non-Native Species (INNS) from vessels and presence of structures including introduced hard substrates	✓	✓	✓	At specific locations of suitable habitat within footprint of the Project (and surrounding area depending on the mobility of the species)
	Increased local predation pressure around wind turbines (from fish aggregation)	X	✓	X	Within footprint of the Project
	Electromagnetic field (EMF) from operational cables	X	✓	X	Within 10-20 m of the cable footprint
	Heat generated from operational cables	X	✓	X	Within 10-20 m of the cable footprint

Ecological group/pathway receptor	Potential impact	C	O&M	D	Zone of impact
	Alterations to the local habitat through introduction of hard surfaces	X	✓	X	Within footprint of the Project
	Localised damage to sensitive epifauna (e.g., sea pens) due to operational mooring lines	X	✓	X	Within mooring swept area
	Alterations to colonised surfaces	X	X	✓	Within footprint of the Project
Metocean processes	Changes to tide and wave regime (pathways)	X	X	X	Within 15 km (encompasses tidal excursion) of Project footprint
Oceanographic processes	Changes to fronts or stratified seas	✓	✓	✓	Within 15 km (encompasses tidal excursion) of Project footprint
Geological/seabed features	Physical changes to seabed topography (for example, abrasion to the seabed surface)	✓	✓	✓	Within footprint of the Project
	Physical removal or deposition of material	✓	✓	✓	Within footprint of the Project
	Sediment transport and potential effects on marine receptors	✓	✓	✓	Within 15 km (encompasses tidal excursion) of Project footprint
Fish species	Direct impact/disturbance leading to temporary or long-term habitat loss	✓	✓	✓	Within footprint of the Project
	Temporary increases in suspended sediments and contaminants	✓	✓	✓	Within 15 km (encompasses tidal excursion) of Project footprint
	Smothering resulting from resettlement of suspended material	✓	✓	✓	Within 15 km (encompasses tidal excursion) of Project footprint

Ecological group/pathway receptor	Potential impact	C	O&M	D	Zone of impact
	Increases in underwater noise	✓	✓	✓	Distance of transmitted noise (based on the results from underwater noise modelling)
	Accidental pollution from vessels	X	X	X	Within 15 km (encompasses tidal excursion) of Project footprint
	Entanglement (primary and secondary)	X	X	X	Within footprint of the Project
	EMF from operational cables	X	✓	X	Within 10-20 m of the cable footprint
	Heat generated from operational cables	X	✓	X	Within 10-20 m of the cable footprint
	Fish aggregation devices altering stock distribution and predator/prey interactions	X	✓	✓	Within 15 km (encompasses tidal excursion) of Project footprint
Marine mammal species	Increased underwater noise (piling, UXO clearance and geophysical/geotechnical surveys)	✓	X	X	Distance of transmitted noise (based on the results from underwater noise modelling)
	Increased underwater noise from vessels	✓	✓	✓	Distance of transmitted noise along shipping routes and around vessel activities
	Operational noise (including mooring noise, for example cable "snap") has the potential to cause displacement and disturbance to marine mammals.	X	✓	X	Although cable snap is not included in the underwater noise modelling, this impact is scoped in for further qualitative assessment. However, impacts are likely considered to be temporary and spatially restricted.
	Vessel collision risk	X	X	X	Within footprint of the Project (or vessel route)
	Accidental pollution from vessels	X	X	X	Within 15 km (encompasses tidal excursion) of Project footprint

Ecological group/pathway receptor	Potential impact	C	O&M	D	Zone of impact
	Seabed works disturbing the seabed and increased suspended matter directly affecting marine mammals	X	X	X	Within 15 km (encompasses tidal excursion) of Project footprint
	Seabed works disturbing the seabed and increased suspended matter affecting prey species distribution/availability	✓	X	X	Within 15 km (encompasses tidal excursion) of Project footprint
	Entanglement (primary and secondary)	X	X	X	Within footprint of the Project
	Barrier effects due to presence of infrastructure	X	X	X	Within footprint of the Project
	EMF from operational cables	X	X	X	Within 10-20 m of the cable footprint
	Heat generated from operational cables	X	X	X	Within 10-20 m of the cable footprint
	Physical removal of offshore structures	X	X	X	Within footprint of the Project

Screened out impacts

1.5.3.3 Several impacts have been screened out of the assessment due to absence of a credible pathway, based on professional judgement and a literature review, as well as taking into account the proposed mitigation. These are set out below.

Accidental pollution

1.5.3.4 There is a risk of accidental pollution events from vessels and equipment. However, such events are rare and amenable to mitigation through standard best practice controls and are not considered to result in a significant risk to benthic, fish or marine mammal ecological receptors. Pollution from accidental events could impact both directly and indirectly (via prey species availability or contamination), however no significant pollution scenarios are expected with appropriate vessel management in place, hence no significant effects on marine mammals are predicted.

1.5.3.5 All vessels on the Project will be required to comply with strict environmental controls including an approved Marine Pollution Contingency Plan secured through s.36 conditions, marine licence conditions and Outline Environmental Management Plan (OEMP). Furthermore, the magnitude of an accidental spill will be limited by the small quantity of chemical or fuel inventory on vessels.

1.5.3.6 Accidental release of pollutants from vessels and/or equipment will be exceptionally infrequent and amenable to mitigation through appropriate vessel management and adoption of standard good management practices, for example, the International Convention for the Prevention of Pollution from Ships (MARPOL).

1.5.3.7 Therefore, accidental pollution has been scoped out for all receptors during all Project phases.

Entanglement (primary))

1.5.3.8 To date, there have been no recorded instances of marine mammal entanglement from mooring systems of renewable devices[17], or for anchored Floating Production Storage and Offloading (FPSO) vessels in the oil and gas industry[18] which have similar or more complex mooring systems compared to those proposed for the Project's floating turbine structures.

1.5.3.9 As the nature of the mooring lines in terms of tension, rigidity and cable diameter preclude the possibility of forming any entangling loops, unlike the parameters of creel lines which are a known entanglement risk, there is negligible potential for primary entanglement from the subsea mooring systems.

Entanglement (secondary)

1.5.3.10 Derelict or ghost nets are a recognised global issue and widely known to contribute to Abandoned, Lost or Discarded Fishing Gear (ALDFG). This equipment drifts through the sea until it disintegrates or sinks to the seabed, often continuing to trap fish and other marine animals. Given the slow rate at which such equipment decays, the impact of derelict fishing gear, in terms of bycatch and entanglement, can be substantial in a global context. It is possible that lost or abandoned fishing gear may get caught in the WTG mooring lines, posing a risk of secondary entanglement to all marine receptors.

1.5.3.11 Though the scale of the proposed Array Area is large in comparison to floating oil and gas structures in the area (both in areal extent and number of lines), it is important to consider the amount and type of ALDFG in the area rather than solely the scale of the Array Area. The type of fishing activity in the surrounding ICES rectangles means that there is unlikely to be a significant amount of problematic ALDFG that could be snagged on the WTG moorings, therefore the Project is unlikely to substantially increase the risk of secondary entanglement.

1.5.3.12 Fishing activity, within the ICES rectangle in which the Array Area sits (43F1), occurs at low levels and is dominated by demersal trawling for Nephrops. Low levels of demersal seine netting and pelagic trawling also take place. Lost nets from these fisheries are typically recovered in the location in which they were lost[19]. The risk of demersal trawl and seine nets being lost or fouled within the Array Area is exceptionally low due to the fact that these are weighted nets which would sink should they become ensnared. Pelagic trawl nets are unweighted, but the scale and material used in these nets still makes them heavy and it is not anticipated that they would remain within the water column for an extended period, should they be lost by a fishing vessel.

1.5.3.13 In the semi-submersible design, the keel of the floating substructure will be submerged to approximately 10 – 20 m depth before a chain will connect the floating foundation substructure to catenary mooring lines. This largely removes the potential for diving seabirds to become ensnared in derelict fishing gear. Buoyant fishing gear which could pose a risk to pelagic fish, basking sharks and large baleen whales is unlikely to become ensnared on the keel of the floating substructure reducing the potential for secondary entanglement from this type of fishing gear.

1.5.3.14 For the TLP design, the angle and material of the mooring lines suggests it is likely that ALDFG will slide down the lines rather than hang in the water column. A build-up of marine debris at the bottom of the mooring lines is only likely for heavy fishing gear, such as demersal trawling nets, which would be too heavy to remain suspended in the water column, even when snagged on a mooring line. Receptors with the greatest potential to be impacted include demersal fish and to a lesser extent large baleen whales. It is not yet known if marine debris became entangled on the mooring system whether it would it increase the risk to marine life against the baseline of ghost fishing.

1.5.3.15 In the context of the existing O&G infrastructure in the area and the type of fishing in the vicinity, as described above, entanglement as a potential impact has been scoped out for all.

EMF and heat

1.5.3.16 Marine mammals are not known to possess specialist electro- or magneto-receptive organs. There is, however, evidence of magnetoreception in a range of cetacean species (e.g. humpback whales, bottlenose dolphin, harbour porpoise) meaning the B-field component of EMF can affect these species.

1.5.3.17 It is considered that many cetaceans and some pinnipeds use the Earth's GMF to navigate and particularly during long migrations, with implications that EMF may interfere with the navigational cues. Modelling conducted by Tricas and Gill (2011) on bottlenose dolphins indicated that they could detect B-fields from a subsea cable up to 50 m away when directly above the cable, causing alteration to the direction of travel. However, due to the high mobility of marine mammal species and capability to move away from the EMF influence, it is not considered that they would experience long-term impacts.

1.5.3.18 The risk of direct impacts of EMF and heat to marine mammals is minimal and therefore has been scoped out of further assessment.

Table 1-4: Summary of screened in (✓) and screened out (x) sites and impacts requiring assessment during construction (C), operation and maintenance (O&M) and decommissioning (D)

Site name	Impacts requiring assessment			
	Potential impact	**C**	**O&M**	**D**
East of Gannet and Montrose Fields NCMPA (benthic features)	Direct impact/disturbance leading to temporary or long-term habitat loss	✓	X	X
	Long-term or short-term disturbance resulting in displacement due to landfall works	X	X	X
	Temporary increases in suspended sediments and contaminants	✓	X	✓
	Smothering resulting from resettlement of suspended material	✓	X	✓
	Increased turbidity	✓	X	✓
	Accidental pollution from vessels	X	X	X
	Introduction of Invasive Non-Native Species (INNS) from vessels and presence of structures including introduced hard substrates	✓	✓	✓
	Increased local predation pressure around wind turbines (from fish aggregation)	X	✓	X
	EMF from operational cables	X	✓	X
	Heat generated from operational cables	X	✓	X
	Alterations to the local habitat through introduction of hard surfaces	X	✓	X
	Localised damage to sensitive epifauna (e.g., sea pens) due to operational mooring lines	X	✓	X
	Alterations to colonised surfaces	X	X	✓
Southern Trench NCMPA (minke whale)	Increased underwater noise (piling, UXO clearance and geophysical/geotechnical surveys)	✓	X	X
	Increased underwater noise from vessels	✓	✓	✓

Site name	Impacts requiring assessment			
	Potential impact	**C**	**O&M**	**D**
	Increased collision risk with vessels	X	X	X
	Operational noise (including mooring noise, for example cable "snap") has the potential to cause displacement and disturbance to marine mammals.	X	✓	X
	Seabed works disturbing the seabed and increased suspended matter directly affecting marine mammals	X	X	X
	Seabed works disturbing the seabed and increased suspended matter affecting prey species distribution/availability	✓	X	X
	Accidental pollution from vessels	X	X	X
	Seabed works disturbing the seabed and increased suspended matter directly affecting marine mammals	X	X	X
	Seabed works disturbing the seabed and increased suspended matter affecting prey species distribution/availability	✓	X	X
	EMF from operational cables	X	X	X
	Heat generated from operational cables	X	X	X
	Physical removal of offshore structures	X	X	X
	Entanglement (primary and secondary)	X	X	X
	Barrier effects due to presence of infrastructure	X	X	X
Southern Trench NCMPA (benthic features)	Direct impact/disturbance leading to temporary or long-term habitat loss	✓	X	X
	Long-term or short-term disturbance resulting in displacement due to landfall works	X	X	X
	Temporary increases in suspended sediments and contaminants	✓	X	✓
	Smothering resulting from resettlement of suspended material	✓	X	✓

Site name	Impacts requiring assessment			
	Potential impact	C	O&M	D
	Increased turbidity	✓	X	✓
	Accidental pollution from vessels	X	X	X
	Introduction of Invasive Non-Native Species (INNS) from vessels and presence of structures including introduced hard substrates	✓	✓	✓
	Increased local predation pressure around wind turbines (from fish aggregation)	X	✓	X
	EMF from operational cables	X	✓	X
	Heat generated from operational cables	X	✓	X
	Alterations to the local habitat through introduction of hard surfaces	X	✓	X
	Localised damage to sensitive epifauna (e.g., sea pens) due to operational mooring lines	X	✓	X
	Alterations to colonised surfaces	X	X	✓
Southern Trench NCMPA (metocean processes)	Changes to tide and wave regime (pathways)	X	X	X
Southern Trench NCMPA (oceanographic processes)	Changes to fronts or stratified seas	✓	✓	✓
Southern Trench NCMPA (geological/seabed features)	Physical changes to seabed topography (for example, abrasion to the seabed surface)	✓	✓	✓
	Physical removal or deposition of material	✓	✓	✓
	Sediment transport and potential effects on marine receptors	✓	✓	✓

Site name	Impacts requiring assessment			
	Potential impact	C	O&M	D
Turbot Bank NCMPA (sandeels)	Direct impact/disturbance leading to temporary or long-term habitat loss	✓	✓	✓
	Temporary increases in suspended sediments and contaminants	✓	✓	✓
	Smothering resulting from resettlement of suspended material	✓	✓	✓
	Increases in underwater noise	✓	✓	✓
	Accidental pollution from vessels	X	X	X
	Entanglement (primary and secondary)	X	X	X
	EMF from operational cables	X	✓	X
	Heat generated from operational cables	X	✓	X
	Fish aggregation devices altering stock distribution and predator/prey interactions	X	✓	✓
Norwegian Boundary Sediment Plain NCMPA (benthic features)	Direct impact/disturbance leading to temporary or long-term habitat loss	X	X	X
	Long-term or short-term disturbance resulting in displacement	X	X	X
	Temporary increases in suspended sediments and contaminants	X	X	X
	Smothering resulting from resettlement of suspended material	X	X	X
	Increased turbidity	X	X	X
	Accidental pollution from vessels	X	X	X
	Introduction of Invasive Non-Native Species (INNS) from vessels and presence of structures including introduced hard substrates	X	X	X

Site name	Impacts requiring assessment			
	Potential impact	C	O&M	D
	Increased local predation pressure around wind turbines (from fish aggregation)	X	X	X
	EMF from operational cables	X	X	X
	Heat generated from operational cables	X	X	X
	Alterations to the local habitat through introduction of hard surfaces	X	X	X
	Localised damage to sensitive epifauna (e.g., sea pens) due to operational mooring lines	X	X	X
	Alterations to colonised surfaces	X	X	X
Firth of Forth Banks Complex NCMPA (benthic features)	Direct impact/disturbance leading to temporary or long-term habitat loss	X	X	X
	Long-term or short-term disturbance resulting in displacement	X	X	X
	Temporary increases in suspended sediments and contaminants	X	X	X
	Smothering resulting from resettlement of suspended material	X	X	X
	Increased turbidity	X	X	X
	Accidental pollution from vessels	X	X	X
	Introduction of Invasive Non-Native Species (INNS) from vessels and presence of structures including introduced hard substrates	X	X	X
	Increased local predation pressure around wind turbines (from fish aggregation)	X	X	X
	EMF from operational cables	X	X	X
	Heat generated from operational cables	X	X	X
	Alterations to the local habitat through introduction of hard surfaces	X	X	X

Site name	Impacts requiring assessment			
	Potential impact	C	O&M	D
	Localised damage to sensitive epifauna (e.g., sea pens) due to operational mooring lines	X	X	X
	Alterations to colonised surfaces	X	X	X
Firth of Forth Banks Complex NCMPA (geological features)	Physical changes to seabed topography (for example, abrasion to the seabed surface)	X	X	X
	Physical removal or deposition of material	X	X	X
	Sediment transport and potential effects on marine receptors	X	X	X
Fulmar MCZ (benthic features)	Direct impact/disturbance leading to temporary or long-term habitat loss	X	X	X
	Long-term or short-term disturbance resulting in displacement	X	X	X
	Temporary increases in suspended sediments and contaminants	X	X	X
	Smothering resulting from resettlement of suspended material	X	X	X
	Increased turbidity	X	X	X
	Accidental pollution from vessels	X	X	X
	Introduction of Invasive Non-Native Species (INNS) from vessels and presence of structures including introduced hard substrates	X	X	X
	Increased local predation pressure around wind turbines (from fish aggregation)	X	X	X
	EMF from operational cables	X	X	X
	Heat generated from operational cables	X	X	X
	Alterations to the local habitat through introduction of hard surfaces	X	X	X

Site name	Impacts requiring assessment			
	Potential impact	**C**	**O&M**	**D**
	Localised damage to sensitive epifauna (e.g., sea pens) due to operational mooring lines	X	X	X
	Alterations to colonised surfaces	X	X	X
Sea of the Hebrides NCMPA (basking shark)	Direct impact/disturbance leading to temporary or long-term habitat loss	X	X	X
	Temporary increases in suspended sediments and contaminants	X	X	X
	Smothering resulting from resettlement of suspended material	X	X	X
	Increases in underwater noise	X	X	X
	Accidental pollution from vessels	X	X	X
	Entanglement (primary and secondary)	X	X	X
	EMF from operational cables	X	X	X
	Heat generated from operational cables	X	X	X
	Fish aggregation devices altering stock distribution and predator/prey interactions	X	X	X
Sea of the Hebrides NCMPA (minke whale)	Increased underwater noise (piling, UXO clearance and geophysical/geotechnical surveys)	X	X	X
	Increased underwater noise from vessels	X	X	X
	Increased collision risk with vessels	X	X	X
	Operational noise (including mooring noise, for example cable "snap") has the potential to cause displacement and disturbance to marine mammals.	X	X	X

Site name	Impacts requiring assessment			
	Potential impact	C	O&M	D
	Seabed works disturbing the seabed and increased suspended matter directly affecting marine mammals	X	X	X
	Seabed works disturbing the seabed and increased suspended matter affecting prey species distribution/availability	X	X	X
	Accidental pollution from vessels	X	X	X
	Seabed works disturbing the seabed and increased suspended matter directly affecting marine mammals	X	X	X
	Seabed works disturbing the seabed and increased suspended matter affecting prey species distribution/availability	X	X	X
	EMF from operational cables	X	X	X
	Heat generated from operational cables	X	X	X
	Physical removal of offshore structures	X	X	X

1.5.4 Conclusions from MPA screening

1.5.4.1 This section presents the outcomes of the initial screening stage, focusing on what can reasonably be predicted as a result of the Project and whether it is ‘capable of affecting (other than insignificantly)’ a protected feature of an MPA or any ecological or geomorphological process on which the conservation of any protected feature of the site is (wholly or in part) dependent.

1.5.4.2 On the basis of the initial screening, the following sites have been screened out, and therefore do not require further consideration within the next stage of assessment:

- Norwegian Boundary Sediment Plain NCMPA;
- Firth of Forth Banks Complex NCMPA;
- Fulmar MCZ; and
- Sea of the Hebrides NCMPA.

1.5.4.3 This conclusion has been based primarily on the distance from the Project to the designated sites, and the fact that this distance (a minimum of 52 km) results in no legitimate pathways of effect being established. This is predominantly due to the static nature of their qualifying features, meaning there will be no overlap with Project activities. Where mobile features are listed (i.e. the basking shark and minke whale of the Sea of the Hebrides NCMPA), the site is considered a sufficient distance from the Project that no effects will arise.

1.5.4.4 **Table 1-5** below provides an initial screening assessment for the relevant MPA sites to be considered in the Stage 1 MPA Screening Assessment.

Table 1-5: Summary of MPA sites proposed to be taken into Stage 1 MPA Screening Assessment

<table>
<tr><th rowspan="2">Site Name</th><th rowspan="2">Feature(s)</th><th colspan="3">Potential impact pathway(s)</th><th rowspan="2">Likelihood of interaction(s)</th></tr>
<tr><th>Construction</th><th>Operation & maintenance</th><th>Decommissioning</th></tr>
<tr><td>East of Gannet and Montrose Fields</td><td>Ocean quahog aggregations
Offshore deep sea muds
Offshore subtidal sands and gravels (as supporting habitat for ocean quahog)</td><td>Direct impact/disturbance leading to temporary or long-term habitat loss from building the infrastructure.
Temporary increases in suspended sediments and contaminants from building the infrastructure.
Smothering resulting from resettlement of suspended material from building the infrastructure.
Increased turbidity from building the infrastructure.
Introduction of Invasive Non-Native Species (INNS) from construction vessels.</td><td>Introduction of Invasive Non-Native Species (INNS) from maintenance vessels and introduction of areas of hard substrate along the ECC may create “stepping stones”.
Increased local predation pressure around wind turbines (as shelters for fish)
EMF and heat from operational cables.
Alteration to the local habitat through introduction of hard surfaces.
Localised damage to sensitive epifauna (for example, sea pens) due to mooring lines.</td><td>Temporary increases in suspended sediments and contaminants from the removal of the infrastructure.
Smothering resulting from resettlement of suspended material from the removal of the infrastructure.
Increased turbidity from the removal of the infrastructure.
Introduction of Invasive Non-Native Species (INNS) from decommissioning vessels.
Alterations to colonised surfaces that have evolved over the project lifespan.</td><td>All designated features of the East of Gannet and Montrose Fields NCMPA have been identified as having the potential to be affected (other than insignificantly) by the Project.
Based on the appraisal methodology described above and the direct overlap of the Project with the NCMPA, all features have been screened-in for a full assessment.

Screening outcome:
Screened-in for all features; full assessment to be provided in Stage 1 Assessment report.</td></tr>
</table>

<table>
<tr><th rowspan="2">Site Name</th><th rowspan="2">Feature(s)</th><th colspan="3">Potential impact pathway(s)</th><th rowspan="2">Likelihood of interaction(s)</th></tr>
<tr><th>Construction</th><th>Operation & maintenance</th><th>Decommissioning</th></tr>
<tr><td>Southern North Trench</td><td>Minke whale</td><td>Increased underwater noise (piling, UXO clearance and geophysical/geotechnical surveys).
Increased underwater noise from vessels.
Seabed works disturbing the seabed and increased suspended matter affecting prey species distribution/availability.</td><td>Increased underwater noise from vessels.
Operational noise ((including mooring noise, for example cable “snap”) has the potential to cause displacement and disturbance to marine mammals.</td><td>Increased underwater noise from vessels.</td><td rowspan="2">All designated features of the Southern Trench NCMPA have been identified as having the potential to be affected (other than insignificantly) by the Project. Based on the appraisal methodology described above and the direct overlap of the Project with the NCMPA, all features have been screened-in for a full assessment.
Screening outcome: Screened-in for all features; full assessment to be provided in Stage 1 Assessment report.</td></tr>
<tr><td>Southern Trench</td><td>Burrowed mud
Shelf deeps</td><td>Direct impact/disturbance leading to temporary or long-term habitat loss from building the infrastructure.
Temporary increases in suspended sediments and contaminants from building the infrastructure.
Smothering resulting from resettlement of suspended material from building the infrastructure.
Increased turbidity from building the infrastructure.</td><td>Long-term or short-term disturbance resulting in displacement from planned or unplanned maintenance.
Introduction of Invasive Non-Native Species (INNS) from vessels and presence of structures.
Increased local predation pressure around wind turbines (as shelters for fish).</td><td>Temporary increases in suspended sediments and contaminants from the removal of the infrastructure.
Smothering resulting from resettlement of suspended material from the removal of the infrastructure.
Introduction of Invasive Non-Native Species (INNS) from</td></tr>
</table>

Site Name	Feature(s)	Potential impact pathway(s)			Likelihood of interaction(s)
		Construction	Operation & maintenance	Decommissioning	
		• Introduction of Invasive Non-Native Species (INNS) from vessels during construction.	• EMF and heat from operational cables. • Alteration to the local habitat through introduction of hard substrates. Localised damage to sensitive epifauna (e.g., sea pens) due to operational mooring lines.	decommissioning vessels. • Alterations to colonised surfaces	
Southern Trench	• Fronts	• Changes to fronts or stratified seas due to construction activities	• Changes to fronts or stratified seas due to planned or unplanned maintenance activities	• Changes to fronts or stratified seas due to decommissioning activities	
Southern Trench	• Quaternary of Scotland: Moraines • Quaternary of Scotland: Sub-glacial tunnel valleys • Submarine Mass Movement: Slide scars	• Physical changes to seabed topography (for example, abrasion to the seabed surface) during construction activities • Physical removal or deposition of material during construction activities • Sediment transport and potential effects on marine receptors during construction activities	• Physical changes to seabed topography (for example, abrasion to the seabed surface) during planned or unplanned maintenance activities • Physical removal or deposition of material during planned or unplanned maintenance activities	• Physical changes to seabed topography (for example, abrasion to the seabed surface) during decommissioning activities • Physical removal or deposition of material during decommissioning activities	

Site Name	Feature(s)	Potential impact pathway(s)			Likelihood of interaction(s)
		Construction	Operation & maintenance	Decommissioning	
			• Sediment transport and potential effects on marine receptors during planned or unplanned maintenance activities	• Sediment transport and potential effects on marine receptors during decommissioning activities	
Turbot Bank	• Sandeels	• Direct impact/disturbance leading to temporary or long-term habitat loss from building the infrastructure. • Temporary increases in suspended sediments and contaminants from building the infrastructure. • Smothering resulting from resettlement of suspended material from building the infrastructure. • Increase in underwater noise from building the infrastructure.	• Direct impact/disturbance leading to temporary or long-term habitat loss from the presence of the infrastructure and planned or unplanned maintenance. • Temporary increases in suspended sediments and contaminants from planned or unplanned maintenance. • Smothering resulting from resettlement of suspended material from planned or unplanned maintenance.	• Direct impact/disturbance leading to temporary or long-term habitat loss from the removal of the infrastructure. • Temporary increases in suspended sediments and contaminants from the removal of the infrastructure. • Smothering resulting from resettlement of suspended material from the removal of the infrastructure. • Increase in underwater noise from the removal of the infrastructure.	All designated features of the Turbot Bank NCMPA have been identified as having the potential to be affected (other than insignificantly) by the Project. Based on the appraisal methodology described above and the close proximity of the NCMPA to the Project (6km), and the mobile feature, it is screened-in for a full assessment. **Screening outcome:** Screened-in for all features; full assessment to be

Site Name	Feature(s)	Potential impact pathway(s)			Likelihood of interaction(s)
		Construction	Operation & maintenance	Decommissioning	
			• Increase in underwater noise during operation and from planned or unplanned maintenance. • EMF and heat from operational cables. • Fish aggregation devices altering stock distribution and predatory/prey interactions	• Fish aggregation devices altering stock distribution and predatory/prey interactions	provided in Stage 1 Assessment report.

1.6 Next stages – main assessment

1.6.1.1 This section outlines the next steps that will be undertaken following this initial screening assessment and be part of the main assessment.

1.6.1.2 The main assessment will follow an impact specific assessment for each ecological receptor of the MPA. The MPA Main Assessment will be informed by the information presented in the relevant technical chapters of the EIAR to support the conclusions made about whether the Project hinders the achievement of the conservation objectives for each NCMPA/MCZ.

1.6.2 Impact assessment criteria

1.6.2.1 This step refers to the assessment of risks in the context of the conservation status of each of the individual NCMPA's and MCZ's protected features, where the following aspects will be considered:

- Baseline descriptions, established from desk-based information and the site-specific survey data.
- Understanding of site-specific conservation objectives for each designated feature and their conservation status.
- Maximum ZoI, established through Project and site-specific information.
- Qualifying features' sensitivity to proposed activities, established through use of the Feature Activity Sensitivity Tool (FeAST)[20], the Marine Evidence-based Sensitivity Assessment (MarESA)[21] and the Supplementary Advice on the Conservation Objectives.
- Calculating area and percentage of the MPA impacted by the Project (total and impact specific) to help provide a quantitative and qualitative assessment.

1.6.2.2 As with the EIA, the appraisal of the potential effects of the Project on the ecological marine environment, with definitions of impact, effect and significance of effects on the identified receptors is drawn from the Chartered Institute of Ecology and Environmental Management (CIEEM)[22]. These definitions will also be used within the MPA Main Assessment, with the term 'effect' to express the consequence of an impact. This is expressed as the 'significance of effect' and is determined by considering the magnitude of the effect alongside the importance, or sensitivity, of the receptor or resource, in accordance with defined significance criteria (**Chapter 5: Approach to Scoping and EIA** of this 2024 Scoping Report).

Maximum design scenario

1.6.2.3 As described in Section 1.1 of this report, the main assessment will include a full description of the key design parameters relevant to this assessment, as well as the measure adopted as part of the Project, including embedded mitigation.

1.6.2.4 Embedded mitigation measures have been identified and are proposed to be adopted as part of the Project design (primary mitigation); or implemented in accordance with industry standard practice that would occur with or without the input from the environmental assessment feeding into the process (tertiary mitigation). There is a commitment by the Applicant to implement these embedded mitigation measures and they have been considered within the 2024 EIA Scoping Report.

1.6.2.5 The requirement for additional mitigation measures (secondary mitigation) will be dependent on the significance of effects on receptors within each topic and will be consulted upon with consultees throughout the EIA process. Any additional mitigation measures will be presented within the EIA Report and MPA Main Assessment as appropriate.

1.6.2.6 Adopting the maximum design scenario(s) will assist with the selection of those impacts with the potential to result in the greatest effect on key features of the MPA. These scenarios will represent the greatest potential for environmental change and will be selected on a case-by-case basis.

Mitigation measures

1.6.2.7 As part of the Project design process, a number of mitigation measures will be proposed to reduce potential impacts on the different ecological receptor groups. Some measures will be implemented as standard practice (as described in the **Chapter 5: Approach to Scoping and EIA** of this 2024 Scoping Report). However, should the Project likely lead to a significant risk of hindering of achieving conservation objectives of an MPA, secondary mitigation measures will be considered.

Conclusions

1.6.2.8 Following the steps described above and considering all the aspects, a conclusion on the likelihood of the Project to hinder the conservation objectives of each feature of the MPA considered will be drawn. These will be based on the area/percentage of the feature of the MPA impacted, aspects of the Project design and measures applied to mitigate the environmental impact.

1.6.2.9 Conclusions of the significance of the risk of hindering the achievement of the conservation objectives for all features of the MPA will be drawn for both Project alone and in combination.

1.6.3 In-combination and cumulative effects

1.6.3.1 As part of the MPA Screening Assessment, the guidance also recommends considering in combination and cumulative effects of licensable activities. The HRA approach to 'in-combination assessment' will be used to identify other plans and projects that could hinder the conservation objectives of the MPAs in-combination with the Project. The plans and projects identified as requiring further assessment as part of the MPA assessments are listed in the longlist submitted together with this 2024 Scoping Report (Volume 2 Appendix 5C Long List of Projects). The in-combination and cumulative effects of the MPA Screening Assessment will be considered in the final assessment.

1.6.4 Further considerations for consultees

1.6.4.1 This section refers to specific questions relating to the MPA Screening assessment, while the questions addressed under the relevant receptors pertinent to this assessment (such as, **Chapter 9: Benthic Ecology**, **Chapter 10: Marine Mammals**, and **Chapter 12: Fish Ecology**) are also relevant.

- Are the consultees content with using the English guidance (*Marine conservation zones and marine licensing*, by MMO, April 2013), while referring to/consulting the archived Scottish guidance in the MPA Screening assessment?
- Are the consultees content with the list of sites screened into the main assessment?
- Are the consultees content with the methodology presented in the 'Next Stages – Main Assessment' section to be used to determine the likelihood of impacts?
- Can you please advise what site/habitat-specific Impact Thresholds should be utilised for the management and recovery objectives of these sites?

1.7 References

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Appendix 5F: Approach to EMF and Heat as Potential Impacts

Contents

1. APPROACH TO EMF AND HEAT AS POTENTIAL IMPACTS

1.1 Purpose of the document

1.1.1.1 This document is a summary of evidence to objectively consider whether electromagnetic fields (EMF) and heat from the Project's cables have the potential to impact marine ecological receptors. Based on this summary the document identifies which aspects might require assessment within the Environmental Impact Assessment (EIA) and which can be scoped out.

1.1.1.2 Development of the Cenos Offshore Windfarm ("the Project") requires cables for the export and import of electricity to shore, as well as inter-field connections and onward export of electricity to offshore oil and gas users.

1.1.1.3 The voltage across a cable, and the current flowing through it, produce electric and magnetic fields. The former as a result of voltage and the latter as a result of current. Together, they are referred to as EMF. The electromagnetic spectrum emitted by cables also includes heat, as a result of electrical resistance. It is recognised that anthropogenic EMFs may have effects on marine organisms. Similarly, generated heat has the potential for ecological effects. However, there is considerable uncertainty about EMFs and heat emissions associated with subsea power cables and how they interact with the marine environment and species.

1.1.1.4 Marine fauna with potential sensitivities to EMF and heat that are found within the Project Area include fish (migratory, pelagic, demersal and elasmobranchs (sharks, rays, and skates)), benthic species (bivalves, lobsters, and crabs), marine mammals and diving birds.

1.1.1.5 The export/import cable corridor (ECC) is approximately 230 km long from landfall to the Offshore Substation and Converter Platform (OSCP) and will convey direct current (DC) (320 kV or 525 kV, dependant on final design) from an offshore substation to shore. The inter-array cables will have a maximum combined length of approximately 330 km and will conduct 66 kV or 132 kV for alternating current (AC) between offshore structures. Approximately 70 km of inter-array cables will remain suspended within the water column. As a result, there is the potential for interaction between marine organisms and the EMF and heat produced by the Project cables. The following provides an overview of these potential effects and discusses whether certain effects or receptors can be scoped out of further assessment.

1.2 Electromagnetic field (EMF)

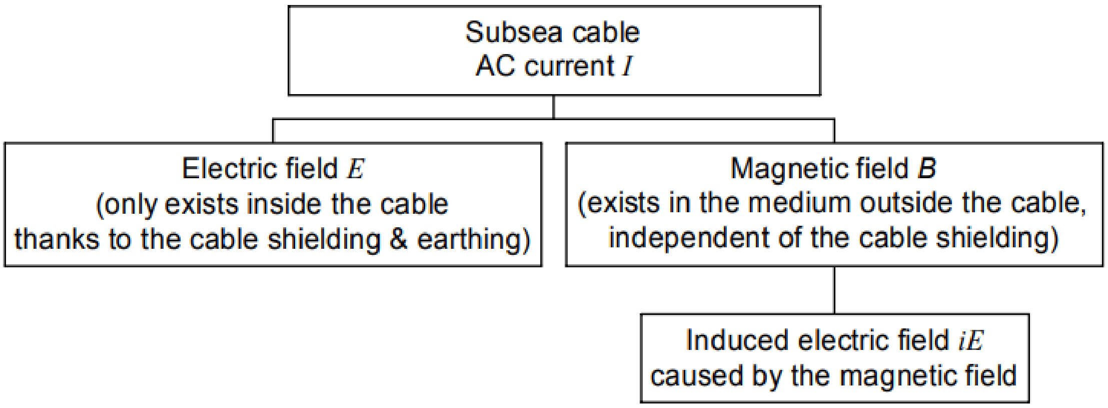
1.2.1 Introduction

1.2.1.1 Electromagnetic fields (EMFs) found in the environment can originate from either natural or anthropogenic sources. The earth's geomagnetic field (GMF) baseline is between 30-60 microtesla (μT), with levels found to be lower at the equator and higher at the poles[1]. Changes or deviations from baseline GMF levels can affect species sensitive to GMF levels (such as changes in food acquisition, survival and reproduction), and therefore potential impacts need to be considered for all receptors.

1.2.1.2 EMF comprises of two components, namely magnetic (B) fields and electric (E) fields[1]. The strength of E- and B-fields depends on the magnitude and type of current flowing through the cable and the cable type (AC vs DC).

1.2.1.3 Standard material used to shield High Voltage Direct Currents (HVDC) cables (i.e. insulation that surrounds the conductor) have been shown to be sufficient to contain the directly emitted E field[2].

1.2.1.4 However, the B field may propagate outside the cable and has the potential to be detected by magneto-sensitive species. Where a fish or tidal movement occurs through a B field, a further induced electric (iE) field can be created. Both AC and DC cables have the potential to create a weak iE field a few micro volts per metre ($\mu V\ m^{-1}$), near the cable[3]. However, the intensity of EMF from a cable decreases approximately as an inverse square of the distance from source; this attenuation is the same for a cable buried in the seabed, lying uncovered on the seabed or suspended in the water column (dynamic cables)[4]



1.2.1.5 AC power transmission cables are more commonly used for offshore renewable projects. However, DC cables are expected to become more widely used as the siting of projects moves further offshore. This is due to the DC cables transmitting more power than AC cables of the same size[3,5,6] and due to DC becoming more efficient for transmission over long distances with a reduction in losses compared to AC.

1.2.2 Species sensitivities

Benthic invertebrates

1.2.2.1 Evidence on the impacts of EMF on benthic invertebrates is unclear with no firm evidence to suggest either way whether EMF can adversely affect benthic invertebrates or not. Results vary considerably between species, on the strength of EMF emitted and dependent on the type of study conducted.

1.2.2.2 Several studies recorded behavioural responses ranging from increased exploration[24], attraction to emitted EMF or reduced burrowing/roaming[7,11]. Additionally, physiological changes in stress related parameters and cellular responses have been recorded, in both EMF field strengths that are magnitudes higher than likely from an HVDC cable utilised by the offshore wind industry but also at levels which may be emitted from similar cable types[7,8,9,10,11,12].

1.2.2.3 In contradiction, other studies have shown no response from either AC or DC EMF gradients[13], and no preferences to energised and non-energised cables[14] or catchability by commercial fisheries that target species such as brown crab, or lobster for instance[15]. Reproduction and early life stages are considered to show particular vulnerability to anthropogenic EMFs. As a result, any potential effects on these life stages may impact on shellfish populations, which in turn may affect the populations available to fisheries that target them.

1.2.2.4 Evidence of invertebrates, such as arthropods and molluscs, responding to natural magnetic fields has been described from a number of studies[16] [17] [18]. Laboratory studies have shown that some crustaceans, such as edible crab (*Cancer pagurus*), may elicit attraction behaviour towards sources of EMF (of a similar strength to that expected around OWF subsea cables), thereby affecting natural behaviour[19], although individuals did not present stress-related physiological signs. Conversely, a study by Taormina *et a;*[20]. found no statistically significant effect on the exploratory and sheltering behaviour of juvenile European lobster (*Hommarus Gammarus*) following exposure to AC B-field EMF. A study by Jacubowska *et al*.[21] on polychaetes indicated that there were no particular physiological effects or attraction/avoidance behaviour towards EMF, but there was an increase in burrowing activity.

1.2.2.5 A study by Love *et al*.[22] compared the differences in soft-sediment invertebrate communities alongside both energised and unenergized subsea cables, and concluded that there were no functional differences between the two groups. The invertebrate assemblage around each was generally similar. A review of studies regarding the response of faunal communities to the presence of subsea cables[23] concluded that benthic communities growing along cable routes are generally similar to those in nearby areas, with some locations perhaps showing a difference in the abundance of a few species. It also was noted in this review that potential changes may also be a result of the physical presence of structures or other environmental factors, rather than EMF. Gill and Desender[23] conclude that, whilst 'research, both field and laboratory studies, has shown measurable effects and responses to E- and/or B-fields on a small number of individual species', this was 'not at the EMF intensities associated with [renewable energy]'.

1.2.2.6 For an assessment of potential impact on the characterising fauna of the habitats/biotopes present at the windfarm site, it is difficult to apply the above studies (which are generally focused at the individual-level, or are species-specific). However, in general it appears that, based on the extremely localised nature to which EMF fields are detectable, changes in community composition and structure due to avoidance and/or attraction of characterising taxa would be minimal.

1.2.2.7 Currently EMF effects on benthic invertebrates are scoped into the assessment, however on the basis of the material presented in this Appendix, the Applicant would welcome further discussion with stakeholders with a view to de-scoping this aspect.

Fish

Overview

1.2.2.8 The localised EMF created by electric current passing through cables has the potential to disrupt electrosensitive and magnetosensitive fish, particularly elasmobranchs, lampreys, eel and salmonids[24].

1.2.2.9 Potential impacts of any electric field may include disrupting sensory feeding cues of elasmobranchs (sharks, rays, and skates) which employ electroreceptive foraging behaviour. Magnetic fields may impact upon the navigational cues to diadromous species such as lamprey species, salmon, sea trout and eel as well as elasmobranchs, impairing orientation which may subsequently influence migratory behaviour.

1.2.2.10 Elasmobranchs are generally considered to be the most electro-sensitive species group as they possess a highly sensitive electrosensory system (ampullae of Lorenzini). Species such as lamprey, sturgeon and a few teleost fish also have advanced electro-sensory systems and have the potential to be similarly electro-sensitive.

Elasmobranchs

1.2.2.11 Published studies showed that elasmobranchs have the ability to detect very low electric fields (starting from 0.005 μV cm^{-1}), and magnetic fields (20–75 μT)[18]. Tricas and Gill[62] noted that submarine power cables have the potential to temporarily affect the seasonal or diel migration pathways of elasmobranchs over short distances. However, this may not necessarily result in adverse effects and may instead act as a recognizable waypoint, aiding navigation.

1.2.2.12 Species such as the small-spotted catshark (*Scyliorhinus canicula;* also known as dogfish) and thornback ray (*Raja clavata*) are well studied species sensitive to the E-fields generated around subsea cables. Such fields may influence fish behaviour, as some species have been shown to detect very weak voltage gradients in the environment around them. Gill *et al.*[24] noted that the ability to detect E-fields is likely to vary between individuals of the same species dependent on the sex, life stage and size of individual, with larger fish becoming more sensitive.

1.2.2.13 Laboratory based studies by Gill and Taylor[25] suggested small-spotted catsharks avoided DC E-fields at emission intensities similar to those predicted from offshore windfarm AC cables, whilst being attracted to DC emissions at levels predicted to emanate from their prey. Resident populations that inhabit areas near cable routes may therefore be attracted, repelled, or unaffected by the presence of power cables[25].

1.2.2.14 The area around which elasmobranchs can detect EMF is limited to a scale of metres around electrical cables buried to a target depth of 0.9-1.8m[26], therefore species that spend time on the seafloor, like skates and rays, have the highest chance of interacting with EMF produced by cables. Skates and rays, including the thornback ray and spotted ray, primarily feed on bottom-dwelling invertebrates and fish. These prey species produce an average bioelectric field that is less than 10Hz, far lower in frequency than that found in the cables used for windfarm sites and therefore outside of the typical tuned range for elasmobranchs[27]. EMF also decays very quickly with distance from the cable, which minimises potential exposure. Based on a similar project, the maximum magnetic field at the seabed for HVAC cables (assuming a 1m HVAC buried cable) is expected to be 26.5μT, reducing to 1μT at 4.4m vertically above the seabed[28]. For context, measurements of background levels of magnetic fields in the northeast Atlantic are 50μT[29].

1.2.2.15 For highly mobile and pelagic elasmobranchs such as the basking shark, EMF effects are unlikely to cause significant behavioural changes, and barrier effects have not been documented from other offshore wind projects. Basking sharks spend up to 75% of their time at, or near, the surface, where their zooplankton prey is found[30], therefore it is unlikely they will encounter EMF from the cables during their migration in summer months.

1.2.2.16 Despite the potential for sensory overlap with expected E-field levels from undersea power cables, there is little evidence to determine whether these currently may occur in the field (as opposed to laboratory conditions). In a strategic review of offshore windfarm monitoring data, post construction monitoring of the Kentish Flats Offshore Windfarm showed no discernible difference between elasmobranch populations at control or reference sites[31].

Salmon and sea trout

1.2.2.17 Salmon and sea trout are anadromous species and are likely to cross the route of the proposed cable corridor on at least two occasions, once as a smolt emigrating from freshwater and a second time as a sexually mature adult returning to spawn. Sea trout do not undertake such an extensive open ocean migration as that observed in salmon, remaining closer to the coast where they feed on fish and crustaceans in estuaries and coastal waters. However, they will interact with nearshore cables and may encounter the cable corridor on numerous occasions whilst foraging. The magnetic fields generated around the cable are a potential source of disruption to fish migration and to sea trout foraging.

1.2.2.18 Returning adult salmon migrating through coastal waters are typically found near the surface (although deeper dives are observed), at depths of between 0.5–5 m[32, 33], where they will not encounter the strongest magnetic flux densities at the substrate surface directly above the cable. While salmon are believed to utilise the earth's magnetic field to aid navigation in open ocean's, in shallow coastal waters their surface migratory behaviour may indicate that olfactory cues contained within the buoyant freshwater plumes that emanate from estuaries override weaker magnetic cues. This theory is supported by the increase in near shore migration speeds observed with increasing river discharge, that may serve to make river recognition easier[32].

1.2.2.19 Swedpower[34] found no measurable impact when subjecting salmon and sea trout to magnetic fields twice the magnitude of the geomagnetic field. Similarly, studies conducted by Marine Scotland Science (Armstrong et al.[35]) and Walker[36], found no evidence of unusual behaviour in Atlantic salmon associated with magnetic fields and EMFs produced by cables. The study undertaken by Armstrong *et al*. observed the response of captive Atlantic salmon to activated Helmholtz coils. The study demonstrated that neither large salmon (62-85 cm) or smaller post-smolts (24-41 cm) showed a significant response (alarm behaviour, avoidance, and accelerated or decelerated swimming) when passing through a magnetic field of up to 95 μT. The

AC and DC fields used in these studies were significantly higher than would be expected at 0 m above the seabed with a cable buried at 1 m depth (Normandeau, 2011). It is acknowledged that these results do not demonstrate that diadromous or other pelagic fish cannot detect fields of these types, merely that so far, no significant effects on behaviour have been found.

1.2.2.20 Whilst there is generally a paucity of studies that observe the effect of subsea cables on Atlantic salmon migration[2], Gill *et al*.[24] cites observations from the Dee estuary where there are several buried cables in existence considered not to have affected salmonid and eel migrations historically. Sigray and Lagenfelt[44] cite an earlier study by Yano *et al.*[37] who were similarly unable to demonstrate that the orientation of chum salmon (*Oncorhynchus keta*) was altered when the magnetic field was increased by two orders of magnitude in relation to the Earth's GMF.

1.2.2.21 At very low-level magnetic fields (<50 µT), improvements in growth and performance have been shown in rainbow trout[38] , but deterioration in egg quality for a range of fish species has been shown at magnetic fields of >2000µT[39], although the fields in this study are several orders of magnitude higher than generally observed form offshore windfarm cables.

1.2.2.22 Most EMF exposures would be expected to be short, in the order of minutes, whilst these highly mobile species are moving through the windfarm site. The area around the cable where EMF is elevated is small (less than 10m, based on Taormina *et al*.[40] analysis of export and interconnector cables), representing a very small fraction of the available habitat for these species, which may travel multiple kilometres per day, and are less likely to swim close to the seafloor (Snyder *et al*., 2019).

European eel

1.2.2.23 The European eel is classed a 'Critically Endangered' species[41] following significant declines in numbers in both the UK and throughout Europe. They are catadromous, living most of their life in freshwater, returning to the sea to spawn. European eels are similarly sensitive to magnetic fields as salmonids[24, 42] .

1.2.2.24 Studies tracking eels in the southern Baltic Sea suggested that migratory eels may be deviated from a straight course as a result of the magnetic anomaly caused by a subsea cable although the spatial resolution of the study was too low to draw a firm conclusion about the effect[43]. Another study carried out in the Baltic Sea, concluded that swim speeds in tagged migrating European eels were significantly lower around a 130 kV AC power cable than elsewhere[44]. Swedish studies have also shown small delays to eel migration resulting in passage across subsea cables[43]. Gill and Bartlett (2010)[2] describe trivial and temporary change in swimming direction by eels that encounter the magnetic field of a HVDC cable. Orpwodd[45] observed the response of European silver eels (i.e. adult migratory stage) to an AC magnetic field of approximately 9.6 µT within a controlled laboratory setting. There was no evidence of a difference in movement due to the magnetic field nor observations of startle or other obvious behavioural changes.

River and sea lamprey

1.2.2.25 Both river lamprey (*Lampetra fluviatilis*) and sea lamprey (*Petromyzon marinus*) are diadromous species. Though at the lower end of the electroreceptive spectrum (*P.*

marinus behavioural response of 10 µV m^{-1}), E-fields have the potential to influence their movements. Studies carried out on a 33 kV cable crossing the Clwyd estuary in North Wales[46] have indicated elevated E-fields (> 70 µV m^{-1}) and B-fields (50 µT) well within the sensory range of both lamprey and salmonids. However, the Clwyd is well known for its lamprey[47], suggesting that the effect of the cables has not adversely affected the population.

1.2.2.26 River lampreys are highly unlikely to be present in the proximity of the Project cables (as detailed within the HRA Screening, 2024, submitted alongside the 2024 rt), as they will not move a great distance from the mouth of their natal rivers. By contrast, trawl data indicate that small sea lamprey (<39 cm) can be present in the bottom continental shelf, and larger individuals (>56 cm) can frequent the midwater along the shelf edge and over the continental slope[48]. Sea lamprey hosts are diverse, ranging from herring to basking shark (*Cetorhinus maximus*), meaning the adult parasitic phase can be distributed widely. However, during this phase they are far less likely to be in contact with EMFs from subsea cables.

1.2.2.27 Although it is likely that sea lampreys are present offshore, there is no evidence that they possess an ability to detect B fields[2] and they rather use olfactory cues to migrate upstream once at the coast.

1.2.2.28 Adult sea lamprey may have behavioural and neuroendocrine responses to weak electric fields[49]. However, no direct research on lamprey behavioural responses to cable induced EMFs or simulations of such fields have been found.

Other teleosts (bony fish)

1.2.2.29 Low-level magnetic fields may induce behavioural change in other marine pelagic and demersal species, but empirical evidence on this is limited. No physiological changes to these species have been found below 3,700 µT[50]. During a study on Nysted Offshore Windfarm, flounder (*Platichthys flesus*) was the only species that showed some evidence of delayed cable crossing, however it is unclear whether this was because of EMFs or due to prior disturbed sediment[51].

Herring (pelagic)

1.2.2.30 A study at Danish Nysted Offshore Windfarm observed a behavioural effect on fish including adult herring (*Clupea harengus*), but this could not be attributed to EMF[52]. A study focusing on herring larvae found no evidence of magnetic compass orientation for this species, indicating that their orientation is not magnetic during this early life stage[53]. Herring spawning grounds are present across the wider North Sea where the Project is located[54].

Haddock (demersal - benthopelagic)

1.2.2.31 Cresci *et al*[55] identified that haddock larvae orientation at sea is guided by a magnetic compass mechanism. Larvae exposed to a B-field with an expected intensity range of a DC subsea cable (50 to 150 µT), showed a decrease in swimming speed and acceleration but no change in spatial distribution[56]. The study was conducted both in the Norwegian Sea and in a magnetic laboratory.

Sandeel

1.2.2.32 Sandeel larvae exposed to a B-field with an expected intensity range of a DC subsea cable (50 to 150 µT) showed no change in swimming speed, acceleration, or spatial distribution[57].

Flatfish (demersal - benthic)

1.2.2.33 Several species of flatfish occur in the Project area. Recent anecdotal evidence suggests that EMFs can influence the behaviour of certain flatfish species, which has caused the fishing community to express their concerns. A partnership between 50Hertz, EirGrid, Europacable, TenneT and RGI was formed to study the impacts that EMFs might have on commercially important flatfish. The study will aim to investigate the effects of AC cables on adult flatfish through bottom trawling, develop a validated EMF model, and disseminate knowledge for fact-based discussion. This is an active area of study and potential impacts on flatfish cannot be ruled out at this stage.

Marine mammals

1.2.2.34 Marine mammals are not known to possess specialist electro- or magneto-receptive organs. There is, however, evidence of magnetoreception in a range of cetacean species (e.g. humpback whales, bottlenose dolphin, harbour porpoise) meaning the B-field component of EMF can potentially affect these species[58,59,60,61.]

1.2.2.35 It is considered that many cetaceans and some pinnipeds use the Earth’s GMF to navigate, particularly during long migrations, with implications that EMF may interfere with navigational cues. Modelling conducted by Tricas and Gill (2011)[62] on bottlenose dolphins indicated that they could detect B-fields from a subsea cable up to 50 m away when directly above the cable, causing alteration to the direction of travel. However, due to the high mobility of marine mammal species and capability to move away from the influence of an EMF, it is not considered that they would experience long-term impacts. There is a greater risk in areas where multiple cables are encountered along migratory routes meaning they are afforded fewer ‘influence-free’ spaces. Magnetoreception is an understudied subject in marine mammals.

1.2.2.36 Though the likelihood of direct impacts to these species is minimal and is scoped out from further assessment, indirect effects through their prey (fish) may be more likely, as discussed above in **Section 1.2.2.8**.

Diving birds

1.2.2.37 Given that EMF influence can fall to ambient levels within 20 m, it is unlikely that birds can be impacted by subsea cables. Diving (foraging) birds are unlikely to be present next to a subsea cable for a significant amount of time[7]. No studies have been conducted on impacts of EMF on diving birds to present. However, impact pathways are more likely to occur through prey and therefore consideration of the knock-on effects on seabirds’ foraging success may be relevant.

1.2.3 Conclusion: EMF

1.2.3.1 As mentioned in the *Evidence Gap FF.07: Electromagnetic fields (EMF) – Fish and fisheries research to inform ScotMER evidence gaps and future strategic research in the UK published* by the Marine Directorate (2022)[63], the evidence available to date suggests that ecological impacts associated with marine renewables subsea power cables may be weak or moderate. However, this is based on evidence from a small number of studies and limited data. As a result, uncertainty remains in relation to how EMF may affect fish and invertebrates[64].

1.2.3.2 On a precautionary basis and given the information presented above, this review concludes the following:

- Despite the reduced ability of some species, such as crustaceans and molluscs, to avoid the zone of influence it is unlikely that significant effects on benthic invertebrates would occur. Based on the available evidence and the extremely localised nature to which EMF fields are detectable, changes in community composition and structure due to avoidance and/or attraction would be minimal. Therefore, EMF effects on benthic invertebrates should be **scoped out** from further assessment.
- Although elasmobranchs can respond to EMF from subsea cables, their response was not found to be predictable and appeared to be species and individual specific. While rays and skates have been recorded during the habitat assessment surveys and these species have the greatest potential for interaction with the cables, any interactions are likely to be over a short timescale. However, there remains some uncertainty of the level of effect on elasmobranch species. Therefore, impacts from EMF will be **scoped out** for further assessment.
- Salmon and sea trout may be impacted during migration although current research . However, the position of these species in the water column and the reduced radius of impact due to cable insulation and burial, are likely to result in minimal impacts to diadromous fish and therefore will be **scoped out** of further assessment.
- European eel exhibit behavioural responses to very low increases in EMF levels. However, migration may not be impacted as they do not orientate using magnetic fields. Therefore, eel species will be **scoped out** of further assessment.
- There is also potential for effect pathways to sea lamprey as a parasitic species which may be impacted via the host. However, migration may not be impacted as they do not orientate using magnetic fields. In addition, populations of lamprey are seen to flourish in the River Clwyd despite the multitude of subsea cables in its vicinity. Therefore, lamprey species will be **scoped out** of further assessment.
- EMF should be considered for demersal species and their larvae, such as haddock, in Project areas where spawning areas are present. Therefore, this will be **scoped in**.
- Direct impacts from EMF on marine mammal species are unlikely and can be credibly **scoped out** as their highly mobile nature allows them to avoid unfavourable stimuli. The potential for indirect impacts through prey will be assessed further.

- Although some birds are known to use the Earth's magnetic fields for navigational purposes, impacts from EMF on this ability are thought to be very low, although the evidence base for this effect is very limited[65]. Direct impacts on bird species will be **scoped out**. However, there may be potential indirect impacts through prey.
- In-combination effects from EMF refer to the potential for the sensitive species to encounter multiple/an agglomeration of subsea cables, likely nearshore (e.g. at landfall). This may result in medium zone impacts, meaning species having more difficulty to freely and swiftly move away from the impact. Therefore, in-combination effects will be assessed to consider any other nearby cables and how these together may affect all the sensitive species mentioned above.

1.2.3.3 Direct impacts from EMF are considered to be **scoped out** for benthic invertebrates, marine mammal, bird species, and diadromous fish but will be carried through to the EIA for all other receptors.

1.3 Heat

1.3.1 Introduction

1.3.1.1 The process by which submarine power cables and other imperfect conductors generate heat is termed resistive heating. It is caused by energy loss as electric current flows through a cable and leads to heating of the cable surface and warming of the surrounding environment. The heat emitted from operational buried cables can extend over several metres[66].

1.3.1.2 Many factors contribute to the amount of heat emitted from operational cables such as physical characteristics and electrical tension of the cable, burial depth, bottom type (thermal conductivity, thermal resistance, etc.) and physical characteristics of the environment. For example, heat dissipation due to transmission losses can be expected to be more significant for HVAC cables than for HVDC cables at equal transmission rates[3]. However, for this Project the AC cables have lower currents passing through them than the DC cables, and it is assumed they will emit less heat than the DC cables.

1.3.1.3 Sediment type will impact the amount of heat dissipated from buried cables into the interstitial water, with coarse sediment allowing for greater increased heat loss than that of fine sands or muds[67]. However, with limited field studies and experiments it is not clear how much of an impact sediment type has on increased temperature above the seabed levels.

1.3.1.4 The extent of sediment heating from cables was modelled by NorthConnect for DC cables with a 525 kV and 1400 Amp, assuming a depth of burial of 0.5 m, an ambient seawater temperature of 9°C and a 20 m distance between adjacent cables. The model output demonstrated that sediment heating effects were extremely localised (>1C° temperature increase < 2.5 m radius; up to 7C° within a radius of 0.5 m55) with no interaction effects found between cables separated at these distances.

1.3.1.5 VikingLink modelled the potential increase in sediment temperatures at 0.2 m below the seabed when the bundled cable is buried at 1.5 m. The conclusions of the study were that bundled cables would be required to be buried between 0.7 m and 1.15 m of sediment for the temperature increase at 0.2 m to be below 2C°. Single cables were found to have a smaller heating effect with required sediment burial between 0.35 m and 0.55 m for the increase temperature at 0.2 m to be below 2C°[68,69].

1.3.1.6 The Nysted Offshore Windfarm is the only windfarm to date that has measured the temperature increase of the sediment near two AC cables of 33 kV and 132 kV that were buried at an approximate depth of 1 m. The results demonstrated a maximal temperature increase of about 2.5C° at 0.5 m[70]. This study was not able to establish a correlation between temperature increase and power transmitted.

1.3.1.7 For this Project, 66 kV or 132 kV AC cables will be used for the inter-array cables and to export power from the OSCP to oil and gas facilities. Unlike, the Nysted Windfarm some of the AC cables will be suspended in the water column, referred to as dynamic cables, rather than buried in the seabed. Little is known about the heat emitted from dynamic cables. However, the heating of these cables is predicted to be lower than the higher voltage DC cables (325 kV or 525 kV) and relatively quickly dissipated in the water column due to currents and the cooling properties of the surrounding water column.

1.3.2 Species sensitivities

Benthic species

1.3.2.1 There is little evidence available of how the heat emitted from electric cables impacts benthic communities[3]. North Sea water temperatures fluctuate significantly with seasons, generally in the range of 6.7 °C to 15.3 °C throughout the year[71]. Surface water temperatures may exhibit more temperature fluctuations than the seabed. However, organisms living close to or buried in the sediment may experience temperature changes due to submarine cables.

1.3.2.2 The most sensitive species to cable heating and that are likely to be present in the Project area are deep burrowing invertebrates. Their burial depth can range from 5 cm to 80 cm[69]. Kingston[72] reported that 95 - 99% of animals are typically within the top 5 cm of sediment. Those species which burrow more deeply tend to be larger and although less abundant[73] their size may mean that a significant proportion of the biomass is present deeper within the sediments.

1.3.2.3 Laboratory studies on two benthic species, mud shrimp (*Corophium volutator*) and the polychaete worm *Marenzelleria viridis*, exposed individuals to a temperature sediment gradient over a seven-day period. Results showed that the distribution of the mud shrimp was not correlated with temperature, whilst the polychaete worms had a tendency to avoid areas with the highest temperature[67].

1.3.2.4 Two species of note have been identified from surveys within the Project area: the Norway lobster (*Nephrops norvegicus*) and the ocean quahog (*Arctica islandica*), the latter being a qualifying feature of the East of Gannet and Montrose NCMPA.

1.3.2.5 Norway lobster have a small range and stay near their burrows (Sabatini & Hill, 2008). They are of commercial and ecological importance. Adults typically burrow to depths of 20-30 cm[74]. A study carried out on the response of embryonic stage of the Norway lobster exposed to elevated temperature (18°C) and ocean acidification found that they were tolerant to this temperature without any negative effects on development or metabolic rate[75]. An increase in temperature from buried cables is unlikely to have any impact on the larvae of this species which are planktonic, but questions remain on the potential effect on benthic post-larvae.

1.3.2.6 Quahog burrow to variable depths according to season and location, usually 0-10 cm, being deepest during winter months. Grab sample surveys by JNCC found juvenile ocean quahog in 44% of samples taken within the East of Gannet and Montrose Fields NCMPA[76]. The distribution of quahog appears correlated to the sediment type, and more individuals were found within areas with a high proportion of fine mud. Buried cables may increase the sediment temperature above levels suitable for adult and juvenile quahogs in close proximity to the buried cables. However, data from studies of heating by cables would suggest an increase of only a few degrees and quahog juveniles have been shown to survive in temperatures as high as 20°C and adults 16°C[77,78,79].

1.3.2.7 Mobile and sessile shellfish species that are associated with the benthos may be more likely to be exposed to heat, particularly over the longer term. However, the burial depths of ~0.5 m will allow greater field dissipation and reduce the likelihood of impacts for such organisms. Considering the localised spatial scale of this impact it is unlikely to negatively impact species such as the Norway lobster that can move out of range and have a planktonic larval stage.

1.3.2.8 For species such as quahog, which may already be living near its thermal tolerance limits in some locations, further study needs to be done to examine the full implications of localised thermal loading, even on such a small spatial scale, therefore heat emitted from buried AC and DC cables cannot be scoped out at this stage. Dynamic AC cables will not impact benthic species and can be scoped out at this stage.

Fish

1.3.2.9 Temperature sensitivities in fish can be related to breeding and spawning behaviours. Many species have specific temperature requirements for successful reproduction. Increases in temperature can increase fish metabolism, leading to increased appetite and more frequent feeding[80].

1.3.2.10 Burial of the cables will reduce the likelihood of fish encountering temperature changes within the water column. Pelagic fish (i.e., herring, mackerel, blue whiting, and sprat) are located mid-water and will not be impacted by a localised increase in temperatures in the vicinity of buried cables. Pelagic species are typically broadcast spawners with all eggs released within a single spawning event and fertilised within the water column and dispersed by ocean currents. Therefore, localised increases in sediment temperatures above buried cables will not impact any life cycles stages of pelagic species.

1.3.2.11 Demersal spawners such as herring, which are found to spawn in the central North Sea from August to September, normally in relatively shallow waters (between 15 – 40 m). Demersal spawners choose where to deposit eggs therefore, areas of increased sediment temperature can be avoided. There is a large area within the central North Sea with suitable substrate (coarse sand, gravel, etc) for herring to deposit their eggs, therefore the small radius of increased temperature around buried cables is unlikely to impact spawning areas.

1.3.2.12 Demersal fish (i.e., cod, haddock, sandeels, sole and whiting) live on or near the seabed. High intensity spawning grounds for sand eel and Norway pout are found within the Project Area. For species such as the Norway pout, the eggs are dispersed by ocean currents[81] and therefore heat emitted from buried cables will not be impact the eggand larval stages of this species. Similarly, sandeel larvae are pelagic and therefore larval survival will not be reduced by a localised increase in temperatures at a buried cable at the seabed. However, sandeel eggs are laid on sandy substrates and are potentially more vulnerable.

1.3.2.13 Elasmobranchs show sensitivity to increased temperature in confined habitats, such as juveniles within nursery habitats, and can experience a reduction of thermal performance (e.g. physiological rates, interaction rates and vital rates)[82]. The potential for nursery grounds of three species was identified within the Project area, namely the critically endangered tope (*Galeorhinus galeus*), the spurdog (*Squalus acanthias)*, and the spotted ray (*Raja montagui)*. Nursery areas for these species within the North Sea are broad[83]. Tope and spurdog are migratory benthopelagic species, and bear live young thus have relatively limited association with the seabed. Conversely, thornback rays are benthic, laying eggs in “mermaid’s purses” that are also benthic, thus closely associated with the seabed throughout their life cycle.

1.3.2.14 Increased heat from DC cables could impact on fish, however the interactions between fish and areas of elevated temperature are likely to be very limited due to the restricted area of effect and mobile nature of the receptors. The heat emitted from the dynamic cables is thought to be less than the buried higher voltage cables and is likely to be rapidly dissipated in the water column. Therefore, the effects of heat emitted from buried and dynamic cables can be scoped out for fish.

Marine Mammals

1.3.2.15 Marine mammals will not be directly affected by heat emitted from operational buried or dynamic cables. Marine mammals spend the majority of their time in the water column and are highly mobile and may only approach the seabed during foraging activity. They generally range of large areas and so will not be in contact with cables and the potential heat emissions for any great length of time. Therefore, marine mammals can be scoped out from further assessment. Indirect impacts via prey species are as discussed per direct impacts to fish.

1.3.3 In-combination effects of heat

1.3.3.1 There is potential for six pipeline crossings and three array cable crossings in the Project. As the extent of the potential impact of increased heat on the ocean quahog is largely unknown at this stage, in-combination effects will need to be looked at in more detail through the EIA process.

1.3.3.2 For all other receptors in-combination effects are scoped out due to the reduced sensitivity and/or location of these species in the water column and the small number of cable crossing locations identified.

1.3.4 Conclusion: Heat

1.3.4.1 In regard to effects of heat dissipation apparent gaps in knowledge exist. There has been limited research into this effect and the potential impact of thermal loading on the benthic community is therefore largely unknown. There may be some species which avoid areas with higher ambient temperatures. However, there is no core habitat for mobile species, such as fish and elasmobranchs, within the Project area. The potential impact to marine mammal species is considered to be through changes in prey distribution and abundance. Based on scoping out impacts to fish species there is not considered a route to impact for marine mammals.

1.3.4.2 It is recommended that this impact is scoped in for benthic species based on the Quahog found within the site and its relative intolerance to high temperatures.

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Appendix 5G: Approach to Secondary Entanglement as a Potential Impact Technical Note

Contents

List of Plates

1. APPROACH TO SECONDARY ENTANGLEMENT AS A POTENTIAL IMPACT TECHNICAL NOTE

1.1 Introduction

1.1.1 Overview

1.1.1.1 Entanglement in fishing gears and marine debris is a global issue which impacts the conservation of marine megafauna (i.e. fish, turtles, marine mammals, and birds). The issue is pervasive and universal, as marine debris now form part of the baseline environment in all seven ocean bodies.

1.1.1.2 There is increasing interest in the potential for floating offshore infrastructure to function as a source for entanglement to marine megafauna, particularly with the recent advent of the floating offshore wind industry in UK waters. Regulators and conservation bodies are interested in the potential for the mooring systems associated with floating offshore wind turbine generators (WTGs) to introduce an entanglement pathway, either via primary or secondary entanglement. These two types of entanglement are distinguished as:

- Primary: direct entanglement with nets, gears, or lines in the water, etc.; and
- Secondary: entanglement in marine debris which has fouled (snagged on) infrastructure within the water column, such as mooring lines and cables.

1.1.1.3 Large cetaceans and basking sharks are thought to be most at risk from entanglement with lines (e.g. from creels and pots) whilst smaller megafauna (i.e. dolphins, porpoises, fish and turtles) are at increased risk of entanglement in netted debris (e.g. derelict gill nets, purse seines etc.) because of their behavioural traits and sizes, respectively.

1.1.1.4 Concerns about the possible entanglement risk to marine megafauna posed by marine renewable energy (MRE) arrays with multiple mooring systems and cables have been raised. However, it should be noted that “entanglement of marine animals with MRE mooring lines and subsea cables has not been observed to date and there is no evidence that suggests an event has occurred around a MRE development”[1].

1.1.2 Project context

1.1.2.1 Cenos Offshore Windfarm Ltd. is considering four mooring system concepts for the two floating WTG substructure concepts being proposed: tension leg platform (TLP) or semi-submersible (see **Plate 1-1** and **Plate 1-2**):

- The TLP design will include taut mooring tendons connecting vertically to the seabed. Tendons are typically made of steel tubes or wires, though synthetic tendons are now on the market, and are connected to anchors located below the footprint of the substructure.
- The semi-submersible design will have a mooring system which utilises a combination of steel chain, steel wire rope and/or synthetic rope in a taut, semi-taut or catenary configuration which connect, at an angle, to seabed anchors located outwith the footprint of the substructure.

1.1.2.2 Mooring lines or tendons will be attached to the floating substructures along the hull, which will be located approximately 15 to 20 m below the waterline.

1.1.2.3 The diameter of the mooring lines will be in excess of 320 mm, which is several orders of magnitude grater than the standard 7 mm associated with synthetic mesh nets which are a common source of entanglement from derelict fishing gears. Mooring chains and synthetic mooring lines at this diameter are too rigid to form entangling loops.

1.1.2.4 Tendons are generally larger in diameter than mooring lines and fully rigid (steel), without any potential to form entangling loops.

Plate 1-1: Semi-sub mooring system components

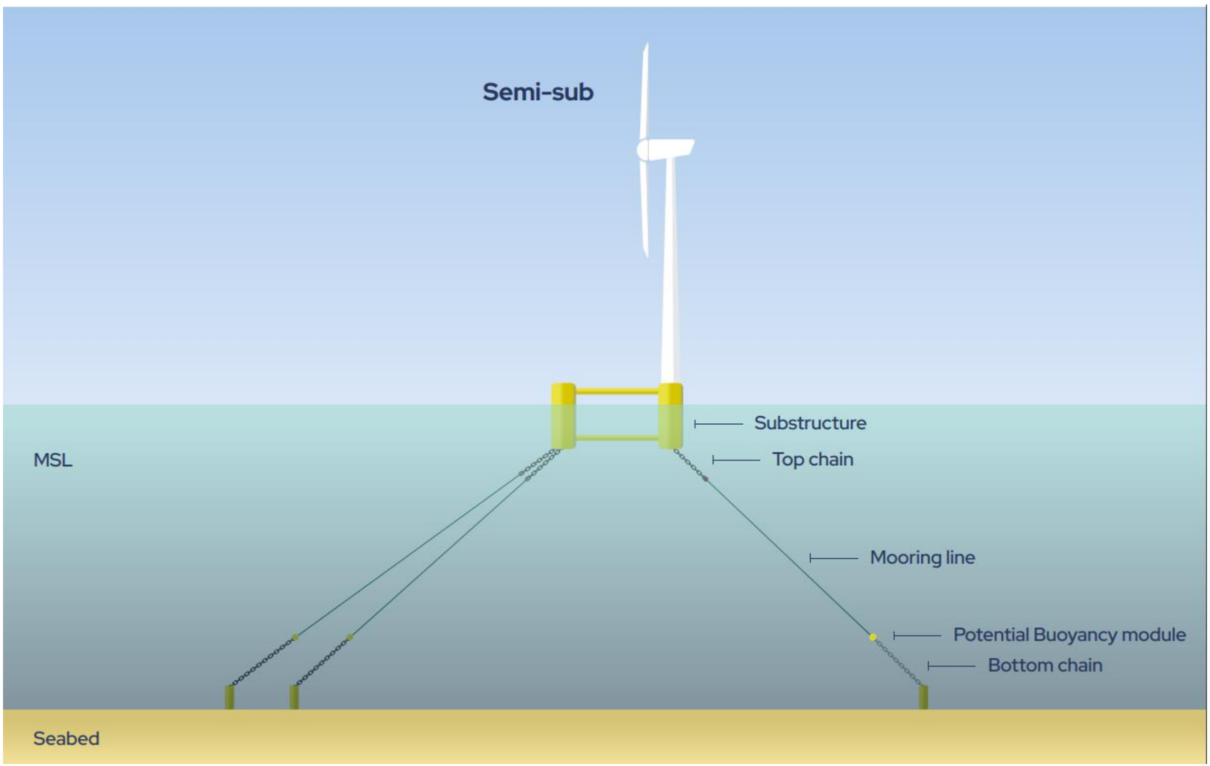
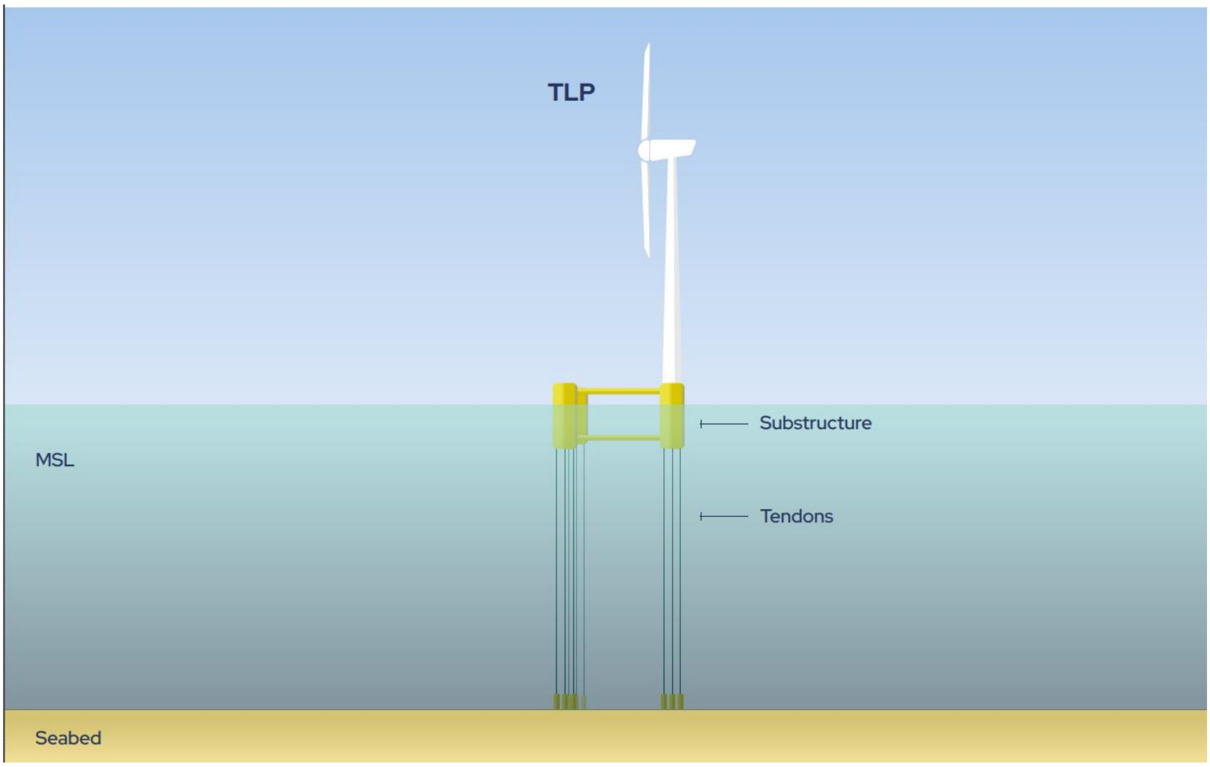


Plate 1-2: TLP mooring system



1.1.3 Purpose of this document

1.1.3.1 This document is a compilation of evidence to objectively consider whether the Project has the potential to impact marine ecological receptors through a secondary entanglement impact pathway. The aims of this report are to identify which aspects of the project have the potential to alter the baseline environment and will thus require scoping in for further assessment within the EIAR. In this regard, this report reviews the nature of entanglement in the baseline environment and characterises the likelihood of Cenos Offshore Windfarm's (the 'Project'), infrastructure increasing the potential for that debris to cause injury or mortality to marine species through entanglement.

1.1.3.2 Primary entanglement is not considered further, as the nature of the mooring lines in terms of tension, rigidity and diameter preclude the possibility of forming entangling loops or capturing marine animals. Furthermore, there is no evidence of primary entanglement within operational floating wind or oil and infrastructure (from which the substructure and mooring system design concepts are derived). Based on discussions during Scoping Workshop, held on 29 February 2024, statutory conservation bodies are in agreement that primary entanglement can be scoped out at this stage for all ecological receptors.

1.2 Secondary entanglement

1.2.1 Overview

1.2.1.1 For the purposes of this review, 'secondary entanglement' is defined as the entanglement of wildlife in marine debris, such as derelict fishing gear, after it has fouled on lines associated with the floating offshore windfarm mooring systems and cables.

1.2.1.2 Derelict or ghost nets are a recognised global issue and widely known to contribute to Abandoned, Lost or Discarded Fishing Gear (ALDFG). This equipment drifts through the sea until it disintegrates or sinks to the seabed, often continuing to trap fish and other marine animals. Because fishing gears are designed to catch marine species, ALDFG has the greatest primary entanglement potential relative to other types of marine debris[2]. Given the slow rate at which such equipment decays, the impact of derelict fishing gear on marine wildlife through entanglement-mediated injury and mortality can be substantial in a global context.

1.2.1.3 Under various international conventions, including the EU's Common Fisheries Policy, commercial fisheries have a legal obligation to retrieve lost gear (Council Regulation (EC) No 1224/2009). However, it is acknowledged that many lost fishing gears are untraceable or irretrievable and therefore remain at-large in the sea. In this regard, derelict fishing gear, like other forms of marine litter, form part of the existing marine baseline environment.

1.2.2 Characterisation of risk

1.2.2.1 To quantify the potential for secondary entanglement, one must consider both the likelihood that marine debris will interact with the floating array infrastructure (called 'fouling'), and the potential for any such interactions to subsequently increase the opportunity for wildlife to become entangled with the fouled material.

1.2.2.2 The perceived likelihood of secondary entanglement with fouling from a single WTG's mooring system must then be scaled across the full array to comprehensively consider the potential impact of the site on baseline levels of entanglement generated by marine debris.

The relationship between fishing practices and ALDGF

1.2.2.3 ALDFG has been ranked based on global adverse effects and the five most problematic gears were identified as set and fixed gillnets and trammel nets, drift gillnets, gears using drifting and anchored FADs (tuna purse seines and pole-and-lines), and bottom trawls[2]. However, the potential 'ghost fishing efficiency' of ALDFG is dependent upon several fishing-related factors, including:

- Whether the gear was set and then lost or abandoned, or if was discarded;
- The potential for the catching process to continue once the gear is lost or abandoned (active gears, such as purse seines and trawls, generally lose their catchability once detached from a moving vessel);

- The potential for self-baiting (i.e. acting as an aggregating device to attract predators or scavengers); and
- Whether the gear incorporates wildlife-sensitive designs, such as degradable escape panels and cords.

1.2.2.4 Local environmental conditions at the source of the ALDFG also influence ghost fishing efficiency. Physical environmental factors have the potential to disable or immobilise ghost fishing gear, such as the presence of seabed features, exposure to physical or coastal processes, and local abundance of biofouling organisms which can weight the gears so they sink from the water column. Moreover, exposure to ongoing vessel and mobile fishing activities can prevent ALDFG from entangling species[2].

1.2.2.5 It is apparent that there are naturally occurring mechanisms which may reduce the potential for ALDFG to act as an ongoing source of primary entanglement to marine organisms via ghost fishing. However, to understand the potential for the Project to generate entanglement-related adverse effects to wildlife in excess of what is naturally occurring within the marine environment, potential interactions between marine debris and the Project infrastructure must first be considered.

1.2.2.6 Fishing activity, within the ICES rectangle in which the Array Area sits (43F1), occurs at low levels and is dominated by demersal trawling for *Nephrops*. Low levels of demersal seine netting and pelagic trawling also take place. There is no reported gill or trammel netting within the ICES rectangles adjacent to the Array Area and lost nets from these fisheries are typically recovered in the location in which they were lost[3].

1.2.2.7 The risk of demersal trawl and seine nets being lost or fouled within the Array Area is exceptionally low due to the fact that these are weighted nets which are dragged along the seabed and would remain on the seabed, should they come loose or ensnare on something. Pelagic trawl nets are unweighted, but the scale and material used in these nets still makes them remarkably heavy and it is not anticipated that they would remain within the water column long enough to be carried by currents into the Array Area.

Secondary entanglement risk review

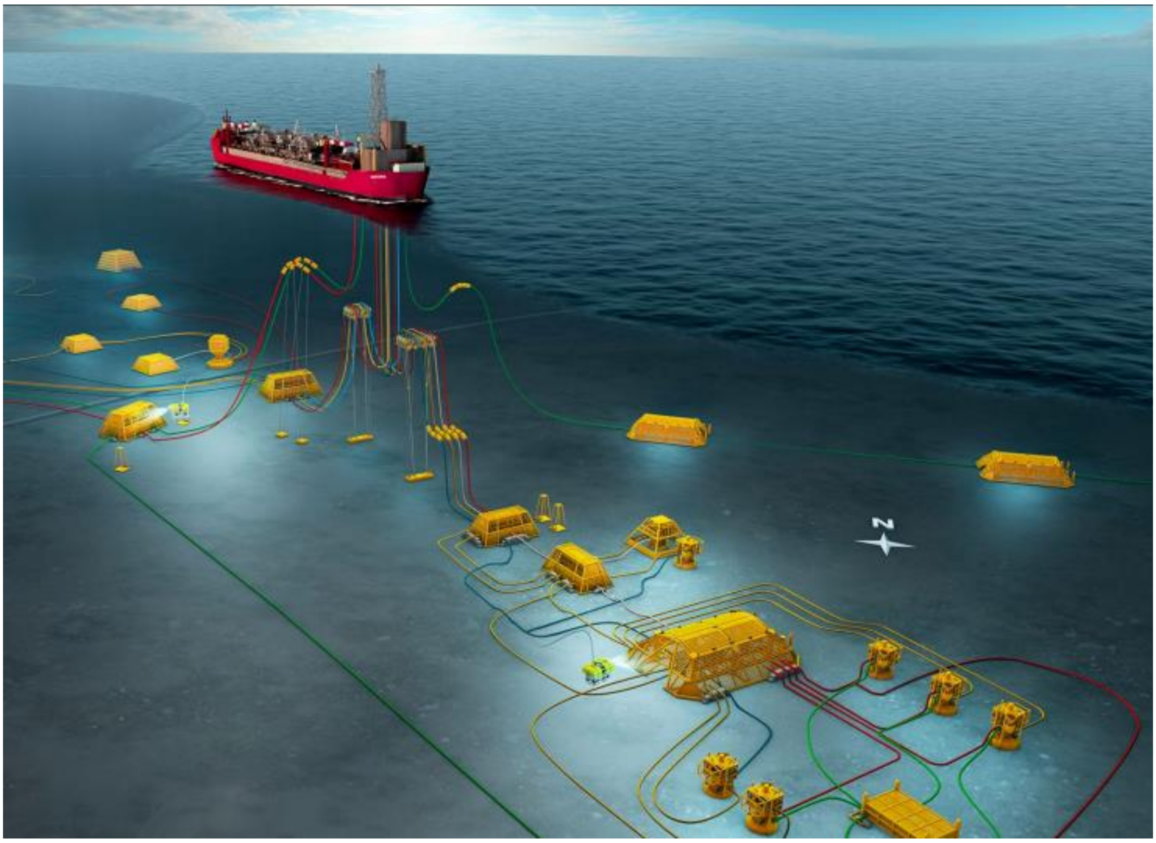
1.2.2.8 With respect to Project-specific influences on entanglement risk, the potential for secondary entanglement only exists within the footprint of the Array Area where there is infrastructure within the water column which could become fouled by marine debris. This infrastructure includes mooring lines, tendons and the floating segments of the inter-array cables. Based on the types of materials used and their movement potential, mooring systems which are not taut (e.g. catenary) are thought to have the greatest potential to introduce secondary entanglement risk from floating offshore marine energy infrastructure[5]. However, there is currently no evidence base to support this claim.

1.2.2.9 To date, there have been no recorded instances of secondary entanglement in the mooring systems of any marine renewable infrastructure[4] or with any anchored Floating Production Storage and Offloading (FPSO) or Floating Storage and Offloading (FSO) units utilised by the oil and gas industry[5], which have similar or more complex floating infrastructure (i.e. mooring systems, production lines, umbilicals, dynamic cables, etc.) than those proposed by the Project.

1.2.2.10 Although floating offshore wind is a relatively new industry, FPSOs such as Anasuria (see **Plate 1-3**) have been operational in the waters surrounding the Project for several decades. Floating offshore WTGs, such as those deployed at Kincardine, Hywind Scotland, WindFloat and Hywind Tampen offshore wind farms, and at test sites in the UK, US, Italy, Spain, Portugal, Japan, and China, have yet to publicly report any incidences of entanglement generated by the fouling of floating infrastructure by marine debris.

1.2.2.11 These projects are much closer to the coastline and many are located in areas with sufficiently more static and pelagic gear fishing activity than that which occurs within the waters comprising the Project Area. As such, these projects arguably have a greater potential to become fouled by ALDFG than Cenos.

Plate 1-3: Anasuria FPSO's complex subsea infrastructure



Species-specific sensitivity to entanglement

1.2.2.12 The risk of entanglement varies between species and depends on the nature of the material interacting with the animal, and the body size, movement and behaviour of the species in question. Key behavioural factors which influence the species-specific risk of entanglement include the ability to detect and avoid material within the water column and behaviours relating to the species' foraging ecology[4] (e.g. consideration given to the depths and methods of foraging). Fish and other animals caught in fouled gears (particularly nets or seines) have the potential to serve as bait for predators, such as seals, sharks or diving birds, bringing them closer to debris and increasing entanglement risk[2].

1.2.2.13 During the two-year Digital Aerial Survey (DAS) of the offshore Array Area and its surrounding waters there was only one minke whale (*Balaenoptera acutorostrata*) recorded. These data corroborate the low-density estimates (0.0419 Block NS-D; 0.0103 Block NS-G) during the SCANS IV surveys in this area of the North Sea6. The habitat within the Array Area is not considered particularly suitable for basking sharks and, therefore, they are unlikely to be found in large numbers7. It is worth noting that no basking sharks were recorded during the DAS. Harbour porpoise and white-beaked dolphins were the most regularly sighted species during the DAS, but these were in relatively low numbers compared to the wider region and this area of the North Sea is not known to be an area of elevated density for these species.

1.2.3 Design-based considerations

1.2.3.1 As discussed in Section 5G.2.2 above, fishing activity across the Array Area remains relatively low and is characterised by fishing practices with relatively low entanglement risk as ALDFG (i.e. demersal trawling, etc.). Additionally, safety zones around project infrastructure will prohibit fishing vessels from occupying areas where interactions with the array infrastructure could occur to generate ALDFG or marine debris.

1.2.3.2 Early consultation and research conducted by the Natural Resources Defence Council (NRDC) indicate that buoyant plastic fishing gear poses a high risk to marine wildlife as an ALDFG source of entanglement. However, this type of marine debris remains within the first few meters of the water column, limiting the potential zone of impact to marine species to the sea surface[8]. Moreover, buoyant fishing gears are unlikely to enter the Array Area, as these types of gears are not regularly used near the Project Area.

1.2.3.3 In the semi-submersible design, the hull of the floating substructure will be submerged to roughly 15 - 20 m depths. The mooring chains will emanate from the hull to connect the floating foundation substructure to the mooring lines and onward to the anchors. The same is true for the inter-array cabling infrastructure. This limits the potential for buoyant fishing gear to interact with any lines in the water associated with the windfarm. Moreover, it limits the potential for diving seabirds to become entangled in fishing gears or debris which have fouled the lines.

1.2.3.4 Any ALDFG that becomes wrapped around the floating infrastructure will have a reduced surface area, thereby reducing the catch potential of those gears versus what it would be should they remain ‘ghost fishing’ within the water column. As well, such fouling would remove the debris from the zone of greatest impact, the uppermost surface waters[8].

1.2.3.5 Similar to the semi-submersible design, the TLP will have tendons emanating from the hull of the substructure. However, the vertical angle, large diameter and smooth, continuous material comprising the taut tendons means that buoyant or neutrally buoyant ALDFG will slide off the tendons and will not remain fixed within the water column.

1.2.3.6 There is exceptionally limited potential for weighted ALDFG to interact directly with the tendons because this would require movement into the array from the point of loss or abandonment. This is because the tendons fall within the footprint of the TLP substructure, benefitting from the safety zone around the WTGs which precludes fishing activity and therefore limits the potential for direct interactions with this type of mooring system.

1.2.3.7 Though the scale of the proposed WTG Array Area is large in comparison to floating oil and gas structures in the area (both in areal extent and number of floating lines), it is important to consider the amount of ALDFG in the area rather than solely the scale of the Array Area. The type of fishing activity in the surrounding ICES rectangles means that there is unlikely to be problematic buoyant ALDFG which could foul the proposed mooring systems and any such interaction has the potential to decrease the risk of wildlife entanglement by removing debris from surface depths wherein the greatest entanglement risk remains. Moreover, the efficacy of buoyant nets and seines would be impacted by the act of fouling floating infrastructure. This is because an ALDFG which wrapped around mooring lines or cables would experience a reduction in the catch efficiency due to the reduced surface area of the net or seine in question.

1.2.3.8 Due to the water depth, distance from shore and fishing practices characteristic of the Project Area and its surrounds, it is considered unlikely that fishing patterns and equipment will change substantially during the life of the Project.

1.2.3.9 For these reasons, the Project is not considered to have the potential to generate adverse effects to marine species via a secondary entanglement impact pathway which would materially alter baseline entanglement levels generated by marine debris occurring in the surrounding marine environment. Consequently, the Project has ruled out any potential for significant effects to any biological receptors from the physical presence of the windfarm infrastructure generating an increased entanglement risk via secondary entanglement.

1.2.4 Management approach

1.2.4.1 A Fisheries Liaison Officer (FLO) will be employed by the Project during various activities across the wind farm's life cycle. This will enable engagement with fishermen to support efforts to record lost gears in the vicinity of the Project Area. Safety and exclusion zones around the Array Area will limit the potential for fishing gear interactions with submerged infrastructure, thereby reducing the likelihood of ALDFG being generated within the Array Area.

1.3 Conclusion

1.3.1.1 The potential for marine species to be impacted by secondary entanglement generated by the physical presence of the Project is considered negligible, with the potential for a net positive gain in entanglement risk against baseline levels in the surrounding environment. This conclusion is based on project design, fishing activity within and around the Project Area, and species sensitivities all limiting interaction potential between marine debris and the floating infrastructure and between marine animals and fouled materials. This conclusion is supported by the absence of historic evidence of secondary entanglement in floating offshore energy infrastructure in the North Sea and globally.

1.4 References

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Appendix 6A: Cenos Offshore Windfarm Scoping Workshop - Discussion Topics and Questions

CENOS OFFSHORE WINDFARM SCOPING WORKSHOP - DISCUSSION TOPICS AND QUESTIONS

Item	Discussion topic and/or question(s)	Attendee response	Applicant response	Scoping Report section
0 Introductory Session				
0.1	Introductory session – array boundary	NatureScot: has the site array boundary changed since last scoping exercise?	Applicant confirmed the array has reduced. The proposed array is now smaller. The larger area of coverage in aerial survey reflects original INTOG option area	
0.2	Introductory session – cumulative strategy	General discussion re cumulative strategy.	Cenos to agree proposed cut off dates for cumulative effects project list with MD-LOT	See Appendix 5C CEA Long List. "*It is proposed the database will be supplemented with additional sources of information until 4 months prior to EIAR submission".*
0.4	Introductory session – onward oil and gas connections	General discussion re consents strategy for onward oil and gas connections	Consenting strategy agreed with MD-LOT. MD-LOT to discuss consenting strategy, including treatment of onward oil and gas connections, for INTOG projects with JNCC.	NA
0.5	Introductory session – ports and wet storage	General discussion re consents strategy for ports and wet storage	It is the Applicant's view that the wet storage of turbines outside of the Array Area in close proximity to a port is linked to a decision on construction and marshalling port(s) and as such potential impacts associated with wet storage (and any port works) are proposed to be scoped out of this assessment and consent application.	

Item	Discussion topic and/or question(s)	Attendee response	Applicant response	Scoping Report section
1. Ornithology – written comments from NatureScot 02 April 2024				
1.1	A summary of legislation and policies relevant for the ornithology assessment: **- EU Habitats Directive (Directive 92/43/EEC) on the Conservation of Natural Habitats and of Wild Fauna and Flora** - *Protection for Annex IV species inside and outside Natura2000 (Special Protection Areas (SPAs) in Europe.* **- EU Birds Directive (Council Directive 2009/147/EC) on the Conservation of Wild Birds** - *Protection for naturally occurring wild bird species and their habitats in Europe.* **- Conservation of European Wildlife and Natural Habitats Convention (Bern convention)The Conservation (Natural Habitats, etc.) (EU Exit) (Scotland) (Amendment) Regulations 2019** - *International treaty for the protection of European wild plants and animals.* **- Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (the '2017' Regulations)** - *Requirement for major building or development projects to be assessed in regard to potential environmental impact.* **- Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019** - *Protection of habitats and European Protected Species (EPS) (as transposed into UK law, post-Brexit).* - **The Conservation of Offshore Marine Habitats and Species (Amendment) (EU Exit) Regulations 2019** - Implementation of species protection requirements of the Habitats and Species Directive in offshore environments (over 12 NM miles from the coast). - **Wildlife and Countryside Act 1981 (as amended)** - Implementation of the Birds Directive and Bern Convention in Great Britain. - **Marine (Scotland) Act 2010** - *Allows Scottish marine planning and licensing while providing protection and enhancement of the marine environment.* - **Scottish Biodiversity Strategy to 2045 -** *UK strategy to achieve biodiversity targets.* **- UK Post-2010 Biodiversity Framework** - *Priority of work needed to meet Scottish biodiversity targets.* - **Scotland National Marine Plan Policy Gen 9** - *Compliance with legal requirements for protected areas and species in inshore and offshore environments.* **Is there any new legislation/policy documents that the Project should be aware of?**		The Applicant understands that at the time of writing the 2024 Scoping Report, no updated legislation has been released.	Table 11-1 within Chapter 11: Ornithology
1.2	A summary of technical guidance that has been used to define the ornithological assessment is as follows: **- Guidelines for Ecological Impact Assessment in the UK and Ireland (CIEEM, 2018) -** *Overarching guidance for UK Environmental Impact Assessment.* - **Advice on marine renewables development (NatureScot, 2023). Marine Ornithology Guidance Notes 1 to 11 -** *Guidance for ornithological modelling*	No response from consultees was received.	The Applicant understands that at the time of writing the 2024 Scoping Report, no updated technical guidance has been released. It is understood further guidance will be available in due course. If the guidance in released in time for the preparation of the EIAR, this guidance will be followed.	Table 11-2 within Chapter 11: Ornithology

Item	Discussion topic and/or question(s)	Attendee response	Applicant response	Scoping Report section
	parameters and approach. - **Seasonal Definitions for Birds in the Scottish Marine Environment (NatureScot, 2020) -** *Presentation of seasons to be used in assessment.* - **A handbook on environmental impact assessment: Guidance for competent authorities, consultees and others involved in the Environmental Impact Assessment process in Scotland (SNH, 2018) -** *Overarching guidance for Scottish Environmental Impact Assessment.* - **Joint Statutory Nature Conservation Bodies (SNCB) Interim Displacement Advice Note (JNCC *et al*., 2022) -** *Species-specific displacement and mortality rates to be used in assessment of distributional responses (displacement and barrier effects).* - **Advice note from the joint Statutory Nature Conservation Bodies (SNCBs) on avoidance rates to use in collision risk modelling (SNCB, 2014) -** *Species-specific collision avoidance rates to be used in assessment of collision risk.* **Is there any new guidance that the Project should be aware of? Is there any emerging guidance, which is relevant to ornithology?**			
1.3	The study area defined for ornithological receptors will be species-specific and derived from breeding season foraging ranges from Woodward *et al*. (2019) and non-breeding season Biologically Defined Minimum Population Scales (BDMPS) regions as defined in Furness (2015). The ornithological study area will be reviewed and amended in response to such matters as refinement of the offshore components, the identification of additional impact pathways and in response where appropriate to feedback from consultation. **Do you agree with the study areas defined for offshore ornithology?**	Comments received from NatureScot on 02 April 2024: Yes. However, please note that there are some exceptions to the standard foraging ranges for guillemot, razorbill and gannet for particular SPAs. These can be found in our guidance note 3. (https://www.nature.scot/doc/guidance-note-3-guidance-support-offshore-wind-applications-marine-birds-identifying-theoretical)	The Applicant understands that NatureScot agree with the Study Areas as defined and presented within the Scoping Workshop held on 29 February 2024. The exceptions to standard foraging ranges as detailed in Guidance Note 3 will be included.	Section 11.3 within Chapter 11: Ornithology
1.4	**Do you agree that the following impact pathways should be scoped in for assessment for ornithology receptors within the offshore EIAR: direct disturbance and displacement during construction and decommissioning; distributional responses during the operational phase; collision risk during the operational phase; changes to prey resources (all life-cycle phases)?**	No response from consultees was received.	The Applicant has scoped in direct disturbance during the O&M phase due to vessel movements.	Table 11-8 within Chapter 11: Ornithology
1.5	**The following impact pathways are proposed to be scoped out from further assessment for impacts to ornithological receptors:** **- Underwater Noise (all project life-cycle phases):** There is potential for diving birds to be present in the vicinity of the Project when noisy activities are occurring. Birds may temporarily be displaced. Although some species are better adapted to hear underwater than other species (Hansen *et al*., 2017), it is assumed that	No response from consultees was received.	Those impact pathways scoped out of the assessment for ornithology receptors are detailed within the 2024 Scoping Report.	Table 11-8 within Chapter 11: Ornithology

Item	Discussion topic and/or question(s)	Attendee response	Applicant response	Scoping Report section
	most diving birds do not have the same capacity to hear underwater as aquatic animals, as they are primarily adapted for aerial environments, Therefore, underwater noise during construction and from UXO clearance is scoped out of the impact assessment. **- Accidental release of pollutants (all phases) is proposed to be scoped out for the following reasons:** Accidental spills from vessels or other equipment are not anticipated, due to standard operating procedures prohibiting releases to the sea. The risk and impact of any pollutant release will be reduced through the MPCP (ORN-003); as such, the likelihood of this impact pathway is considered negligible. **Do you agree that the above impact pathways are scoped out for assessment for ornithology receptors?**			
1.6	The following species have been scoped into the project alone assessment for the following impact pathways: Distributional responses: - Kittiwake; - Guillemot; and - Gannet Collision Risk: - Kittiwake; - Gannet; and - Fulmar **Do you agree with the species which have been scoped into the project alone assessment?**	Comments received from NatureScot on 02 April 2024: The species scoped in are those that were most abundant in the DAS and therefore should be considered for assessment. Puffin should also be included. However, fulmar is not considered to be at high risk of collision impacts, as flight height is generally close to the sea surface and below potential collision height. It is standard practice that collision risk modelling is not undertaken for this species and fulmar is generally scoped out at the stage of considering impact pathways.	The Applicant confirms that puffin will be added to the Distributional responses assessment, and that fulmar will be removed from the CRM assessment.	Table 11-8 within Chapter 11: Ornithology
1.7	**Should collision mortalities using avoidance rates from SNCBs (2014) or Ozsanlav-Harris *et al*. (2023) be taken through to later stages of assessment?**	Comments received from NatureScot on 02 April 2024: We are currently revising our Collision Risk Modelling Guidance Note 7 and this should be available shortly. The revised guidance note recommends using Ozsanlav-Harris *et al*. avoidance rates.	The Applicant understands that NatureScot are in the process of updating CRM guidance note. At the time of writing the 2024 Scoping Report this guidance has not been released. If the guidance in released in time for the preparation of the EIAR, this guidance will be followed. The Applicant understands that the Ozsanlav-Harris rates should be used in the assessment. Results will be presented using Ozsanlav-Harris *et al*. avoidance rates. The avoidance rate for kittiwake is not specified within Ozsanlav-Harris *et al* so the ‘all gulls’ rate will be used.	Within Chapter 11: Ornithology section 11.11.3 contains a sub-section on Collision risk.
1.8	For guillemot, NatureScot guidance states that in the non-breeding season, the breeding season foraging range will be used to define the non-breeding season regional population as this species has been shown to	Comments received from NatureScot on 02 April 2024: In terms of HRA, for guillemot in the non-breeding season we advise the use of breeding season populations within	The Applicant will use the BDMPS regional population as recommended in line with the suggested Option 2 to	Within Chapter 11: Ornithology section 11.5.2 e contains a sub-section on Designated sites and

Item	Discussion topic and/or question(s)	Attendee response	Applicant response	Scoping Report section
	not disperse far offshore during the non-breeding season, but to stay relatively close to breeding colonies (Buckingham *et al*., 2022). However, the Project is outside the mean-max foraging range + 1 Standard Deviation (SD) for guillemot. Two options are proposed to derive the non-breeding season regional population for guillemot: **Option 1:** Build a new 'regional population' from the colonies which are likely to contribute most to the observed guillemot densities recorded at the Project. Buckingham *et al*. (2022) shows that during the non-breeding season, 50% kernel density contours from multiple colonies overlap. At the very least, the colonies included in Buckingham *et al*. (2022) will be used to create the non-breeding season regional population. If more colonies are to be included this will be discussed and agreed during the consultation process. **Option 2:** The BDMPS regional population from Furness (2015) will be used. **What Option do you propose the Project takes, to derive guillemot non-breeding season regional populations?**	foraging range, rather than BDMPS populations, as they tend to stay in vicinity of breeding colonies. For this site there are no SPAs within foraging range so there is no need for an HRA assessment for guillemot in the non-breeding season. However, we recommend that a displacement assessment using the BDMPS regional population, without SPA apportionment, should be presented in the EIA Report with justification for any conclusions. <u>Additional question asked during Scoping Workshop on 29 February 2024:</u> Are you happy for impacts to be considered for both options for displacement and CRM. Impacts will be assigned to your preferred population for Population Viability Analysis? Comments received from NatureScot on 02 April 2024: We are happy to discuss your Option 1 further, with fuller explanation of what you intend and justification for the approach.	contextualise impacts from distributional responses in the EIA. The Applicant notes that no SPA apportioning for guillemot is required in either the breeding or non-breeding season.	section 11.11.3 contains a sub-section on Regional populations to assign impact.
1.9	Breeding season foraging range for fulmar (*Fulmarus glacialis*) encompasses all UK and Irish colonies (mean-max + 1SD 1,200km; Woodward *et al*., 2019). However, it is unlikely that birds further afield, particularly on the west coast of the UK and those in Ireland will have connectivity with the Project. As such, it is proposed that the regional population is composed of birds only on the northern and eastern coasts of Scotland. The list of proposed colonies to be included in the breeding season regional population is: Buchan Ness to Collieson Coast SPA; Calf of Eday SPA; Copinsay SPA; East Caithness Cliffs SPA; Fair Isle SPA; Farne Islands SPA; Fetlar SPA; Flamborough and Filey Coast; Foula SPA; Forth Islands SPA; Fowlsheugh SPA; Hermaness, Saxa Vord and Valla Field SPA; Hoy SPA; North Caithness Cliffs SPA; Noss SPA; Rousay SPA; Sumburgh Head SPA; Troup, Pennan and Lion's Head SPA; West Westray SPA. **Do you agree with the list of colonies to be included in the breeding season regional population for fulmar?**	Comments received from NatureScot on 02 April 2024: Initially, we would expect all designated sites with theoretical connectivity to the development for each relevant qualifying species to be included based on mean-max + 1SD foraging ranges in the breeding season. This should define the maximum extent of the offshore ornithology regional study area and the regional population for a species. However, please note our comments above regarding fulmar and impact pathways.	The query for fulmar within the scoping workshop was related to the CRM assessment specifically rather than HRA. However, the Applicant notes the comments relating to fulmar and impact pathways and will scope out fulmar from CRM assessment.	Table 11-10 within Chapter 11: Ornithology
1.10	**What is your preferred approach for non-breeding season apportioning? Should we use colony counts from the BDMPS (Furness, 2015) or are there more up to date data we should be using?**	No response from consultees was received.	The Applicant understands NatureScot have proposed the use of the BDMPS regional population when conducting non-breeding season apportioning for all species except guillemot. The normal recommendation for guillemot is to use breeding season foraging range, however, the project is outside this	Within Chapter 11: Ornithology section 11.11.3 contains a sub-section on Regional populations to assign impact.

Item	Discussion topic and/or question(s)	Attendee response	Applicant response	Scoping Report section
			range, therefore the advice is to not conduct non-breeding season apportioning for guillemot.	
1.11	Each project or plan screened in for quantitative cumulative assessment with potential to contribute to the above impacts will be assessed using the same methodology as is applied to EIA project alone impacts. To screen in projects to assess cumulative impacts for the EIA, species-specific foraging ranges will be used for the breeding and non-breeding seasons using Woodward *et al*. (2019) and Furness (2015), measured from the Project. For HRA purposes, foraging ranges, will be measured from SPA colonies to determine project inclusion. As has been advised for other Scottish projects, two cumulative scenarios will be run per species and season, one including Berwick Bank estimated mortalities, and one without. **Do you agree with the approach for cumulative effects, in particular, how projects will be screened in for quantitative assessment of collision risk and distributional responses?**	Comments received from NatureScot on 02 April 2024: Projects located in Scottish and English waters should be scoped in/out of the cumulative assessment for breeding birds based on the mean-maximum foraging ranges from Woodward *et al*. (2019). The non-breeding season cumulative assessment, for species that migrate or disperse from their colonies, should include relevant developments within the BDMPS region (Furness, 2015). <u>Additional question asked during Scoping Workshop on 29 February 2024:</u> Do you agree with the approach and assessment methodology proposed for project alone assessment? Comments received from NatureScot on 02 April 2024:Yes, the methods presented are appropriate and follow our guidance.	The Applicant understands NatureScot agree with the approach for cumulative effects, in particular, how projects will be screened in for quantitative assessment of collision risk and distributional responses. It is understood NatureScot support doing with and without Berwick Bank and this is the advice currently being given to other projects. The Applicant confirms it will follow the advice given.	Section 11.9 within Chapter 11: Ornithology
1.12	Due to the proximity of the Project to the eastern boundary of the UK EEZ, and therefore seabird colonies in the eastern North Sea, and the wide-ranging distribution of seabirds, there is potential for transboundary effects to occur to ornithological receptors. The area of search for Transboundary Effects is the North Sea, with potential connectivity between the Project and seabird colonies at designated sites out with Scotland. During the breeding season, Woodward *et al*. (2019) foraging ranges will be used to determine transboundary connectivity. **Do you agree with the proposed approach, or is there guidance on a different preferred approach that can be employed?**	No response from consultees was received.	The Applicant's approach follows NatureScot's guidance and therefore the proposed approach is deemed acceptable.	Section 11.10 within Chapter 11: Ornithology
1.13	**With the information presented in the questions above for ornithology, do you wish to raise any additional matters on the overview of the ornithology assessment presented?**	No response from consultees was received.	N/A	Chapter 11: Ornithology
1.14	**Additional question asked during Scoping Workshop on 29 February 2024: Is there updated guidance on how to address avian flu in assessments?**	Comments received from NatureScot on 02 April 2024: There is a need for ongoing engagement in relation to the impacts of HPAI and how to incorporate these impacts within assessments. Work is continuing within NatureScot to provide further information which we will do when we can. In the meantime, we expect the impact of HPAI on colonies to be considered qualitatively especially when reviewing PVA outputs.	The Applicant confirms that recent data found on the SMP database will be utilised within the assessment, and that the RSPB report on HPAI effects will be used to inform assessment.	N/A

Item	Discussion topic and/or question(s)	Attendee response	Applicant response	Scoping Report section
		As the DAS survey work straddles the HPAI outbreak it will be important for assessment purposes to consider the current status of seabird populations at SPA colonies. Surveys have been undertaken at a number of key seabird colonies in 2023, coordinated by RSPB, and some will be repeated in 2024. Recent data for key species at some sites can already be found on the SMP database. RSPB have just published a report on HPAI effects which will provide helpful context: UK seabird colony counts in 2023 following the 2021-22 outbreak of Highly Pathogenic Avian Influenza Research Report 76. RSPB Conservation Science (https://www.rspb.org.uk/birds-and-wildlife/seabird-surveys-project-report).		
1.15	**Additional question asked during Scoping Workshop on 29 February 2024: Do you agree with the proposed approach for transboundary and inter-related effects? Is there guidance or a preferred approach that should be employed?**	Comments received from NatureScot on 02 April 2024: The approach described above for cumulative effects should also be used for wider transboundary effects. The inter-related effects are appropriate. We do not currently have any specific guidance on these topics.	The Applicant's approach to transboundary effects is detailed within the 2024 Scoping Report.	Section 11.10 within Chapter 11: Ornithology
1.16	**Further comments received from NatureScot on 02 April 2024**	Comments received from NatureScot on 02 April 2024: Direct disturbance and displacement during construction and decommissioning - Disturbance and displacement also apply to the operational phase from maintenance activities and vessel movements. Please note that assessment of vessel movements should include potential impacts from vessels transiting between ports and the array area.	The Applicant understands that NatureScot would prefer direct disturbance and displacement during the operational phase from maintenance activities and vessel movements to be scoped in. The Applicant can confirm this activity is scoped into the EIA.	Table 11-8 within Chapter 11: Ornithology
1.17	**Further comments received from NatureScot on 02 April 2024**	Comments received from NatureScot on 02 April 2024: Entanglement - We advise that secondary entanglement (e.g. ghost nets entangled on subsea mooring lines) should be scoped in as a potential impact pathway during the operation and maintenance phase. Although there is limited evidence of secondary entanglement occurring, it's possible this is due to limited monitoring. Also, floating wind is a relatively new technology and the small demonstration inshore floating sites don't compare to the larger sites offshore. Further, fishing patterns may change once the proposed windfarm is operational through the displacement of fishers from other areas, which could lead to more lost equipment in the area that isn't perhaps currently seen. Lastly, the forthcoming scaling up of turbines in the ocean may result in a cumulative risk effect for secondary entanglement. That said, we are mindful that during the workshop there was discussion around potential evidence and experience from other floating offshore assets that could provide useful information and context with respect to this impact pathway. We would be happy to review this and advise further.	Primary entanglement (direct entanglement with mooring lines or cables etc.) is scoped out as the nature of the mooring lines in terms of tension, rigidity and cable diameter preclude the possibility of forming any entangling loops. Secondary entanglement is therefore scoped out with respect to diving birds, based on the likely fishing gear types around the Array Area, and the lack of evidence of secondary entanglement from similar industries.	Table 11-8 within Chapter 11: Ornithology

Item	Discussion topic and/or question(s)	Attendee response	Applicant response	Scoping Report section
1.18	**Further comments received from NatureScot on 02 April 2024**	Comments received from NatureScot on 02 April 2024: Wet storage - Impact pathways associated with wet storage activities should be considered for ornithology. We appreciate that there are ongoing discussions regarding who has the responsibility for assessing impacts arising from wet storage and so we raise here just to highlight that it could represent a very significant impact pathway for ornithological receptors.	The Applicant is pleased to see NatureScot acknowledges that the responsibility for assessing impacts arising from wet storage is under discussion. It is the Applicant's view that the wet storage of turbines outside of the Array Area in close proximity to a port is linked to a decision on construction and marshalling port(s) and as such potential impacts associated with wet storage are proposed to be scoped out of this assessment.	Within Chapter 3: Project Description
1. Ornithology – Scoping Workshop 29 February 2024				
1.2	General discussion re entanglement	General discussion re entanglement	Cenos to provide robust justification for scoping out entanglement as an impact pathway in 2024 Scoping Report.	Appendix 5G: Approach to secondary entanglement as a potential impact
1.3	Ornithology surveys	Cenos to provide NatureScot with an update on survey strategy – including planned ornithology survey work.	Separate meeting to be set up	See Appendix 5A Survey Strategy
1.4	Migratory waterbird screening of LSE	General discussion on approach for CRM for migratory waterbirds and screening out LSE. Ensure approach is justified.	WSP to review updated CRM guidance that will be published by NatureScot in a few weeks.	NA
1.5	HRA Degradation and availability of MRF	MD-LOT to update the project on progress in relation to MRF and compensations.		NA
1.7	Legislation and policy	MD-LOT to update the project via quarterly meetings. NatureScot to update Cenos on emerging guidance through ongoing engagement.		NA
1.10	Impact pathways scoped in/out	NatureScot: Do not think direct disturbance should be scoped out for O&M and would like to see wet storage considered in EIAR.	Cenos will scope in direct disturbance to ornithology receptors during O&M Cenos will engage with MD-LOT and advisors on further discussions around wet storage.	Chapter 11: Ornithology NA
1.12	Ornithology species scoped into assessment	NatureScot: Unable to comment until viewed DAS reports.	Cenos to provide NatureScot with DAS reports for their review and feedback.	NA
1.13	Collision mortality avoidance rates – should collision mortalities using avoidance rates from SNCBs (2014) or Ozsanlav-Harris *et al*. (2023) be taken further into assessment	NatureScot: In the process of updating CRM guidance note, recommend looking at this when available.	Cenos will include the Ozsanlav-Harris rates in its assessment and will await the updated guidance from NatureScot to inform the EIAR.	NA
1.14	Approach to guillemot non-breeding season regional populations	NatureScot: Will need to come back to this.	Cenos to discuss further with NatureScot directly.	NA
1.15	Colonies to include in the breeding season regional population for fulmar	NatureScot: Request more information prior to advising on approach. General approach would not expect any colonies to be excluded initially. At a later stage this gets refined down.	Cenos to discuss survey strategy for ornithology receptors with NatureScot directly.	NA
1.16	Approach for non-breeding season apportioning	NatureScot: Acknowledge that this is a novel situation and require more detail.	Cenos to discuss further with NatureScot directly.	NA
1.19	Any other issues	2024 Scoping Report to detail approach to scoping of entanglement as a potential impact pathway.	Cenos to provide robust justification for scoping out entanglement as an impact pathway in 2024 Scoping Report.	Appendix 5G: Approach to secondary entanglement as a potential impact
2. Fish Ecology - written comments from NatureScot 02 April 2024				

Item	Discussion topic and/or question(s)	Attendee response	Applicant response	Scoping Report section
2.1	The following aspects have been scoped into Fish Ecology: - EMF Scoped in - ECC bisects migratory pathways and dynamic cabling is deployed throughout the water column within the Project with the potential for EMF to result in likely significant effect through behavioural changes. - Thermal impacts from export cable scoped in - there is uncertainty on the thermal impacts from cables, through behavioural changes (demersal fish and elasmobranchs). - Fish aggregation and abundance scoped in - potential for a change in abundance of fish species due to presence of infrastructure and reduced fishing effort - cross ref. ornithology and marine mammals - Waterborne noise scoped in - underwater noise and vibration, including UXO clearance during pre-construction, construction/operation, and maintenance, has the potential for likely significant effect through mortality, injury, behavioural changes and auditory masking in sensitive receptor. - Habitat loss/disturbance scoped in - temporary/permanent habitat loss and/ or disturbance result from sand wave clearance, scour/cable protection has potential for like significant effect through behavioural changes, foraging or spawning habitat. - Increase in suspended solids scoped in - temporary localised increases in suspended sediment concentrations and smothering from sandwave clearance, cable lay, placement, maintenance and removal of infrastructure, resulting in displacement, smothering. - Potential impacts on designated sites such as SAC's and MPA scoped in. **Confirmation required from MDLOT and advisors that they agree with fish ecology being scoped in (previously scoped out)?**	Comments received from NatureScot on 02 April 2024: Yes, we agree that fish ecology should be scoped in and we are keen to better understand predicated impacts to PMFs and key prey species.	The Applicant understands NatureScot would like Priority Marine Features (PMFs) in Scotland to be scoped in. The Applicant can confirm these species of principal importance for biodiversity conservation in Scotland will be taken forward for further consideration in the EIA. These species have been considered within the existing baseline of 2024 Scoping Report.	Section 12.5.2 within Chapter 12: Fish Ecology
2.2	We propose that the following impact pathways should be scoped out from further assessment for fish ecology receptors: - Accidental pollution scoped out - The magnitude of any accidental spill limited by the size of chemical or oil inventory on construction/maintenance vessels. Any release of hydrocarbons would be subject to rapid dilution and dispersion and unlikely to persist in the marine environment. The likelihood of a spill is reduced by adoption of Marine Pollution Contingency Plan as embedded mitigation. Compliance with MARPOL convention. - Collision / Entanglement risk scoped out - cables or chains associated with the offshore array are likely to be taut within the water column with no loops that could potentially result in entanglement. There have been no records of shark entanglement or collision from cables or midwater chains. Harnois *et al* 2015, note that the absolute risk of entanglement is found to be low,	Comments received from NatureScot on 02 April 2024: We advise that it is too early to scope out 'effects to fish ecology due to smoothing' in the decommissioning phase of the project. The methods used for decommissioning and the amount of infrastructure that will need to be taken out is unknown at present and therefore this impact pathway should be scoped in. We advise that secondary entanglement (e.g. ghost nets entangled on subsea mooring lines) should be scoped in as a potential impact pathway during the operation and maintenance phase. Although there is limited evidence of secondary entanglement occurring, it’s possible this is due to limited monitoring. Also, floating wind is a relatively new technology and the small demonstration inshore floating sites don't compare to the larger sites offshore. Further, fishing patterns may change once the proposed windfarm is operational through the displacement of	Given no response on accidental pollution, flicker from turbine blades and basking sharks has been received from the consultees, the Applicant deems it acceptable that these aspects can be scoped out. Smothering effects during the decommissioning phase will be taken forward for further assessment in the EIA for pelagic, elasmobranch and demersal species. Given the number, size and physical characteristics of mooring lines associated with offshore wind turbines it is considered highly unlikely that any fish species with potential to occur in the	Table 12-11 within Chapter 12: Fish Ecology and Appendix 5G: Approach to secondary entanglement as a potential impact

Item	Discussion topic and/or question(s)	Attendee response	Applicant response	Scoping Report section
	regardless of the mooring configuration however results indicate that the taut configuration has the lowest relative risk of entanglement, the highest relative risk occurs with catenary moorings with chains and nylon ropes or with catenary moorings with accessory buoys. Oil and Gas Floating Production Storage and Offloading use similar technology and there is no indication of any potential impacts. - Flicker from turbine blades resulting in avoidance scoped out - A study by CREW 2021 concluded There is no specific evidence available to support or refute any biological or ecological impact of shadow flicker from wind turbine blades on Atlantic salmon, however it is likely that any impact from exposure would be low due to the limited exposure an individual would be exposed to. The magnitude of any impact is likely to be influenced both spatially and temporally through the course of a day, depending on the position of the sun (and height), the orientation of the turbine (as determined by wind speed and direction) and cloud cover. - Basking Sharks - Offshore waters in the North Sea, including the Project area, were not found to have high habitat suitability for basking shark presence. No basking sharks have been identified from the aerial survey data of the development area and the wider survey area during the last two years. **Do you agree that the aforementioned impacts should be scoped out?**	fishers from other areas, which could lead to more lost equipment in the area that isn't perhaps currently seen. Lastly, the forthcoming scaling up of turbines in the ocean may result in a cumulative risk effect for secondary entanglement. That said, we are mindful that during the workshop there was discussion around potential evidence and experience from other floating offshore assets that could provide useful information and context with respect to this impact pathway. We would be happy to review this and advise further.	Study Area would be of greater enough size to become directly entangled in the mooring lines or associated structures. Based on the fishing gear type used within the Array Area, historic evidence and the risk-based adaptive management approach which will be applied to the Project the risk of secondary entanglement to all fish is considered low, and has been scoped-out from further assessment. The Applicant has prepared a Technical Note as evidence to support scoping out secondary entanglement.	
2.3	Turbot Bank NCMPA, designated for the protection of sandeels, is approximately 6 km away from the ECC. The following impacts have been considered in the MPA screening assessment for this feature: >Direct impact/disturbance leading to temporary or long-term habitat loss >Long-term or short-term disturbance resulting in displacement >Temporary increases in suspended sediments and contaminants >Smothering resulting from resettlement of suspended material >Increases in underwater noise >Accidental pollution from vessels (to be scoped out) >EMF and heat **Are the stakeholders content with the impacts considered in the MPA screening assessment for fish receptors?**	Comments received from NatureScot on 02 April 2024: Yes, we agree with the impacts considered in the MPA screening assessment for fish receptors, i.e. sandeels at Turbot Bank ncMPA. We also highlight that the subtidal sand and gravel feature at East of Gannet and Montrose Fields MPA is perfect spawning habitat for herring. We advise this is considered, particularly for the export and array cables.	The Applicant understands that NatureScot would like impacts to spawning habitat of herring to be considered within the EIA. Potential impacts to spawning habitat, including herring will be assessed in the EIA, and consideration will be given to the potential use of subtidal sand and gravel features within the East of Gannet and Montrose as herring spawning habitat.	Table 12-11 within Chapter 12: Fish Ecology
2.4	**Additional question asked during Scoping Workshop on 29 February 2024: Do you have any additional specific requirements for the underwater noise modelling and assessment methodology?**	Comments received from NatureScot on 02 April 2024: The underwater noise modelling should include egg and larvae as per Popper *et al*. (2014). [Popper, A. N., Hawkins, A. D., Fay, R. R., Mann, D., Bartol, S., Carlson, T., Coombs, S., Ellison, W. T., Gentry, R., Halvorsen, M. B., Løkkeborg, S., Rogers, P., Southall, B. L., Zeddies, D., and Tavolga, W. N. (2014). "Sound Exposure Guidelines for Fishes and Sea Turtles: A	The Applicant understands that NatureScot would like underwater noise effects on eggs and larvae to be considered within the EIA. Potential impacts from underwater noise on eggs and larvae will be considered in the EIA, and will be based on the criteria published in Popper *et al.* (2014).	Table 12-11 within Chapter 12: Fish Ecology

Item	Discussion topic and/or question(s)	Attendee response	Applicant response	Scoping Report section
		Technical Report," ASA S3/SC1.4 TR-2014 prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI. Springer and ASA Press, Cham, Switzerland.]		
2.5	**Additional question asked during Scoping Workshop on 29 February 2024: Based on low abundance and current known distribution NatureScot have advised that an EPS licence is not required for basking shark. Does this position hold for the EIA.**	Comments received from NatureScot on 02 April 2024: We advise that basking shark is scoped into the EIA as there are potential impact pathways (EMF, entanglement and collision). We understand that there is limited data on their distribution in this region, but they do need to be considered through a qualitative assessment. We also advise that mitigation used for other species (e.g. cetaceans) also covers basking shark. Note that basking shark is fully protected in Scottish inshore waters under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) – basking shark are not a European protected species. Therefore, impacts to basking shark which could result in an offence are dealt with through the Wildlife and Countryside Act 1981 (as amended).	The Applicant understands that NatureScot advise that basking sharks are considered within the EIA. basking sharks will be considered further in the EIA, under the elasmobranch ecological group. The Applicant understands that basking sharks are protected under the Wildlife and Countryside Act 1981 (as amended) in Scotland.	Table 12-11 within Chapter 12: Fish Ecology
2.6	**Further comments received from NatureScot on 02 April 2024**	Comments received from NatureScot on 02 April 2024: DIADROMOUS FISH - We note that for diadromous fish species there is limited knowledge of distribution and behaviour of these species in the marine environment. For example, the precise migration routes of adult or juvenile Atlantic salmon or direction taken by migrating adult European eels is not fully known. Published information indicates that European smelt and River lamprey are primarily, though probably not exclusively, associated with estuarine environments. Shad might also prefer estuarine environments. Furthermore, for some species, like seals, we have a reasonable understanding of connectivity to individual SACs. We also have population estimates for nearly all seal SAC populations in the standard data forms which forms part of the citation package. For diadromous fish species we do not have population data for any salmon or lamprey SAC on the data forms. This inability to understand connectivity to and within individual rivers to the development area, currently prohibits an informed assessment of the impact on individual site integrity. This is a necessary step within HRA assessment process. The recently updated ScotMER evidence map4 process for diadromous fish confirms these evidence gaps, particularly with respect to spatial and temporal distribution as well as uncertainty around migration routes and connectivity to protected sites. The ScotMER process is an important vehicle for helping to address these evidence gaps and uncertainties. We specifically welcome	Applicant confirms diadromous fish species will be assessed through EIA only and not through HRA	Table 12-11 within Chapter 12: Fish Ecology

Item	Discussion topic and/or question(s)	Attendee response	Applicant response	Scoping Report section
		the ScotMER project 'Diadromous Fish in the Context of Offshore Wind – Review of Current Knowledge & Future Research' due to be published soon. However, this research is not expected to significantly change our conclusions on how diadromous fish are treated in both EIA and HRA going forward. We advise based on evidence currently available to us, it is not possible for us to carry out an assessment of diadromous fish to the level required under HRA. We therefore advise that diadromous fish species should be assessed through EIA only and not through HRA. We advise that offshore wind developers should be contributing to ScotMER research as well as other initiatives such as the Wild Salmon Strategy Implementation Plan5 and any other strategies that are developed for diadromous fish interests.		
2. Fish Ecology - Scoping Workshop 29 February 2024				
2.2	Approach to fish considered	NatureScot: Assume static and fleeing fish as well as eggs and larvae for all different groups will be considered.	2024 Scoping Report to detail approach to scoping of entanglement as a potential impact pathway.	Appendix 5G: Approach to secondary entanglement as a potential impact
2.3	Should basking sharks be scoped in to the assessment?	NatureScot: Advise basking sharks to be scoped in at this stage	Cenos to scope in basking shark as a fish ecology receptor species.	Table 12-11 within Chapter 12: Fish Ecology
3. Benthic Ecology - written comments from NatureScot 02 April 2024				
3.1	The Nearshore Cable Corridor (NCC) will utilise the consented NorthConnect cable corridor between mean high water springs (MHWS) and 12 NM. As such, the likely significant effects of a cable corridor in this location has already been assessed within the EIA Report submitted for NorthConnect (application reference number 06771 & 06870) and judged acceptable through the consenting of NorthConnect. An application for a new marine licence for the NCC will be submitted in parallel with the marine licence and section 36 consent applications beyond 12 NM. The NCC will be assessed separately from the remainder of the Project and will outline the relevant assessment work undertaken for NorthConnect and conclude whether there are any new or different likely significant effects to what was previously concluded for NorthConnect. The mitigation measures for the Project NCC will be largely the same as those previously proposed (and accepted) for the NorthConnect cable, given that the locations coincide and the broad characteristics of the benthic environment between MHWS and 12 NM are as previously described. It is acknowledged that small scale variations may have occurred in the intervening period since NorthConnect's assessment, and these minor changes will require management through micro siting the route of the NCC. The requirement for micro siting will be determined by pre-construction surveys, and reported prior to construction commencing. **Do MD-LOT and their advisors agree with the**	Comments received from NatureScot on 02 April 2024: MD-LOT is best placed to advise on consenting requirements and the relationship between Cenos and NorthConnect.	The Applicant has updated the consenting strategy and does not intend to split the NCC with the rest of the ECC. The Applicant will fully assess, and seek to gain marine consents for the entire cable route from the array to landfall.	N/A

<table>
<tr><th>Item</th><th>Discussion topic and/or question(s)</th><th>Attendee response</th><th>Applicant response</th><th>Scoping Report section</th></tr>
<tr><td></td><td>proposed approach to the Nearshore Cable Corridor assessment?</td><td></td><td></td><td></td></tr>
<tr><td>3.2</td><td>The Project proposes to use the results of dedicated surveys in the array area and along the ECC, as well as published data and information from previous consented developments in the NCC. Habitats will be mapped, and priority features identified. Where possible, loss of habitat will be quantified based on a realistic worst case design. Impacts of seabed disturbance out with the direct footprint will also be considered, alongside indirect impacts from water quality changes, heat and EMF.

Do you agree that this approach is robust enough and sufficient for the purposes of mitigating impacts to Benthic Ecology, given the technical and environmental constraints on the Project?</td><td>Comments received from NatureScot on 02 April 2024: In principle, the high-level approach outlined is appropriate to enable an assessment of the potential impacts of the project on benthic ecology. The outcome of the assessment will indicate where there are benthic ecology impacts and what mitigation may be required. Therefore, we are unable to comment on how this approach relates to mitigation of impacts until we have sight of the results of the survey work. We are unsure what is meant by “technical and environmental constraints on the Project”.</td><td>The Applicant’s approach will be robust enough and sufficient for the purposes of mitigating impacts to Benthic Ecology.</td><td>N/A</td></tr>
<tr><td>3.3</td><td>For the Nearshore Cable (MHWS to 12 NM) it is proposed that Horizontal Directional Drilling (HDD) will be undertaken from Mean High Water Springs (MHWS)) to approximately 200m offshore (below MHWS) from the cliffs. This exit point of the HDD punch-out, on the seawards side, will be in approximately 26m of water depth. The project proposes careful management of offshore vessel operations through all phases of the project, including SOPEPs and Vessel Management Plans.

We propose that impacts to intertidal habitats and species are scoped out because the landfall will be trenchless and tunnelled under the seabed and onward into the cliffside. This means that no surface works will take place in the intertidal zone between MHWS and MLWS and no intertidal habitats will be disturbed.

Do you agree that intertidal habitats and species should be scoped out?</td><td>Comments received from NatureScot on 02 April 2024: We agree with the impact pathways scoped in.

Please see Table 1 below, which contains NatureScot’s and JNCC’s comments on the impact pathways proposed to be scoped out, where we agree or disagree.

<table>
<tr><th>Impact Pathway proposed to be scoped out</th><th>NatureScot/JNCC advice</th></tr>
<tr><td>Subtidal benthic species – habitat loss and direct damage to biota within footprint</td><td>This impact pathway has been scoped out for decommissioning. JNCC advise that habitat loss does occur at decommissioning and therefore this impact pathway should be scoped in.</td></tr>
<tr><td>Subtidal benthic species – sediment associated pollutants may be remobilised</td><td>This impact pathway has been scoped out for decommissioning. JNCC query the reasoning behind this as further disturbance would be expected when infrastructure is removed at the decommissioning phase.</td></tr>
<tr><td>Sea pens and other epifauna – mechanical damage to sensitive epifauna</td><td>This impact pathway has been scoped out for the construction phase. JNCC advise that this impact pathway should be scoped in for the construction phase.</td></tr>
</table></td><td>The Applicant understands the need to provide a narrative about why the original data and EIA conclusions and mitigations are still relevant and to show re-working of environmental impact assessment. This is included within the 2024 Scoping Report.

<table>
<tr><th>Applicant Response</th></tr>
<tr><td>The Applicant agrees for this to be scoped in for decommissioning.</td></tr>
<tr><td>The Applicant agrees for this to be scoped in for decommissioning.</td></tr>
<tr><td>The Applicant agrees for this to be scoped in for construction.</td></tr>
</table></td><td>Section 9.3, section 9.5.1 and section 9.5.2 within Chapter 9: Benthic Ecology</td></tr>
</table>

Item	Discussion topic and/or question(s)	Attendee response		Applicant response	Scoping Report section
		Subtidal benthic habitats – changes in the character of the benthic community	This impact pathway has been scoped out for the construction and decommissioning phase. JNCC advise that this impact pathway should be scoped in for all phases.	Introduction of hard substrate will alter the benthic habitat and the communities of associated organisms, with associated ecological effects, however the Applicant suggest this change will only occur once the infrastructure is constructed and therefore suggest this impact remains scoped out during construction and decommissioning.	
		Impacts to intertidal habitats and species from landfall construction	We agree with this impact pathway being scoped out if it can be confirmed that HDD is definitely going to be used.	The Applicant can confirm the HDD will be used and therefore this remains scoped out.	
		Subtidal benthic species –colonised surfaces will be lost, altering the structure of the benthic community that has evolved over the project lifespan	We advise that this impact pathway should be scoped in, even if it can only be assessed qualitatively. We need to try to understand how, when, or indeed if, the habitats will return to their pre-impact states.	Removal of introduced hard substrates represents a return to pre-impact conditions and will promote re-establishment of the soft substrate communities characteristic of the area that support notable species such as seapens and quahog. Therefore this impact remains scoped out.	
		Subtidal benthic species and communities – INNS may affect communities and individual species through competition, predation, parasitism and disease	We also advise that invasive non-native species (INNS) should be scoped in, because the mitigation measures and protocols are not yet established enough to have confidence in their effectiveness. This will be particularly important within East of Gannet and Montrose Fields MPA. JNCC highlight that deposited hard substrates (such as rock) can act as stepping stones for INNS.	The Applicant agrees for this to be scoped in.	
3.4	The project proposes careful management of offshore vessel operations through all phases of the project, including SOPEPs and Vessel Management Plans. We propose that accidental pollution events from sources vessels and equipment should be scoped out. Accidental pollution events from sources vessels and equipment are rare and amenable to mitigation through standard best practice controls and are thus scoped out. **Do you agree that accidental pollution events from sources vessels and equipment should be scoped out?**	No response from consultees was received.		The Applicant understands that there will be the potential for the growth of invasive non-native species (INNS) to grown on wind turbines (WTGs) or that INNS may grow on vessels and therefore be towed to the Project Area or to other areas for maintenance. An INNS Management Plan will be developed and adhered to for the Project. It will set out methods for minimising the potential for the	Table 9-5 and Table 9-6 within Chapter 9: Benthic Ecology

Item	Discussion topic and/or question(s)	Attendee response	Applicant response	Scoping Report section
			introduction of INNS. The plan will include, but may not be limited to, measures to facilitate vessel compliance with the International Maritime Organisation (IMO) ballast water management guidelines (International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004) and adherence to the IMO guidelines for the control and management of ships' biofouling to minimise the transfer of invasive aquatic species (Biofouling Guidelines).	
3. Benthic Ecology - Scoping Workshop 29 February 2024				
3.1	Scope of INNS	NatureScot: Concern for potential impact of INNS transported on turbines. JNCC: Support the scoping in of INNS.	Cenos to scope in impacts from INNS.	Chapter 9: Benthic Ecology
3.3	Scope in of Turbot Bank NCMPA	JNCC: Expect scoping in of Turbot Bank NCMPA to understand impacts of sediment transport impacts to benthic features of the site.	Cenos to provide additional details and robust justification for scoping out impacts to Turbot Bank NCMPA.	Chapter 9: Benthic Ecology
3.4	MPA	NatureScot to provide current guidance on MPA screening assessment requirements in Scottish waters.	Cenos to await new JNCC Conservation Advice Package to inform EIAR.	NA
3.7	Scope of intertidal habitats and species	NatureScot: Require narrative about why original data and EIA conclusions and mitigations are still relevant.	Cenos will provide robust justification for employing NorthConnect data or reaching the same conclusions as NorthConnect in the EIAR.	NA
3.8	Do you agree that accidental pollution events from sources vessels and equipment should be scoped out?	It was agreed accidental pollution events scoped out. Consider INNS and include any relevant design or management information in the 2024 Scoping Report.	Scoped out. Cenos to consider impacts from INNS in 2024 Scoping Report.	NA Chapter 9: Benthic Ecology

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4. Marine Mammals - written comments from NatureScot 02 April 2024				
4.1	The marine mammals baseline characterisation is built on: - 2 years of monthly digital aerial survey (DAS) conducted by HiDef from 2021-2023 - Additional MMO observations and PAM conducted during geophysical campaign in 2023 - Harbour porpoise, white beaked dolphin, minke whale & grey seal detected offshore through DAS - Other species to be considered include harbour seal and bottlenose dolphin, given likely presence inshore along ECC (12 NM to array area) and Nearshore Cable Corridor (MHWS to 12 NM) - Other megafauna are considered under this chapter, such as marine turtles, therefore this chapter will be called 'Marine Mammals and Other Megafauna'; however, basking shark (a cartilaginous fish) will be considered under the fish ecology receptors **Do you agree that the data sources and receptors identified are sufficient to inform the marine mammal baseline for the EIA Report?**	Comments received from NatureScot on 02 April 2024: Yes, we agree. SCANS surveys (https://www.tiho-hannover.de/en/clinics-institutes/institutes/institute-of-terrestrial-and-aquatic-wildlife-research-itaw/scans-iv-survey) are not listed on slide 52 of the Scoping Workshop presentation, but it is referred to later on. You could also consider ORCA survey (https://orca.org.uk/whale-dolphin-sightings) results for further context on sightings in the central North Sea.	The Applicant understand NatureScot are content that turtles are scoped out. This is covered with Chapter 5: Approach to Scoping and EIA. The Applicant understands that NatureScot would like a clear explanation and justification for scoping out vessel based collision, as well as discussion of mitigation measures. The Applicant has included the agreed approaches in the 2024 Scoping Report and where additional information has been requested, this has been included within the relevant sections. To date, there have been no recorded instances of marine mammal entanglement from mooring systems in terms of tension, rigidity and cable diameter preclude the possibility of forming any entangling loops, there is negligible potential for primary entanglement for the subsea mooring systems. The risk of secondary entanglement is considered low due to the type of fishing activity in the surrounding ICES rectangles.	Turtles: Chapter 5: Approach to Scoping and EIA. Vessel based collision: Table 10-8 within Chapter 10: Marine Mammals Entanglement: Table 10-8 within Chapter 10: Marine Mammals
4.2	The project proposes the installation of offshore floating structures and cables to shore. Disturbance to the seabed, noise, and vessel movements associated with construction may affect marine mammals. The physical presence of the operational facilities may also have an effect. The following impacts for marine mammal receptors have been identified: - construction noise - Jacket piling will be required during installation of offshore converter station(s) (OSCP), which has the potential to cause injury at very close range and behavioural effects over a wider area. - disturbance from vessels - there may be the requirement for relatively frequent vessel movements during construction and decommissioning that could introduce disturbance impacts to marine mammals; however, it is difficult to separate disturbance caused by vessel presence from that generated by vessel noise. The project proposes that, in lieu of characterising vessel-related disturbance due to the physical presence of vessels, that disturbance-related impacts to marine mammals are considered as part of the underwater noise assessment. - barrier effects - the presence of the windfarm may change the movement patterns of marine mammals - heat - the operational cable will generate heat that may	Comments received from NatureScot on 02 April 2024: Yes.	All potential impacts from the Project have been identified for marine mammal receptors and are detailed within the 2024 Scoping Report.	Table 10-8 within Chapter 10: Marine Mammals

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	be detected by and potentially affect their prey - secondary effects relating to water quality and prey distribution. Impaired water quality may influence the behaviour or distribution of prey organisms, that in turn may alter the behaviour and distribution of marine mammals **Do you agree that all potential impacts resulting from the Project have been identified for marine mammal receptors?**			
4.3	We propose that the following impact pathways should be scoped out: - Marine turtles are only rare vagrants within the Project Area and many of the mitigation measures for marine mammals can also be applied in the exceptional circumstances of turtles being present. - Secondary impacts of water quality changes will be localised and short duration. - Impacts from accidental events will be exceptionally infrequent and amenable to mitigation through standard good management practices. - Entanglement - There have been no documented instances of entanglement with moorings occurring in the offshore renewables or hydrocarbons industries. - EMF - Both primary and secondary impacts from EMF are proposed to be scoped out, this is in line with other recent applications such as Pentland Floating Offshore Windfarm and supported by for example: Kempster and Collin (2011); Copping *et al.* (2020); and Prysmian (2022). The buried HDVC cable infrastructure is expected to generate the greatest EMF emissions, but these will still be well below those from the Earth's magnetic field and are anticipated to be indetectable within a few tens of metres of the cables (Drewery, 2011). It is therefore considered unlikely that the Project has the potential to bring about perceptible physiological or behavioural changes to the marine mammal receptors identified in the region. -Basking sharks will be scoped out of further assessment as they are considered to be only a vagrant species on the east coast. - Disturbance by, and collision with, vessels during operation are scoped out because of the very infrequent nature and adoption of standard best operating practice will minimise the probability of such events. **Do you agree that these impact pathways should be scoped out?**	Comments received from NatureScot on 02 April 2024: We advise that secondary entanglement (e.g. ghost nets entangled on subsea mooring lines) should be scoped in as a potential impact pathway during the operation and maintenance phase. Although there is limited evidence of secondary entanglement occurring, it's possible this is due to limited monitoring. Also, floating wind is a relatively new technology and the small demonstration inshore floating sites don't compare to the larger sites offshore. Further, fishing patterns may change once the proposed windfarm is operational through the displacement of fishers from other areas, which could lead to more lost equipment in the area that isn't perhaps currently seen. Lastly, the forthcoming scaling up of turbines in the ocean may result in a cumulative risk effect for secondary entanglement. That said, we are mindful that during the workshop there was discussion around potential evidence and experience from other floating offshore assets that could provide useful information and context with respect to this impact pathway. We would be happy to review this and advise further. It was confirmed in the workshop that the pathway "secondary effects relating to prey distribution" would include indirect EMF effects and changes to fish distribution (e.g. aggregation). We agree that this pathway should be scoped in for the operation and maintenance phase. We agree that direct EMF effects can be scoped out. Regarding vessel based collisions, we would expect to see clear explanation and justification for scoping out collision, along with details of good practice measures to be implemented.	To date, there have been no recorded instances of marine mammal entanglement from mooring systems in terms of tension, rigidity and cable diameter preclude the possibility of forming any entangling loops, there is negligible potential for primary entanglement for the subsea mooring systems. The risk of secondary entanglement is considered low due to the type of fishing activity in the surrounding ICES rectangles. Electromagnetic Field (EMF): Direct impacts from EMF on dolphins and harbour porpoises are low and can be credibly scoped out as their highly mobile nature allows them to avoid unfavourable stimuli. However, there are potential indirect impacts through prey that should be assessed. Vessel collisions: The likelihood for vessel interactions during the Project is extremely low. Avoidance behaviour by cetaceans is often associated with unpredictable boats transiting at higher speeds. Slower vessels following a consistent trajectory allow marine mammals the opportunity to avoid collisions. The probability of collision is estimated to decrease to <50% when large vessels reduce speeds to 10 knots and fatal collisions are more likely when vessels are transiting at higher speeds. The risk of collision increases in areas of high animal density and with species that are more likely to spend time close to the surface , such as baleen whales. Species such as harbour porpoise, which are the most frequently sighted species within the Array Area, have been recorded to dive deeper in the presence of vessels reducing the potential for collision. With	Table 10-8 within Chapter 10: Marine Mammals

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			embedded mitigation, the risk to the more susceptible species (minke whale) is negligible. Given the extremely low likelihood of interaction between any project vessels and marine mammal receptors, it is proposed to scope physical vessel interactions out. Information that will form the Vessel Management Plan will include the following, but is not limited to:Vessel transit speeds; Predetermined routes whereby transiting through the Outer Trench Marine Protected Area (MPA) is avoided, where possible; Vessels follow a consistent predictable trajectory with high powered manoeuvres limited, where possible and safe to do so; Ensuring animals are avoided to a safe distance (100 m or more) where possible; Marine mammals will not be intentionally pursued; Contact will not be instigated with marine mammals; and Vessel masters will be actively scanning the path of transit.	
4.4	We are proposing the following for the underwater noise modelling and assessment methodology: - Source-pathway-receptor model - Population density of key species in the project area derived from site-specific surveys and published regional-scale data (e.g. SCANS-IV etc.) - PTS and TTS ranges will be calculated for UXO clearance using a dual metric approach, including SELcum and SPLpeak, and noise contours of potential behavioural disturbance will be generated. - This approach will also be applied to calculate PTS ranges for piling activities. - If the number of disturbed animals predicted is over the 1% of the reference population, then iPCoD modelling is undertaken to check that there is no risk of a population impact. At this stage it is considered that it may be needed for porpoise, but unlikely for other species. **Do you have any additional specific requirements for the underwater noise modelling and assessment methodology?**	Comments received from NatureScot on 02 April 2024: We have not seen the detail of the underwater noise modelling and assessment methodology yet. However, based on the information provided so far, the general approach appears appropriate. It was confirmed at the workshop that the proposed 1% 'threshold' for iPCoD modelling is not a hard threshold and that other factors would be considered. We agree with this approach.	The Applicant notes that NatureScot are content with the approach based on the information presented within the Scoping Workshop on 29 February 2024. Further details on the underwater noise modelling and assessment methodology is presented within the 2024 Scoping Report.	Section 10.11.3 within Chapter 10: Marine Mammals
4.5	We are proposing the following approach to the assessment of operational noise: Currently, there is limited operational noise measurement data available from the floating offshore wind industry (acknowledge Risch *et al* (2023). *Characterisation of underwater operational noise of two types of floating offshore wind turbines*), and none available for the turbine, substructure and cabling	Comments received from NatureScot on 02 April 2024: Yes.	The Applicant notes that operational noise (including mooring noise, for example cable "snap") has the potential to cause displacement and disturbance to marine mammals. Operational noise is therefore scoped into the assessment. It is proposed that operational noise will be assessed qualitatively, including a review of all available literature.	Table 10-8 and section 10.11 within Chapter 10: Marine Mammals

Item	Discussion topic and/or question(s)	Attendee response	Applicant response	Scoping Report section
	parameters characterising the Project. Consequently, the project does not propose to undertake any noise modelling to characterise underwater noise emissions during the operational phase of the project. Thus, it is proposed that operational underwater noise will be assessed qualitatively within the Offshore EIAR. **Do you agree with this approach?**			
4.3	HRA	NatureScot: Happy with assessment approach but recommend confirming with Natural England about boundary sites. General discussion on assessment approach for entanglement.	Cenos to discuss assessment approach with Natural England. 2024 Scoping Report to detail approach to scoping of entanglement as a potential impact pathway.	Appendix 5G: Approach to secondary entanglement as a potential impact.
4.4	Do you agree that the data sources and receptors identified are sufficient to inform the marine mammal baseline for the EIA Report?	NatureScot: Agree that turtles can be scoped out. Would want a clear explanation and justification for scoping out collision, and discussion of mitigation measures to be put in place around that. On entanglement, not yet much evidence of secondary entanglement happening, but there has not been much monitoring. Scale issue – starting to see rapid scaling up of number of turbines in water which may have a cumulative risk effect. Would want to see scoped in.	2024 Scoping Report to detail approach to scoping of entanglement as a potential impact pathway.	Appendix 5G: Approach to secondary entanglement as a potential impact.

Item	Discussion topic and/or question(s)	Attendee response	Applicant response	Scoping Report section
5. Marine and Coastal Processes - written comments from NatureScot 02 April 2024				
5.1	The Project proposals has the potential to mobilise seabed sediments. The marine and coastal processes section aims to evaluate the pathways in response to mobilisation that will be used to inform other topics. We proposed the following aspects should be scoped out: (1) Modifications to the wave and tidal regime is expected to be scoped out due to the distance of the windfarm offshore (approximately 185 km offshore) and the buried nature of the cables inshore. (2) Modifications to stratification and front features (all activities) is expected to be scoped out. Fronts are identified at the nearshore environment only. Here the works are subsea bed and as such have no impact. Offshore stratification is identified at different intensities throughout the year, primarily during summer months during stable weather. The turbine setup will see the body infrastructure located in the top thermocline and chains/anchors in the bottom. Whilst the interaction of tides/waves/wind has the potential to cause turbulent effects and mixing, the relatively stable weather during the summer minimises this risk. Alterations to the stratified layer are primarily associated with seasonal changes in weather conditions, having a much larger influence than the project infrastructure. **Do you agree that these aspects should be scoped out from detailed assessment within the EIAR?**	No response from consultees was received.	The Applicant understands NatureScot agree with all aspects to be scoped out except stratification/mixing. NatureScot confirmed there is evidence that Floating infrastructure can cause mixing which may change stratification. The Applicant has scoped in stratification and frontal features to the operations and maintenance phase of the Project. The EIA will review in detail the temporal formation of stratification using various sources including Scottish Shelf Model, CTD profiles from BODC, satellite information e.g. Copernicus.	Table 7-8 within Chapter 7: Marine and Coastal Processes
5.2	The methodology does not include sediment dispersion modelling. The Project's Nearshore Cable Corridor (from MHWS to 12 NM) will be using the same cable corridor as proposed by NorthConnect, which was judged acceptable through the consenting of NorthConnect. Therefore, on this basis we are going to use a worst case scenario that evaluates the maximum pathway lengths of sediment transport using 1D qualitative approach. **Do MD-LOT and their advisors agree with using the 1D qualitative approach for the Nearshore Cable Corridor?**	No response from consultees was received.	The approach used is detailed within the 2024 Scoping Report.	Section 7.5 and Table 7-8 within Chapter 7: Marine and Coastal Processes
5.3	The methodology underpinning the impact assessment of marine and coastal processes will: (1) evaluate baseline conditions from available data sources (tidal velocities, water levels, waves climate, seabed sediment, suspended particulate matter, fronts and stratified layers); (2) examine the influence of the various project components (anchors, mooring line systems, floating, cable lay, jetting, HDD punch out); (3) determine the divergence from normal conditions. Principally we are interested in damage to	No response from consultees was received.	The methodology detailed within the 2024 Scoping Report.	Section 7.11 within Chapter 7: Marine and Coastal Processes

Item	Discussion topic and/or question(s)	Attendee response	Applicant response	Scoping Report section
	geological/seabed geomorphology and changes to turbidity; and (4) determine the pathways of effect and associated distance - potential for sediment dispersal. **Do you agree that the methodology is acceptable?**			
5.4	The Nearshore Cable Corridor (NCC) will utilise the NorthConnect cable corridor between mean high water springs (MHWS) and 12 NM. As such, the likely significant effects of a cable corridor in this location has already been assessed within the EIA Report submitted for NorthConnect (application reference number 06771 & 06870) and judged acceptable through the consenting of NorthConnect. An application for a new marine licence for the NCC will be submitted in parallel with the marine licence and section 36 consent applications beyond 12 NM. The NCC will be assessed separately from the remainder of the Project and will outline the relevant assessment work undertaken for NorthConnect and conclude whether there are any new or different likely significant effects to what was previously concluded for NorthConnect. It is proposed to rely on sediment data collected by NorthConnect in 2016 as part of their EIA baseline studies. The likelihood of changes since this date has been reviewed and no recent developments or changes in coastal discharge arrangements that would be likely to affect coastal sediment quality has been identified. It has been assumed, therefore, that these data are representative of the current baseline. **Do MD-LOT and their advisors agree with the proposed approach to the Nearshore Cable Corridor assessment?**	No response from consultees was received.	The approach used is detailed within the 2024 Scoping Report. The Applicant has updated the consenting strategy and does not intend to split the NCC with the rest of the ECC. The Applicant will fully assess, and seek to gain marine consents for the entire cable route from the array to landfall.	Section 7.3 within Chapter 7: Marine and Coastal Processes
6. Marine Water and Sediment Quality - written comments from NatureScot 02 April 2024				
6.1	A list of desk-based sourced to be used in the marine water quality assessment include: - Scottish Government (2011) Scotland's Marine Atlas - Marine Directorate (2024) – National Marine Plan Interactive - SEPA (2024) – Bathing waters data - SEPA (2024) – WFD Datasheets - WFD data on coastal water bodies extending out 3 NM from the coastal baseline. - SEPA (2024) – Water Classification Hub - WFD data on coastal water bodies extending out 3 NM from the coastal baseline. - Cefas (2016) – Provides a summary of suspended particulate matter (SPM) for the whole of the UK continental shelf. - Hywind (2015) - Surveys undertaken in 2013. Grab sampling gear were deployed to collect sediment for analysis of particle size across the survey area and along their export cable corridor to determine levels of metals and hydrocarbons.	No response from consultees was received.	All baseline data sources are detailed within the 2024 Scoping Report.	Section 8.5 within Chapter 8: Marine Water and Sediment Quality

Item	Discussion topic and/or question(s)	Attendee response	Applicant response	Scoping Report section
	- NorthConnect (2018) - Surveys undertaken in 2016. Grab sampling gear were deployed to collect sediment for analysis of particle size across the survey area and along their export cable corridor to determine levels of metals and hydrocarbons. - GreenVolt (2021) - Surveys undertaken in 2021. Grab sampling was deployed to collect sediment for physio-chemical substances analysis (including contaminants) and macrofaunal identification. The survey covered Green Volt's windfarm area and two export cable routes. In addition, site specific water quality surveys were undertaken across the Cenos project area in 2023 at three water column depths (surface, mid-depth and near-bed) at six stations along the ECC and at 10 stations within the array area. **Can you advise on any additional sources of baseline data?**			
6.2	The following key receptors have been scoped into the marine water and sediment quality assessment: - Compliance with Water Framework Directive (including protected areas) and Marine Strategy Framework Directive considered as direct receptors in themselves (targets designed to be generally environmentally protective) - Indirect receptors potentially include marine biota and users of the sea **Can MD-LOT and their advisors advise whether any other key receptors that should be considered?**	No response from consultees was received.	Key receptors are detailed within the 2024 Scoping Report.	Section 8.5 within Chapter 8: Marine Water and Sediment Quality
6.3	The following aspects have been scoped out: - Accidental pollution events caused by accidental release of fuel or chemicals from vessels or WTG: scoped out on the basis that inventories will be limited, vessels are going to be managed under best practice (all will have SOPEPs in place - standard), and with a Marine Pollution Contingency Plan in place, the risks can be reduced to negligible levels - Effects on compliance of designated Bathing waters caused by sewage discharges from SOV, CSOV or accommodation platforms: scoped-out on the basis that accommodation provision for significant periods is only likely to be required well offshore, so, taking account of dilution, distances involved, principal tidal stream directions and bacterial die-off, significant effects on bathing water compliance with bacterial standards are highly unlikely. **Do you agree that these aspects should be scoped out?**	No response from consultees was received.	The aspects scoped out are detailed within the 2024 Scoping Report.	Table 8-7 within Chapter 8: Marine Water and Sediment Quality

Item	Discussion topic and/or question(s)	Attendee response	Applicant response	Scoping Report section
6.4	The Nearshore Cable Corridor (NCC) will utilise the NorthConnect cable corridor between mean high water springs (MHWS) and 12 NM. As such, the likely significant effects of a cable corridor in this location has already been assessed within the EIA Report submitted for NorthConnect (application reference number 06771 & 06870) and judged acceptable through the consenting of NorthConnect. An application for a new marine licence for the NCC will be submitted in parallel with the marine licence and section 36 consent applications beyond 12 NM. The NCC will be assessed separately from the remainder of the Project and will outline the relevant assessment work undertaken for NorthConnect and conclude whether there are any new or different likely significant effects to what was previously concluded for NorthConnect. It is proposed to rely on sediment quality data collected by NorthConnect in 2016 as part of their EIA baseline studies. The likelihood of changes since this date has been reviewed and no recent developments or changes in coastal discharge arrangements that would be likely to affect coastal sediment quality has been identified. It has been assumed, therefore, that these data are representative of the current baseline. **Do MD-LOT and their advisors agree with the proposed approach to the Nearshore Cable Corridor assessment?**	No response from consultees was received.	The approach used is detailed within the 2024 Scoping Report. The Applicant has updated the consenting strategy and does not intend to split the NCC with the rest of the ECC. The Applicant will fully assess, and seek to gain marine consents for the entire cable route from the array to landfall.	Section 8.3 within Chapter 8: Marine Water and Sediment Quality
6.5	**What is your preference for presentation of WFD and MSFD assessments – separate appendices or embedded in chapters?**	No response from consultees was received.	The Applicant's preference is for the WFD and MSFD compliance assessments to be included as separate technical appendices. The Applicant will proceed on this basis for the application submission.	N/A
6. Marine Water and Sediment Quality - Scoping Workshop 29 February 2024				
6	Additional point during Scoping Workshop on 29 February 2024.	Marine Directorate – Science, Evidence, Data and Digital (MD-SEDD) advised that the Applicant should discuss marine water and sediment quality methodology and approach to the assessment directly with MD-SEDD.	The Applicant will contact MD-SEDD directly.	N/A
7. Marine Cultural Heritage and Archaeology - written comments from NatureScot 02 April 2024				
7.1	We propose including discoveries found during construction as indirect impacts. This is due to the impact to shipwrecks from discovery having been a risk on other projects. The inadvertent discovery of shipwrecks and the potential dissemination of their location can pose a significant risk to the asset if it isn't mitigated. This is for wrecks with valuable or important cargoes, fixtures fittings or equipment. **Do you agree with this approach to characterising impacts to marine cultural heritage and archaeology?**	No response from consultees was received.	The approach used is detailed within the 2024 Scoping Report.	Section 15.11 within Chapter 15: Marine Cultural Heritage and Archaeology

Item	Discussion topic and/or question(s)	Attendee response	Applicant response	Scoping Report section
7.2	The Project would potentially cause direct impacts to marine heritage assets through the preparation of the route and construction of the cable trench and the installation of the foundations for the floating turbine anchorage and moorings. The change in sediment regimes as a result of the seabed disturbance could also expose previously buried remains to further degradation. The project proposes the following aspects should be scoped out: - Visual impacts to submerged cultural heritage - Visual impacts to submerged cultural heritage has been scoped out because this is generally understood as an impact to setting. The setting of marine heritage assets is normally not purposeful as the views from and to the assets are not integral to the understanding of the asset or its significance. Therefore they would not change the asset's significance and would not constitute a significant effect on the asset's significance. - Decommissioning - Impacts from decommissioning have been scoped out because the physical impact to assets as a result of the Project would have already happened. It is unlikely to cause substantially more impact to that asset and therefore would not potentially constitute a significant effect on the asset's significance. **Do you agree that the following aspects should be scoped out?**	No response from consultees was received.	The aspects scoped out are detailed within the 2024 Scoping Report.	Table 15-6 within Chapter 15: Marine Cultural Heritage and Archaeology
7.3	We are proposing to include the following site-specific geophysical survey data (which may be completed or still in the planning phase) to inform the methodology: - Sidescan sonar (SSS) - sub-bottom profiler (SBP) - Multibeam echosounder (MBES) and Magnetometer surveys will inform Archaeological/Geoarchaeological constraints **Do you agree the above is sufficient to inform the baseline?**	No response from consultees was received.	The baseline data is detailed within the 2024 Scoping Report.	Section 15.5 within Chapter 15: Marine Cultural Heritage and Archaeology
7.4	The Project would potentially cause direct impacts to marine heritage assets through the route preparation and construction of the cable trench and the installation of the foundations for the floating turbine anchorage and moorings. The change in sediment regimes as a result of the seabed disturbance could also expose previously buried remains to further degradation. The following impacts and key receptors for marine cultural heritage and archaeology receptors have been identified: - Shipwrecks (impact to discovery) - The remains of historic shipwrecks and military aircraft wrecks are noted within the publicly available heritage data within the site and study area. The location used for the wreck sites is often based on loss records or is approximate which	No response from consultees was received.	All potential impacts and receptors are detailed within the 2024 Scoping Report.	Figure 15 1, Figure 15 2, Figure 15 3 and Figure 15 4 within Chapter 15: Marine Cultural Heritage and Archaeology

Item	Discussion topic and/or question(s)	Attendee response	Applicant response	Scoping Report section
	adds uncertainty to the potential for the assets to be directly impacted by the Project. - Military aircraft wrecks (3 noted on Canmore Maritime data) - justification provided above. - Submerged palaeolandscapes (nearshore) - the potential for submerged palaeolandscapes has been identified within the study area, particularly near the shore and have the potential to inform the understanding of past landscapes and how they were used. The extent of the submerged palaeolandscapes isn't well understood in this area and impacts to it can further degrade the asset resulting in a diminished understanding. - Direct physical impacts from cable and anchor systems preparation and installation - Direct physical impacts from the cable and anchor system installation would truncate, remove or disturb remains within their footprint or immediately adjacent resulting in changes to the impacted asset's significance. - Indirect physical impacts from scour activity resulting from the changes to marine processes - Indirect physical impacts from scour activity can result in changes to the burial regime of the asset which may result in changes to it survival. Some assets could become exposed to marine processes resulting in further degradation of the asset and causing the asset's significance to be diminished. **Do you agree that all potential impacts and receptors resulting from the Project have been identified for marine cultural heritage and archaeology?**			
7.5	We are proposing the following methodology: - A review of known receptors and the potential for receptors to be present in the study area (DBA) - Proposed study area comprised of 5 km buffer from the array area and the export/import cable corridor (ECC) as far as MHWS - Review of marine geophysics and geotechnical data - A WSI will outline methodological approach to mitigate the impact of the proposed works on UCH **Do you have any additional specific requirements for the assessment methodology?**	No response from consultees was received.	The proposed assessment methodology is detailed within the 2024 Scoping Report.	Section 15.11 within Chapter 15: Marine Cultural Heritage and Archaeology
7	Additional point during Scoping Workshop on 29 February 2024.	No consultees joined the Scoping Workshop for this discussion.	The Application has contacted Historic Environment Scotland directly on 08 March 2024 for further consultation.	N/A
8. Commercial fisheries - written comments from NatureScot 02 April 2024				
8.1	The Project proposes that MMO Vessel Monitoring System (VMS) data will be used to capture commercial fishing activity in the array area, specifically looking at ICES rectangle 43F1 in which the array is located, and relevant surrounding ICES rectangles. Demersal trawling is the principle method undertaken within the array, while *nephrops* are the predominant species caught. Fishing takes place throughout the year, with overall landings	No response from consultees was received.	N/A	N/A

Item	Discussion topic and/or question(s)	Attendee response	Applicant response	Scoping Report section
	peaking in January and August. Landings data will be reviewed by weight, value and species caught. In addition to demersal trawl, there are low levels of demersal seine and pelagic trawl in the area. We will also undertake direct consultation with the fishing industry (e.g. SFF, SWFPA and N&EC RIFG), to gather additional information for the characterisation of the baseline. Engagement will be undertaken in-person by the FLO to gather fishing activity information from local fishermen, SFF etc. In line with current Commercial Fisheries Working Groups (CFWG) set up for post consented projects, the Project intends to utilise Fishing Industry Representatives (FIR) contracted through the CFWG to represent the concerns of multiple fishing sectors that may be relevant to the Project. **How do MD-LOT and its Advisors (e.g. MDSEDD) anticipate the management of compensation, mitigation, alternative investment etc?**			
8.2	The key sources of data and information that will be used to inform the commercial fisheries baseline are as follows: - UK Landings Data by ICES Rectangle (Marine Management Organisation (MMO) / Marine Directorate) - *2018 to 2022* *(2013 to 2022 for scallop dredging to take account of the cyclical nature of the fishery)* - UK Fisheries Surveillance Sightings (MMO / Marine Directorate) - *2012 to 2021* - Data for OSPAR request on the production of spatial data layers of fishing intensity pressure (ICES) - *2010 to 2020* - Fishing Activity for UK Vessels 15m and over Data layers (MMO) - *2016 to 2020* - Fishing Activity for UK Vessels 12m and under Data layers (Marine Directorate) - *2017 to 2021* This will be complemented with information collected through consultation with the fishing industry which will help further characterise the baseline. **Is there any other sources to inform the baseline characterisation that we should be aware of?**	No response from consultees was received.	The baseline data is detailed within the 2024 Scoping Report.	Section 13.5 within Chapter 13: Commercial Fisheries
8.3 & 8.4	Additional topic raised during Scoping Workshop on 29 February 2024: Socio-economic impacts	Marine Analytical Unit (MAU) advised that during any consultation questionnaires a question could be included to inform any knock-on socio-economic impacts to fisheries.	Data will be obtained through direct consultation with the fishing industry, this consultation will include questions relevant to the socio-economic assessment. The Applicant will confirm the scope of any questionnaires and engage with MAU to discuss further.	The Applicant will request a meeting

Item	Discussion topic and/or question(s)	Attendee response	Applicant response	Scoping Report section
9. Military and Civil Aviation - written comments from NatureScot 02 April 2024				
9.1	In June 2023, as part of the Scoping Opinion, Scottish Ministers were content that aviation can be scoped out of the EIAR for all phases of the Project but note the need to address the impact on low flying aircraft, particularly military aircraft, in the EIAR. The following is scoped in to the military and civil aviation assessment: Impacts on civil aviation and creation of an aviation obstacle during construction, operation and decommissioning. This poses a likely significant effect, due to the increased collision risk and interference due to presence of high structures such as cranes and partial and permanent offshore structures. **Do you agree that the above should be scoped in to the military and aviation assessment?**	No response from consultees was received.	The aspects scoped in are detailed within the 2024 Scoping Report.	Table 18-6 within Chapter 18: Military and Civil Aviation
9.1	The following is scoped out of the military and civil aviation assessment: - Military radar - Civil radar and air traffic service provision - Potential effects on MOD ATC radar and MOD operations / AARA - Potential effects on MOD ATC radar and air defence radar - Potential effects on MOD Operations / Air to Air Refuelling Areas **Do you agree that the above can be scoped out of the military and civil aviation assessment?**	No response from consultees was received.	The aspects scoped out are detailed within the 2024 Scoping Report.	Table 18-6 within Chapter 18: Military and Civil Aviation
10. Socio-economics and Tourism (includes human health appendix) - written comments from NatureScot 02 April 2024				
10.1	The Project proposes installation of offshore floating structures and cables to shore. The Project would lead to the generation of employment opportunities and gross value added, and could lead to education and training opportunities. The Project would also require products and services. The array area is located over 185km from shore, and therefore is not visible and not used recreationally or for tourism purposes. The Nearshore Cable Corridor (MHWS to 12 NM) construction could disrupt recreational and tourism receptors locally; however, these are extremely limited in the Peterhead area to a small number of recreational sailors and kayakers. The Project could also affect commercial activities and businesses including commercial fisheries, oil and gas operators as well as recreation and tourism businesses operating in the nearshore area. **Can you confirm whether there are any other impact pathways / baseline conditions that should be considered?**	No response from consultees was received.	The impact pathways and baseline are detailed within the 2024 Scoping Report.	Section 19.5 within Chapter 19: Socio Economics

Item	Discussion topic and/or question(s)	Attendee response	Applicant response	Scoping Report section
10.2	We are proposing that no onshore socio-economic effects will be considered within the assessment. The Project is only assessing infrastructure and physical works seaward of mean high water springs (MHWS) including the Nearshore Cable Corridor (MHWS to 12 NM), Export/Import Cable Corridor (12 NM to the array area), the array area (185km offshore northeast of Aberdeen). Therefore, the Socio-economic assessment considers impacts on offshore receptors as well as onshore receptors which would be affected by offshore elements of the Project (i.e. seaward of MHWS). **Do you agree that onshore socio-economic impacts should be scoped out?**	No response from consultees was received.	The Applicant will engage with MD-LOT to discuss best practice for Socio-Economic assessment and how this can be applied to the Project. Guidance was provided by MD-LOT and this will be discussed further at EIAR stage.	Table 19-10 within Chapter 19: Socio Economics
10.3	A construction and marshalling and Operations and Maintenance port(s) has not yet been identified for the Project and may not be known prior to finalisation of the EIA Report and is subject to commercial agreement. The Project are however committed to the development of Scotland and as such, for the purpose of socio economic assessment, it is proposed to assume that both the construction and marshalling and O&M ports are located on the East Coast of Scotland. **Do you agree with this approach?**	No response from consultees was received.	The Socio-economics assessment will undertake a proportionate assessment of the short-listed port locations likely to be used for the construction, operation, and maintenance of the Project.	Section 19.1 within Chapter 19: Socio Economics
10. Socio-economics and Tourism (includes human health appendix) - Scoping Workshop 29 February 2024				
10.1 & 10.4	Additional topic raised during Scoping Workshop on 29 February 2024: Onshore Impacts	Marine Analytical Unit (MAU) believe onshore impacts should be scoped in e.g. employment.	The Applicant will only consider the offshore elements of the Project. Therefore, the Socio-economic assessment considers impacts on offshore receptors as well as impacts on onshore receptors which would be affected by offshore elements of the Project. For example, an onshore recreation receptor could have reduced amenity as a result of offshore construction works.	Table 19-10 within Chapter 19: Socio Economics.
11. Major Accidents and Disasters (MA&D) - written comments from NatureScot 02 April 2024				
11.1	The vulnerability of the Project to a major accidents and disasters event during decommissioning is anticipated to be no worse than that for the construction phase following the implementation of risk management plans for decommissioning. Therefore, it is proposed to consider construction and decommissioning together. **Do you agree major accidents and disasters event during decommissioning phase is equal to or less than that for the construction phase and can therefore be considered together?**	No response from consultees was received.	The approach is detailed within the 2024 Scoping Report.	Section 21.9 of Chapter 21:Major Accidents and Disasters and Appendix 21A: Major Accidents and Disasters Long List
11.2	In accordance with emerging EIA practice, occupational Health and Safety (H&S) is scoped out of this topic as it is covered by detailed H&S legislation (e.g. The Management of Health and Safety at Work Regulations	No response from consultees was received.	The aspects scoped out are detailed within the 2024 Scoping Report.	Section 21.9 of Chapter 21:Major Accidents and Disasters and Appendix 21A: Major Accidents and Disasters Long List

Item	Discussion topic and/or question(s)	Attendee response	Applicant response	Scoping Report section
	1999 , The Workplace (Health, Safety and Welfare) Regulations 1992 and The Electricity at Work Regulations 1989). **Do you agree that occupational health and safety is scoped out of the major accidents and disasters assessment?**			
11.3	Employees of the Applicant and/or its suppliers, whether during construction, operation, or maintenance are excluded from the assessment as the Employer's commitment and obligations to manage risks to employees are addressed in the Health and Safety at Work etc Act 1974. **Do you agree that employees of the Applicant and/or its suppliers are scoped out of the major accidents and disasters assessment?**	No response from consultees was received.	The aspects scoped out are detailed within the 2024 Scoping Report.	Section 21.9 of Chapter 21:Major Accidents and Disasters and Appendix 21A: Major Accidents and Disasters Long List
11.4	Members of the public who are wilfully trespassing are excluded from the assessment as they are outside the occupier's legal requirements under the Occupiers' Liability (Scotland) Act 1960. **Do you agree members of the public who are wilfully trespassing are scoped out of the major accidents and disasters assessment?**	No response from consultees was received.	The aspects scoped out are detailed within the 2024 Scoping Report.	Section 21.9 of Chapter 21:Major Accidents and Disasters and Appendix 21A: Major Accidents and Disasters Long List
11.5	MA&D will be assessed in accordance with the institute of Environmental Management & Assessment, (2020). 'Major Accidents and Disasters in EIA: A Primer'. The purpose of the primer is to increase awareness of the MA&D topic and its application within all stages of EIA. The primer outlines an assessment methodology based on known current practice within the UK and provides definitions of key terminology. The Primer is structured around a typical assessment approach and provides a proportionate method for considering major accidents and disasters through the stages of EIA. **What matter do you think are relevant to floating offshore wind?**	No response from consultees was received.	The relevant matter is detailed within the 2024 Scoping Report.	Section 21.2.2 of Chapter 21:Major Accidents and Disasters
12. Materials and Waste - written comments from NatureScot 02 April 2024				
12.1	Materials and waste methodology will be aligned to IEMA Guidance *"IEMA Guide to Materials and Waste in Environmental Impact Assessment."* **Do you agree with proposed methodology for Material and Waste assessment?**	No response from consultees was received.	The proposed methodology is detailed within the 2024 Scoping Report.	Section 20.11 within Chapter 20: Materials and Waste
12.2	Baseline data (material resource availability and remaining landfill capacity) will be obtained from publicly available sources including SEPA for waste data. **Do you agree with the proposed baseline data to be used for the materials and waste assessment? Is there any other data you would expect to be used?**	No response from consultees was received.	The baseline data is detailed within the 2024 Scoping Report.	Section 20.5 within Chapter 20: Materials and Waste

Item	Discussion topic and/or question(s)	Attendee response	Applicant response	Scoping Report section
12.3	Propose to scope in construction materials and waste. **Do you agree that this should be scoped in?**	No response from consultees was received.	The aspects scoped in are detailed within the 2024 Scoping Report.	Table 20-8 within Chapter 20: Materials and Waste
12.4	Propose to scope out the following materials and waste streams from further assessment: - operational material and waste as this will comprise minor repair/maintenance activities which will not require significant quantities of materials or generate significant quantities of waste. - decommissioning materials and waste. Material requirements will be minimal and project has been designed to minimise decommissioning waste where possible. Governance will be achieved through a detailed Decommissioning Plan. Any waste disposal required will follow legislative / policy requirements at the time of decommissioning. **Do you agree that these aspects can be scoped out?**	No response from consultees was received.	The aspects scoped out are detailed within the 2024 Scoping Report.	Table 20-8 within Chapter 20: Materials and Waste
13. Cumulative and transboundary impacts approaches - written comments from NatureScot 02 April 2024				
13.1	**Can you please provide further information on when the CEF will be available for use?**	No response from consultees was received.	N/A	N/A
13.2	Projects that will be considered are those that are already operational, constructed, those under construction, permitted but not yet implemented, submitted but not yet determined and projects that are 'reasonably foreseeable'. We are proposing that the following search areas will be used to develop the long list of projects: **Aggregate, dredging and disposal -** Up to 50km from the Site **Cables and Pipelines -** Up to 50km from the Site **Commercial fisheries -** Up to 200km from the Site **Port and Harbour Development -** Up to 200km from the Site (Existing operational ports and harbours will be considered as part of the baseline. **Military, aviation and radar -** Up to 200km from the Site **Offshore energy -** Up to 500km from the Site. (NB Projects on the West Coast of England/Scotland will not be included even if within the 500 km distance as no pathway for cumulative impact) **Oil and Gas Field Developments -** Up to 200km from the Site (search extended to 500 km for oil and gas licences projects in planning) **Shipping -** Up to 200km from the Site **Carbon Capture and Storage (CCS) -** Up to 50km from the Site Where other developments are expected to be completed before the construction of the Project and the effects are fully determined, effects arising from them will be considered as part of the baseline. Existing operational developments will only be screened into the long list if there is considered to be the potential for an ongoing impact from that development type. The long list of projects will be provided with the 2024 Scoping	No response from consultees was received.	The Applicant understands NatureScot would find it helpful to understand that figures given are maximum extents and ensure the 2024 Scoping Report includes this clearly in narrative.	Table 1-1 within Appendix 5C: Cumulative Effects Assessment Long List of Projects

Item	Discussion topic and/or question(s)	Attendee response	Applicant response	Scoping Report section
	Report. **Do you agree with the search areas used to develop the long list of projects? Do you have any other guidance or feedback on this approach?**			
13.3	The following topic specific screening ZOI's are to be used within the assessment to screen the long list to a short list of developments: - Aviation, military, and communications - Distance at which disturbance from the Project would interact with that of an 'other development' (50 km). - Benthic and intertidal ecology - 20 km - Marine Mammals - Dependent on the relevant marine mammal and seal management units. - Underwater noise - Dependent on the underwater noise modelling and the nature of the receptor which will determine the limit of audition and therefore the maximum extent of possible impact. - Commercial fisheries - Dependent on the extent of the relevant fishing grounds targeted by each fleet affected. Anticipated to cover grounds off the East Coast of Scotland and off North East England. - Fish and shellfish ecology. The North East anadromous fish region boundary. ZOI will be set by the spatial extent over which and likely significant effects may occur. This will be determined by modelling (e.g. waterborne noise and suspended sediment) established from baseline investigations. - Marine Infrastructure and other users - Any development overlapping the Project Area. - Marine cultural heritage and archaeology - Dependent on the archaeological receptor in question but a max of 5-10 km. - Marine and coastal processes - The assessment of potential impacts will be limited to the spatial extent over which any likely significant effects may occur. This extent will be based on the understanding of likely effects established from baseline investigations and assessment work. In spatial terms, this is expected to equate to up to 50 km from the Project (including consideration of any downstream/ far-field effects). - Offshore ornithology - The species-specific foraging ranges from Woodward *et al*.(2019) is used in the breeding season, and in the non-breeding season, the Furness BDMPS regions are used. The exception is for guillemot and herring gull, where the breeding season foraging range is used during the non-breeding season because they are assumed to not disperse widely during the non-breeding season. - Shipping and navigation - 50 NM (approximately 92.6km) - Climate change - Intrinsically considered as part of the assessment of climate change - Socio-economics - Regional study area of Scotland, local study area of the local authority area of Aberdeenshire Council. - Water and Sediment Quality - 5 km for array area and	No response from consultees was received.	The ZOI's used within the assessment are detailed within the 2024 Scoping Report.	Table 1-1 within Appendix 5C: Cumulative Effects Assessment Long List of Projects

Item	Discussion topic and/or question(s)	Attendee response	Applicant response	Scoping Report section
	15 km for ECC. - Materials and Waste - 10 km **Are the consultee's content with the ZOI's used in the assessment?**			
13.4	The following topics have been proposed to be scoped out from further assessment within the Offshore EIAR: - Marine Water and Sediment Quality is scoped out. - Benthic Ecology: There are no anticipated transboundary effects from construction, operation and maintenance, or decommissioning on benthic - ecology. - Marine Cultural Heritage and Archaeology: No effects on Marine Cultural Heritage and Archaeology receptors are likely to be transboundary. - Seascape, Landscape and Visual: Given the closest distance from land is 185km it is proposed that seascape, landscape and visual is scoped out for transboundary effects. - Military and Civil Aviation: Due to the localised nature of potential impacts, transboundary impacts are considered unlikely to occur and therefore it is proposed that military and civil aviation and telecommunications is considered scoped out. - Climate Change resilience: is scoped out - Socio-economics: An extended supply chain for labour, services, equipment or materials may lead to transboundary socio-economic impacts outside the UK. However, the level of purchases arising from the Project is considered to be relatively small compared to the size of the well-developed international markets in which they take place and the assessment of effects is proposed to be scoped out. - Materials and Waste: No transboundary impacts are anticipated in relation to materials and waste. The materials and waste assessment considers the material resources required form the scheme which will be from regional / national sources. The assessment also considers remaining landfill capacity which is local / regional to the scheme. - Marine and Coastal Processes: is scoped out. **Are the consultee's content with the proposed topics being 'scoped out' for the assessment of transboundary effects in the Offshore EIAR?**	No response from consultees was received.	The topics scoped out are detailed within the 2024 Scoping Report.	Table 5-6 within Chapter 5: Approach to Scoping and EIA
13.5	The following topics are scoped in for transboundary effects: -Major Accident and Disaster -Marine Mammals -Ornithology -Fish Ecology -Commercial Fisheries -Shipping and Navigation -Marine Infrastructure and Other Users **Do you agree with the topics which have been**	No response from consultees was received.	The topics scoped in are detailed within the 2024 Scoping Report.	Section 5.9.4 within Chapter 5: Approach to Scoping and EIA

Item	Discussion topic and/or question(s)	Attendee response	Applicant response	Scoping Report section
	scoped in for the assessment of transboundary effects?			
13.6	In the CEA, the Project will consider other plans/projects that have submitted a Scoping Report no less than four months prior to application submission of the Project. **Do you agree with this proposed cut-off date?**	No response from consultees was received.	The Applicant understands the cut off date will be agreed with MD-LOT through separate consultation. The suggested date is detailed within the 2024 Scoping Report.	Section 1.2 within Appendix 5C: Cumulative Effects Assessment Long List of Projects
13.7	The EIA Regulations require an EIA to assess a 'project' and not just the topics of a project covered by a particular consent/licence application. In the absence of details of onward connections to oil and gas platforms, a likely scenario for onward connection to oil and gas platforms has been assumed. It is anticipated that the Project will provide onward connection to five oil and gas assets located in the waters to the northeast and southeast of the proposed array area within the Targeted Oil and Gas Onward Development Area. Marine licences for these cables will be applied for separately in the future. These will be considered as part of the environmental assessment, albeit not part of the marine licence application. This assessment is included within the cumulative effects assessment. **Do MD-LOT and their advisors agree with the proposed approach to assess the Oil and Gas Platforms?**	No response from consultees was received.	The approach is detailed within the 2024 Scoping Report.	Section 5.9 within Chapter 5: Approach to Scoping and EIA and Table 1-1 within Appendix 5C: Cumulative Effects Assessment Long List of Projects
14. Marine Infrastructure and Other Users - written comments from NatureScot 02 April 2024				
14.1	The Project is likely to interact with a range of potential types of marine infrastructure and other uses. The following is scoped in: - Fill aggregates (because the Project area overlaps with mapped resource areas) - Evaporite resources (because the Project area overlaps with resource areas) - Dredge soils (scoped into inshore cable corridor only) (because cable installation and operation may affect use of disposal sites near the coast) - Pipelines (because the Project area overlaps with pipelines) - Power and telecommunication cables (because the Project area overlaps with pipelines) - Aquaculture (scoped in for seaweed resource only) (because of potential Kelp resource in near shore area crossed by export cable) - Renewable energy (because of proximity and similar supply chain) - UXO (because of uncertainty over locations with UXO) **Do you agree with the scoped in aspects of marine infrastructure and other users?** **Do you have recommended distances or buffers for these?**	No response from consultees was received.	The aspects scoped in are detailed within the 2024 Scoping Report.	Table 17-7 within Chapter 17: Marine Infrastructure and Other Users

Item	Discussion topic and/or question(s)	Attendee response	Applicant response	Scoping Report section
14.2	The Project is likely to interact with a range of potential types of marine infrastructure and other uses. The following is scoped out: - All other aggregates and mineral resources, and CCUS (because identified resource/licence areas do not overlap with the Project area) - Surface infrastructure (excluding renewable energy) (because effects are expected to be related to shipping which is covered in a separate chapter) and/or to major hazards (covered in separate chapter) - Defence (because facilities, exercise and danger areas are remote and military aviation is covered in a separate chapter) Note that recreation is covered in socio-economics chapter. **Do you agree with the scoped out aspects of marine infrastructure and other users?**	No response from consultees was received.	The aspects scoped out are detailed within the 2024 Scoping Report.	Table 17-7 within Chapter 17: Marine Infrastructure and Other Users
14.3	**In addition to directly affected infrastructure owners/operators, do you recommend that the impact assessment should also consider knock-on and indirect effects on societal receptors (e.g. Scottish energy consumers)?**	No response from consultees was received.	The Applicant's approach to assessment is detailed within the 2024 Scoping Report.	Section 17.11 within Chapter 17: Marine Infrastructure and Other Users
14.4	Cenos has and will continue to contact owners/operators of relevant infrastructure and/or assets in the waters surrounding the project. Records of the project's engagement with other marine users will be included within the impact assessment. **Could you please highlight any relevant stakeholders which you recommend to be contacted in reference to marine infrastructure or use?**	No response from consultees was received.	The Applicant will seek to consult with owners and operators of existing assets and representatives of institutions with responsibilities or concerns related to future uses.	Section 17.4 within Chapter 17: Marine Infrastructure and Other Users
14.5	**Are there any references or data sources that you recommend should be utilised as part of the assessment?**	No response from consultees was received.	The data sources are detailed within the 2024 Scoping Report.	Section 17.5 within Chapter 17: Marine Infrastructure and Other Users
15. Climate Change Resilience - written comments from NatureScot 02 April 2024				
15.1	**Are there any centralised databases / mapping services that can be provided by MD-LOT to support the characterisation of climate change?**	No response from consultees was received.	The data sources are detailed within the 2024 Scoping Report.	Section 22.5 within Chapter 22: Climate Change Resilience
15.2	The 2024 Scoping Report assesses the vulnerability of the assets to climate change through a scoring of sensitivity and exposure. Through this assessment, impacts with low vulnerability can be scoped out of further assessment as they are unlikely to give rise to significant effects. Extensive engagement and workshops with the engineering design team has allowed for early identification of climate change impacts that could result in likely significant effects, and embedded measures have been developed to mitigate this and reduce the assets vulnerability. It is, therefore, proposed and justified through the vulnerability assessment that climate change impacts can be scoped	No response from consultees was received.	The aspects scoped out are detailed within the 2024 Scoping Report.	Section 22.8 within Chapter 22: Climate Change Resilience

Item	Discussion topic and/or question(s)	Attendee response	Applicant response	Scoping Report section
	out. The iterative design process will refine the details of climate change mitigation and design measures and will be captured within the Project Description and detailed design. **Do you agree that all assets considered in the vulnerability assessment can be scoped out?**			
16. Carbon and Greenhouse Gases - written comments from NatureScot 02 April 2024				
16.1	Proposed assessment methodology is to follow PAS 2080: 2023 guidance, aligning with IEMA, covering 'before use', 'use', and 'end-of-life' stages of the infrastructure lifecycle. **Do you agree?**	No response from consultees was received.	The proposed methodology is detailed within the 2024 Scoping Report.	Section 23.11 within Chapter 23: Carbon and Greenhouse Gases
16.2	The Project can reduce carbon emissions by generating clean electricity from wind and thus mitigating the impact of greenhouse gases on the environment. The GHG assessment helps in establishing a baseline to understand the significant potential impacts of the Project in the future. We propose the following aspects should be scoped in: - Construction stage emissions including embodied emissions from materials are scoped into the assessment considering the significant embodied emissions from raw material assets, transportation of construction materials and offshore installation activities. - Operational energy, as it includes aspects such as electricity production and maintenance; these emissions have a significant impact on the Project if not assessed during the EIA. - Decommissioning stage emissions including offshore decommissioning, have a significant impact on the global atmosphere. This encompasses emissions from transporting waste materials to their end-of-waste state, as well as activities like treatment, recovery, recycling, and the final disposal of demolition materials, all contributing to substantial GHG emissions. **Do you agree that the aspects listed above should be scoped in?**	No response from consultees was received.	The aspects scoped in are detailed within the 2024 Scoping Report.	Table 23.5 within Chapter 23: Carbon and Greenhouse Gases
16.3	The Project can reduce carbon emissions by generating clean electricity from wind and thus mitigating the impact of greenhouse gases on the environment. The GHG assessment helps in establishing a baseline to understand the significant potential impacts of the Project in the future. We proposed the following aspects should be scoped out: - Operational water is scoped out as it is anticipated that the GHG emissions related to operational water use will be minimal and not likely to be significant; - Other operational processes from the operation stage of the lifecycle based on minimal emissions to the project: scoped out as we assume that there will be	No response from consultees was received.	The aspects scoped out are detailed within the 2024 Scoping Report.	Table 23.5 within Chapter 23: Carbon and Greenhouse Gases

Item	Discussion topic and/or question(s)	Attendee response	Applicant response	Scoping Report section
	minimal emissions beyond the transportation of the workforce and those associated with the maintenance and repair of materials, as considered in stage B2-B5, have been identified for this Project. **Do you agree that the aspects listed above should be scoped out?**			
16.4	**Could MD-LOT provide feedback and agreement on the approach, as outlined above?**	No response from consultees was received.	The approach is detailed within the 2024 Scoping Report.	Section 23.11 within Chapter 23: Carbon and Greenhouse Gases
17. Shipping and Navigation - written comments from NatureScot 02 April 2024				
17.1	No impacts will be scoped out of the NRA process, as this is a stipulated MCA requirement to assess via the NRA. - The NRA will be undertaken in compliance with MCA requirements under MGN 654 - This will be demonstrated via completion of an MGN 654 checklist which will be appended to the NRA - Vessel traffic data collection approach has been agreed with the MCA **Are the consultees content with this approach to scoping for shipping and navigation?**	No response from consultees was received.	As per the methodology provided in the MCA methodology (Annex 1 to MGN 654), the NRA should assess impacts on a preliminary basis to identify which should be included within the EIA. Given that the NRA includes a set of criteria under MGN 654 which must be considered, no impact will be scoped out at this scoping stage, and all impacts will be considered within the NRA process. The NRA will be undertaken in compliance with MCA requirements set out in MGN 654. Vessel traffic approach has been agreed with MCA. This will be demonstrated via completion of an MGN 654 checklist which will be appended to the NRA Vessel traffic data collection approach has been agreed with the MCA,	N/A - NRA will be appendix to the EIAR.
18. MPA screening assessment - written comments from NatureScot 02 April 2024				
18.1	**Are the consultees content with using the English guidance (*Marine conservation zones and marine licensing*, by MMO, April 2013), while referring to/consulting the archived Scottish guidance in the MPA screening assessment?**	Comments received from NatureScot on 02 April 2024: NatureScot and JNCC are content with the above-mentioned approach. As mentioned in the workshop, we recommend that Cenos outline pressures, impact pathways, receptors, footprints, etc. and ensure that everything is evidence based and referenced. Any uncertainties should be appropriately recognised. JNCC recommend that you familiarise yourselves with the conservation advice with respect to East of Gannet and Montrose Fields ncMPA (https://jncc.gov.uk/our-work/east-of-gannet-and-montrose-fields-mpa/) and Turbot Bank ncMPA (https://jncc.gov.uk/our-work/turbot-bank-mpa/), noting that the conservation package for East of Gannet and Montrose Fields will be updated and available early in the next financial year. The Conservation and Management advice for the Southern Trench ncMPA can be found on SiteLink (https://sitelink.nature.scot/site/10477). To follow up on our action from the Scoping workshop,	The approach is detailed within the 2024 Scoping Report.	Section 1.1 within Appendix 5E: Marine Protected Area Screening Assessment

Item	Discussion topic and/or question(s)	Attendee response	Applicant response	Scoping Report section
		there is no MPA screening assessment guidance specific to Scotland.		
18.2	After an initial screening of 100 km and using the MMMUs for marine mammals, 3 sites are considered further within the Stage 1 assessment (main assessment): 1) East of Gannet and Montrose Fields NCMPA, 2) Southern Trench NCMPA and 3) Turbot Bank NCMPA. The Stage 1 assessment (main assessment) will include a maximum ZoI. **Are the consultees content with the list of sites to be taken into the main assessment?**	Comments received from NatureScot on 02 April 2024: NatureScot and JNCC are content with the list of sites taken forward for the main MPA screening assessment, namely East of Gannet and Montrose Fields ncMPA, Turbot Bank ncMPA and Southern Trench ncMPA. While we appreciate that Turbot Bank ncMPA is 6km from the cable corridor, we believe that the site should be scoped in as a precautionary measure at this stage until data can be provided demonstrating the distance to which impacts from the cable corridor are be expected to reach.	The Applicant understands NatureScot and JNCC are content with the list of sites taken forward for the MPA Screening Assessment. The Applicant can confirm that Turbot Bank has been screened in for the following impacts: - Direct impact/disturbance leading to temporary or long-term habitat loss; - Temporary increases in suspended sediments and contaminants; - Smothering resulting from resettlement of suspended material; and - Increases in underwater noise.	Table 1-4 and Table 1-5 within Appendix 5E: Marine Protected Area Screening Assessment
18.3	To support sufficient assessment, with impacts to MPAs including the East of Gannet and Montrose Fields, or other NCMPAs identified, we would like to agree Impact Thresholds, with the relevant Agencies who are managing such protected sites. **Can you please advise what site/habitat-specific Impact Thresholds should be utilised for the management and recovery objectives of these sites?**	Comments received from NatureScot on 02 April 2024: NatureScot and JNCC do not support the use of thresholds. Currently, we support a case-by-case approach to project impact assessment and will consider the impacts from the project in the context of the site-specific survey data analysis, the spatial footprint of the windfarm, impact pathways and potential cumulative effects.	The Applicant notes NatureScot's response and would seek to have a separate discussion with NatureScot.	N/A
19. HRA Screening - written comments from NatureScot 02 April 2024				
19.1	The following types of effects are considered in the HRA Screening Report: **Benthic Ecology**: Physical disturbance & habitat loss; Increases in suspended sediments / contaminants; Pollution **Marine Mammals**: Underwater noise; Vessel disturbance; Vessel collision risk; Changes in prey availability / behaviour; Pollution; Increases in suspended sediments / contaminants; Entanglement; Barrier effects; EMF **Migratory Fish**: Habitat loss /disturbance; Increases in suspended sediments / contaminants; Underwater noise; Pollution; EMF. **Offshore Ornithology:** Habitat loss; Distributional responses; Changes in prey availability / behaviour; Collision; Entanglement; UXO; Underwater noise **Are the consultee's content with the types of effects considered in the HRA Screening Report?**	No response from consultees was received.	The types of effects are detailed within the 2024 Scoping Report.	HRA Screening Report
19.2	The following ZOI's have been used in the HRA Screening Report: **Annex I habitats:** 20 km (extent of two mean tidal excursions) **Marine Mammals:** Marine Mammal Management Unit (cetaceans); 20 km (Grey Seal); 50 km (Harbour Seal)	No response from consultees was received.	The ZOI's are detailed within the HRA Screening Report.	HRA Screening Report

Item	Discussion topic and/or question(s)	Attendee response	Applicant response	Scoping Report section
	Migratory Fish: NatureScot have advised that diadromous fish species should be considered as part of the EIA and not as part of the HRA. The Dee District Salmon Fishery Board however consider that 'whilst it is unlikely that significant numbers of migrating diadromous fish would be present, we feel the that the precautionary principle should be applied due to the lack of evidence to the contrary'. Given the extensive open ocean and near shore migrations undertaken by diadromous fish (Malcom *et al*., 2010) there is the potential for activities associated with the construction, operation, maintenance, and decommissioning of the proposed windfarm (array area) and the export cable to result in impacts on Annex II species at a distance from the SAC for which they are a qualifying interest feature. On this basis, it is recommended the all SACs for Atlantic salmon located within the North East anadromous fish region boundary are screened in. **Offshore Ornithology:** Mean-maximum foraging range (and NatureScot specific advice); Biological Defined Minimum Population Scales (non-breeding) **Are the consultee's content with the ZOI's considered in the HRA Screening Report?**			
19.3	The following sites are where Likely Significant Effects (LSEs) have been identified: **Marine Mammals:** Moray Firth SAC **Migratory Fish:** River Dee SAC; River Spey SAC; River South Esk SAC; River Tay SAC; Berriedale and Langwell Waters SAC; River Evelix SAC; River Oykel SAC; River Moriston SAC; River Tweed SAC; River Teith SAC **Offshore Ornithology**: Buchan Ness to Collieston Coast; Loch of Strathbeg; Ythan Estuary, Sands of Forvie; Fowlsheugh; Troup, Pennan and Lion's Head; Farne Islands; Forth Islands; East Caithness Cliffs; Copinsay; North Caithness Cliffs; Fair Isle; Hoy; Calf of Eday; Sumburgh Head; Flamborough and Filey Coast, Rousay; West Westray, Papa Westray; Marwick Head; Noss; Foula; Fetlar; Cape Wrath; North Rona and Sula Sgeir; Rona Hill; Handa. Hermaness; St Kilda **Are the consultee's content with the list of sites screened into the assessment for RIAA?** **With regards to diadromous fish, we are aware of NatureScot's advice on other projects that they are not considered through the HRA process. On a precautionary basis, we have however incorporated the relevant sites in HRA screening. Do the consultees have any feedback on this advice?**	See ID 2.6.	The list of sites to be screened into the assessment are detailed within the 2024 Scoping Report. The Applicant understand that based on evidence currently available to NatureScot, it is not possible for to carry out an assessment of diadromous fish to the level required under HRA and therefore NatureScot advise that diadromous fish species should be assessed through EIA only and not through HRA. The Applicant has however on a precautionary basis, incorporated the relevant sites in HRA screening.	HRA Screening Report
19.4	**When will the MRF be available as an option for strategic compensation for Scottish Projects when required to compensate for in-combination impacts?**	No response from consultees was received.	N/A	N/A
19.5	**Will Strategic Fisheries Management be an option for Offshore Wind Projects?**	No response from consultees was received.	N/A	N/A

Item	Discussion topic and/or question(s)	Attendee response	Applicant response	Scoping Report section
19.6	**When will updated guidance be released on the Compensation Framework?**	No response from consultees was received.	The Applicant understands that at the time of writing the 2024 Scoping Report, no updated guidance has been released on the Compensation Framework. If the guidance in released in time for the preparation of the EIAR, this guidance will be followed.	N/A
19. HRA Screening - Scoping Workshop 29 February 2024				
19.7	**Additional question asked during Scoping Workshop on 29 February 2024: Are the consultees content with the approach to site selection applied in the HRA Screening Report?**	Comments received from NatureScot on 02 April 2024: Initial HRA screening should include all sites with theoretical connectivity with the project - i.e. within foraging range for each species, taking into account at sea distances. This list will be refined by considering the species present in the DAS surveys and appropriate impact pathways.	The Applicant understands that the initial HRA screening should include all sites with theoretical connectivity with the Project. The list of sites is included within the HRA Screening Report.	HRA Screening Report
19.8	**Additional question asked during Scoping Workshop on 29 February 2024: Are the consultees content with screening out of SPAs for migratory waterbirds considering the location of the Project Array Area?**	Comments received from NatureScot on 02 April 2024: Insufficient information was provided on this topic at the scoping workshop to justify the screening out of SPAs for migratory waterbirds. To identify any European sites designated for migratory waterbirds which have potential connectivity with the Project, consideration should be given to the likely migratory pathways and distribution of relevant coastal estuarine sites and inland waterbody sites for the associated species. An updated review of migratory routes and vulnerabilities across the UK has been prepared via ScotMER on behalf of Marine Director and The Crown Estate - Strategic study of collision risk for birds on migration and further development of the stochastic collision risk modelling tool Work Package 1: Strategic review of birds on migration in Scottish waters, Woodward *et al* 2022. The development of a stochastic migration CRM tool (mCRM) to enable quantitative assessment of risks to migratory SPA is also under development, but the tool is not yet available. Currently, we recommend using the updated strategic review to inform a qualitative assessment of potential impacts on migratory waterbirds.	The Applicant has agreed that SPAs for migratory birds will be screened in for the Report to Inform the Appropriate Assessment. The Applicant has considered the Woodward *et al* (2023) report on migratory birds. The HRA Screening Report will conclude, where relevant, that there are Likely significant effects for certain migratory species - these will be further assessed in the Report to Inform Appropriate Assessment.	HRA Screening Report
4.3	**Additional topic raised during Scoping Workshop on 29 February 2024, in relation to marine mammals: NatureScot agree with assessment approach for the HRA, but advise the Applicant should check with Natural England about boundary sites.**	NatureScot advise the Applicant should check with Natural England about boundary sites for marine mammals.	The Applicant will discuss the assessment approach with Natural England.	
20. Migratory Bats - written comments from NatureScot 02 April 2024				
20.1	Cenos propose to scope out migratory bats on the basis of the location of the windfarm array being over 200 km offshore and the paucity of evidence of bats being found in the far offshore Central North Sea marine	No response from consultees was received.	Whilst there is now evidence of bat migration in the southern North Sea between the UK and The Netherlands and Belgium and between Denmark,	Appendix 5B: Approach to Migratory Bats

Item	Discussion topic and/or question(s)	Attendee response	Applicant response	Scoping Report section
	environment. **Do you agree with this approach?**		Germany and Sweden over the Baltic Sea there is no confirmed evidence of a more northern migration over the North Sea. Eurobats have published a possible migratory route between Norway and Scotland for Nathusius' Pipistrelle but this is speculative – based on the migratory capability of the species and land-based distributions. Therefore, it is anticipated that an evaluation of migratory bat impact should be scoped out from the EIA as a consequence of there being no confirmed evidence of a migratory route between Norway and Scotland and significant effects being unlikely.	
21. Cumulative and Transboundary Impacts Approaches - written comments from NatureScot 02 April 2024				
21.1	Do you agree with the search areas used to develop the long list of projects? Do you have any other guidance or feedback on this approach?	Comments received from NatureScot on 02 April 2024: Ornithology - Projects located in Scottish and English waters should be scoped in/out of the cumulative assessment for breeding birds based on the mean-maximum foraging ranges from Woodward *et al*. (2019). The non-breeding season cumulative assessment, for species that migrate or disperse from their colonies, will include relevant developments within the BDMPS region (Furness, 2015). Marine mammals - Yes, we agree with the search areas used to develop the long list of projects with regards to marine mammals. Management Units should also be considered where appropriate for cetaceans and seals.	The Applicant understands NatureScot agrees with the search areas used to develop the long list of projects.	Appendix 5C: Cumulative Effects Assessment Long List of Projects
21.2	Do you agree with the proposed topic-specific ZoIs to be used within the assessment?	Comments received from NatureScot on 02 April 2024: Yes, we agree with the proposed topic-specific ZoIs for fish ecology, benthic ecology, ornithology, based on information provided in the Cenos spreadsheet titled "Cenos Offshore Windfarm Scoping Workshop – Discussion Topics and Questions". We agree with the marine mammal ZoIs, dependent on management units. But we caution that the cumulative assessment may need to consider more than the immediate ZoI, i.e. there can be cumulative impacts even where ZoIs don't directly overlap. For some topics, it was not clear how the ZoIs had been determined and what information was used to inform the decision making. We would expect to see this information provided in the upcoming 2024 Scoping report.	The justification for ZoIs is included within the 2024 Scoping Report.	Appendix 5C: Cumulative Effects Assessment Long List of Projects
21.3	Do you agree with the list of topics proposed to be scoped out from further transboundary assessment?	Comments received from NatureScot on 02 April 2024: We agree that benthic ecology and seascape, landscape	The Applicant notes that NatureScot agree that benthic ecology and	Appendix 5D: Transboundary Screening Matrix

Item	Discussion topic and/or question(s)	Attendee response	Applicant response	Scoping Report section
		and visual should be scoped out for the assessment of transboundary effects.	seascape, landscape and visual should be scoped out for the assessment of transboundary effects.	
21.4	Do you agree with the topics which have been scoped in for the assessment of transboundary effects?	Comments received from NatureScot on 02 April 2024: We agree that ornithology, fish ecology and marine mammals should be scoped in for the assessment of transboundary effects.	The Applicant notes that NatureScot agree that ornithology, fish ecology and marine mammals should be scoped in for the assessment of transboundary effects.	Appendix 5D: Transboundary Screening Matrix
22. Landscape, Seascape and Visual - written comments from NatureScot 02 April 2024				
22.1	Further comments received from NatureScot on 02 April 2024	Comments received from NatureScot on 02 April 2024: Due to the location of this proposal and the distance from shore, we agree that the Project in the windfarm array area and the export cable corridor to MHWS is unlikely to give rise to significant effects to coastal character and/or visual receptors and therefore can be scoped out. However, we advise that the assembly and pre-commissioning of the turbines, including any wet storage and related activity is an aspect that requires further consideration. It is unclear whether this should form part of the EIA report for this application or should be considered as an aspect related to the relevant port and harbour expansion considerations. We would welcome further discussions on this issue with regulators and developers as we consider this could have considerable project specific and/or cumulative impacts that should be assessed.	The Applicant understands NatureScot agree that Seascape, Landscape and Visual Impact Assessment can be scoped out of the EIA. The wet storage of turbines outside of the Array Area, in close proximity to a port, is linked to a decision on construction and marshalling port(s) and as such potential impacts associated with wet storage are proposed to be scoped out of this assessment. This should be considered as an aspect related to the relevant port and harbour expansion considerations.	Chapter 16 Seascape Landscape Visual Impact Assessment

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Appendix 10A: Benthic Marine Mammal Observation and Passive Acoustic Monitoring Report

Benthic Marine Mammal Observation and Passive Acoustic Monitoring Report

Cenos OWF Array and Export Cable Corridor Geophysical Survey

In accordance with ISO14001:2015, ISO9001:2015 and ISO45001:2018

Document Code:	**FLO-CEN-REP-0035**	
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Date:	*11/12/2023*	
Prepared by:	*DW, HB, CC*	*D. White, H. Bailey, C. Cooke*
Checked by:	*PC*	*P. Collins*
Approved by Client:		*Electronic signature*

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Benthic Marine Mammal Observation and Passive Acoustic Monitoring Report

Cenos OWF Array and Export Cable Corridor Geophysical Survey

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Prepared by: Rovco Ltd

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Commercial Security

Flotation Energy

Cenos Offshore Windfarm Array and Export Cable Corridor Geophysical Survey

Marine Mammal Observation and Passive Acoustic Monitoring Report

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Table of Abbreviations

Abbreviation	Meaning	Abbreviation	Meaning
AD	Acoustic Detection	MF	Medium Frequency
BOEM	Bureau of Ocean Energy Management	MMO	Marine Mammal Observer OR Marine Management Organisation
BSL	Benthic solutions Limited	NM	Nautical Miles
BSB	Below Seabed	OWF	Offshore Wind Farm
CD	Chart Datum	PAM	Passive Acoustic Monitoring
DAQ	Digital Acquisition	PAMS	Passive Acoustic Monitoring System
DPR	Daily Project Report	PSO	Protected Species Observer
ECC	Export Cable Corridor	SAC	Special Area of Conservation
ECR	Export Cable Route	SBP	Sub-Bottom Profiler
EMEC	European Marine Energy Centre	SLR	Single Lens Reflex
EOL	End of Line	SOL	Start of Line
EOW	End of Watch	SOW	Start of Watch
EPS	European Protected Species	SSS	Side Scan Sonar
EU	European Union	SVP	Sound Velocity Profile
FFT	Fast Fourier Transform	TBT	Toolbox Talk
GPS	Global Positioning Systems	UHR	Ultra High Resolution
HF	High Frequency	UKCS	United Kingdom Continental Shelf
IBAMA	Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (Brazilian Institute of the Environment and Renewable Natural Resources)	USBL	Ultra-Short Baseline
JNCC	Joint Nature Conservation Committee	UTC	Universal Coordinated Time
LF	Low Frequency	UXO	Unexploded Ordnance
MAG	Magnetometer	WOW	Waiting on Weather
MBES	Multibeam Echosounder	WTG	Wind Turbine Generator

1 Introduction

1.1 Project Overview

The Cenos Offshore Wind Farm (OWF) is located 200 km offshore of the east coast of Scotland. The floating offshore development planned by Flotation Energy aims to produce 1.4 GW of wind power in the Central North Sea area. The Cenos OWF covers an approximate area of 333 km^2. At present, it is envisaged that the project, within the array area, shall comprise:

- Floating Wind Turbine Generators (WTG),
- Mooring lines,
- Anchor systems,
- Inter-array cables,
- Fixed foundation substation, and
- Export cable.

The ECC has a total length of approximately 225 km and will make landfall to the south of Peterhead, Scotland.

Rovco, supported by Benthic Solutions Limited (BSL), executed the geophysical and environmental survey for Flotation Energy at the Cenos OWF aboard the *Glomar Supporter* between the 23$^{rd\ of}$ July and 27th of September 2023. An overview of the survey is presented in Figure 1.1.

This report presents the results of marine mammal mitigation and monitoring during the geophysical and environmental phases of the Cenos OWF project. For this survey, Marine Scotland issued an EPS licence (EPS/BS-00010419) for Sub-Bottom Profiler (SBP) survey operations within the ECC. An EPS licence for geophysical activity within the array area was not required. A risk assessment conducted by Affric (Geophysical Surveys, Cenos Floating Offshore Windfarm – Marine Mammal and Basking Shark Risk Assessment, 16/05/2023) was commissioned. The risk assessment recommendations aligned with the guidelines outlined in JNCC (2017), and these were implemented consistently during the survey to adhere to the legal requirements specified in the license conditions.

Three experienced and dedicated UK JNCC approved Marine Mammal Observers (MMOs) were on board for the duration of the survey to ensure that all operations fulfilled the consent conditions. A passive acoustic monitoring (PAM) system was operated by two of the MMOs so that the mitigation zone could be monitored for marine mammals during 24-hour geophysical operations.

1.2 Scope of Work

The Scope of Work was undertaken within the project array area and the ECC out with 12 nautical miles (NM) of land. The scope was split into 3 Work Packs across 2 survey areas. For the reconnaissance of the Project area, the following Work Packages were established:

- Work Package 1 – Geophysical Surveys Array area

  The Geophysical surveys are intended to provide significant seabed and subsurface information to assist in the consenting, design and installation phases of the project.

- Work Package 2 – Targeted Environmental Surveys Array Area

  The Targeted Environmental surveys are intended to provide a detailed understanding of:
  - Seabed sediments including any potential contamination
  - Benthic habitat mapping
  - Water quality
  - Understanding of archaeological features

- Work Package 3 – Geophysical Surveys and Targeted Environmental Surveys Export Cable route

  To provide significant seabed and subsurface information to assist in the consenting, design and installation phases of the project.

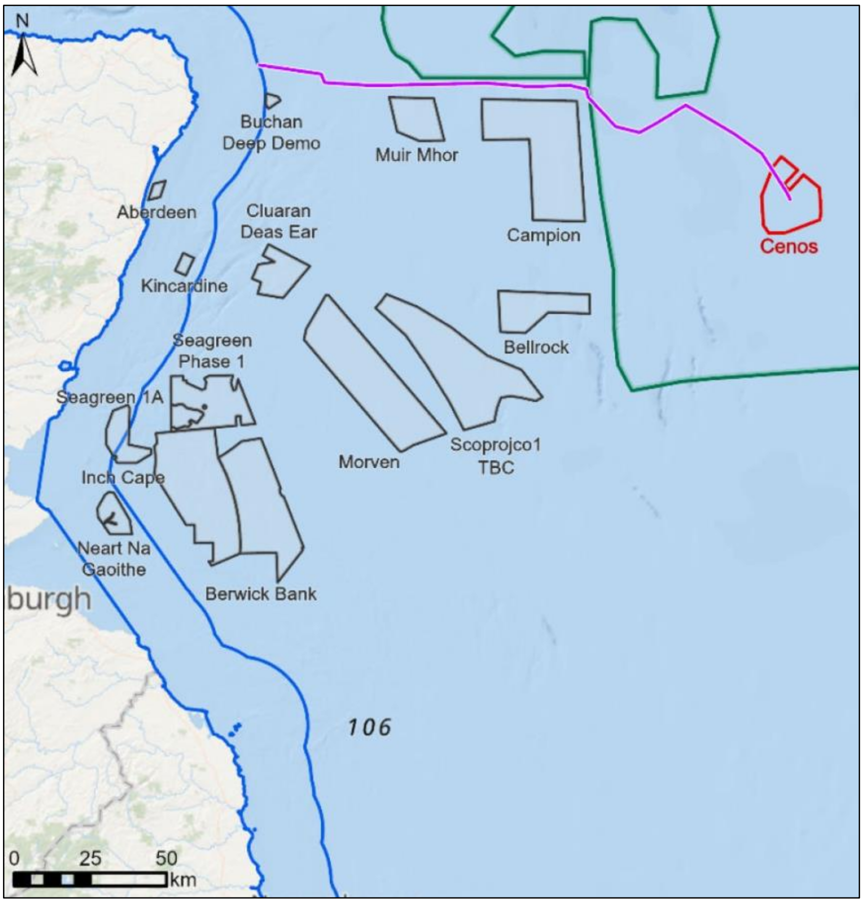


Figure 1.1 Project location map – Cenos OWF array area (red) and ECC route (pink)

1.2.1 Survey Objectives

The results of the surveys shall enable Flotation to develop the following understanding:

- Seabed conditions and existing infrastructure and features;
- Seabed sediments and any associated contamination;
- Planning of future geotechnical investigations;
- Planning of detailed UXO (unexploded ordnance) investigations;
- Decision of anchoring concept and preliminary anchor design;
- Decisions on the siting of, and concept for the substation foundations;
- Identification of suitable cable routes and burial techniques;
- Shallow geology up to 50 m below seabed (BSB);
- Benthic habitats present;
- Incidental identification of any archaeological features present;
- Water quality.

1.2.2 MMO and PAM Objectives

The objectives for marine mammal mitigation during the Cenos Floating Offshore Windfarm Project were to:

- Undertake pre-shooting visual watches/acoustic monitoring prior to the use of sound sources which require the use of mitigation procedures – e.g. while using SBP and 2DUHR (2-Dimensional Ultra-High Resolution).
- Delay survey operations if marine mammals or basking sharks were seen/detected in the mitigation zone during pre-watches.
- Advise vessel on mitigation requirements, including soft-starts and time constraints on line turns and breaks in operations.
- Record geophysical operations, monitoring effort, marine mammal sightings and acoustic detections.

1.3 Scope of Document

This report documents marine mammal observation, passive acoustic monitoring and geophysical and environmental survey operations on board the *Glomar Supporter* between the 23rd of July to 27th of September 2023, and details the mitigation measures taken to minimise harm to marine mammals and basking sharks. The survey was conducted by Rovco and BSL for Flotation Energy with MMO and PAM marine mammal mitigation carried out by BSL.

2 Methodology

2.1 Geophysical Survey

The SBP and 2DUHR data acquisition was subject to mitigation. The SBP was subject to the EPS licence (EPS/BS-00010419) within the ECC (no 2DUHR was allowed within the ECC) and both 2DUHR and SBP were governed by the Risk Assessment conducted by Affric. A technical summary of the SBP and 2DUHR can be found in Table 2.1 below.

Table 2.1 Sound source parameters subject to mitigation

SBP	
Type	Innomar Medium-100 SBP
PF Source Level / Acoustic Power	>247 dB/1 µPa @ 1 m
Frequency Range	100 kHz (primary frequency) and 6-12 kHz (secondary frequency range)
Shot Point Interval	N/A
2DUHR	
Type	AAE Stacked DuraSpark 400+400 Sparker
PF Source Level / Acoustic Power	226 dB/1 µPa @ 1 m
Frequency Range	0.5-4.0 kHz (primary frequency range), sample rate 0.0625 ms / 16 kHz
Shot Point Interval	1m

The Multibeam Echosounder (MBES), Side Scan Sonar (SSS), Magnetometer (MAG) and Ultra-Short Baseline (USBL) beacon positioning system were not subject to the requirements of the EPS licence or the Risk Assessment. A technical summary of this equipment can be found in Table 2.2.

Table 2.2 Other sound sources and survey equipment

Type	Manufacturer - Model
MBES	R2sonic 2026 MBES (400 kHz)
Magnetometer	Geometrix G882 magnetometer
Side Scan Sonar	Edgetech 4205 tri-frequency 230/540/850 kHz
USBL	Kongsberg HiPAP

2.2 Vessel

Survey operations were conducted from the *Glomar Supporter* (Table 2.3).

Table 2.3 Specifications and image of survey vessel Glomar Supporter

Glomar Supporter	
Glomar Supporter	ROVCO
Length	60 m
Width	15.6 m
Draft	3.5 m
Cruising Speed	9 knots

2.3 MMO and PAM Operator Experience

At any one time, there were three UK JNCC approved MMOs were onboard the *Glomar Supporter* to cover 24-hour geophysical operations. The training and experience of these personnel is summarised in Table 2.4.

Table 2.4 Summary of MMO/PAM personnel training and experience

Role	Dedicated MMO/PAM				
Name	Ossie Stewart	David Meléndez Bravo	Jessica Brigg	Boglarka Baksay	Camila Azevedo
Dates Onboard	20/07/2023-06/09/2023	20/07/2023 – 29/09/2023	09/08/2023 – 06/09/2023	06/09/2023 – 28/09/2023	06/09/2023 – 29/09/2023
MMO Training	JNCC MMO @ Carolyn Barton BOEM PSO @ Carolyn Barton (2014)	JNCC Accredited MMO @ Carolyn Barton (2021) BOEM Accredited PSO @ CSA Ocean Sciences & MVI (2021) @ RPS Energy (2015)	JNCC MMO @ Seiche Ltd. Training (2022)	JNCC MMO @ Seiche Training (2020) BOEM PSO @ Seiche Training (2020)	BOEM Accredited PSO JNCC Accredited MMO @ CSA Ocean Sciences & MVI (2013) Environmental Advisor and MMO IBAMA Accredited @ EcoHub (2011)
MMO Experience	8 Years	7 Years	1.5 years	3 years	3 years
PAM Training	'Passive Acoustic Monitoring and PAMGuard Software Training' @ Seiche (2017) PAMGuard Software Training @ Intelligent Ocean (2021)	QuietSea @ SERCEL (2019) PAMGuard and Ishmael Software Basics @ Ocean Sciences Analytics (2020) MSeis Nighthawk III and SEICHE experienced operator	PAM Operator Training @ Intelligent Ocean (2022)	PAM Operator @ PAMGuard Software Training @ Intelligent Ocean (2020) Sub-E Broad Frequency PAM @ BSL / Subacoustech (2022)	'Passive Acoustic Monitoring and PAMGuard Software Training' @ RPS Energy (2013) @ Seiche Measurements (2015) Passive Acoustic Monitoring and PAMGuard Software Training L2' @ Seiche Measurements (2018) QuietSea @ SERCEL (2014)
PAM Experience	6 Years	4 Years	1 Year	2.5 Years	9 Years

2.4 Disturbance Mitigation

Marine mammal mitigation was guided by three documents on this project. The first was an EPS licence (EPS/BS-00010419), which was granted for SBP operations within the ECC, no 2DUHR operations were allowed within the ECC. It makes reference to target species in the area:

- 'This licence is granted for the purpose of permitting the disturbance of harbour porpoise (*Phocoena phocoena*); bottlenose dolphin (*Tursiops truncatus*); minke whale (*Balaenoptera acutorostrata*); white-beaked dolphin (*Lagenorhynchus albirostris*) at Cenos Cable Routes…'

The EPS licence refers to the other documents, a risk assessment carried out by Affric, and JNCC (2017) guidelines:

- 'The Licence must ensure that all licenced activities are carried out in strict accordance with the mitigation and working methods and timescales proposed in the application and detailed in the Flotation Energy Ltd. Cenos EPS Risk Assessment Ref 108_REP_02_2 document dated 16 May 2023.'
- 'The Licence must ensure that the Joint Nature Conservation Committee ("JNCC") 2017 Guidelines for minimizing the risk of injury and disturbance to marine mammals from seismic surveys is followed at all times in connection with the undertaking of such surveys as far as it is practical to do so.'

The Affric risk assessment covers both SBP and 2DUHR operations within the array area and is in line with the JNCC (2017) guidelines. It sets out a mitigation plan for both marine mammals and basking sharks as follows:

Visual monitoring will be used during daylight hours where weather conditions allow. The MMO protocol is outlined below:

1. The Survey Party Chief will inform the MMO of the intention to commence acoustic survey operations, at least 1 hour prior to arrival at the Start of Line (SOL) position.

2. The MMO will commence a continuous pre-shooting search using binoculars, at least 30 min before the intended arrival at the SOL.

3. If marine mammals are observed, the MMO will advise the Survey Party Chief, so that measures can be taken to minimise the impacts of any potential delays on the survey operations.

4. When the vessel is arriving at the SOL and the 30 min pre-watch is complete, the Survey Party Chief will ask the MMO whether acoustic survey operations can commence.

- If no marine mammals have been observed within the 500m mitigation zone, the MMO will give permission to commence a soft start. The MMO will continue to monitor the mitigation zone during the soft start.

- If marine mammals have been observed inside the 500m mitigation zone, the MMO will delay acoustic survey operations until at least 20 min after the last sighting within the mitigation zone.

5. Once the acoustic survey operations have commenced whilst the airguns are firing either during the soft start procedure or at full power, there will be no requirement to stop if a marine mammal enters the mitigation zone.

6. If line changes are expected to take longer than 40 minutes:

- Firing is to be terminated at the end of the survey line (or during geophone repositioning);
- A pre-shooting search is to be undertaken during the schedule line change (or geophone repositioning);
- The soft start is to be delayed if marine mammals are seen within the mitigation zone during the pre-shooting search; and
- A full 20-minute soft start is to be undertaken before the start of the next line.
- 7. If line changes are expected to take less than 40 minutes:
- Airgun firing can continue during the line change if power is reduced to 180 cubic inches (or as close as practically feasible) at standard pressure. Airgun volumes of less than 180 cubic inches can continue to fire at their operational volume and pressure; and
- The Shot Point Interval (SPI) is increased to provide a longer duration between shots, with the SPI not to exceed 5 minutes; and
- The power is increased and the SPI is decreased in uniform stages during the final 10 minutes of the line change (or geophone repositioning), prior to data collection recommencing.

8. In the event that an unplanned or unexpected break in survey operations occurs, the Survey Party Chief will inform the MMO who will begin to monitor the mitigation zone as quickly as possible following the break.

- If the break is less than 10 minutes in duration, and airguns can be restarted and data acquisition resumed in less than 10 minutes, there is no requirement for a soft start and firing can commence at the same power level or less provided no marine mammals have been detected in the mitigation zone during the breakdown period. If a marine mammal is detected in the mitigation zone during the breakdown period, the MMO will delay the recommencement of the acoustic survey operations until at least 20 minutes after the last sighting within the mitigation zone.
- If the break exceeds 10 minutes, a full start-up procedure will be required (see steps 1-4). If an MMO has been monitoring during the breakdown period, this time can contribute to the pre-shooting search.

9. If the visibility falls to below 500m around the survey vessel, or the sea state increases to greater than 3, then the Acoustic Monitoring Protocol will be used (replace MMO with PAM for the above mitigation plan).

Table 2.5 Summary of mitigation measures and requirements

Mitigation zone	500 metres	
Pre-shooting search period	30 minutes	
Soft-Start	20 mins for SBP (power % increase) and UHR (SPI decrease)	
Line changes	Less than 40 minutes:	1. SBP continued at operational power (not practical to reduce power on line turns). 2. 2DUHR on reduced power with increased SPI followed by decreasing SPI in the final 10 mins to full power
	More than 40 minutes:	1. Stop all sources as soon as possible after end of survey line and conduct full start up procedure before the next line
Delay length	20 minutes after last sighting in mitigation zone	
Shutdown during works	Not required	
Species	Marine mammals and basking sharks	

Should further information be required relating to the noise disturbance mitigation undertaken during the survey, enquiries should be directed to BSL (E-mail: enquiries@benthicsolutions.com; Tel: 01603 784726).

2.5 Marine Mammal Observation

2.5.1 Fauna Diversity and Abundance in the Survey Area

Out of the 25 species of marine mammal observed in UK waters, 17 can be found within the North Sea. Both grey and harbour seals are found within the region, while several species of odontocete are also present. One mysticete species, the minke whale, is commonly observed in both coastal and more offshore areas within the North Sea. Basking sharks have also been recorded on the east coast of Scotland and in offshore waters. For the purposes of the risk assessment the available information on spatial & temporal distribution, abundance/density and known behaviours of the most frequently observed cetacean species within the CNS, and therefore within the project area and associated cable routes, were examined.

The Cenos windfarm area straddles Small Cetaceans in European Atlantic Waters and the North Sea (SCANS-III) survey blocks R and Q, shown in Figure 2.1. The Cable Routes pass through Block R. The abundance and density (animals per km^2) from the SCANS-III aerial surveys for various mammals in the relevant block is summarised in Table 2.6, from the EPS Risk Assessment (Flotation Energy Ltd Cenos Ref 108_REP_02 May 2023)

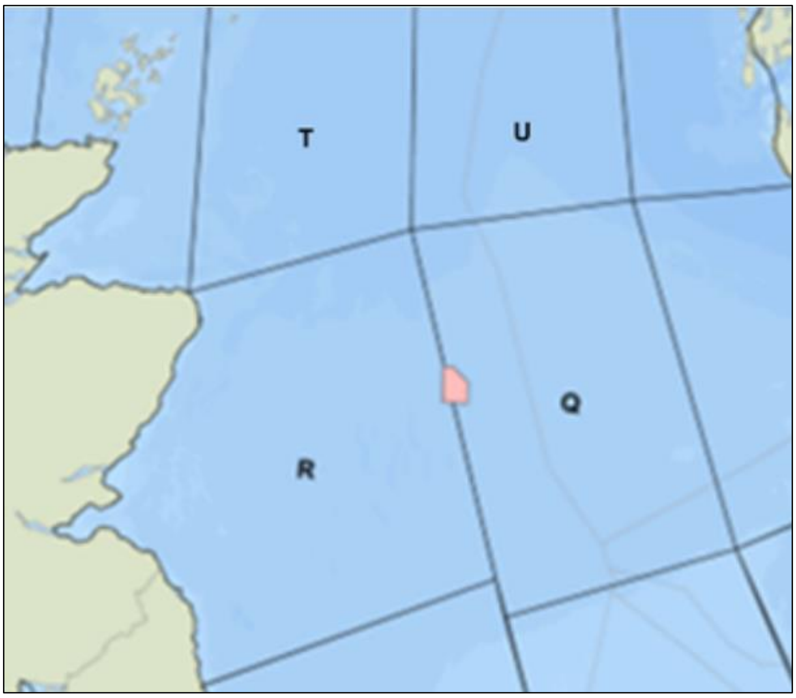


Figure 2.1 Survey blocks Q, R, from the SCANS-III aerial surveys with the Cenos Windfarm Project area highlighted in pink

Cetacean species most likely to be encountered within the project area and cable routes include harbour porpoise, bottlenose dolphin, white-beaked dolphin and minke whale. While other species have been recorded in the region, the baseline data available indicate that their abundance and density are considered low (Table 2.6).

Table 2.6 Abundance and density (animals per km^2) from the SCANS-III aerial surveys (Hammond et al., 2017), where – indicates no sightings of the species were made during the surveys

Species	Block Q			Block R		
		Abundance	Density	Mean Group Size	Abundance	Density
Harbour Porpoise	1.31	16,569	0.333	1.38	38,646	0.599
Bottlenose Dolphin	6.3*	-	-	5.25	1924	0.030
White-Beaked Dolphin	3.43	-	-	3.7	15,694	0.243
Minke Whale	1	348	0.007	1.18	2,498	0.039
Risso's Dolphin		-	-		-	-
White-Sided Dolphin		-	-		644	0.010
Common Dolphin		-	-	-	-	-
Striped Dolphin		-	-	-	-	-
Pilot Whale		-	-	-	-	-
Beaked Whale		-	-	-	-	-

**Wilson et al., 1993*

2.5.2 Visual Monitoring

Three dedicated UK JNCC approved MMOs were onboard the *Glomar Supporter* to conduct visual searches for marine mammals throughout the geophysical survey. Observations of marine mammals were conducted from the bridge wings and from inside the bridge (12 metres above sea level plus observer eye height), moving regularly to attain a 360-degree view of the mitigation zone. The sea was scanned alternately with the naked eye and through 7 x 50 and 10 x 50 binoculars to maximise the chance of sighting animals. Distances to sightings were estimated using binocular reticules. Splashes, dorsal fins and saddle areas, and aggregations of seabirds were among the cues used to locate and identify animals.

An observer's ability to visually detect marine mammals is affected by several environmental conditions including sea state, swell, visibility, and sun glare. Conditions which are considered optimal for cetacean observation are: Beaufort 0-3; calm to slight sea states, swell below 2 m; visibility of 1 km or above, with no, weak, or variable sun glare.

Wind speed was classified according to the Beaufort scale; other classifications for sea state, swell, visibility, and glare followed the UK JNCC guidelines. A new effort record was entered every time environmental conditions changes, when the MMOs changed shift, or otherwise approximately every hour.

A Cannon EOS 750D digital SLR camera with a 70-200 mm zoom lens and a Canon EOS Rebel T7 with an EF f/4-5.6 75-300 mm lens was used to take photographs of marine mammals and thus aid species identification. The reference book 'Whales, Dolphins, and Seals: A Field Guide to the Marine Mammals of the World' by Shirihai & Jarrett (2006) served as a tool for identifying sighted cetaceans and pinnipeds.

Data were recorded in the standard JNCC format. The start and end of all geophysical operations, including the start and end of each line or test, the length of soft starts and the times of pre-shooting searches were recorded (Appendix II).

The start and end of all effort watches (i.e. periods when effort was made to monitor for marine mammals) with descriptors including source status, location, weather, depth, and sea conditions were recorded at least once every hour (Appendix III) or following changes in operations. Under JNCC methodology, sea state is described as glassy (like a mirror), slight (no or few white caps), choppy (several white caps) or rough (large waves, foam crests, spray). Swell height is categorised as low (below 2 m), medium (2-4 m), or large (above 4 m); and visibility as poor (under 1 km), moderate (1-5 km) or good (minimum 5 km).

Sighting location, species, distinguishing characteristics, number of individuals, behaviour and relevant details about any mitigation required or interactions with operations were recorded (Appendix IV). A sighting was defined as an encounter with an animal, or a discrete group of animals deemed associated behaving in a relatively unified manner, i.e., encountering a pod of ten dolphins at one time, is still counted as one sighting.

2.5.3 Passive Acoustic Monitoring

Two of the MMOs also operated the PAM system onboard. Acoustic searches were primarily conducted during night hours and periods of low visibility to allow geophysical operations to continue at these times.

The PAM equipment was supplied by Vanishing Point Marine (www.vpmarine.co.uk) and consisted of a four-element hydrophone array and depth gauge on a 150 m tow cable connected, via a 50 m deck cable, to a signal processing unit with an audio output and laptop computers running PAMGuard software (www.pamguard.org) in the UHR operations container on main deck.

While PAM is an effective and well-established method of monitoring marine mammals, it is important to understand its limitations. Just as marine mammals can only be sighted by MMOs when they are active at the surface, marine mammals can only be detected by PAM if they are vocalising. It is also entirely possible for vocalising animals to be present, but be undetectable by PAM, both because of their physical orientation relative to the array and a low signal to noise ratio masking their vocalisations (Todd *et al.,* 2015).

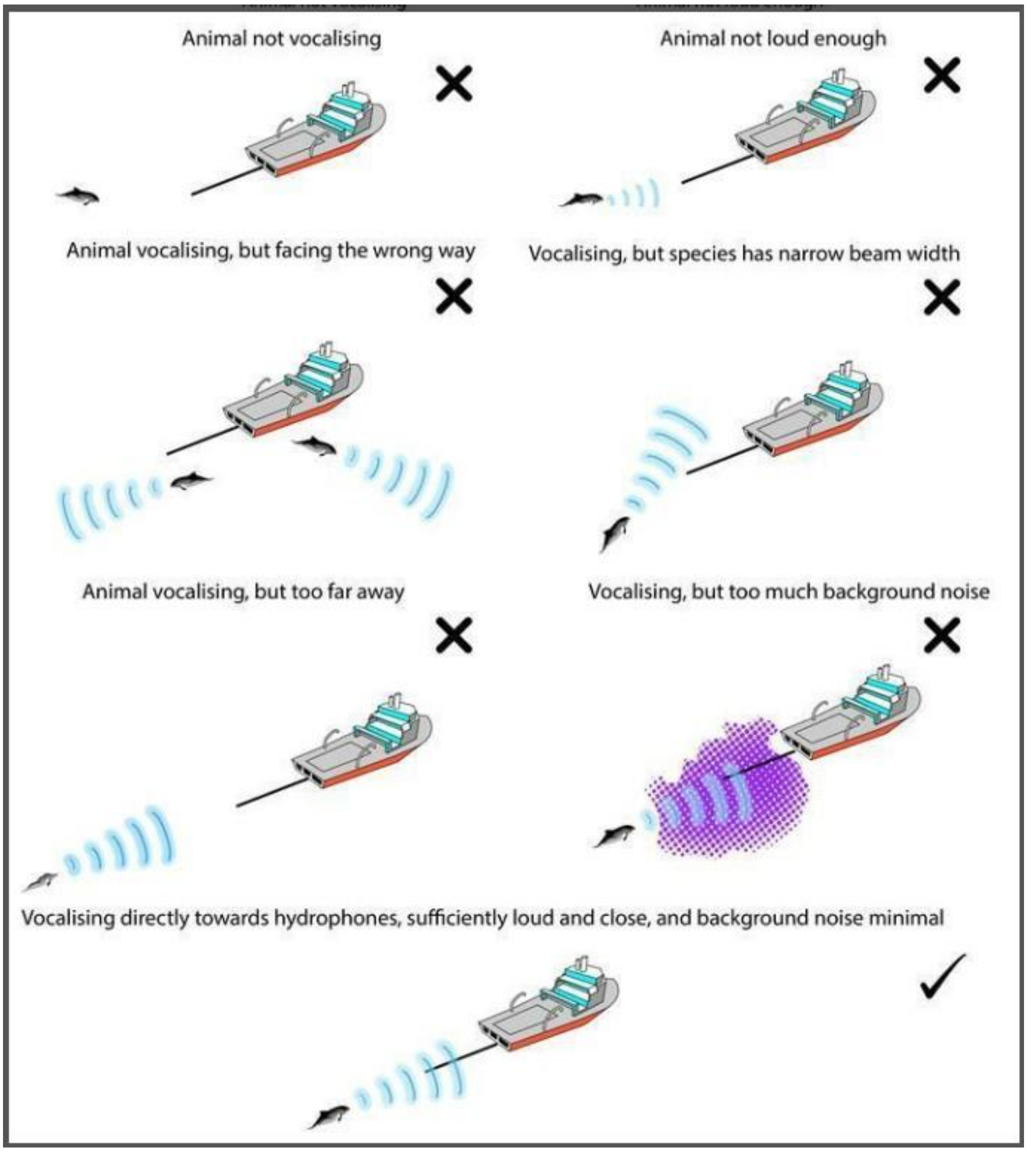


Figure 2.2 PAM limitations (Source: OSC MMO and PAM Handbook)

Elements in the array were arranged in two pairs: two Magrec HP03 hydrophone preamp units (low cut filter at 2kHz) with a good frequency response between 2 kHz and 150 kHz (-159 dB rel. 1V/µPA sensitivity), spaced 30 cm apart for targeting high frequency sounds; and two Benthos AQ4 hydrophone Magrec HP02 preamp units with a -3 dB low cut filter at 10-100 Hz and flat response to 15 kHz and reasonable sensitivity up to 50 kHz (-165 dB rel. 1V/µPA sensitivity), spaced 3 m apart for targeting lower audio band sounds. The depth pressure sensor was at the front of the array.

The array was deployed 50 m effective in the water, astern from the port side aft deck (Figure 2.3 PAM setup A). It was deployed and retrieved by hand following the on-board PAM Procedure; the hydrophone cable was recovered on deck coiled in the cable drum. A toolbox talk was conducted before each deployment and recovery.

Communication with the surveyor was via radio as the PAM listening station (Figure 2.3 PAM setup) was located in a container on deck.

An instance of PAMGuard Beta version 2.02.07 CORE was run on laptop computers with configuration settings (Table) tailored for high frequency (HF; 20 – 150 kHz) to detect harbour porpoises and delphinid whistles and clicks; and low to mid frequency (MF; 0.1 – 48 kHz) delphinid whistles, sperm whale, and baleen whale vocalisations. Note: delphinid vocalisations span a wide range of frequencies and may therefore be detected in both the low and mid to high frequency ranges. The HF system used the middle pair of Magrec HP03 elements while the MF system used both pairs, the Benthos AQ4 and the Magrec HP03 elements.

The PAM operator listened to the audio signal while simultaneously interpreting detector displays to discriminate between the sounds produced by marine mammals and background noise. Settings were adjusted to balance levels and best filter noise (Table 2.6).

A:

B:

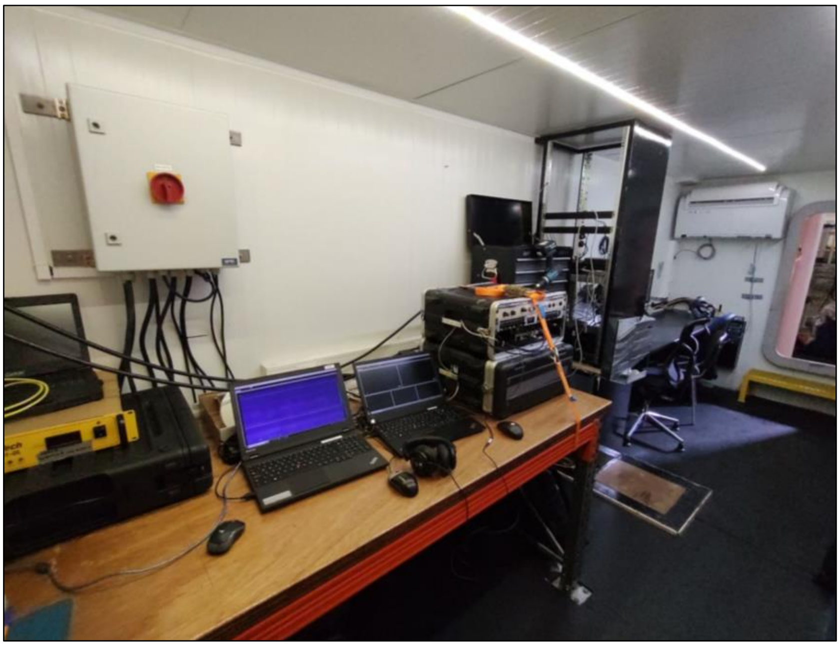


Figure 2.3 PAM setup
A: Deployment from starboard side of vessel aft;
B: PAM monitoring station in a container on deck

Table 2.6 PAMGuard detector settings

Laptop	Sound Card / DAQ	Channels / Sample	Detector	Settings	Display	Target Species
MF	Behringer UMC404HD	2 x 48 kHz (decimated)	Human eye	FFT 1024, Hop 512; 0-48 kHz; rainbow scale 48-118 dB re µPa/√Hz; clip generator & spectrogram annotation	Spectrogram, 20 s window	Odontocetes
MF	Behringer UMC404HD	4 x 48 kHz (decimated)	Whistle & Moan	2-17 kHz; connect 4 sides; length 40, total 80; all FFT noise filters, thresholding 5.	Spectrogram overlay	Odontocetes
MF	Behringer UMC404HD	2 x 48 kHz	Click detector	10 kHz 4th high pass pre-filter; 12 kHz 4th high pass trigger filter. PAMGuard default 'beaked whale' click classification	Time vs bearing, Time vs amplitude, 2 min window,	Odontocetes
MF	Behringer UMC404HD	2 x 48 kHz (decimated)	Click detector	2.5-18 kHz 6th band pass pre-filter; 2-18 kHz 2nd band pass trigger filter; Auto click train identification;	Time vs bearing; 2 min window; colour by click train event	Odontocetes, Sperm whale
MF	Behringer UMC404HD	1 x 2 kHz (decimated)	Human eye	FFT 1024, Hop 250; 0-500 Hz, multi-colour scale 49-120 dB re µPa/√Hz; clip generator & spectrogram annotation.	Spectrogram, 60 s window	Baleen whales
HF	National Instruments NI-6251	2 x 500 kHz	Broadband click detector	20 kHz 2nd high pass pre-filter; 20-180 kHz 4th band pass trigg filter; Click classification frequency-sweep: 'USBL 23-28 kHz (discarded)', default 'beaked whale', 'Dolphin 50-90 kHz', 'Dolphin 24-90 kHz', and default 'porpoise' classifier	Bearing vs Time display; Amplitude vs Time display; 10 s window; Colour by click classification	Harbour porpoise, & other Odontocetes
HF	National Instruments NI-6251	2 x 500 kHz	Noise Band Monitor	Third Octave; top band 53; decimators 10; filter order 8; Gamma 2.5; interval 60s and then 1 s	–	Noise

Acoustic detections are defined as discrete marine mammal acoustic contacts separated by at least 10 minutes of silence or clearly representing a different species. At a survey speed of 4 knots, the vessel travels 1250 m in this time. Click detections are identified as including several regular repetitive clicks or click trains above background noise with similar, 'good-looking' frequency and time spectra on both channels with a logical bearing progression and inter-click interval. Tonal detections were heard or seen on the real-time spectrogram.

Distances to detections were calculated in PAMGuard by the sequential crossing of bearings to the same acoustic contact plotted on a map of the ship and mitigation zone relative to the PAM array and source. Any porpoise detection was deemed to be in the mitigation zone because porpoise band clicks attenuate quickly.

A database-logged GPS track (at 10 s intervals), binary files, and recordings were made continuously. Screen grabs, binary files of detections, and interesting events or noises were kept aside for reference and to verify the identity of acoustic events. PAM effort, operations, and detection data were recorded in the standard JNCC format.

3 Results and Interpretation

3.1 Visual Monitoring

A total of 735 hours and 7 minutes of visual monitoring were conducted between the 23rd of July and 27th of September 2023. While visual monitoring was conducted, the source was active for 382 hours 41 minutes, and inactive for 348 hours and 26 minutes (Table 3.1).

Table 3.1 Duration of visual monitoring with and without source activity

Hours of Visual Observation (MMO Effort)		
Source power setting	**During SBP-only survey activity (h:min)**	**During full spread survey activity (h:min)**
No Power (N)	82:00	266:26
Soft Start (SS)	05:54	20:38
Full Power (F)	54:18	147:55
Reduced Power (Line Turns) (R)	80:23	64:16
Variable Power (Test) (V)	00:00	09:17
Subtotal	***222:35***	***512:32***
TOTAL Duration	**735:07**	

During daytime observations, sea conditions were adequate to moderate for sighting marine mammals. The wind was predominantly force 4 or lower on the Beaufort scale from southwest with typically slight or choppy sea state and low swell (details further illustrated in Figure 3.1 to Figure 3.6 below.)

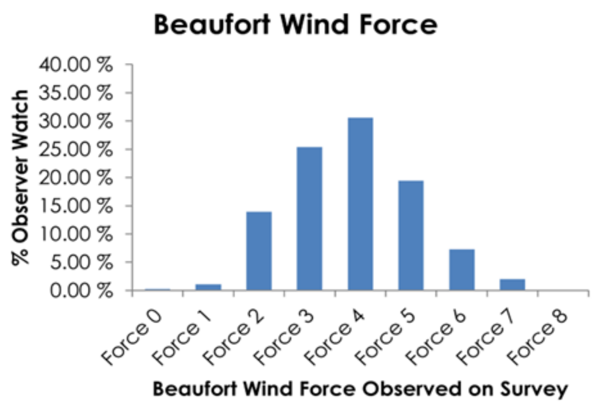


Figure 3.1 Beaufort wind force

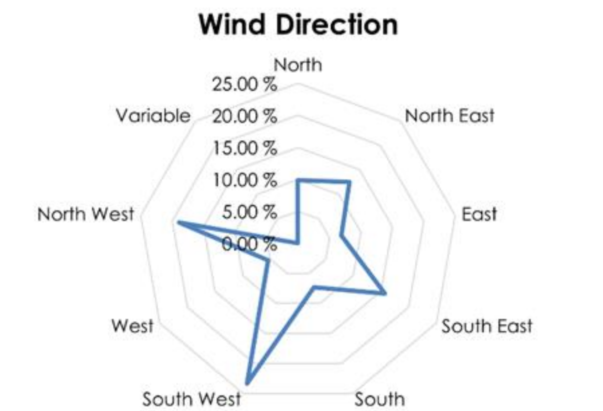


Figure 3.2 Wind direction

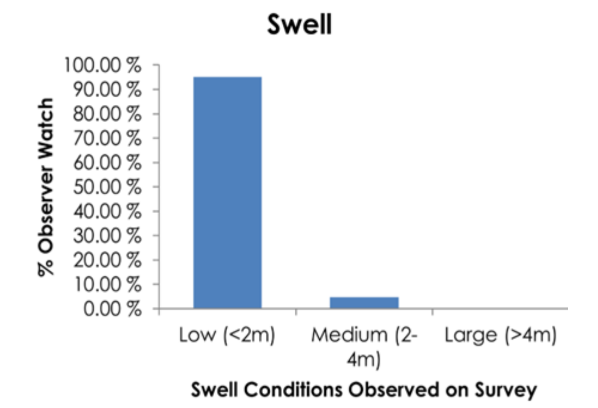


Figure 3.3 Swell

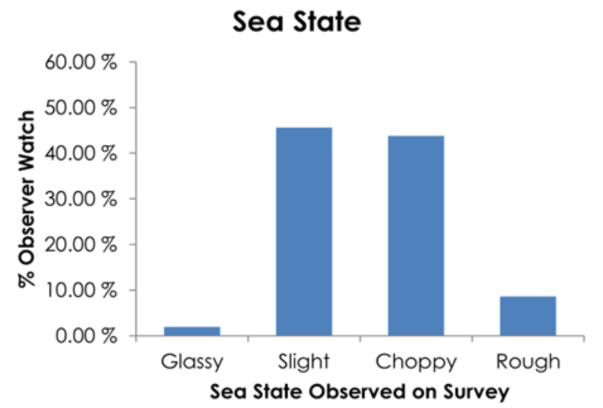


Figure 3.4 Sea state

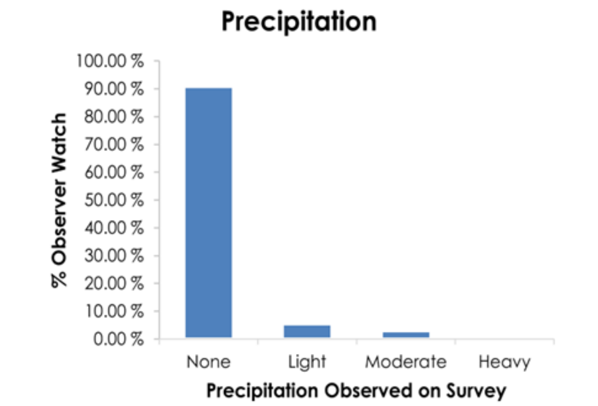


Figure 3.5 Precipitation

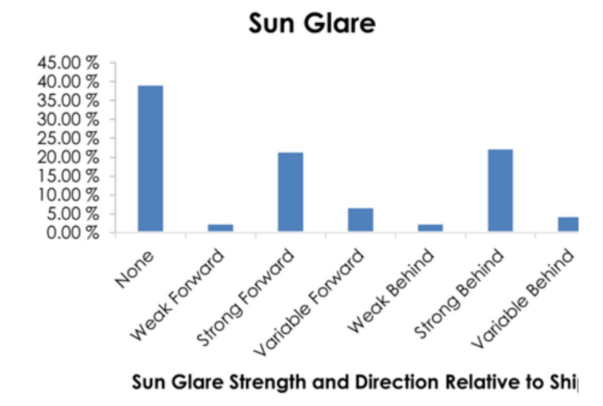


Figure 3.6 Sun glare relative to ship direction

The most observed species during this survey was the white beaked dolphin, with a total of 109 individuals documented throughout eight separate occasions. Balaenopterids (baleen whales) were less likely sightings over the monitored period, with a total of four minke whales appearing in the area. Several unidentified cetaceans and in particular, delphinids, were also sighted. One deceased cetacean was recorded during transit; the animal could not be identified due to the level of decomposition. Coordinates of the body’s location (at the time of recording) were shared with relevant environmental authorities.

Pinniped sightings included three grey seals and one unidentified seal.

Although two thirds of effort could be said to have taken place in fair to moderate sighting conditions (Figure 3.7), the resolution of the JNCC criteria for swell, for example, means that seas approaching 2 m are categorised as 'low' but would still be difficult to sight these species at any distance.

Table 3.2 Total sightings

Sighting Number	Date	Time (UTC)	Species	Number of Individuals	Distance from Source (m)	Source Activity*	Action Taken**
0	23/07/2023	10:20	Unidentified odontocete	2	N/A	N	N
1	25/07/2023	20:15	Minke whale	1	30	N	N
2	26/07/2023	19:11	Grey seal	1	200	N	N
3	31/07/2023	07:49	White beaked dolphin	25	700	F	N
4	04/08/2023	13:23	Minke whale	1	100	N	N
5	07/08/2023	16:47	Minke whale	1	100	N	D
6	10/08/2023	07:35	White beaked dolphin	2	350	N	N
7	10/08/2023	08:49	White beaked dolphin	15	100	N	N
8	10/08/2023	12:26	White beaked dolphin	50	100	N	N
9	10/08/2023	12:46	Unidentified seal	1	50	N	N
10	10/08/2023	18:55	White beaked dolphin	6	900	N	N
11	10/08/2023	19:57	White beaked dolphin	2	400	N	N
12	12/08/2023	08:33	White beaked dolphin	3	650	F	N
13	17/08/2023	04:42	White beaked dolphin	6	600	F	N
14	18/08/2023	13:30	Unidentified dolphin	8	1000	F	N
15	20/08/2023	08:40	Unidentified dolphin	1	50	F	N
16	26/08/2023	13:20	Unidentified dolphin	6	650	N	N
17	31/08/2023	17:28	Grey seal	1	120	N	N
18	13/09/2023	15:18	Delphinidae	1	600	N	N
19	13/09/2023	17:38	Delphinidae	6	600	N	N
20	13/09/2023	18:00	Minke whale	1	600	N	N
21	14/09/2023	09:30	Delphinidae (sus. White beaked dolphin)	4	200	N	N
22	17/09/2023	16:03	Sus. Ziphiidae	1	2500	N	N
23	17/09/2023	16:22	Grey seal	1	2200	N	N

** No Power (N); Soft Start (SS); Full Power (F); Reduced Power (Line Turns) (R); Variable Power (Test) (V)*
***; D = Delayed, N= No action*
Sus. = Suspected

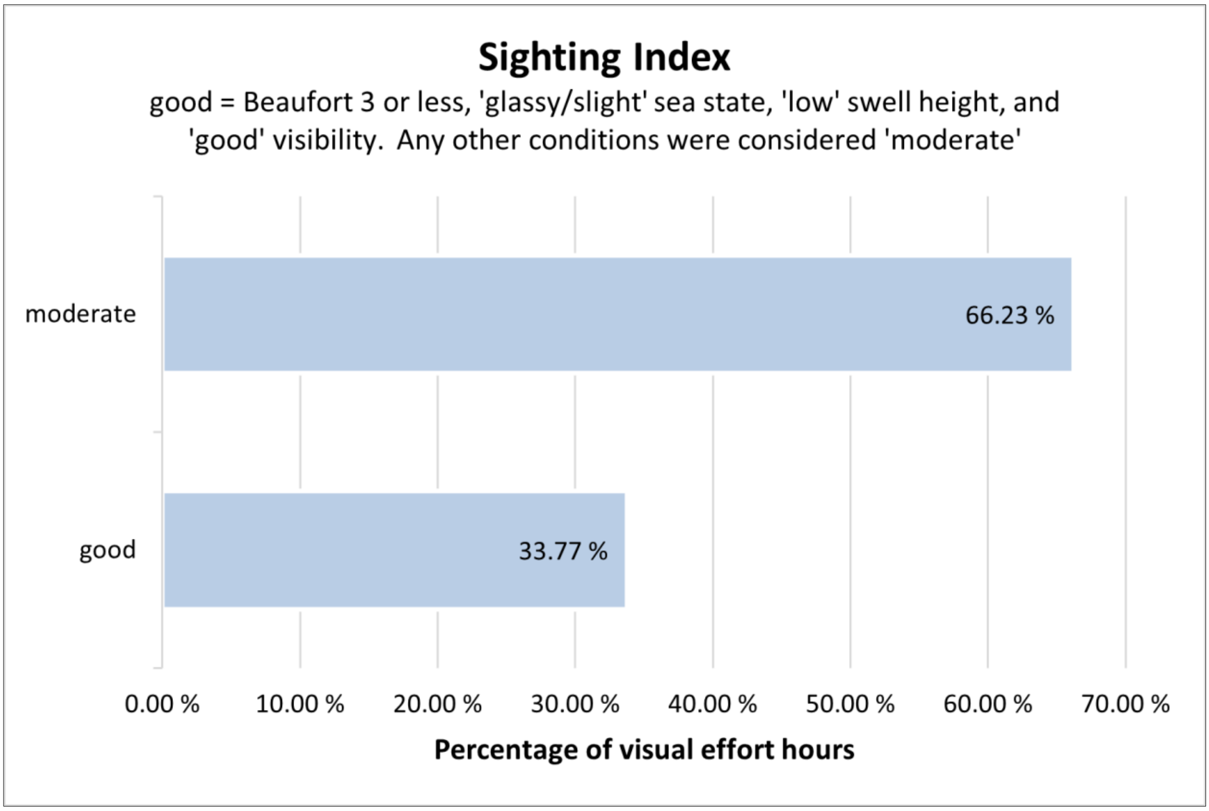
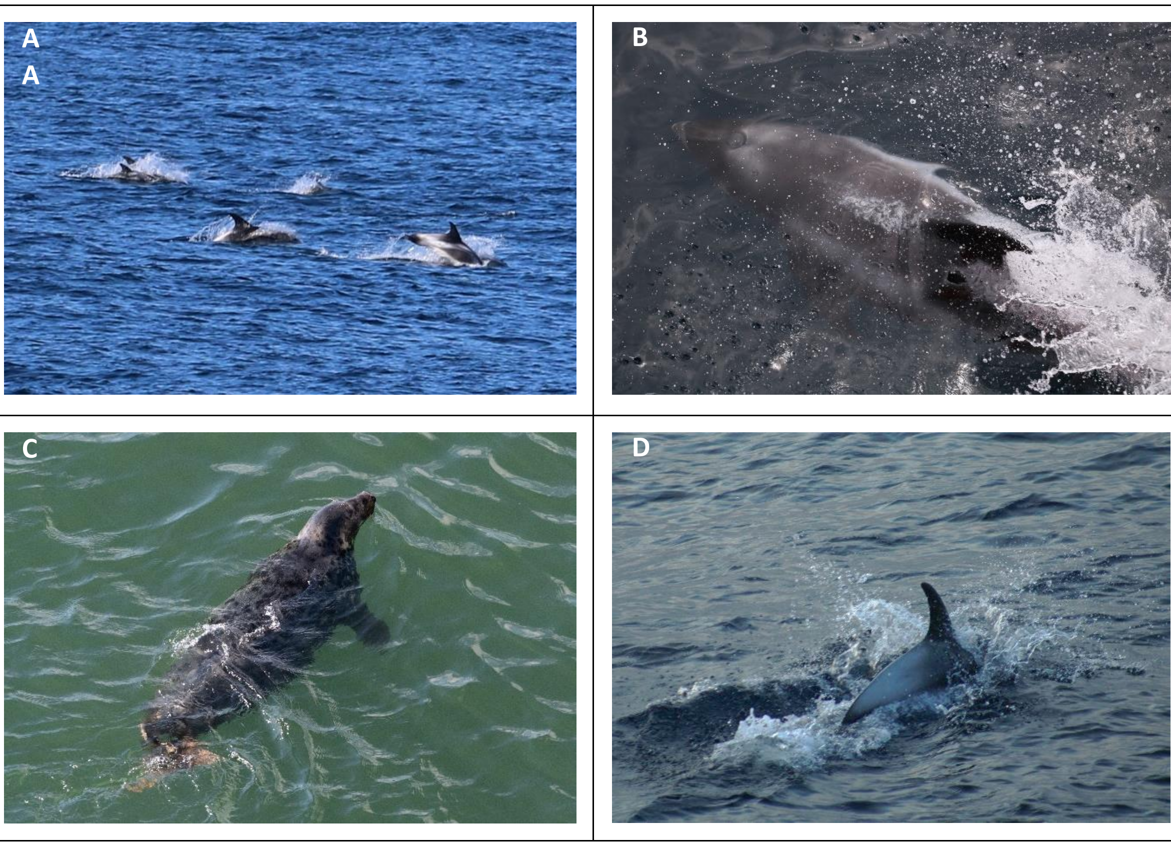


Figure 3.7 Sighting conditions during visual monitoring

A total of 24 visual marine mammal encounters were recorded during the period of survey activity (Table 3.2). As operations occurred in the autumn, it was expected to have a moderate probability of cetacean presence based on cetacean abundance in the area across the seasons (Figure 3.8). Weather was categorised as 'good' for 33.77% of effort hours (Figure 3.7) which means sightings could have been missed across 66.23% of operations; however, it is believed no marine mammal was within the mitigation zone during operational times. A deceased cetacean was observed in the survey area during transit, however, it is believed that this has no relation to the survey activity due to the high level of decomposition.



A: White beaked dolphins *(Lagenorhynchus albirostris)*
B: White beaked dolphin
C: Grey seal *(Halichoerus grypus)*
D: White beaked dolphin

Figure 3.8 A selection of documented sightings during project

There were regular sightings of seabirds including northern gannets (*Morus bassanu*), greater black-backed gulls (*Larus marinus*), lesser black-backed gulls (*Larus fuscus*), herring gulls (*Larus argentatus*), common gulls (*Larus canus*), fulmars (*Fulmarus glacialis*), and guillemots (*Uria aalge*). Several migratory and other land birds have also made an appearance, such as the common kestrel, common eiders, European shags, and a northern wheatear (pictured below in Figure 3.9 3.9).

A: Common kestrel *(Falco tinnunculus)*
B: Common eider *(Somateira mollissima)*
C: A colony of European shags *(Gulosus aristotelis)*
D: Northern wheatear *(Oenanthe oenanthe)*

Figure 3.9 Bird sightings during the project

3.2 Passive Acoustic Monitoring

A total of 318 hours and 22 minutes of PAM was conducted between the 23rd of July and the 27th of September 2023. While passive acoustic monitoring was carried out, the seismic sources were active for 288 hours and 31 minutes and inactive for 20 hours and 51 minutes (Table 3.3.)

Table 3.3 Duration of acoustic monitoring with and without source activity

Hours of PAM Effort		
Source power	**During SBP-only survey activity (h:min)**	**During full spread survey activity (h:min)**
No Power (N)	11:54	17:57
Soft Start (SS)	08:00	06:23
Full Power (F)	57:19	73:31
Reduced Power (Line Turns) (R)	114:47	26:08
Variable Power (Test) (V)	00:00	02:23
Subtotal	***192:00***	***126:22***
TOTAL Duration	**318:22**	

There were six acoustic detections (Table 3.4), all of which were recorded during survey operations. Every detection was recognised as delphinid vocalisations. None of these recordings corresponded with a visual sightings as they occurred during the hours of darkness (detections 02-06) or during incidental recording while on line (detection 01).

The noise output within the environment varied throughout the survey. The main contributing sound sources were the output from the geophysical survey equipment on this survey (Table 2.1 and Table 2.2), and ship noise. In terms of odontocete detection, the SBP (primary frequency: 85-115 kHz, secondary frequency: 4-15 kHz), the SSS (300/900 kHz), the magnetometer (70-350 kHz), the MBES (12 kHz), and the USBL were predominant sources of high frequency noise that could obscure a detection. The noise from USBL and SSS would vary depending on the position of the SSS towfish and beacon in the water column.

Table 3.4 Total detections

Detection Number	Date	Time	Species	Distance from Source (m)	Source Activity*	Action Taken**
01	09/09/2023	10:57	Delphinidae	200	R	N
02	10/09/2023	22:30	Delphinidae	100	R	N
03	15/09/2023	03:24	Delphinidae	150	R	N
04	16/09/2023	19:36	Delphinidae	160	R	N
05	17/09/2023	04:05	Delphinidae	150	R	N
06	17/09/2023	05:08	Delphinidae	250	N	N

** No Power (N); Soft Start (SS); Full Power (F); Reduced Power (Line Turns) (R); Variable Power (Test) (V)*
*** D = Delayed, N= No action*

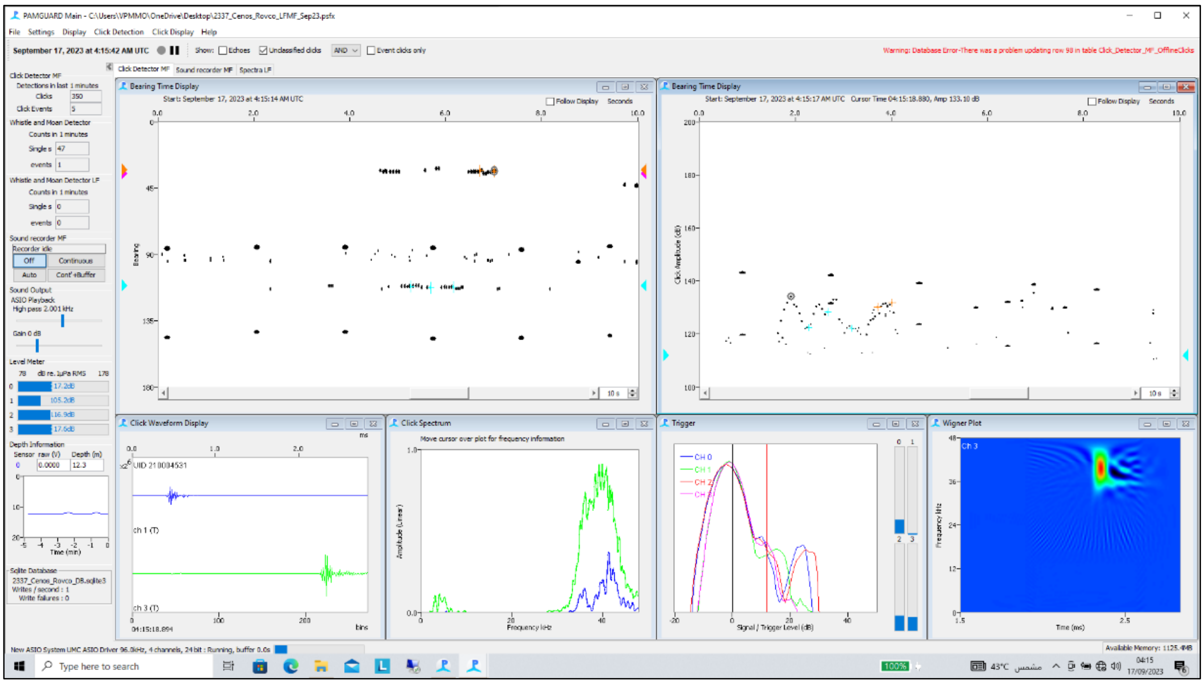


Figure 3.10 A click detector screenshot of AD05 displaying clear click trains of a delphinid

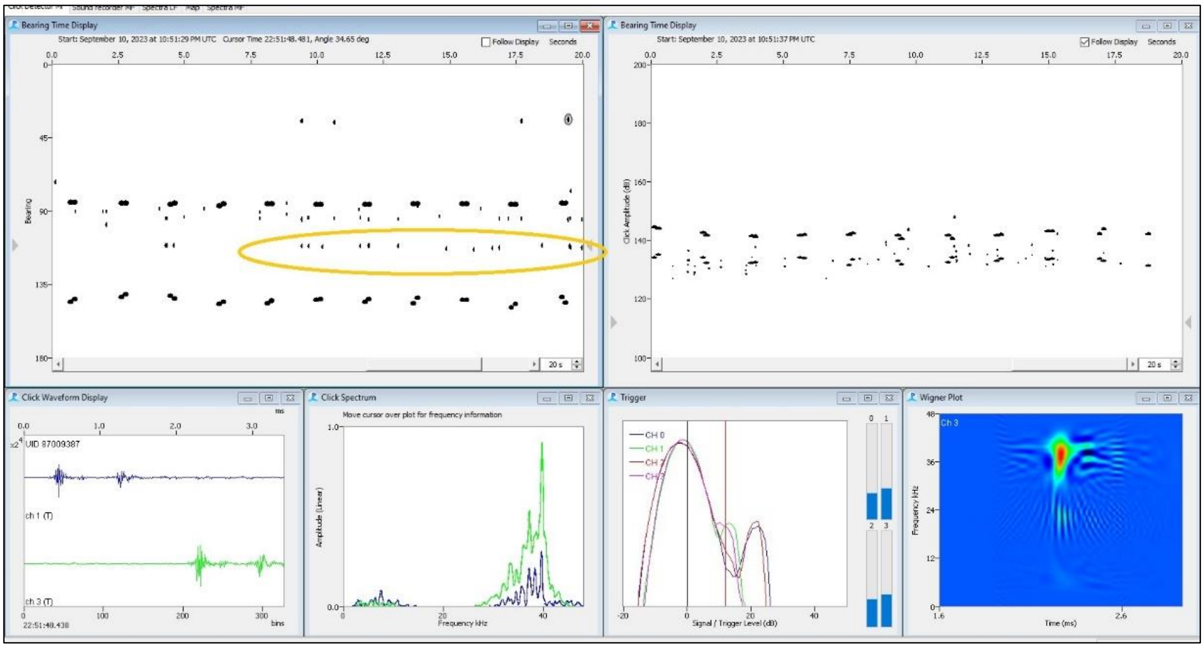


Figure 3.11 Echolocation clicks of a delphinid as shown on a click detector screen (AD02)

3.3 Geophysical Site Survey Summary

3.3.1 Full spread survey activity

The first stage of this survey consisted of full-spread acquisition using UHR sparker and SBP, alongside other equipment such as MBES and SSS which did not require marine mammal mitigation. The vessel ran a total of 149 full spread survey lines with a combined duration of 304 hours and 15 minutes, taking place between the 27th of July and the 27th of August. A total of 76 soft starts were carried out to ramp up UHR and/or SBP equipment, totalling 27 hours and 47 minutes; a number of these were abandoned to comply with JNCC guidelines, or due to technical issues.

Table 3.5 Duration of full spread seismic source activity

Source Activity	Full Power	
	Total Duration (hh:mm)	Number
Soft Start (incl. aborted ones)	27:47	76
Lines	304:15	149
TOTAL Duration	**332:02**	

Table 3.6 Duration of visual and acoustic monitoring with and without full spread seismic source activity

Full spread seismic activity during monitoring hours		
Seismic source	**Duration of visual observation (h:min)**	**Duration of acoustic monitoring (h:min)**
No power	266:26	17:57
Soft start	20:38	06:23
Full power	147:55	73:31
Reduced power	64:16	26:08
Variable power (test)	09:17	02:23
Subtotal	512:32	126:22
TOTAL duration	**638:54**	

3.3.2 SBP-only survey activity

Throughout the second survey stage, acquisition was carried out using SBP as the sole seismic source; the UHR sparker had been demobilised at this point. The vessel ran 139 SBP-only lines with a total duration of 276 hours and 41 minutes between the 27th of August and 27th of September. This number of lines includes virgin lines as well as infills where SBP was used. Certain infills only required the use of MBES, these did not require marine mammal mitigation or monitoring, although the MMO/PAM personnel often stayed on watch throughout these periods as well.

Due to the nature of the SBP, power reduction, soft starting equipment, and other variations in output are severely limited. Although the survey crew kept noise mitigation and following guidelines as a priority, SBP-only acquisition simply cannot always be conducted the same way some other equipment (e.g., UHR sparker, airguns) may allow. As a result, reducing power for line turns of less than 40 minutes was not possible most of the time, and some soft starts (ramp-ups) did not reach a duration of 20 minutes. The MMO/PAM personnel made the survey and bridge crew aware that JNCC (2017: Section 2.2) guidelines recognise the technical limitations of electromagnetic equipment during surveys.

Table 3.7 Duration of SBP only source activity

Source Activity	Full Power	
	Total Duration (hh:mm)	Number
SBP Soft Start (incl. aborted ones)	32:19	40
Lines	276:41	139
TOTAL Duration	**309:00**	

Table 3.8 Duration of visual and acoustic monitoring with and without SBP only source activity

SBP-only survey activity during monitoring hours		
Source power (SBP)	**Duration of visual observation (h:min)**	**Duration of acoustic monitoring (h:min)**
No power	82:00	11:54
Soft start	05:54	08:00
Full power	54:18	57:19
Reduced power	80:23	114:47
Variable power (test)	00:00	00:00
Subtotal	222:35	192:00
TOTAL duration	**414:35**	

3.4 Disturbance and Mitigation Actions

One mitigation action was required, a 20-minute delay to soft-start occurred as a result of sighting number 5 (see Table 3.2), a minke whale inside the mitigation zone, on 07/08/2023. These mitigations were in accordance with the JNCC guidelines, with the UHR/SBP being turned on 20 minutes after the last sighting inside the mitigation zone.

3.5 Compliance with the Mitigation Protocol

There were five non-compliances that occurred during the beginning of the project, resulting from a number of technical difficulties with the survey equipment. The MMO team recognised that these were not deliberate non-compliances but the result of technical issues, genuine misunderstanding of the mitigation guidelines, or environmental conditions affecting the vessel movement.

- **NC1 – 29/07/2023** the line turn was 44 minutes - there was a problem with the UHR computer clock along with technical issues.
- **NC2 – 30/07/2023** Soft-start to start of line was 59 minutes – misunderstanding of guidelines.
- **NC3 – 30/07/2023** Soft-start to start of line was 49 minutes – misunderstanding of guidelines.
- **NC4 – 01/08/2023** Soft-start to start of line was 42 minutes – technical issues.
- **NC5 – 10/09/2023** the line turn took 43 minutes – technical issues in survey.

4 Conclusion

All efforts were made to minimise impacts to marine mammals and adhere to Joint Nature Conservation Committee (JNCC) 'Guidelines for minimising the risk of injury to marine mammals from geophysical surveys' (JNCC, 2017) during the survey.

Between the 23rd of July and 27th of September 2023, a total of 1053 hours and 29 minutes of visual and acoustic observation took place. A total of 638 hours and 54 minutes of visual observation was carried out by MMOs, and Passive Acoustic Monitoring effort covered 414 hours and 35 minutes throughout the survey. There were a total of 24 visual marine mammal sightings and 6 acoustic detections during the period of survey activity. No deliberate non-compliant activity occurred during the while survey; accidental non-compliances have been listed in this report. If it was known that the vessel was leaving the survey area, open communications were delivered through the appropriate channels and the sources were switched off.

One mitigating action was required over the course of the survey where a 20-minute delay was imposed on equipment ramp-up due to a sighting in the mitigation zone of the sound source.

The sound sources were active with a combination of UHR sparker and/or SBP, as well as SSS, MBES, USBL, and/or MAG. Out of these types of equipment, sparker and SBP were subject to marine mammal mitigation.

The timings of all pre-shooting searches and geophysical operations are recorded in Appendix II – Marine Mammal Recording Form: Operation log, while all visual and acoustic monitoring effort is recorded in Appendix III – Marine Mammal Recording Form: Effort Log.

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Appendix I – Marine Mammal Recording Form: Cover Page

Provided as a separate MS Excel file and copied below.

Regulatory reference number	Country	Location	Ship/ platform name	Client	Contractor	Survey type (site, 2D, 3D, 4D, OBC, VSP, etc.)	Start date	End date	Number of source vessels	Type of source (e.g. airguns)	Number of airguns (only if airguns used)	Source volume (cu. in.)	Source depth (metres)	Frequency (Hz)	Intensity (dB re. 1μPa or bar metres)	Shot point interval (metres)	Method of soft start	Visual monitoring equipment used	Magnification of optical equipment	Height of eye above water surface (metres)	How was distance of animals estimated?	Number of dedicated MMOs	Training of MMOs	Was PAM used?	Number of PAM operators (PAM only)	Description of PAM equipment (PAM only)	Range of hydrophones from airguns (PAM only)	Bearing of hydrophones from airguns (PAM only)	Depth of hydrophones (PAM only)	Comments	Flag record
	UK	Cenos OWF (North Sea)	*Glomar Supporter*	Flotation Energy	ROVCO	other	23/07/2023	27/09/2023	1	SBP			100.0	15000	182 dB re. 1μPa	4Hz	o	Binoculars	7X50, 12.5x50	11.3	b	2	u	y	1	Vanishing Point	30	90	7.0	SBP (EdgeTech 516), SSS (Edgetech 2205 - 230kHz), MBES (R2Sonic 2026), HiPAP (Kongsberg 501) USBL	

Appendix II –Marine Mammal Recording Form: Operations Log

Provided as a separate MS Excel file and copied below.

Ship/ platform name	Date	Reason for firing	Time soft start/ ramp-up began (UTC)	Time of full power (UTC)	Time of start of line (UTC)	Time of end of line (UTC)	Time of reduced output (UTC) (if relevant)	Time airguns/ source stopped (UTC)	Time pre-shooting search began (UTC)	Time search ended (UTC)	Time PAM began (UTC)	Time PAM ended (UTC)	Depth range	Was it day or night in the period prior to firing?	Was any mitigating action required?	Comments
Glomar Supporter	28/07/2022	t	02:22	02:44	02:44	07:10		07:10			01:52	02:22	s	n	n	SBP testing
Glomar Supporter	28/07/2022	t	11:35	11:58	11:58	12:11		12:11			11:05	11:35	s	d	n	SBP testing
Glomar Supporter	29/07/2023	t	00:44	01:17	01:17	01:41	01:41	02:25			00:14	00:44	s	n	n	UHR testing; UHR Operator clock is 2 minutes ahead; Requested to turn OFF the source since turn was longer than 40min, still without route monitoring in TTS screens
Glomar Supporter	29/07/2023	t	02:53	03:25	03:30	05:14		05:14			02:23	02:53	s	n	n	SBP & UHR testing; UHR Operator clock is corrected
Glomar Supporter	29/07/2023	t	06:06	06:35	06:40	07:03		07:03			05:36	06:06	s	d	n	SBP& UHR testing
Glomar Supporter	29/07/2023	t					14:00	14:01	13:30	14:00						UHR reduced power one shot test, no SS as just a single RP shot
Glomar Supporter	29/07/2023	l	15:37	15:57	15:59	18:11			15:07	15:37			s	d	n	SBP & UHR: Line: M002U
Glomar Supporter	29/07/2023	t	18:11	18:40				18:40	17:50	18:20			s	d	n	UHR Test, aborted @18:40
Glomar Supporter	29/07/2023	l	19:16	19:38	19:41	19:56			18:46	19:16			s	d	n	SBP & UHR Line M010U; aborted
Glomar Supporter	29/07/2023	t	19:56	20:18	20:18	20:26	20:26						s	d	n	UHR Test; UHR Mitigation commenced at 20:26
Glomar Supporter	29/07/2023	l	21:00	21:20	21:33	01:10		01:15								No need for Prewatch because UHR was Mitigating; **SBP** Soft-Start; SBP & UHR Line X006U; EOL @01:10 30Jul2023
Glomar Supporter	30/07/2023	l	01:58	02:29	02:57	04:35	04:35	04:45			01:28	01:58	s	n	n	SBP Line X005U; 59min from begin SS to SOL
Glomar Supporter	30/07/2023	l	08:16	08:50	09:05	10:35	10:35		07:46	08:16			s	d	n	SBP & UHR Line X001u: start of SS to SOL is 49 mins due to a technical issue
Glomar Supporter	30/07/2023	l		10:53	10:53	13:34	13:37	13:49								SBP & UHR: Line: M010u; UHR had to switch bang boxes so switched off UHR at 13:47 SBP of 13:49
Glomar Supporter	30/07/2023	l	15:27	15:49	16:00	16:07	16:07	16:09	14:57	15:27			s	d	n	SBP & UHR: Line M006u: line aborted, RP then all off as LT going to be > 40mins
Glomar Supporter	30/07/2023	l	16:36	16:58	17:10	17:34		17:38	16:06	16:36			s	d	n	SBP & UHR: Line:M006u_A
Glomar Supporter	30/07/2023	t	18:55	19:17	19:19	19:45	19:45		18:25	18:55			s	d	n	SBP & UHR Test M006u_B;
Glomar Supporter	30/07/2023	l	19:53	20:15	20:31	23:04		23:04	19:23	19:53			s	d	n	SBP & UHR Line M006u_C
Glomar Supporter	31/07/2023	l	00:06	00:26	00:26	00:45		00:47			23:56	00:26	s	n	n	SBP & UHR Line X002u
Glomar Supporter	31/07/2023	l	01:14	01:34	01:40	04:41		04:41			00:44	01:14	s	n	n	SBP & UHR Line X002u_A
Glomar Supporter	31/07/2023	l	05:10	05:30	05:31	08:26		08:26	04:40	05:10			s	d	n	SBP & UHR: Line:X003u
Glomar Supporter	31/07/2023	l	11:28	11:49	12:00	13:45			10:58	11:28			s	d	n	SBP: Line M001G
Glomar Supporter	31/07/2023	l	14:49	15:09	15:22	16:27	16:27	16:32	14:19	14:49			s	d	n	SBP & UHR: Line: X014U
Glomar Supporter	31/07/2023	l	16:56	17:16	17:23	20:01	20:01		16:26	16:56			s	d	n	SBP & UHR Line M124U_M123U
Glomar Supporter	31/07/2023	l		20:23	20:23	23:33		23:33								SBP & UHR Line M118U
Glomar Supporter	01/08/2023	l	23:53	00:32	00:35	00:52		00:52			23:23	23:53	s	n	n	SBP & UHR Line: M148U, SS commenced on 31Jul23 @23:53; Start of SS to SOL 42min
Glomar Supporter	01/08/2023	l	02:03	02:24	02:25	03:12		03:12			01:33	02:03	s	n	n	SBP & UHR Line M148U_A
Glomar Supporter	01/08/2023	l	03:25	03:45	03:45	04:19	04:19				02:55	03:25	s	n	n	SBP & UHR Line M156U
Glomar Supporter	01/08/2023	l		04:38	04:38	05:01	05:01									SBP & UHR Line M164U
Glomar Supporter	01/08/2023	l		05:28	05:28	08:04		08:04								SBP & UHR Line: X013U
Glomar Supporter	01/08/2023	l	11:13	11:34	11:43	12:00		12:01	10:43	11:13			s	d	n	SBP & UHR Line: X011U
Glomar Supporter	01/08/2023	l	14:00	14:20	14:28	17:38		17:38	13:30	14:00			s	d	n	SBP & UHR Line: X011U A & X012U
Glomar Supporter	01/08/2023	l	18:53	19:13	19:20	20:44	20:44	21:12	18:23	18:53			s	d	n	SBP & UHR Line: X010U_X009U
Glomar Supporter	01/08/2023	l	21:25	21:45	21:48	23:59		00:18			20:55	21:25	s	n	n	SBP & UHR Line X010U_X009U A
Glomar Supporter	02/08/2023	l	01:16	01:36	01:45	03:20		03:20			00:46	01:16	s	n	n	SBP & UHR Line X004U
Glomar Supporter	02/08/2023	l	03:49	04:10	04:25	06:30		06:30			03:19	03:49	s	n	n	SBP & UHR Line Resume X004U
Glomar Supporter	02/08/2023	l	06:52	07:13	07:14	10:55		10:55	06:22	06:52			s	d	n	SBP & UHR Line X005U
Glomar Supporter	02/08/2023	l	12:03	12:25	12:35	15:19		15:19	11:33	12:03			s	d	n	SBP & UHR Line OM016U
Glomar Supporter	02/08/2023	l	16:25	16:48	17:01	19:12		19:12	15:55	16:25			s	d	n	SBP & UHR Line OM001U
Glomar Supporter	02/08/2023	l	20:07	20:30	20:36	23:29	23:29		19:37	20:07			s	d	n	SBP & UHR Line OM021U;
Glomar Supporter	02/08/2023	l		23:48	23:48	02:21	02:22									SBP & UHR Line OM011U; EOL @02:21 on 03Aug23; RP LT
Glomar Supporter	03/08/2023	l		03:00	03:00	06:15	06:15									SBP & UHR Line OM026U RP LT
Glomar Supporter	03/08/2023	l		06:31	06:31	09:50		09:50								SBP & UHR Line: OM031U; vessel lost steering, line aborted
Glomar Supporter	03/08/2023	l	11:51	12:12	12:18	14:05			11:21	11:51			s	d	n	SBP Line: OM004G;
Glomar Supporter	03/08/2023	l			14:29	16:17										SBP Line: OM002G;
Glomar Supporter	03/08/2023	l			16:36	18:34										SBP Line: OM007G;
Glomar Supporter	03/08/2023	l			18:55	19:57		19:57								SBP Line: OM009G; Operations stopped for weather
Glomar Supporter	05/08/2023	l	09:32	09:52	10:03	12:34			09:02	09:32			s	d	n	SBP Line: OM014G;
Glomar Supporter	05/08/2023	l			12:55	15:25		15:29								SBP Line: OM018G; All off
Glomar Supporter	05/08/2023	t	16:41	17:02	17:03	17:06			16:11	16:41			s	d	n	SBP Test

Ship/ platform name	Date	Reason for firing	Time soft start/ ramp-up began (UTC)	Time of full power (UTC)	Time of start of line (UTC)	Time of end of line (UTC)	Time of reduced output (UTC) (if relevant)	Time airguns/ source stopped (UTC)	Time pre-shooting search began (UTC)	Time search ended (UTC)	Time PAM began (UTC)	Time PAM ended (UTC)	Depth range	Was it day or night in the period prior to firing?	Was any mitigating action required?	Comments
Glomar Supporter	05/08/2023	t			17:25	17:28										SBP Test
Glomar Supporter	05/08/2023	t			18:04	18:07										SBP Test
Glomar Supporter	05/08/2023	t			18:25	18:27		18:28								SBP Test; All OFF
Glomar Supporter	05/08/2023	l	19:38	19:58	20:00	22:33			19:08	19:38			s	d	n	SBP Line: EM002G_13
Glomar Supporter	05/08/2023	l			22:53	03:00										SBP Line: EM002G_12; EOL on 06Aug23 @03:00
Glomar Supporter	06/08/2023	l			03:27	05:43										SBP Line: EM002G_11
Glomar Supporter	06/08/2023	l			06:13	07:28										SBP Line: EM002G_10
Glomar Supporter	06/08/2023	l			08:04	09:05										SBP Line: EM002G_09
Glomar Supporter	06/08/2023	l	09:54	10:14	10:14	11:18		11:29					s	d	n	SBP Line: EM004G_9
Glomar Supporter	06/08/2023	l	11:32	11:48	11:48	12:44		12:44					s	d	n	SBP Line:EM005G_09; SS short as automatically started but could have restarted FP as <10 mins off
Glomar Supporter	06/08/2023	l	21:00	21:20	21:21	01:49					20:30	21:00	s	n	n	SBP Line: EM002G_03
Glomar Supporter	07/08/2023	l			02:28	06:08										SBP Line: EM002G_03 - re-run line
Glomar Supporter	07/08/2023	l			06:40	09:49		09:49								SBP Line: EM002G_03
Glomar Supporter	07/08/2023	l	10:39	10:59	11:09	11:44		11:44	10:09	10:39			s	d	n	SBP Line: EM002G_02
Glomar Supporter	07/08/2023	l	12:12	12:32	12:35	15:27		15:24	11:42	12:12			s	d	n	SBP Line: EM002G_01; SBP turned off before EOL
Glomar Supporter	07/08/2023	l	16:11	16:31	16:31	18:47			15:40	16:10			s	d	n	SBP Line: EM002G_01;SS delayed for whale, line started at 15:51, SBP line started at 16:31
Glomar Supporter	07/08/2023	l			19:12	19:45		19:45								SBP Line: EM003G_02
Glomar Supporter	07/08/2023	l	20:38	20:57	20:57	21:10			20:07	20:37			s	d	n	SBP Line: EM004G_02
Glomar Supporter	07/08/2023	l			21:37	00:22		00:19								SBP Line: EM004G_01; SBP OFF on 08Aug23 @00:19; EOL @00:22
Glomar Supporter	11/08/2023	t	13:49	13:55					13:19	13:49			s	d	n	SBP & UHR; SS aborted
Glomar Supporter	11/08/2023	l	14:07	14:28	14:28	17:17	17:17		13:37	14:07			s	d	n	SBP & UHR Line: OM036U; issues with UHR triggering at beginning, will do infill
Glomar Supporter	11/08/2023	l		17:42	17:42	20:37	20:37									SBP & UHR Line: OM041U
Glomar Supporter	11/08/2023	l		20:58	20:58	23:48	23:48									SBP & UHR Line: OM046U
Glomar Supporter	12/08/2023	l		00:10	00:10	03:06	03:06									SBP & UHR Line: OM051U
Glomar Supporter	12/08/2023	l		03:24	03:24	06:23	06:23									SBP & UHR Line: OM056U
Glomar Supporter	12/08/2023	l		06:48	06:48	10:05	10:05									SBP & UHR Line: OM061U
Glomar Supporter	12/08/2023	l		10:25	10:30	13:52		13:52								SBP & UHR Line: OM066U
Glomar Supporter	12/08/2023	l	14:45	15:11	15:20	18:41	18:41		14:15	14:45			s	d	n	SBP & UHR Line: OM071U
Glomar Supporter	12/08/2023	l		19:01	19:01	22:25	22:25									SBP & UHR Line: OM076U
Glomar Supporter	12/08/2023	l		22:49	22:49	02:10	02:10									SBP & UHR Line: OM081U
Glomar Supporter	13/08/2023	l		02:28	02:35	05:53	05:53									SBP & UHR Line: OM086U - UHR off EOL due to tech issues
Glomar Supporter	13/08/2023	l			06:17	09:34	09:34									SBP Line:OM083G; issues with UHR streamer, SBP only
Glomar Supporter	13/08/2023	t			09:15	09:20		09:20								UHR test while on SBP line, just a couple of shots while SBP on so no SS
Glomar Supporter	13/08/2023	l			09:56	13:04		13:04								SBP Line: OM084G, all off 13:04
Glomar Supporter	13/08/2023	t	12:34	12:57				12:57	12:04	12:34			s	d	n	UHR Test soft start while on SBP line OM084G, aborted 12:57 - SBP line continues so RP in effort
Glomar Supporter	13/08/2023	l	13:55					14:12	13:26	13:56			s	d	n	SS UHR and SBP, aborted all off
Glomar Supporter	13/08/2023	x	14:38	15:05	15:10	18:02			14:08	14:38			s	d	n	SBP Line OM020G; UHR tests along line marked as 'X' to distinguish from 'l' or 't'
Glomar Supporter	13/08/2023	t					18:07	18:27								UHR Test
Glomar Supporter	13/08/2023	l			18:27	19:37	19:37	19:37								SBP Line OM022G; Aborted
Glomar Supporter	13/08/2023	l	20:57	21:28							20:27	20:57	s	n	n	SS Aborted
Glomar Supporter	13/08/2023	x	21:33	21:53	21:59	01:14	01:14				20:53	21:23	s	n	n	Trigger Test; SBP & UHR Line: OM036U_A_UHRS; EOL on 14Aug23 @01:14
Glomar Supporter	14/08/2023	l		01:29	01:29	04:44	04:44									SBP & UHR Line: OM041U_A_UHRS; UHR off at EOL will cont. with SBP only
Glomar Supporter	14/08/2023	l			05:08	08:10										SBP Line: OM044G
Glomar Supporter	14/08/2023	t	06:15	06:37	06:39	08:10		08:10	05:45	06:15			s	d	n	UHR FP test line while on SBP line is underway, UHR off at EOL, SBP stays on
Glomar Supporter	14/08/2023	l			08:34	11:45										SBP Line: OM047G
Glomar Supporter	14/08/2023	t	08:30	08:52	08:54	11:45	11:45		08:00	08:30			s	d	n	UHR test line, SS for UHR only, UHR starts after SOL on SBP line above
Glomar Supporter	14/08/2023	l		12:09	12:09	15:01		15:01								SBP & UHR Line:OM045G; all off EOL for SVP
Glomar Supporter	14/08/2023	l	16:02	16:22	16:35	19:28	19:28		15:32	16:02			s	d	n	SBP & UHR Line: OM049G
Glomar Supporter	14/08/2023	l		19:56	19:56	22:50	22:50									SBP & UHR Line: OM052G;
Glomar Supporter	14/08/2023	l		23:12	23:12	02:07	02:07									SBP & UHR ON, Same line (OM052G); EOL on 15Aug23 @02:07
Glomar Supporter	15/08/2023	l		02:27	02:27	05:24	05:24									SBP & UHR Line: OM057G
Glomar Supporter	15/08/2023	l		05:45	05:45	08:40	08:40									SBP & UHR Line: OM059G
Glomar Supporter	15/08/2023	l		08:59	08:59	11:57		11:57								SBP & UHR Line: OM062G
Glomar Supporter	15/08/2023	l	12:55	13:25	13:45	15:20		15:30	12:25	12:55			s	d	n	SBP & UHR Line: OM067G
Glomar Supporter	16/08/2023	l	04:31	04:56	05:11	08:05	08:05		04:01	04:31			s	d	n	SBP & UHR Line: OM092G
Glomar Supporter	16/08/2023	l		08:27	08:27	11:24	11:24									SBP & UHR Line: OM091U
Glomar Supporter	16/08/2023	l		11:45	11:45	14:46		14:46								SBP & UHR Line: OM096U
Glomar Supporter	16/08/2023	l	15:34	15:55	16:04	19:07	19:07		15:04	15:34			s	d	n	SBP & UHR Line: OM101U

Ship/ platform name	Date	Reason for firing	Time soft start/ ramp-up began (UTC)	Time of full power (UTC)	Time of start of line (UTC)	Time of end of line (UTC)	Time of reduced output (UTC) (if relevant)	Time airguns/ source stopped (UTC)	Time pre-shooting search began (UTC)	Time search ended (UTC)	Time PAM began (UTC)	Time PAM ended (UTC)	Depth range	Was it day or night in the period prior to firing?	Was any mitigating action required?	Comments
Glomar Supporter	16/08/2023	I		19:30	19:30	22:28	22:28									SBP & UHR Line: OM106U
Glomar Supporter	16/08/2023	I		22:53	22:53	01:38	01:38									SBP & UHR Line: OM111U; EOL on 17Aug23 @01:38
Glomar Supporter	17/08/2023	I		01:59	01:59	04:46	04:46									SBP & UHR Line: OM116U
Glomar Supporter	17/08/2023	I		05:04	05:04	07:58	07:58									SBP & UHR Line: OM121U
Glomar Supporter	17/08/2023	I		08:15	08:15	11:01	11:01									SBP & UHR Line: OM126U
Glomar Supporter	17/08/2023	I		11:24	11:24	14:02		14:02								SBP & UHR Line: OM131U
Glomar Supporter	17/08/2023	I	14:59	15:19	15:30	16:54	16:54		14:29	14:59			s	d	n	SBP & UHR Line: OM152U
Glomar Supporter	17/08/2023	I		17:03	17:03	17:58	17:58									SBP & UHR Line: OM153U
Glomar Supporter	17/08/2023	I		18:21	18:21	19:06	19:06									SBP & UHR Line: OM163U
Glomar Supporter	17/08/2023	I		19:25	19:25	20:45	20:45									SBP & UHR Line: OM162U
Glomar Supporter	17/08/2023	I		21:09	21:09	22:32	22:32									SBP & UHR Line: OM172U
Glomar Supporter	17/08/2023	I		22:53	22:53	23:26	23:26									SBP & UHR Line: OM173U
Glomar Supporter	17/08/2023	I		23:46	23:46	00:10	00:10									SBP & UHR Line: OM183U
Glomar Supporter	18/08/2023	I		00:33	00:33	02:04	02:04									SBP & UHR Line: OM182U
Glomar Supporter	18/08/2023	I		02:22	02:22	03:56	03:56									SBP & UHR Line: OM192U
Glomar Supporter	18/08/2023	I		04:18	04:18	04:30	04:30									SBP & UHR Line: OM193U
Glomar Supporter	18/08/2023	I		05:08	05:08	06:49	06:49									SBP & UHR Line: OM200U
Glomar Supporter	18/08/2023	I		07:12	07:12	08:59	08:59									SBP & UHR Line: OM205U
Glomar Supporter	18/08/2023	I		09:21	09:21	11:11	11:11									SBP & UHR Line: OM210U
Glomar Supporter	18/08/2023	I		11:37	11:37	13:19	13:19	13:19								SBP & UHR Line: OM215U
Glomar Supporter	18/08/2023	I	13:58	14:23	14:30	16:08	16:08		13:28	13:58			s	d	n	SBP & UHR Line: OM220U
Glomar Supporter	18/08/2023	I		16:33	16:33	18:07	18:07									SBP & UHR Line: OM225U
Glomar Supporter	18/08/2023	I		18:27	18:27	18:30		18:30								SBP & UHR Line: OM330U - aborted
Glomar Supporter	18/08/2023	I	18:45	19:05	19:17	19:43		20:05	18:15	18:45			s	d	n	SBP & UHR Line: OM230U
Glomar Supporter	20/08/2023	I	06:35	06:56	07:08	07:39	07:39		06:05	06:35			s	d	n	SBP & UHR Line: OM096U_02_UHRS
Glomar Supporter	20/08/2023	I		07:59	07:59	11:19	11:19	11:19								SBP & UHR Line: OM087G
Glomar Supporter	20/08/2023	I		11:39	11:39	11:49		11:49								SBP & UHR Line: OM096U_01
Glomar Supporter	20/08/2023	I	12:13	12:33	12:44	13:03		13:03	11:43	12:13			s	d	n	SBP & UHR Line: X004U_01
Glomar Supporter	20/08/2023	I	13:57	14:17	14:25	17:38	17:38		13:27	13:57			s	d	n	SBP & UHR Line: OM082G
Glomar Supporter	20/08/2023	I		18:03	18:03	21:08	21:08									SBP & UHR Line: OM077G
Glomar Supporter	20/08/2023	I		21:32	21:32	00:27	00:27									SBP & UHR Line: OM072G; EOL on 21Aug23 @00:27
Glomar Supporter	21/08/2023	I		00:46	00:46	03:46		03:46								SBP & UHR Line: OM067G
Glomar Supporter	21/08/2023	I	04:02	04:24	04:36	05:04	05:04				03:32	04:02	s	w	n	SBP & UHR Line: OM031U_01, survey log says EOL@ 04:54, incorrect
Glomar Supporter	21/08/2023	I		05:19	05:19	08:08	08:08									SBP & UHR Line: OM032G
Glomar Supporter	21/08/2023	I		08:38	08:38	09:03		09:03								SBP & UHR Line: OM047G_01
Glomar Supporter	21/08/2023	I	09:42	10:03	10:15	13:18	13:18		09:12	09:42			s	d	n	SBP & UHR Line: OM027G
Glomar Supporter	21/08/2023	I		13:42	13:42	14:20	14:20									SBP & UHR Line: OM021U_01
Glomar Supporter	21/08/2023	I		14:53	14:53	16:54	16:54									SBP & UHR Line: OM006U
Glomar Supporter	21/08/2023	I		17:17	17:17	17:38	17:38	17:42								SBP & UHR Line: OM011U_01 Recovered equipment for weather downtime. Typo in survey log says EOL 17:48
Glomar Supporter	22/08/2023	I	05:33	05:53	06:04	06:28	06:28		05:03	05:33			s	d	n	SBP & UHR Line: OM011U_02; survey log says sol @17:13, EOL @17:58, UHR Operator Log says SOL @17:17, EOL @17:42 - same as MMO log
Glomar Supporter	22/08/2023	I		07:00	07:00	09:33	09:33									SBP & UHR Line: X011U_B
Glomar Supporter	22/08/2023	I		09:43	09:43	10:10	10:10									SBP & UHR Line: X012U_A
Glomar Supporter	22/08/2023	I		10:43	10:43	11:05		11:07								SBP & UHR Line: OM220U_01
Glomar Supporter	22/08/2023	I	11:31					11:42	11:01	11:31			s	d	n	Abort SS and UHR off, continued with SBP only due to weather
Glomar Supporter	22/08/2023	I	12:08	12:28	12:40	14:19	14:19	14:30	11:38	12:08			s	d	n	SBP Line: OM217G, all off as vessel was coming outside of survey site for LT
Glomar Supporter	22/08/2023	I	14:36	14:56	14:57	16:34		16:34	14:06	14:36			s	d	n	SBP Line: OM227G
Glomar Supporter	22/08/2023	I	16:46	17:06	17:13	17:23		17:23	17:16	16:46			s	d	n	SBP & UHR Line: X005U_01
Glomar Supporter	22/08/2023	I	18:16	18:36	18:52	20:18	20:18		17:46	18:16			s	d	n	SBP & UHR Line:OM230U
Glomar Supporter	22/08/2023	I		20:34	20:34	21:57	21:57									SBP & UHR Line: OM235U
Glomar Supporter	22/08/2023	I		22:18	22:18	23:39	23:39									SBP & UHR Line: OM240U
Glomar Supporter	22/08/2023	I		23:52	23:52	01:00	01:00									SBP & UHR Line: OM254U;
Glomar Supporter	23/08/2023	I		01:18	01:18	02:16	02:16									SBP & UHR Line: OM250U
Glomar Supporter	23/08/2023	I		02:36	02:36	03:29	03:29									SBP & UHR Line: OM255U
Glomar Supporter	23/08/2023	I		03:47	03:47	04:39	04:39									SBP & UHR Line: OM260U
Glomar Supporter	23/08/2023	I		04:57	04:57	05:40	05:40									SBP & UHR Line:OM265U
Glomar Supporter	23/08/2023	I		05:57	05:57	06:34	06:34									SBP & UHR Line:OM270U

Ship/ platform name	Date	Reason for firing	Time soft start/ ramp-up began (UTC)	Time of full power (UTC)	Time of start of line (UTC)	Time of end of line (UTC)	Time of reduced output (UTC) (if relevant)	Time airguns/ source stopped (UTC)	Time pre-shooting search began (UTC)	Time search ended (UTC)	Time PAM began (UTC)	Time PAM ended (UTC)	Depth range	Was it day or night in the period prior to firing?	Was any mitigating action required?	Comments
Glomar Supporter	23/08/2023	I		06:53	06:53	07:16	07:16									SBP & UHR Line:OM275U
Glomar Supporter	23/08/2023	I		07:34	07:34	10:54	10:54									SBP & UHR Line:X006U
Glomar Supporter	23/08/2023	I		11:22	11:22	13:35		13:35								SBP & UHR Line:X007U
Glomar Supporter	23/08/2023	I	13:50	14:12	14:18	15:45	15:45		13:20	13:50			s	d	n	SBP & UHR Line:X008U
Glomar Supporter	23/08/2023	I		16:23	16:23	17:27		17:27								SBP & UHR Line:X010U_A
Glomar Supporter	23/08/2023	I	17:47	18:07	18:18	20:43		20:43	17:17	17:47			s	d	n	SBP & UHR Line: X013U_A
Glomar Supporter	27/08/2023	I	16:17	16:37	16:47	17:22		17:22	15:47	16:17			s	d	n	SBP Line: OM162U_01
Glomar Supporter	29/08/2023	I	05:22	05:42	05:52	06:53			04:52	05:22			s	d	n	SBP Line: EM02G_03_01, aborted due to nav issues, will circle back to re-run
Glomar Supporter	29/08/2023	I			07:31	14:23		14:24								SBP Line: EM02G_03_01
Glomar Supporter	29/08/2023	I	16:13	16:33	16:39	03:08		03:08	15:43	16:13			s	d	n	SBP Line: EM003G_03; EOL on 30Aug23 @03:08
Glomar Supporter	31/08/2023	I	05:02	05:22	05:22	05:35		05:35			04:32	05:02	s	w	n	SBP Line: EM001G_01 - aborted as going into port
Glomar Supporter	31/08/2023	I	17:10	17:30	17:30	19:57		20:06	16:40	17:10			s	n	n	SBP Line: EM005G_01 - Line began at 17:00 with SSS, SBP SS 17:10-17:30, SBP SOL 17:30
Glomar Supporter	31/08/2023	I			20:09	20:18		23:13								SBP Line: EM005G_01 - continue same line after SBP back on
Glomar Supporter	01/09/2023	I	23:44					00:06			23:14	23:44	s	n	n	SS Aborted
Glomar Supporter	02/09/2023	I	00:14	00:35	00:49	01:18					23:44	00:14	s	n	n	SBP Line: EM005G_02
Glomar Supporter	02/09/2023	I			01:49	11:48										SBP Line: EM005G_03
Glomar Supporter	02/09/2023	I			12:21	12:59		13:01								SBP Line: EM003G_04
Glomar Supporter	02/09/2023	I	16:10	16:30	16:47	17:14			15:40	16:10			s	d	n	SBP Line: EM004G_05
Glomar Supporter	02/09/2023	I			17:45	18:18										SBP Line: EM003G_05
Glomar Supporter	02/09/2023	I			18:40	19:48										SBP Line: EM003G_06
Glomar Supporter	02/09/2023	I			20:19	20:49										SBP Line: EM003G_07
Glomar Supporter	02/09/2023	I			21:23	22:40										SBP Line: EM003G_08
Glomar Supporter	02/09/2023	I			23:17	00:12										SBP Line: EM003G_09
Glomar Supporter	03/09/2023	I			00:46	01:58		01:58								SBP Line: EM003G_10
Glomar Supporter	03/09/2023	I	04:21	04:41	04:52	07:26					03:51	04:21	s	n	n	SBP Line: EM003G_11
Glomar Supporter	03/09/2023	I			07:54	12:04										SBP Line: EM003G_12
Glomar Supporter	03/09/2023	I			12:39	15:13		15:13								SBP Line: EM003G_13
Glomar Supporter	03/09/2023	I	21:00	21:21	21:37	00:16					20:30	21:00	s	n	n	SBP Line: OM042G
Glomar Supporter	04/09/2023	I			00:47	03:33										SBP Line: OM043G
Glomar Supporter	04/09/2023	I			03:49	06:45										SBP Line: OM048G
Glomar Supporter	04/09/2023	I			07:02	10:06										SBP Line: OM050G
Glomar Supporter	04/09/2023	I			10:22	13:13		13:13								SBP Line: OM053G
Glomar Supporter	04/09/2023	I	13:47	14:08	14:16	17:25			13:17	13:47			s	d	n	SBP Line: OM055G, line aborted; SSS Test, SBP kept ON
Glomar Supporter	04/09/2023	I			17:29	17:47		17:52								SBP Line: OM055G, continued same line
Glomar Supporter	04/09/2023	I	18:28	18:52	18:52	21:44			17:58	18:28			s	d	n	SBP Line: OM058G_A
Glomar Supporter	04/09/2023	I			22:05	01:00										SBP Line: OM060G
Glomar Supporter	05/09/2023	I			01:19	04:20										SBP Line: OM063G
Glomar Supporter	05/09/2023	I			04:41	07:31										SBP Line: OM064G
Glomar Supporter	05/09/2023	I			07:50	10:44										SBP Line: OM065G
Glomar Supporter	05/09/2023	I			11:01	13:50										SBP Line: OM068G
Glomar Supporter	05/09/2023	I			14:14	17:09										SBP Line: OM069G
Glomar Supporter	05/09/2023	I			17:27	20:25		20:25								SBP Line: OM070G
Glomar Supporter	06/09/2023	I	23:43	00:10	23:43	02:57					23:13	23:43	s	n	n	SBP Line: EM005G_01_A; SOL @23:44 with SBP SS starting
Glomar Supporter	07/09/2023	I			03:34	04:05							s	n	n	SBP Line: EM001G_02
Glomar Supporter	07/09/2023	I			04:35	07:05							s	d	n	SBP Line: EM004G_03_A
Glomar Supporter	07/09/2023	I			07:39	08:32							s	d	n	SBP Line: B1005G
Glomar Supporter	07/09/2023	I			08:58	10:00							s	d	n	SBP Line: B1003G
Glomar Supporter	07/09/2023	I			10:15	11:27							s	d	n	SBP Line B1001G
Glomar Supporter	07/09/2023	I			11:46	12:50							s	d	n	SBP Line B1004G
Glomar Supporter	07/09/2023	I			13:07	14:12		14:12					s	d	n	SBP Line B1002G. All off at EOL for SVP
Glomar Supporter	07/09/2023	I	17:36	17:39	17:39	03:14	03:14	03:45					s	k	n	SBP Line: EM004G_03B. NAV & survey network issues. EOL 03:14, SBP off 03:45
Glomar Supporter	08/09/2023	I	04:28	04:48	04:53	05:28					03:58	04:28	s	n	n	SBP Line: EM004G_04
Glomar Supporter	08/09/2023	I			05:56	06:25							s	d	n	SBP Line: EM005G_05
Glomar Supporter	08/09/2023	I			06:58	08:00							s	d	n	SBP Line: EM004G_06
Glomar Supporter	08/09/2023	I			08:30	09:00							s	d	n	SBP Line: EM004G_07
Glomar Supporter	08/09/2023	I			09:28	09:54							s	d	n	SBP Line: EM002G_07
Glomar Supporter	08/09/2023	I			10:20	10:56							s	d	n	SBP Line: EM005G_07. Restarting NAV
Glomar Supporter	08/09/2023	I			10:56	11:36		11:36					s	d	n	SBP Line: EM005G_07 continued - aborted after multiple NAV issues, SBP off for troubleshooting

Ship/ platform name	Date	Reason for firing	Time soft start/ ramp-up began (UTC)	Time of full power (UTC)	Time of start of line (UTC)	Time of end of line (UTC)	Time of reduced output (UTC) (if relevant)	Time airguns/ source stopped (UTC)	Time pre-shooting search began (UTC)	Time search ended (UTC)	Time PAM began (UTC)	Time PAM ended (UTC)	Depth range	Was it day or night in the period prior to firing?	Was any mitigating action required?	Comments
Glomar Supporter	08/09/2023	l	16:08	16:28	16:28	17:35					15:38	16:08	s	d	n	SBP Line: EM003G_06A
Glomar Supporter	08/09/2023	l			18:08	18:12							s	k	n	SBP Line: EM002G_07B
Glomar Supporter	08/09/2023	l			18:34	18:50							s	n	n	SBP Line: EM004G_07A
Glomar Supporter	08/09/2023	l			19:22	20:44							s	n	n	SBP Line: EM004G_08
Glomar Supporter	08/09/2023	l			21:23	22:26							s	n	n	SBP Line: EM001G_09
Glomar Supporter	08/09/2023	l			22:59	00:20		00:35					s	n	n	SBP Line: EM004G_10
Glomar Supporter	09/09/2023	l	00:45	01:05	01:05	03:35					23:15	00:45	s	n	n	SBP Line: EM004G_11
Glomar Supporter	09/09/2023	l			04:10	08:22		08:35					s	n	n	SBP Line: EM004G_12
Glomar Supporter	09/09/2023	l	08:45	09:05	09:13	11:00					08:15	08:45	s	d	n	SBP Line: EM004G_13
Glomar Supporter	09/09/2023	l			11:31	12:21		12:21					s	d	n	SBP Line EM004G_13A
Glomar Supporter	09/09/2023	l	14:08	14:28	14:37	16:36			13:38	14:08			s	d	n	SBP Line: OM073G. Abandoned due to system crash
Glomar Supporter	09/09/2023	l			17:10	18:21							s	d	n	SBP Line: OM073G_A
Glomar Supporter	09/09/2023	l			18:37	21:40							s	n	n	SBP Line: OM074G
Glomar Supporter	09/09/2023	l			21:54	00:58							s	n	n	SBP Line: OM075G
Glomar Supporter	10/09/2023	l			01:19	04:21							s	n	n	SBP Line: OM078G
Glomar Supporter	10/09/2023	l			04:42	07:15		07:39					s	w	n	SBP Line: OM085G. Abandoned due to system crash
Glomar Supporter	10/09/2023	l	07:45	08:05	08:13	08:43							s	d	n	SBP Line: OM085G_a
Glomar Supporter	10/09/2023	l			08:58	11:58							s	d	n	SBP Line: OM078G_A
Glomar Supporter	10/09/2023	l			12:14	15:13							s	d	n	SBP Line: OM079G
Glomar Supporter	10/09/2023	l			15:26	18:27	18:27						s	d	n	SBP Line: OM080G
Glomar Supporter	10/09/2023	l			19:09	19:52		19:52					s	d	n	SBP Line: OM088G; 42 Minutes with SBP on in LT
Glomar Supporter	10/09/2023	l	20:27	20:48	20:57	00:02							s	n	n	SBP Line: OM088G_A. Line aborted
Glomar Supporter	11/09/2023	l			00:20	03:32							s	n	n	SBP Line: OM089G
Glomar Supporter	11/09/2023	l			03:51	06:56							s	n	n	SBP Line: OM090G
Glomar Supporter	11/09/2023	l			07:14	10:15							s	d	n	SBP Line: OM093G
Glomar Supporter	11/09/2023	l			10:34	11:53		11:53					s	d	n	SBP Line: OM094G
Glomar Supporter	11/09/2023	l	13:05	13:26	13:26	15:23			12:35	13:05			s	d	n	SBP Line: OM094G_A
Glomar Supporter	11/09/2023	l			15:40	18:42		18:42					s	d	n	SBP Line: OM095G
Glomar Supporter	11/09/2023	l	19:07	19:27	19:27	22:55			18:37	19:07			s	k	n	SBP Line: OM0097G
Glomar Supporter	11/09/2023	l			23:09	00:27							s	n	n	SBP Line: OM098G; Line aborted
Glomar Supporter	12/09/2023	l	00:50	01:12	01:12	01:22	01:22	01:34			00:30	00:50	s	n	n	SBP Line: OM098G_A; Line aborted
Glomar Supporter	12/09/2023	l	01:35	02:14	02:14	02:22	02:22	02:37			01:05	01:35	s	n	n	SBP Line: OM098G_B; Line aborted
Glomar Supporter	12/09/2023	l	03:22	03:43	03:49	05:38					02:52	03:22	s	n	n	SBP Line: OM098G_C
Glomar Supporter	12/09/2023	l			05:58	09:03							s	d	n	SBP Line: OM099G
Glomar Supporter	12/09/2023	l			09:21	12:23		12:23					s	d	n	SBP Line: OM100G
Glomar Supporter	12/09/2023	l	12:35	12:55	13:23	16:35			12:05	12:35			s	d	n	SBP Line: OM102G. SS-SOL longer than 40' d/t Technical issues
Glomar Supporter	12/09/2023	l			16:52	20:00							s	d	n	SBP Line: OM103G
Glomar Supporter	12/09/2023	l			20:14	23:23		23:23					s	n	n	SBP Line: OM104G; Source recovered, waiting on weather
Glomar Supporter	13/09/2023	l	07:50	08:10				08:10			07:20	07:50	s	d	n	SBP Line: OM061U_i01. SS abandoned
Glomar Supporter	13/09/2023	l	08:14	08:38	08:38	08:43		08:43					s	d	n	SBP Line: OM061U_i01. Line aborted due to weather
Glomar Supporter	14/09/2023	l	23:15	23:35	23:41	02:59							s	n	n	SBP Line: CM108G
Glomar Supporter	15/09/2023	l			03:24	06:28							s	n	n	SBP Line: CM113G
Glomar Supporter	15/09/2023	l			06:47	09:51		09:51					s	d	n	SBP Line: CM118G
Glomar Supporter	15/09/2023	l	10:33	10:53	11:03	13:54			10:03	10:33			s	d	n	SBP Line: CM123G
Glomar Supporter	15/09/2023	l			14:15	17:05							s	d	n	SBP Line: CM128G
Glomar Supporter	15/09/2023	l			17:23	20:12							s	d	n	SBP Line: CM133G
Glomar Supporter	15/09/2023	l			20:31	22:13							s	n	n	SBP Line: CM138G
Glomar Supporter	15/09/2023	l			22:18	23:56							s	n	n	SBP Line: CM146G
Glomar Supporter	16/09/2023	l			00:15	03:16							s	n	n	SBP Line: CM156G_CM157G
Glomar Supporter	16/09/2023	l			03:31	04:29							s	n	n	SBP Line: CM138G
Glomar Supporter	16/09/2023	l			04:38	05:32							s	n	n	
Glomar Supporter	16/09/2023	l			05:49	08:30							s	w	n	SBP Line: CM166G_CM167G
Glomar Supporter	16/09/2023	l			08:52	09:56		09:56					s	d	n	SBP Line: CM176G_OM177G. Abandoned as beacon signal lost
Glomar Supporter	16/09/2023	l	11:00	11:20	11:31	13:21					10:30	11:00	s	d	n	SBP Line: CM176G_OM177G
Glomar Supporter	16/09/2023	l			13:37	15:57							s	d	n	SBP Line: CM186G_OM187G
Glomar Supporter	16/09/2023	l			16:11	17:37							s	d	n	SBP Line: CM196G
Glomar Supporter	16/09/2023	l			17:52	19:15							s	k	n	SBP Line: CM202G
Glomar Supporter	16/09/2023	l			19:29	20:48							s	n	n	SBP Line:

Ship/ platform name	Date	Reason for firing	Time soft start/ ramp-up began (UTC)	Time of full power (UTC)	Time of start of line (UTC)	Time of end of line (UTC)	Time of reduced output (UTC) (if relevant)	Time airguns/ source stopped (UTC)	Time pre-shooting search began (UTC)	Time search ended (UTC)	Time PAM began (UTC)	Time PAM ended (UTC)	Depth range	Was it day or night in the period prior to firing?	Was any mitigating action required?	Comments
Glomar Supporter	16/09/2023	I			21:05	22:15		22:15					s	n	n	SBP Line: CM212G
Glomar Supporter	16/09/2023	I	23:25	23:45	23:49	00:00					22:55	23:25	s	n	n	SBP Line: OM121U_i01
Glomar Supporter	17/09/2023	I			00:21	01:04							s	n	n	SBP Line: CM108_i01
Glomar Supporter	17/09/2023	I			01:24	04:34							s	n	n	SBP Line: OM107G
Glomar Supporter	17/09/2023	I			04:54	05:20		05:20					s	w	n	
Glomar Supporter	17/09/2023	I	06:20	06:41	06:46	06:57		07:18	05:50	06:20			s	d	n	SBP Line: OM061U_i02. SBP off during SSS deployment
Glomar Supporter	17/09/2023	I	07:24	07:45	07:51	10:52							s	d	n	SBP Line: OM039G
Glomar Supporter	17/09/2023	I			11:11	13:27							s	d	n	SBP Line: OM038G
Glomar Supporter	17/09/2023	I			13:52	14:43		14:43					s	d	n	SBP Line: OM038G_A
Glomar Supporter	17/09/2023	I	16:28	16:48	16:54	17:14					15:58	16:28	s	d	n	SBP Line: OM92G_i01
Glomar Supporter	17/09/2023	I			17:40	18:22							s	d	n	SBP Line: OM091U_i01
Glomar Supporter	17/09/2023	I			18:41	19:15							s	k	n	SBP Line: EM001G_13
Glomar Supporter	17/09/2023	I			19:39	21:46							s	n	n	SBP Line: EM001G_13
Glomar Supporter	17/09/2023	I			22:35	02:47							s	n	n	SBP Line: EM001G_12
Glomar Supporter	18/09/2023	I			03:05	06:22		06:22					s	n	n	SBP Line: EM004G_12
Glomar Supporter	18/09/2023	I	11:30	11:50	11:52	14:38					11:00	11:30	s	d	n	SBP Line: EM005G_11
Glomar Supporter	18/09/2023	I			15:04	16:28							s	d	n	SBP Line: EM004G_09_A
Glomar Supporter	18/09/2023	I			16:57	18:05							s	d	n	SBP Line: EM004G_09_A
Glomar Supporter	18/09/2023	I			18:36	20:03							s	k	n	SBP Line: EM003G_08_A
Glomar Supporter	18/09/2023	I			20:27	21:01		21:01					s	n	n	SBP Line: EM001G_07
Glomar Supporter	23/09/2023	I	16:30	16:50	16:50	18:08			16:00	16:30			s	d	n	SBP Line: EM003G_03_i01
Glomar Supporter	23/09/2023	I			18:08	19:41							s	k	n	SBP Line: EM001G_03_i02
Glomar Supporter	26/09/2023	I	22:27	22:48	23:03	00:45					21:57	22:27	s	n	n	SBP Line: EM001G_08
Glomar Supporter	27/09/2023	I			01:11	01:26							s	n	n	SBP Line: EM001G_07_A
Glomar Supporter	27/09/2023	I			01:50	02:24							s	n	n	SBP Line: EM001G_07_B
Glomar Supporter	27/09/2023	I			02:54	04:05							s	n	n	SBP Line: EM001G_06
Glomar Supporter	27/09/2023	I	05:06	05:27	05:34	06:03				04:36	05:06		s	n	n	SBP Line: EM001G_05
Glomar Supporter	27/09/2023	I			06:31	07:24		07:24					s	d	n	SBP Line: EM001G_04. All off for transit to next site
Glomar Supporter	27/09/2023	I							11:55	12:25			s	d	n	PW and line abandoned due to weather, all off, end of survey.

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	23/07/2023	v	Ossie Stewart	10:45	11:45	n	57	11.00	n	1	57.16	w	39.7	57	16.43	n	1	43.85	w	73.0	9.3	ne	4	c	o	g	sb	n	Transit to test site Buchan Deep
Glomar Supporter	23/07/2023	v	Ossie Stewart	11:45	12:45	n	57	16.43	n	1	43.85	w	73.0	57	21.33	n	1	31.35	w	83.6	9.0	ne	4	c	o	g	sf	n	Transit to test site Buchan Deep
Glomar Supporter	23/07/2023	v	Ossie Stewart	12:45	13:30	n	57	21.33	n	1	31.35	w	83.6	57	25.06	n	1	21.78	w	112.0	8.6	ne	5	c	o	g	sb	n	Transit to test site Buchan Deep
Glomar Supporter	23/07/2023	v	Ossie Stewart	13:30	14:00	n	57	25.06	n	1	21.78	w	112.0	57	27.39	n	1	16.22	w	114.0	8.1	ne	6	r	o	g	n	m	Transit to test site Buchan Deep
Glomar Supporter	23/07/2023	v	Ossie Stewart	14:00	15:00	n	57	27.39	n	1	16.22	w	114.0	57	32.71	n	1	13.01	w	113.0	7.9	ne	6	r	o	g	wb	n	Transit to test site Buchan Deep
Glomar Supporter	23/07/2023	v	Ossie Stewart	15:00	16:00	n	57	32.71	n	1	13.01	w	113.0	57	32.72	n	1	12.98	w	113.0	0.1	ne	5	c	o	g	n	n	On site stopped for SVP
Glomar Supporter	23/07/2023	v	Ossie Stewart	16:00	17:00	n	57	32.72	n	1	12.98	w	113.0	57	32.71	n	1	12.90	w	114.0	0.0	ne	5	c	o	g	n	n	On site
Glomar Supporter	23/07/2023	v	David Melendez	17:00	18:00	n	57	32.71	n	1	12.90	w	114.0	57	32.67	n	1	12.73	w	114.0	0.2	ne	4	c	o	g	n	n	On site, watch change
Glomar Supporter	23/07/2023	v	David Melendez	18:00	19:00	n	57	32.67	n	1	12.73	w	114.0	57	32.67	n	1	12.94	w	112.0	0.0	nw	4	c	o	g	n	n	
Glomar Supporter	23/07/2023	v	David Melendez	19:00	20:00	n	57	32.67	n	1	12.94	w	112.0	57	31.75	n	1	9.55	w	104.0	0.1	n	4	c	o	g	n	n	Transit to MBES Calibration @19:24
Glomar Supporter	23/07/2023	v	David Melendez	20:00	20:40	n	57	31.75	n	1	9.55	w	104.0	57	32.83	n	1	9.12	w	104.0	0.3	nw	4	c	o	g	n	n	MBES Calibration commences @20:00; EOW; MBES Cal finished @21:29
Glomar Supporter	24/07/2023	v	David Melendez	03:06	03:40	n	57	32.83	n	1	9.12	w	104.0	57	32.83	n	1	8.70	w	101.0	0.3	nw	4	c	o	g	n	n	SOW on site waiting for conditions for calibration
Glomar Supporter	24/07/2023	v	David Melendez	03:40	04:00	n	57	32.83	n	1	8.70	w	101.0	57	32.82	n	1	8.68	w	98.2	0.5	nw	5	c	o	m	n	l	WOW
Glomar Supporter	24/07/2023	v	David Melendez	04:00	05:00	n	57	32.82	n	1	8.68	w	98.2	57	32.82	n	1	8.68	w	98.2	0.5	nw	5	c	o	g	n	n	WOW
Glomar Supporter	24/07/2023	v	Ossie Stewart	05:00	06:40	n	57	32.82	n	1	8.68	w	98.2	57	32.76	n	1	8.69	w	101.0	0.2	nw	6	r	o	g	n	n	WOW
Glomar Supporter	24/07/2023	v	Ossie Stewart	06:40	07:44	n	57	32.76	n	1	8.69	w	101.0	57	32.72	n	1	8.85	w	101.0	0.3	n	6	r	o	g	n	n	WOW
Glomar Supporter	24/07/2023	v	Ossie Stewart	07:44	08:40	n	57	32.72	n	1	8.85	w	101.0	57	32.89	n	1	8.05	w	98.7	0.3	n	6	r	o	g	n	n	WOW
Glomar Supporter	24/07/2023	v	Ossie Stewart	08:40	09:07	n	57	32.89	n	1	8.05	w	98.7	57	33.04	n	1	7.35	w	97.2	0.6	n	7	r	o	m	n	m	WOW
Glomar Supporter	24/07/2023	v	Ossie Stewart	09:07	09:50	n	57	33.04	n	1	7.35	w	97.2	57	33.25	n	1	6.37	w	97.0	0.7	n	7	r	o	g	n	n	WOW - morning meeting/lunch
Glomar Supporter	24/07/2023	v	Ossie Stewart	11:00	12:00	n	57	33.33	n	1	6.04	w	98.4	57	33.34	n	1	6.03	w	98.2	0.2	nw	7	r	o	g	n	n	WOW
Glomar Supporter	24/07/2023	v	Ossie Stewart	12:00	13:00	n	57	33.34	n	1	6.03	w	98.2	57	33.35	n	1	5.92	w	98.0	0.1	nw	6	r	o	g	n	n	WOW
Glomar Supporter	24/07/2023	v	Ossie Stewart	13:00	14:00	n	57	33.35	n	1	5.92	w	98.0	57	33.20	n	1	6.37	w	97.0	0.2	nw	6	r	o	g	vb	n	WOW
Glomar Supporter	24/07/2023	v	Ossie Stewart	14:00	15:00	n	57	33.20	n	1	6.37	w	97.0	57	33.16	n	1	4.41	w	98.6	0.2	nw	6	r	o	g	n	n	WOW
Glomar Supporter	24/07/2023	v	Ossie Stewart	15:00	16:00	n	57	33.16	n	1	4.41	w	98.6	57	33.10	n	1	6.57	w	98.0	0.3	nw	6	r	o	g	sf	n	WOW
Glomar Supporter	24/07/2023	v	Ossie Stewart	16:00	17:00	n	57	33.10	n	1	6.57	w	98.0	57	33.16	n	1	6.28	w	99.3	0.3	nw	6	r	o	g	sf	n	WOW
Glomar Supporter	24/07/2023	v	David Melendez	17:00	18:00	n	57	33.16	n	1	6.28	w	99.3	57	33.16	n	1	6.35	w	98.6	0.3	nw	5	r	o	g	n	n	Shift change
Glomar Supporter	24/07/2023	v	David Melendez	18:00	19:00	n	57	33.16	n	1	6.35	w	98.6	57	33.12	n	1	6.46	w	98.3	0.5	nw	5	r	o	g	sf	n	
Glomar Supporter	24/07/2023	v	David Melendez	19:00	20:00	n	57	33.12	n	1	6.46	w	98.3	57	33.12	n	1	6.47	w	98.5	0.0	nw	5	r	o	g	sf	n	
Glomar Supporter	24/07/2023	v	David Melendez	20:00	20:50	n	57	33.12	n	1	6.47	w	98.5	57	33.10	n	1	6.48	w	97.6	0.3	nw	5	r	o	g	n	n	EOW
Glomar Supporter	25/07/2023	v	David Melendez	03:29	03:43	n	57	32.09	n	1	8.43	w	100.0	57	32.12	n	1	8.36	w	98.7	0.1	w	3	s	o	m	n	l	SOW; WOW
Glomar Supporter	25/07/2023	v	David Melendez	03:43	04:43	n	57	32.12	n	1	8.36	w	98.7	57	32.18	n	1	8.23	w	98.0	0.4	w	3	s	o	g	n	n	WOW
Glomar Supporter	25/07/2023	v	David Melendez	04:43	04:55	n	57	32.18	n	1	8.23	w	98.0	57	32.15	n	1	8.22	w	98.2	0.2	w	4	c	o	g	n	n	WOW
Glomar Supporter	25/07/2023	v	Ossie Stewart	04:55	05:55	n	57	32.15	n	1	8.22	w	98.2	57	31.80	n	1	9.01	w	103.0	0.3	w	5	c	o	g	n	n	WOW, shift change

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	25/07/2023	v	Ossie Stewart	05:55	06:55	n	57	31.80	n	1	9.01	w	103.0	57	34.49	n	1	6.70	w	100.0	1.6	w	4	c	o	g	n	n	WOW, moving position for another survey vessel
Glomar Supporter	25/07/2023	v	Ossie Stewart	06:55	07:55	n	57	34.49	n	1	6.70	w	100.0	57	32.57	n	1	12.94	w	113.0	5.7	w	4	c	o	m	n	m	WOW, TBT for USBL cal - assessing weather
Glomar Supporter	25/07/2023	v	Ossie Stewart	07:55	08:55	n	57	32.57	n	1	12.94	w	113.0	57	35.52	n	1	8.42	w	92.0	3.4	nw	5	c	o	g	sb	n	WOW
Glomar Supporter	25/07/2023	v	Ossie Stewart	08:55	09:50	n	57	35.52	n	1	8.42	w	92.0	57	40.06	n	0	58.37	w	101.0	9.0	nw	4	c	o	g	sf	n	transit to USBL cal site, WOW, break for meeting and lunch
Glomar Supporter	25/07/2023	v	Ossie Stewart	10:50	11:50	n	57	48.02	n	0	58.51	w	103.0	57	42.10	n	0	55.46	w	103.0	3.1	nw	5	c	o	g	sb	n	WOW
Glomar Supporter	25/07/2023	v	Ossie Stewart	11:50	12:50	n	57	42.10	n	0	55.46	w	103.0	57	36.96	n	0	46.93	w	105.0	9.0	nw	5	c	o	g	sf	n	WOW transit towards Cenos site
Glomar Supporter	25/07/2023	v	Ossie Stewart	12:50	13:55	n	57	36.96	n	0	46.93	w	105.0	57	33.77	n	0	28.77	w	97.7	9.0	nw	6	c	o	g	sb	n	WOW transit towards Cenos site
Glomar Supporter	25/07/2023	v	Ossie Stewart	13:55	15:10	n	57	33.77	n	0	28.77	w	97.7	57	30.28	n	0	8.24	w	95.0	9.0	nw	6	c	o	g	sb	n	WOW transit towards Cenos site
Glomar Supporter	25/07/2023	v	Ossie Stewart	15:10	16:15	n	57	30.28	n	0	8.24	w	95.0	57	27.17	n	0	8.72	w	86.6	9.0	nw	6	c	o	g	sb	n	WOW transit towards Cenos site
Glomar Supporter	25/07/2023	v	Ossie Stewart	16:15	16:55	n	57	27.17	n	0	8.72	w	86.6	57	25.06	n	0	2.28	w	76.6	9.0	nw	6	r	m	g	sb	n	WOW
Glomar Supporter	25/07/2023	v	David Melendez	16:55	18:00	n	57	25.06	n	0	2.28	w	76.6	57	22.07	n	0	36.60	w	83.5	9.0	nw	6	r	m	g	sb	n	Shift change
Glomar Supporter	25/07/2023	v	David Melendez	18:00	19:00	n	57	22.07	n	0	36.60	w	83.5	57	18.28	n	0	51.09	w	88.7	8.9	n	6	r	m	g	wb	n	WOW
Glomar Supporter	25/07/2023	v	David Melendez	19:00	20:00	n	57	18.28	n	0	51.09	w	88.7	57	13.72	n	1	3.14	e	89.8	8.9	nw	6	r	m	g	wb	n	WOW
Glomar Supporter	25/07/2023	v	David Melendez	20:00	20:15	n	57	13.72	n	1	3.14	e	89.8	57	13.79	n	1	3.44	e	90.0	0.2	nw	6	r	m	g	wb	n	WOW
Glomar Supporter	25/07/2023	v	David Melendez	20:15	21:42	n	57	13.79	n	1	3.44	e	90.0	57	13.84	n	1	3.65	e	90.0	0.2	nw	6	r	m	g	wb	n	VD #02; EOW
Glomar Supporter	26/07/2023	v	David Melendez	03:31	04:31	n	57	17.28	n	1	10.14	e	89.0	57	17.28	n	1	10.14	e	89.0	0.4	nw	7	r	m	g	n	n	WOW
Glomar Supporter	26/07/2023	v	David Melendez	04:31	05:00	n	57	17.54	n	1	11.28	e	84.0	57	17.65	n	1	11.47	e	84.0	1.1	nw	7	r	m	g	n	n	WOW
Glomar Supporter	26/07/2023	v	Ossie Stewart	05:00	06:00	n	57	17.65	n	1	11.47	e	84.0	57	17.19	n	1	13.86	e	85.6	1.1	nw	6	r	m	g	n	n	WOW
Glomar Supporter	26/07/2023	v	Ossie Stewart	06:00	07:11	n	57	17.19	n	1	13.86	e	85.6	57	16.58	n	1	15.82	e	87.2	1.1	nw	6	r	m	g	sb	n	WOW
Glomar Supporter	26/07/2023	v	Ossie Stewart	07:11	08:11	n	57	16.58	n	1	15.82	e	87.2	57	16.37	n	1	16.82	e	87.0	1.1	nw	6	r	m	g	wb	n	WOW
Glomar Supporter	26/07/2023	v	Ossie Stewart	08:11	09:11	n	57	16.37	n	1	16.82	e	87.0	57	15.94	n	1	17.86	e	85.0	0.6	nw	5	r	m	g	sb	n	WOW
Glomar Supporter	26/07/2023	v	Ossie Stewart	09:11	09:55	n	57	15.94	n	1	17.86	e	85.0	57	16.05	n	1	18.48	e	85.0	1.1	w	5	c	m	g	vb	n	WOW - morning meeting and lunch
Glomar Supporter	26/07/2023	v	Ossie Stewart	10:40	11:48	n	57	15.90	n	1	19.63	e	88.7	57	16.92	n	1	20.01	e	87.0	0.6	w	5	c	m	g	n	n	WOW
Glomar Supporter	26/07/2023	v	Ossie Stewart	11:48	12:58	n	57	16.92	n	1	20.01	e	87.0	57	16.78	n	1	21.95	e	91.0	1.1	w	5	c	m	g	n	n	WOW
Glomar Supporter	26/07/2023	v	Ossie Stewart	12:58	14:11	n	57	16.78	n	1	21.95	e	91.0	57	16.72	n	1	24.09	e	93.0	1.0	w	5	c	m	g	wb	n	WOW
Glomar Supporter	26/07/2023	v	Ossie Stewart	14:11	15:57	n	57	16.72	n	1	24.09	e	93.0	57	11.06	n	1	19.23	e	90.0	1.1	w	4	c	o	g	wb	n	WOW
Glomar Supporter	26/07/2023	v	Ossie Stewart	15:57	17:00	n	57	11.06	n	1	19.23	e	90.0	57	10.46	n	1	20.21	e	92.4	3.8	w	4	c	o	g	sb	n	WOW
Glomar Supporter	26/07/2023	v	David Melendez	17:00	18:00	n	57	10.46	n	1	20.21	e	92.4	57	18.98	n	1	20.62	e	92.4	3.7	nw	3	s	o	g	sf	n	Shift change
Glomar Supporter	26/07/2023	v	David Melendez	18:00	19:00	n	57	18.98	n	1	20.62	e	92.4	57	11.45	n	1	19.77	e	91.3	2.9	w	3	s	o	g	sb	n	WOW
Glomar Supporter	26/07/2023	v	David Melendez	19:00	19:13	n	57	11.45	n	1	19.77	e	91.3	57	11.18	n	1	19.34	e	91.0	3.5	nw	3	s	o	g	sf	n	WOW
Glomar Supporter	26/07/2023	v	David Melendez	19:13	20:00	n	57	11.18	n	1	19.34	e	91.0	57	9.22	n	1	21.42	e	94.7	4.7	sw	3	s	o	g	sb	n	VD #03
Glomar Supporter	26/07/2023	v	David Melendez	20:00	20:52	n	57	9.22	n	1	21.42	e	94.7	57	11.50	n	1	19.33	e	91.2	2.5	nw	3	s	o	g	wf	n	WOW; EOW
Glomar Supporter	27/07/2023	v	David Melendez	03:18	04:00	n	57	5.60	n	1	37.65	e	91.2	57	6.09	n	1	36.76	e	90.6	0.5	e	2	s	o	g	n	n	SOW

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	27/07/2023	v	David Melendez	04:00	05:00	n	57	6.09	n	1	36.76	e	90.6	57	6.21	n	1	36.73	e	90.0	0.3	e	2	s	o	g	sf	n	
Glomar Supporter	27/07/2023	v	Ossie Stewart	05:00	06:00	n	57	6.21	n	1	36.73	e	90.0	57	6.21	n	1	36.73	e	91.0	0.1	e	3	s	o	g	sf	n	TBT for USBL beacon deployment
Glomar Supporter	27/07/2023	v	Ossie Stewart	06:00	07:00	n	57	6.21	n	1	36.73	e	91.0	57	6.21	n	1	36.73	e	91.0	0.1	e	4	c	o	g	sf	n	USBL beacon deployment and cal
Glomar Supporter	27/07/2023	v	Ossie Stewart	07:00	08:00	n	57	6.21	n	1	36.73	e	91.0	57	6.20	n	1	36.70	e	91.0	0.1	e	4	c	o	g	sf	n	USBL cal
Glomar Supporter	27/07/2023	v	Ossie Stewart	08:00	09:00	n	57	6.20	n	1	36.70	e	91.0	57	6.21	n	1	36.65	e	91.0	0.1	e	4	c	o	g	sf	n	USBL cal
Glomar Supporter	27/07/2023	v	Ossie Stewart	09:00	09:55	n	57	6.21	n	1	36.65	e	91.0	57	6.21	n	1	36.65	e	91.0	0.0	e	4	c	o	g	sf	n	USBL cal - morning meeting and lunch
Glomar Supporter	27/07/2023	v	Ossie Stewart	10:37	11:37	n	57	6.19	n	1	36.71	e	91.0	57	6.18	n	1	36.75	e	91.0	0.1	e	4	c	o	g	sf	n	USBL cal
Glomar Supporter	27/07/2023	v	Ossie Stewart	11:37	12:45	n	57	6.18	n	1	36.75	e	91.0	57	6.20	n	1	36.66	e	91.0	0.1	e	5	c	o	g	sf	n	USBL cal
Glomar Supporter	27/07/2023	v	Ossie Stewart	12:45	13:45	n	57	6.20	n	1	36.66	e	91.0	57	6.20	n	1	36.66	e	91.0	0.0	e	4	s	o	g	sf	n	USBL cal
Glomar Supporter	27/07/2023	v	Ossie Stewart	13:45	14:45	n	57	6.20	n	1	36.66	e	91.0	57	6.21	n	1	36.66	e	91.0	0.0	e	4	s	o	g	n	n	USBL cal
Glomar Supporter	27/07/2023	v	Ossie Stewart	14:45	15:55	n	57	6.21	n	1	36.66	e	91.0	57	6.14	n	1	36.68	e	91.0	0.0	e	4	s	o	g	n	n	USBL cal
Glomar Supporter	27/07/2023	v	Ossie Stewart	15:55	17:00	n	57	6.14	n	1	36.68	e	91.0	57	6.44	n	1	38.29	e	92.2	0.7	e	4	s	o	g	n	n	USBL cal
Glomar Supporter	27/07/2023	v	David Melendez	17:00	18:03	n	57	6.44	n	1	38.29	e	92.2	57	6.35	n	1	37.59	e	90.9	4.0	e	3	s	o	g	n	n	Shift change
Glomar Supporter	27/07/2023	v	David Melendez	18:03	19:00	n	57	6.35	n	1	37.59	e	90.9	57	6.44	n	1	38.29	e	92.2	4.0	e	3	s	o	g	n	n	SSS cal
Glomar Supporter	27/07/2023	v	David Melendez	19:00	20:03	n	57	6.44	n	1	38.29	e	92.2	57	6.03	n	1	35.97	e	91.1	4.0	e	2	s	o	g	n	n	SSS cal
Glomar Supporter	27/07/2023	v	David Melendez	20:03	20:15	n	57	6.03	n	1	35.97	e	91.1	57	6.26	n	1	37.32	e	90.8	3.9	se	2	s	o	g	n	n	EOW Visual
Glomar Supporter	28/07/2023	p	David Melendez	01:19	02:22	n	57	8.42	n	1	40.16	e	91.0	57	7.12	n	1	40.16	e	92.0	3.0								SOW Acoustic for SBP Cal
Glomar Supporter	28/07/2023	p	David Melendez	02:22	02:44	s	57	7.12	n	1	40.16	e	92.0	57	6.53	n	1	30.37	e	92.0	5.1								SBP SS
Glomar Supporter	28/07/2023	p	David Melendez	02:44	03:52	v	57	6.53	n	1	30.37	e	92.0	57	5.05	n	1	29.13	e	92.4	4.6								Only SBP ON; EOW Acoustic
Glomar Supporter	28/07/2023	v	David Melendez	04:06	05:00	v	57	4.22	n	1	29.78	e	92.4	57	5.11	n	1	29.07	e	93.6	3.0	se	2	s	o	g	n	n	SOW Visual
Glomar Supporter	28/07/2023	v	Ossie Stewart	05:00	06:00	v	57	5.11	n	1	29.07	e	93.6	57	5.74	n	1	28.73	e	93.0	2.9	se	4	s	o	g	sf	n	SBP testing
Glomar Supporter	28/07/2023	v	Ossie Stewart	06:00	07:00	v	57	5.74	n	1	28.73	e	93.0	57	4.73	n	1	29.32	e	94.0	3.9	se	4	s	o	g	sf	n	SBP testing
Glomar Supporter	28/07/2023	v	Ossie Stewart	07:00	07:10	v	57	4.73	n	1	29.32	e	94.0	57	4.43	n	1	29.82	e	93.0	3.8	se	4	s	o	g	wf	n	SBP testing
Glomar Supporter	28/07/2023	v	Ossie Stewart	07:10	08:10	n	57	4.43	n	1	29.82	e	93.0	57	6.15	n	1	17.78	e	91.0	4.0	se	4	s	o	g	sb	n	SBP off, getting in position for MBES testing
Glomar Supporter	28/07/2023	v	Ossie Stewart	08:10	09:10	n	57	6.15	n	1	17.78	e	91.0	57	6.59	n	1	15.22	e	88.0	4.0	s	4	s	o	g	wb	l	
Glomar Supporter	28/07/2023	v	Ossie Stewart	09:10	09:55	n	57	6.59	n	1	15.22	e	88.0	57	7.77	n	1	16.17	e	89.0	1.6	se	4	s	o	g	n	l	MBES testing, morning meeting and lunch
Glomar Supporter	28/07/2023	v	Ossie Stewart	10:55	11:35	n	57	7.88	n	1	16.03	e	89.0	57	7.63	n	1	16.87	e	90.0	2.9	se	4	s	o	g	n	l	MBES testing
Glomar Supporter	28/07/2023	v	Ossie Stewart	11:35	11:58	s	57	7.63	n	1	16.87	e	90.0	57	7.55	n	1	19.70	e	92.6	3.0	s	4	s	o	g	n	l	SBP SS
Glomar Supporter	28/07/2023	v	Ossie Stewart	11:58	12:11	v	57	7.55	n	1	19.70	e	92.6	57	7.67	n	1	21.39	e	93.0	4.0	s	4	s	o	g	n	n	SBP testing
Glomar Supporter	28/07/2023	v	Ossie Stewart	12:11	13:11	n	57	7.67	n	1	21.39	e	93.0	57	8.47	n	1	34.05	e	92.5	5.5	s	4	s	o	g	n	n	SBP off
Glomar Supporter	28/07/2023	v	Ossie Stewart	13:11	14:10	n	57	8.47	n	1	34.05	e	92.5	57	5.98	n	1	36.78	e	90.4	4.0	se	4	s	o	g	n	n	TBT for SSS deployment
Glomar Supporter	28/07/2023	v	Ossie Stewart	14:10	15:15	n	57	5.98	n	1	36.78	e	90.4	57	6.70	n	1	37.17	e	92.0	4.0	s	4	s	o	g	sf	n	SSS cal
Glomar Supporter	28/07/2023	v	Ossie Stewart	15:15	16:00	n	57	6.70	n	1	37.17	e	92.0	57	5.30	n	1	37.33	e	91.0	3.0	s	3	s	o	g	n	n	SSS
Glomar Supporter	28/07/2023	v	Ossie Stewart	16:00	17:00	n	57	5.30	n	1	37.33	e	91.0	57	8.74	n	1	35.19	e	92.5	3.9	s	3	s	o	g	sf	n	SSS recovered going to rerun test line
Glomar Supporter	28/07/2023	v	David Melendez	17:00	18:10	n	57	8.74	n	1	35.19	e	92.5	57	6.31	n	1	37.47	e	91.5	2.5	se	3	s	o	g	sf	n	Shift change
Glomar Supporter	28/07/2023	v	David Melendez	18:10	19:00	n	57	6.31	n	1	37.47	e	91.5	57	6.27	n	1	36.60	e	90.8	5.2	e	3	s	o	g	n	n	

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	28/07/2023	v	David Melendez	19:00	20:00	n	57	6.27	n	1	36.60	e	90.8	57	6.27	n	1	36.74	e	91.1	0.0	w	3	s	o	g	n	n	Beacon recovery Ops
Glomar Supporter	28/07/2023	v	David Melendez	20:00	20:20	n	57	6.27	n	1	36.74	e	91.1	57	5.80	n	1	36.01	e	91.8	0.3	s							EOW Visual
Glomar Supporter	28/07/2023	p	David Melendez	21:56	22:37	n	57	4.22	n	1	29.68	e	91.6	57	3.08	n	1	25.48	e	95.4	3.2								SOW Acoustic
Glomar Supporter	28/07/2023	p	David Melendez	23:04	24:00	n	57	2.93	n	1	27.61	e	96.4	57	3.33	n	1	33.33	e	93.0	3.8								
Glomar Supporter	29/07/2023	p	David Melendez	00:00	00:44	n	57	3.33	n	1	33.33	e	93.0	57	2.50	n	1	31.45	e	96.0	2.6								Midnight UTC
Glomar Supporter	29/07/2023	p	David Melendez	00:44	01:17	s	57	2.50	n	1	31.45	e	96.0	57	3.83	n	1	29.85	e	98.5	2.9								UHR SS
Glomar Supporter	29/07/2023	p	David Melendez	01:17	02:25	v	57	3.83	n	1	29.85	e	98.5	57	4.83	n	1	29.29	e	98.0	3.6								UHR Testing
Glomar Supporter	29/07/2023	p	David Melendez	02:25	02:53	n	57	4.83	n	1	29.29	e	98.0	57	3.66	n	1	31.89	e	97.0	3.6								UHR OFF
Glomar Supporter	29/07/2023	p	David Melendez	02:53	03:25	s	57	3.66	n	1	31.89	e	97.0	57	4.17	n	1	29.64	e	98.0	3.0								UHR & SBP SS
Glomar Supporter	29/07/2023	p	David Melendez	03:25	03:30	v	57	4.17	n	1	29.64	e	98.0	57	4.40	n	1	29.52	e	98.0	3.2								UHR & SBP Test; SOL @03:30; EOW Acoustic
Glomar Supporter	29/07/2023	v	David Melendez	04:00	05:00	v	57	6.06	n	1	28.68	e	93.2	57	7.14	n	1	29.91	e	93.0	3.4	s	4	s	o	g	n	n	Only SBP ON; UHR recovery Ops
Glomar Supporter	29/07/2023	v	Ossie Stewart	05:00	05:14	v	57	7.14	n	1	29.91	e	93.0	57	5.20	n	1	30.10	e	92.0	3.5	s	3	s	o	g	n	n	SBP
Glomar Supporter	29/07/2023	v	Ossie Stewart	05:14	06:06	n	57	5.20	n	1	30.10	e	92.0	57	3.64	n	1	31.23	e	93.0	3.3	s	3	s	o	g	n	l	All off, UHR deployed
Glomar Supporter	29/07/2023	v	Ossie Stewart	06:06	06:35	s	57	3.64	n	1	31.23	e	93.0	57	3.91	n	1	29.79	e	93.6	3.4	s	3	s	o	g	n	m	SS SBP and UHR same time
Glomar Supporter	29/07/2023	v	Ossie Stewart	06:35	07:03	v	57	3.91	n	1	29.79	e	93.6	57	5.49	n	1	28.85	e	93.2	3.5	s	3	s	o	g	n	l	FP
Glomar Supporter	29/07/2023	v	Ossie Stewart	07:03	08:05	n	57	5.49	n	1	28.85	e	93.2	57	6.12	n	1	35.02	e	92.0	4.0	s	3	s	o	g	n	l	SBP and UHR off, continue SSS
Glomar Supporter	29/07/2023	v	Ossie Stewart	08:05	09:00	n	57	6.12	n	1	35.02	e	92.0	57	5.98	n	1	36.42	e	91.0	4.0	s	2	s	o	g	n	m	SSS
Glomar Supporter	29/07/2023	v	Ossie Stewart	09:00	09:55	n	57	5.98	n	1	36.42	e	91.0	57	6.11	n	1	35.15	e	92.0	3.7	sw	3	s	o	g	n	n	SSS
Glomar Supporter	29/07/2023	v	Ossie Stewart	10:37	11:50	n	57	4.95	n	1	36.33	e	91.4	57	8.96	n	1	36.18	e	92.0	3.5	sw	2	s	o	g	vb	n	SSS
Glomar Supporter	29/07/2023	v	Ossie Stewart	11:50	12:50	n	57	8.96	n	1	36.18	e	92.0	57	11.74	n	1	35.64	e	93.0	2.7	s	3	s	o	g	vb	n	SSS and UHR recovery (to make adjustment on UHR)
Glomar Supporter	29/07/2023	v	Ossie Stewart	12:50	14:00	n	57	9.71	n	1	34.20	e	93.0	57	9.13	n	1	34.94	e	92.5	3.1	s	3	s	o	g	vb	n	UHR test shot RP
Glomar Supporter	29/07/2023	v	Ossie Stewart	14:00	14:01	v	57	9.13	n	1	34.94	e	92.5	57	4.83	n	1	37.97	e	97.0	4.0	s	3	s	o	g	vb	n	
Glomar Supporter	29/07/2023	v	Ossie Stewart	14:01	15:10	n	57	4.83	n	1	37.97	e	97.0	57	3.73	n	1	37.22	e	91.1	4.2	s	4	c	o	g	sf	n	
Glomar Supporter	29/07/2023	v	Ossie Stewart	15:10	15:37	n	57	3.73	n	1	37.22	e	91.1	57	3.65	n	1	36.30	e	92	2.6	sw	4	c	o	g	sf	n	
Glomar Supporter	29/07/2023	v	Ossie Stewart	15:37	15:57	s	57	3.65	n	1	36.30	e	92	57	3.51	n	1	35.93	e	92.3	3.0	sw	4	c	o	g	sf	n	UHR & SBP SS
Glomar Supporter	29/07/2023	v	Ossie Stewart	15:57	17:10	f	57	3.51	n	1	35.93	e	92.3	57	3.51	n	1	35.93	e	92.3	3.2	sw	4	c	o	g	sf	n	UHR & SBP FP online
Glomar Supporter	29/07/2023	v	David Melendez	17:10	18:11	r	57	2.45	n	1	29.78	e	92.9	57	1.69	n	1	25.38	e	95.8	3.2	sw	4	c	o	g	sf	n	UHR OFF @17;10; UHR test in reduced power @17:25
Glomar Supporter	29/07/2023	v	David Melendez	18:11	18:40	s	57	1.28	n	1	22.85	e	96.3	57	0.92	n	1	19.67	e	95.4	3.3	sw	4	c	o	g	sf	n	SS UHR Test
Glomar Supporter	29/07/2023	v	David Melendez	18:40	19:16	n	57	0.92	n	1	19.67	e	95.4	57	1.36	n	1	20.53	e	95.8	3.2	sw	4	c	o	g	sb	n	Test stopped
Glomar Supporter	29/07/2023	v	David Melendez	19:16	19:38	s	57	1.36	n	1	20.53	e	95.8	57	1.65	n	1	22.03	e	96.0	3.5	s	4	c	o	g	sb	n	
Glomar Supporter	29/07/2023	v	David Melendez	19:38	19:56	f	57	1.65	n	1	22.03	e	96.0	57	1.70	n	1	22.50	e	96.6	3.2	sw	4	c	o	g	sb	n	Ops aborted
Glomar Supporter	29/07/2023	v	David Melendez	19:56	20:18	s	57	1.70	n	1	22.50	e	96.6	57	6.27	n	1	36.74	e	91.1	3.4	s	4	c	o	g	wb	n	SS UHR
Glomar Supporter	29/07/2023	v	David Melendez	20:18	20:26	v	57	6.27	n	1	36.74	e	91.1	57	11.51	n	1	27.43	e	91.8	0.0								UHR Testing; EOW Visual @20:26
Glomar Supporter	29/07/2023	p	David Melendez	21:15	21:20	s	57	1.34	n	1	28.73	e	95.0	57	4.04	n	1	27.65	e	94.0	3.2								SS SBP @21:00; UHR ON; SOW Acoustic

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	29/07/2023	p	David Melendez	21:20	22:06	f	57	4.04	n	1	27.65	e	94.0	57	3.96	n	1	28	e	91.0	3.7								SOL @21:33 XU006
Glomar Supporter	29/07/2023	p	David Melendez	22:06	22:53	f	57	3.96	n	1	28	e	91.0	57	6.82	n	1	26.02	e	91.5	4.0								Break in watch for supper
Glomar Supporter	29/07/2023	p	David Melendez	23:24	24:00	f	57	8.60	n	1	24.98	e	93.1	57	11.31	n	1	23.39	e	93.8	3.6								Back to watch
Glomar Supporter	30/07/2023	p	David Melendez	00:00	01:10	f	57	11.31	n	1	23.39	e	93.8	57	14.68	n	1	21.40	e	92.5	3.8								Midnight UTC
Glomar Supporter	30/07/2023	p	David Melendez	01:10	01:15	r	57	14.68	n	1	21.40	e	92.5	57	16.55	n	1	20.28	e	88.6	3.9								SBP Acquisition
Glomar Supporter	30/07/2023	p	David Melendez	01:15	01:58	n	57	16.55	n	1	20.28	e	88.6	57	16.90	n	1	18.84	e	85.9	3.9								EOL, SBP OFF
Glomar Supporter	30/07/2023	p	David Melendez	01:58	02:29	s	57	16.90	n	1	18.84	e	85.9	57	15.32	n	1	18.95	e	86.4	3.7								SS SBP
Glomar Supporter	30/07/2023	p	David Melendez	02:29	02:57	r	57	15.32	n	1	18.95	e	86.4	57	11.25	n	1	21.35	e	91.7	3.1								SOL @02:57 only SBP ON; EOW Acoustic @03:25
Glomar Supporter	30/07/2023	v	David Melendez	03:48	04:35	r	57	10.95	n	1	21.52	e	92.1	57	8.13	n	1	23.19	e	92.8	3.6	sw	4	c	o	g	n	n	SOW Visual
Glomar Supporter	30/07/2023	v	David Melendez	04:35	04:45	r	57	8.13	n	1	23.19	e	92.8	57	7.37	n	1	23.57	e	93.0	3.6	sw	4	c	o	g	n	n	EOL @04:35
Glomar Supporter	30/07/2023	v	David Melendez	04:45	05:10	n	57	7.37	n	1	23.57	e	93.0	57	6.99	n	1	22.59	e	93.0	2.6	sw	5	c	o	g	n	n	SBP OFF
Glomar Supporter	30/07/2023	v	Ossie Stewart	05:10	06:25	n	57	6.99	n	1	22.59	e	93.0	57	7.79	n	1	15.83	e	89.0	2.9	sw	5	c	o	g	n	n	
Glomar Supporter	30/07/2023	v	Ossie Stewart	06:25	07:29	n	57	7.79	n	1	15.83	e	89.0	57	8.03	n	1	13.22	e	87.8	3.2	sw	5	c	o	g	sb	n	
Glomar Supporter	30/07/2023	v	Ossie Stewart	07:29	08:16	n	57	8.03	n	1	13.22	e	87.8	57	8.73	n	1	15.71	e	89.1	3.7	s	4	c	o	g	sf	n	
Glomar Supporter	30/07/2023	v	Ossie Stewart	08:16	08:50	s	57	8.73	n	1	15.71	e	89.1	57	6.75	n	1	15.68	e	89.0	2.7	s	5	c	o	g	sb	n	SS UHR & SBP
Glomar Supporter	30/07/2023	v	Ossie Stewart	08:50	09:55	f	57	6.75	n	1	15.68	e	89.0	57	3.40	n	1	17.64	e	92.0	4.0	s	4	c	o	g	vf	n	FP UHR & SBP online, log off for meeting/lunch
Glomar Supporter	30/07/2023	v	Ossie Stewart	09:55	10:35	f	57	3.40	n	1	17.64	e	92.0	57	1.27	n	1	18.88	e	91.0	3.5	s	4	c	o	g	vf	n	
Glomar Supporter	30/07/2023	v	Harley Bailey	10:35	10:53	r	57	1.27	n	1	18.88	e	91.0	57	1.41	n	1	20.84	e	96.4	3.4	s	4	c	o	g	sb	n	EOL UHR & SBP RP LT
Glomar Supporter	30/07/2023	v	Ossie Stewart	10:53	12:03	f	57	1.41	n	1	20.84	e	96.4	57	2.58	n	1	27.48	e	94.4	3.4	s	2	s	o	g	sb	n	UHR & SBP online
Glomar Supporter	30/07/2023	v	Ossie Stewart	12:03	12:44	f	57	2.58	n	1	27.48	e	94.4	57	3.27	n	1	31.49	e	93.4	3.5	se	4	c	o	m	n	m	Squally weather conditions
Glomar Supporter	30/07/2023	v	Ossie Stewart	12:44	13:37	f	57	3.27	n	1	31.49	e	93.4	57	4.13	n	1	36.29	e	92.0	3.0	se	2	s	o	g	n	m	
Glomar Supporter	30/07/2023	v	Ossie Stewart	13:37	13:49	r	57	4.13	n	1	36.29	e	92.0	57	3.89	n	1	36.82	e	92.0	3.3	se	3	s	o	g	n	l	UHR off to switch bang boxes
Glomar Supporter	30/07/2023	v	Ossie Stewart	13:49	14:50	n	57	3.89	n	1	36.82	e	92.0	57	4.08	n	1	31.98	e	93.0	3.0	s	3	s	o	g	vb	l	SBP off as LT going to be more than 40 mins
Glomar Supporter	30/07/2023	v	Ossie Stewart	14:50	15:27	n	57	4.08	n	1	31.98	e	93.0	57	4.32	n	1	36.28	e	91.0	4.0	s	2	s	o	g	sb	n	
Glomar Supporter	30/07/2023	v	Ossie Stewart	15:27	15:49	s	57	4.32	n	1	36.28	e	91.0	57	3.95	n	1	37.99	e	91.5	3.5	s	3	s	o	g	n	n	UHR @15:28 & SBP:15:27 SS
Glomar Supporter	30/07/2023	v	Ossie Stewart	15:49	16:07	f	57	3.95	n	1	37.99	e	91.5	57	3.65	n	1	35.29	e	93.0	3.3	s	3	s	o	g	n	n	UHR & SBP FP online
Glomar Supporter	30/07/2023	v	Ossie Stewart	16:07	16:09	r	57	3.65	n	1	35.29	e	93.0	57	3.65	n	1	35.29	e	93.0	3.3	s	3	s	o	g	n	n	Line aborted, UHR & SBP RP
Glomar Supporter	30/07/2023	v	Ossie Stewart	16:09	16:36	n	57	3.65	n	1	35.29	e	93.0	57	4.52	n	1	36.28	e	91.3	3.6	se	3	s	o	g	sb	n	UHR & SBP off as LT going to be >40 mins
Glomar Supporter	30/07/2023	v	Ossie Stewart	16:36	16:58	s	57	4.52	n	1	36.28	e	91.3	57	3.95	n	1	36.96	e	91.4	3.5	se	3	s	o	g	sf	n	UHR @16:37 & SBP @16:36 SS
Glomar Supporter	30/07/2023	v	Ossie Stewart	16:58	17:38	f	57	3.95	n	1	36.96	e	91.4	57	3.19	n	1	32.38	e	91.9	3.0	sw	3	s	o	g	sf	n	UHR & SBP FP online 2nd attempt same line
Glomar Supporter	30/07/2023	v	David Melendez	17:38	18:55	n	57	3.19	n	1	32.38	e	91.9	57	2.75	n	1	28.56	e	93.7	3.0	w	3	s	o	g	sf	n	
Glomar Supporter	30/07/2023	v	David Melendez	18:55	19:17	s	57	2.89	n	1	30.71	e	92.1	57	2.28	n	1	33.10	e	92.8	3.7	n	3	s	o	g	sb	n	SS
Glomar Supporter	30/07/2023	v	David Melendez	19:17	19:45	v	57	2.28	n	1	33.10	e	92.8	57	3.76	n	1	35.88	e	91.9	4.0	n	3	s	o	g	sb	n	UHR & SBP FP Test

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	30/07/2023	v	David Melendez	19:45	19:55	r	57	3.76	n	1	35.88	e	91.9	57	4.24	n	1	36.56	e	91.2	3.2	n	3	s	o	g	n	n	EOL UHR OFF
Glomar Supporter	30/07/2023	v	David Melendez	19:53	20:15	s	57	4.24	n	1	36.56	e	91.2	57	3.88	n	1	36.84	e	90.8	3.0	n	3	s	o	g	n	n	SS UHR; FP @20:15; EOW Visual 20:15
Glomar Supporter	30/07/2023	p	David Melendez	20:48	21:45	f	57	3.48	n	1	34.18	e	93.4	57	2.59	n	1	28.91	e	94.4	3.4								SOW Acoustic
Glomar Supporter	30/07/2023	p	David Melendez	21:45	22:22	f	57	2.59	n	1	28.91	e	94.4	57	1.98	n	1	25.50	e	96.3	2.8								Break for supper
Glomar Supporter	30/07/2023	p	David Melendez	22:45	23:04	f	57	1.63	n	1	23.41	e	96.0	57	1.38	n	1	21.91	e	95.0	3.3								
Glomar Supporter	30/07/2023	p	David Melendez	23:04	24:00	n	57	1.38	n	1	21.91	e	95.0	57	0.90	n	1	23.04	e	101.0	3.2								EOL SBP & UHR OFF
Glomar Supporter	31/07/2023	p	David Melendez	00:00	00:06	n	57	0.90	n	1	23.04	e	101.0	57	0.78	n	1	22.48	e	101.0	3.6								Midnight UTC
Glomar Supporter	31/07/2023	p	David Melendez	00:06	00:26	s	57	0.78	n	1	22.48	e	101.0	57	1.27	n	1	20.91	e	102.0	3.6								SS SBP & UHR
Glomar Supporter	31/07/2023	p	David Melendez	00:26	00:47	f	57	1.27	n	1	20.91	e	102.0	57	2.31	n	1	20.22	e	101.0	3.3								
Glomar Supporter	31/07/2023	p	David Melendez	00:47	01:14	n	57	2.31	n	1	20.22	e	101.0	57	1.01	n	1	22.70	e	102.0	3.7								Line aborted, SBP & UHR OFF
Glomar Supporter	31/07/2023	p	David Melendez	01:14	01:34	s	57	1.01	n	1	22.70	e	102.0	57	0.88	n	1	21.17	e	101.0	3.8								SS SBP & UHR
Glomar Supporter	31/07/2023	p	David Melendez	01:34	03:28	f	57	0.88	n	1	21.17	e	101.0	57	4.28	n	1	19.20	e	100.0	3.8								SOL @01:40; EOW Acoustic
Glomar Supporter	31/07/2023	v	David Melendez	03:49	04:41	f	57	5.68	n	1	18.40	e	91.1	57	8.43	n	1	16.76	e	95.0	4.1	ne	1	s	o	g	n	n	SOW Visual
Glomar Supporter	31/07/2023	v	David Melendez	04:41	05:00	n	57	9.20	n	1	16.30	e	95.0	57	10.26	n	1	16.36	e	89.0	4.0	ne	2	s	o	g	sf	n	EOL @04:32; SBP & UHR OFF @04:41
Glomar Supporter	31/07/2023	v	Ossie Stewart	05:00	05:10	n	57	10.26	n	1	16.36	e	89.0	57	10.78	n	1	16.74	e	89.5	3.7	ne	2	s	o	g	sf	n	
Glomar Supporter	31/07/2023	v	Ossie Stewart	05:10	05:30	s	57	10.78	n	1	16.74	e	89.5	57	10.28	n	1	17.73	e	89.6	3.8	ne	3	s	o	g	sf	n	UHR & SBP SS
Glomar Supporter	31/07/2023	v	Ossie Stewart	05:30	06:30	f	57	10.28	n	1	17.73	e	89.6	57	7.25	n	1	19.51	e	92.0	3.3	ne	2	s	o	g	sf	n	UHR & SBP FP online
Glomar Supporter	31/07/2023	v	Ossie Stewart	06:30	07:34	f	57	7.25	n	1	19.51	e	92.0	57	3.92	n	1	21.47	e	92.0	3.1	s	3	s	o	g	sf	n	
Glomar Supporter	31/07/2023	v	Ossie Stewart	07:34	08:26	f	57	3.92	n	1	21.47	e	92.0	57	1.13	n	1	23.09	e	96.2	3.3	s	3	s	o	g	sf	n	
Glomar Supporter	31/07/2023	v	Ossie Stewart	08:26	09:26	n	57	1.13	n	1	23.09	e	96.2	57	58.56	n	1	24.51	e	98.5	3.0	s	3	s	o	g	sf	n	All off to recover UHR tail buoy
Glomar Supporter	31/07/2023	v	Ossie Stewart	09:26	09:55	n	57	58.56	n	1	24.51	e	98.5	57	0.36	n	1	23.81	e	97.7	0.7	s	3	s	o	g	sf	n	
Glomar Supporter	31/07/2023	v	Harley Bailey	09:55	10:35	n	57	0.36	n	1	23.81	e	97.7	57	1.68	n	1	22.90	e	96.6	4.6	s	2	s	o	g	sb	n	
Glomar Supporter	31/07/2023	v	Ossie Stewart	10:35	11:28	n	57	1.68	n	1	22.90	e	96.6	57	0.95	n	1	20.95	e	97.1	3.1	s	3	s	o	g	sb	n	
Glomar Supporter	31/07/2023	v	Ossie Stewart	11:28	11:49	s	57	0.95	n	1	20.95	e	97.1	57	1.20	n	1	23.90	e	97.0	3.5	se	4	s	o	g	sf	n	SBP only SS
Glomar Supporter	31/07/2023	v	Ossie Stewart	11:49	12:49	r	57	1.20	n	1	23.90	e	97.0	57	2.31	n	1	29.34	e	94.0	4.0	se	4	s	o	g	sf	n	SBP FP online, no UHR so RP
Glomar Supporter	31/07/2023	v	Ossie Stewart	12:49	13:45	r	57	2.31	n	1	29.34	e	94.0	57	3.51	n	1	36.25	e	93.0	3.3	se	4	c	o	g	sb	n	
Glomar Supporter	31/07/2023	v	Ossie Stewart	13:45	14:49	n	57	3.51	n	1	36.25	e	93.0	57	5.08	n	1	37.42	e	91.5	3.9	se	4	c	o	g	sb	n	EOL: UHR & SBP off
Glomar Supporter	31/07/2023	v	Ossie Stewart	14:49	15:09	s	57	5.08	n	1	37.42	e	91.5	57	6.28	n	1	36.72	e	91.4	3.3	se	4	c	o	g	sb	n	SS; UHR & SBP
Glomar Supporter	31/07/2023	v	Ossie Stewart	15:09	16:06	f	57	6.28	n	1	36.72	e	91.4	57	9.33	n	1	34.95	e	92.5	3.5	se	4	c	o	g	sb	n	SOL; UHR & SBP
Glomar Supporter	31/07/2023	v	Ossie Stewart	16:06	16:27	f	57	9.33	n	1	34.95	e	92.5	57	10.70	n	1	34.00	e	92	3.5	se	4	c	o	g	sb	n	* informed afterwards from log that they went to mitigation RP from 16:27 - 16:32 - recorded in operations
Glomar Supporter	31/07/2023	v	Ossie Stewart	16:27	16:32	r	57	10.70	n	1	34.00	e	92.0	57	10.72	n	1	34.15	e	91.5	3.3	se	4	c	o	g	sb	n	
Glomar Supporter	31/07/2023	v	Ossie Stewart	16:32	16:56	n	57	10.72	n	1	34.15	e	91.5	57	10.57	n	1	34.43	e	91.1	3.4	se	4	c	o	g	sb	n	EOL; UHR & SBP off
Glomar Supporter	31/07/2023	v	David Melendez	16:56	17:16	s	57	10.57	n	1	34.43	e	91.1	57	11.02	n	1	34.07	e	91.1	3.9	se	4	c	o	g	sf	n	SS; UHR & SBP
Glomar Supporter	31/07/2023	v	David Melendez	17:16	18:16	f	57	11.02	n	1	34.07	e	91.1	57	9.91	n	1	27.69	e	91.4	3.4	se	4	c	o	g	sf	n	SOL; UHR & SBP

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	31/07/2023	v	David Melendez	18:16	19:22	f	57	9.91	n	1	27.69	e	91.4	57	8.62	n	1	20.40	e	91.4	3.9	e	4	c	o	g	sf	n	
Glomar Supporter	31/07/2023	v	David Melendez	19:22	20:01	f	57	8.62	n	1	20.40	e	91.4	57	4.86	n	1	16.01	e	89.3	3.9	e	4	c	o	g	sf	n	
Glomar Supporter	31/07/2023	v	David Melendez	20:01	20:16	r	57	4.86	n	1	16.01	e	89.3	57	7.56	n	1	15.81	e	89.8	3.9	e	4	c	o	g	n	n	UHR on mitigation shot @20:01; EOW Visual @20:16
Glomar Supporter	31/07/2023	p	David Melendez	20:43	21:45	f	57	8.00	n	1	18.30	e	96.0	57	9.02	n	1	24.16	e	98.0	3.1								SOW Acoustic; SOL @20:24
Glomar Supporter	31/07/2023	p	David Melendez	21:45	22:23	f	57	9.02	n	1	24.16	e	98.0	57	9.65	n	1	27.70	e	92.0	3.3								Break for supper
Glomar Supporter	31/07/2023	p	David Melendez	23:14	23:33	f	57	10.48	n	1	32.55	e	98.0	57	10.79	n	1	34.35	e	98.0	3.1								
Glomar Supporter	31/07/2023	p	David Melendez	23:33	23:53	n	57	10.79	n	1	34.35	e	98.0	57	11.47	n	1	34.12	e	98.0	3.1								SBP & UHR OFF
Glomar Supporter	31/07/2023	p	David Melendez	23:53	24:00	s	57	11.47	n	1	34.12	e	98.0	57	11.59	n	1	33.21	e	98.0	3.9								
Glomar Supporter	01/08/2023	p	David Melendez	00:00	00:32	s	57	11.59	n	1	33.21	e	98.0	57	11.53	n	1	33.39	e	99.0	3.5								Midnight UTC
Glomar Supporter	01/08/2023	p	David Melendez	00:32	00:52	f	57	11.53	n	1	33.39	e	99.0	57	11.29	n	1	31.99	e	100.0	3.8								SOL @00:35
Glomar Supporter	01/08/2023	p	David Melendez	00:52	01:52	n	57	11.29	n	1	31.99	e	100.0	57	11.63	n	1	26.34	e	101.0	4.2								Line aborted, SBP & UHR OFF
Glomar Supporter	01/08/2023	p	David Melendez	01:52	02:04	n	57	11.63	n	1	26.34	e	101.0	57	11.11	n	1	26.64	e	100.0	3.2								
Glomar Supporter	01/08/2023	p	David Melendez	02:03	02:24	s	57	11.11	n	1	26.64	e	100.0	57	10.70	n	1	27.87	e	99.5	3.0								SS SBP & UHR
Glomar Supporter	01/08/2023	p	David Melendez	02:24	03:12	f	57	10.70	n	1	27.87	e	99.5	57	11.52	n	1	32.53	e	99.0	3.3								FP SBP & UHR
Glomar Supporter	01/08/2023	p	David Melendez	03:12	03:25	n	57	11.52	n	1	32.53	e	99.0	57	11.78	n	1	33.56	e	90.5	3.1								SBP & UHR OFF
Glomar Supporter	01/08/2023	p	David Melendez	03:25	03:45	s	57	11.78	n	1	33.56	e	90.5	57	11.78	n	1	32.66	e	90.0	4.0								SS SBP & UHR; EOW Acoustic @03:39
Glomar Supporter	01/08/2023	v	David Melendez	03:45	04:19	f	57	11.49	n	1	30.99	e	92.8	57	11.13	n	1	28.63	e	89.4	2.8	ne	3	c	o	g	n	n	SOW Visual
Glomar Supporter	01/08/2023	v	David Melendez	04:19	04:38	r	57	11.13	n	1	28.63	e	89.4	57	11.51	n	1	29.63	e	92.9	2.9	ne	3	c	o	g	n	n	EOL Mitigation
Glomar Supporter	01/08/2023	v	David Melendez	04:38	05:01	f	57	11.51	n	1	29.63	e	92.9	57	11.90	n	1	31.90	e	92.0	3.3	ne	3	c	o	g	wf	n	FP; UHR & SBP
Glomar Supporter	01/08/2023	v	Ossie Stewart	05:01	05:28	r	57	11.90	n	1	31.90	e	92.0	57	12.04	n	1	31.26	e	93.0	3.3	ne	4	c	o	g	wf	n	EOL; RP LT
Glomar Supporter	01/08/2023	v	Ossie Stewart	05:28	06:28	f	57	12.04	n	1	31.26	e	93.0	57	8.73	n	1	33.21	e	91.0	3.3	ne	4	c	o	g	sb	n	FP; UHR & SBP
Glomar Supporter	01/08/2023	v	Ossie Stewart	06:28	07:28	f	57	8.73	n	1	33.21	e	91.0	57	5.61	n	1	35.03	e	91.2	3.4	ne	4	c	o	g	sf	n	
Glomar Supporter	01/08/2023	v	Ossie Stewart	07:28	08:04	f	57	5.61	n	1	35.03	e	91.2	57	3.63	n	1	36.19	e	92.0	3.3	ne	5	c	o	g	sf	n	
Glomar Supporter	01/08/2023	v	Ossie Stewart	08:04	09:04	n	57	3.63	n	1	36.19	e	92.0	57	59.42	n	1	38.92	e	91.3	3.4	ne	5	c	o	g	sf	n	EOL; All off troubleshooting winch
Glomar Supporter	01/08/2023	v	Ossie Stewart	09:04	09:53	n	57	59.42	n	1	38.92	e	91.3	56	58.13	n	1	41.57	e	90.4	4.7	ne	5	c	o	g	sf	n	
Glomar Supporter	01/08/2023	v	Ossie Stewart	10:43	11:13	n	57	1.08	n	1	38.61	e	91.0	57	1.53	n	1	35.30	e	93.6	3.3	ne	4	c	o	g	sb	n	
Glomar Supporter	01/08/2023	v	Ossie Stewart	11:13	11:34	s	57	1.53	n	1	35.30	e	93.6	57	2.64	n	1	32.71	e	93.2	3.7	ne	4	c	o	g	sb	n	SS; UHR & SBP
Glomar Supporter	01/08/2023	v	Ossie Stewart	11:34	12:00	f	57	2.64	n	1	32.71	e	93.2	57	4.11	n	1	33.84	e	93.0	3.3	ne	4	c	o	g	vb	n	FP; UHR & SBP
Glomar Supporter	01/08/2023	v	Ossie Stewart	12:00	13:04	n	57	4.11	n	1	33.84	e	93.0	57	6.52	n	1	31.29	e	93.7	3.5	ne	4	c	o	g	sb	n	All off to troubleshoot UHR
Glomar Supporter	01/08/2023	v	Ossie Stewart	13:04	14:00	n	57	6.52	n	1	31.29	e	93.7	57	2.86	n	1	33.21	e	92.1	4.3	ne	3	s	o	g	sf	n	
Glomar Supporter	01/08/2023	v	Ossie Stewart	14:00	14:20	s	57	2.86	n	1	33.21	e	92.1	57	2.62	n	1	34.68	e	93.0	3.9	ne	3	s	o	g	sf	n	SS UHR & SBP
Glomar Supporter	01/08/2023	v	Ossie Stewart	14:20	15:20	f	57	2.62	n	1	34.68	e	93.0	57	5.99	n	1	32.77	e	93.0	4.1	ne	3	s	o	g	sb	n	FP; UHR & SBP
Glomar Supporter	01/08/2023	v	Ossie Stewart	15:20	16:20	f	57	5.99	n	1	32.77	e	93.0	57	9.35	n	1	30.75	e	91.5	3.5	ne	3	s	o	g	sb	n	
Glomar Supporter	01/08/2023	v	Ossie Stewart	16:20	17:09	f	57	9.35	n	1	30.75	e	91.5	57	12.11	n	1	29.17	e	92.7	3.4	ne	3	s	o	g	sf	n	
Glomar Supporter	01/08/2023	v	David Melendez	17:09	17:38	f	57	12.11	n	1	29.17	e	92.7	57	13.63	n	1	28.28	e	92.5	3.6	n	2	s	o	g	sf	n	
Glomar Supporter	01/08/2023	v	David Melendez	17:38	18:30	n	57	13.63	n	1	28.28	e	92.5	57	16.51	n	1	26.49	e	91.5	3.6	n	2	s	o	g	sf	n	EOL; SBP & UHR OFF
Glomar Supporter	01/08/2023	v	David Melendez	18:30	18:53	n	57	16.51	n	1	26.49	e	91.5	57	16.20	n	1	24.76	e	92.8	3.0	n	2	s	o	g	sf	n	
Glomar Supporter	01/08/2023	v	David Melendez	18:53	19:13	s	57	16.20	n	1	24.76	e	92.8	57	15.19	n	1	25.27	e	91.3	3.0	ne	2	s	o	g	sb	n	SS

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	01/08/2023	v	David Melendez	19:13	20:21	f	57	15.19	n	1	25.27	e	91.3	57	11.51	n	1	27.43	e	91.8	3.3	ne	3	s	o	g	sb	n	FP SBP & UHR; SOL @19:20; EOW Visual
Glomar Supporter	01/08/2023	p	David Melendez	20:51	21:13	r	57	9.89	n	1	28.39	e	97.0	57	10.55	n	1	29.03	e	95.5	3.6								SOW Acoustic
Glomar Supporter	01/08/2023	p	David Melendez	21:13	21:25	n	57	10.55	n	1	29.03	e	95.5	57	11.14	n	1	28.87	e	95.0	3.7								EOL; SBP & UHR OFF
Glomar Supporter	01/08/2023	p	David Melendez	21:25	21:45	s	57	11.14	n	1	28.87	e	95.0	57	11.13	n	1	27.64	e	98.0	3.4								SS
Glomar Supporter	01/08/2023	p	David Melendez	21:45	22:33	f	57	11.13	n	1	27.64	e	98.0	57	8.48	n	1	29.21	e	92.0	3.7								FP SBP & UHR; SOL @21:48; Break for supper @22:33
Glomar Supporter	01/08/2023	p	David Melendez	23:00	24:00	f	57	6.91	n	1	30.13	e	99.0	57	3.49	n	1	32.14	e	99.5	3.5								EOL @23:59 because software malfunction UHR & SBP ON
Glomar Supporter	02/08/2023	p	David Melendez	00:00	00:18	f	57	3.49	n	1	32.14	e	99.5	57	2.49	n	1	32.77	e	99.3	3.6								Midnight UTC
Glomar Supporter	02/08/2023	p	David Melendez	00:18	01:16	n	57	2.49	n	1	32.77	e	99.3	57	0.98	n	1	27.04	e	104.0	3.6								SBP & UHR OFF
Glomar Supporter	02/08/2023	p	David Melendez	01:16	01:36	s	57	0.98	n	1	27.04	e	104.0	57	1.05	n	1	25.12	e	104.0	3.9								SS
Glomar Supporter	02/08/2023	p	David Melendez	01:36	02:36	f	57	1.05	n	1	25.12	e	104.0	57	3.90	n	1	23.58	e	102.0	2.6								FP SBP & UHR; SOL @01:45
Glomar Supporter	02/08/2023	p	David Melendez	02:36	03:20	f	57	3.90	n	1	23.58	e	102.0	57	6.23	n	1	22.20	e	98.0	3.2								
Glomar Supporter	02/08/2023	v	David Melendez	03:20	03:49	n	57	6.23	n	1	22.20	e	98.0	57	6.23	n	1	23.00	e	101.0	2.7								Line Aborted SBP & UHR OFF; SS @03:49; EOW Acoustic
Glomar Supporter	02/08/2023	v	David Melendez	04:08	04:10	s	57	5.15	n	1	23.61	e	94.6	57	5.37	n	1	22.71	e	93.8	3.2	se	2	s	o	g	n	n	SOW Visual
Glomar Supporter	02/08/2023	v	David Melendez	04:10	05:11	f	57	5.37	n	1	22.71	e	93.8	57	7.86	n	1	21.24	e	92.0	3.2	se	2	s	o	g	n	n	SOL @04:25
Glomar Supporter	02/08/2023	v	Ossie Stewart	05:11	06:16	f	57	7.86	n	1	21.24	e	92.0	57	11.16	n	1	19.29	e	90.0	3.3	se	2	s	o	g	n	n	
Glomar Supporter	02/08/2023	v	Ossie Stewart	06:16	06:30	f	57	11.16	n	1	19.29	e	90.0	57	11.89	n	1	18.84	e	90.0	3.3	se	3	s	o	g	sb	n	
Glomar Supporter	02/08/2023	v	Ossie Stewart	06:30	06:52	n	57	11.89	n	1	18.84	e	90.0	57	13.19	n	1	18.80	e	86.4	3.4	se	3	s	o	g	sb	n	EOL all off
Glomar Supporter	02/08/2023	v	Ossie Stewart	06:52	07:13	s	57	13.19	n	1	18.80	e	86.4	57	13.41	n	1	20.08	e	89.0	3.4	e	4	c	o	g	sf	n	SS
Glomar Supporter	02/08/2023	v	Ossie Stewart	07:13	08:10	f	57	13.41	n	1	20.08	e	89.0	57	10.32	n	1	21.87	e	92.0	3.3	e	5	c	o	g	sf	n	FP, online SOL @07:14
Glomar Supporter	02/08/2023	v	Ossie Stewart	08:10	09:11	f	57	10.32	n	1	21.87	e	92.0	57	7.04	n	1	23.78	e	93.0	3.4	e	5	c	o	g	sf	n	
Glomar Supporter	02/08/2023	v	Ossie Stewart	09:11	09:53	f	57	7.04	n	1	23.78	e	93.0	57	4.81	n	1	25.11	e	94.2	3.4	ne	5	c	o	g	sf	n	log off for meeting
Glomar Supporter	02/08/2023	v	Harley Bailey	10:10	10:42	f	57	3.75	n	1	25.76	e	95.0	57	2.18	n	1	26.65	e	95.5	3.4	ne	5	c	o	g	sf	n	
Glomar Supporter	02/08/2023	v	Ossie Stewart	10:42	10:55	f	57	2.18	n	1	26.65	e	95.5	57	1.50	n	1	27.08	e	95.0	3.4	ne	5	c	o	g	vf	n	
Glomar Supporter	02/08/2023	v	Ossie Stewart	10:55	12:03	n	57	1.50	n	1	27.08	e	95.0	57	1.01	n	1	20.73	e	97.2	3.4	ne	5	c	o	g	n	n	EOL all off
Glomar Supporter	02/08/2023	v	Ossie Stewart	12:03	12:25	s	57	1.01	n	1	20.73	e	97.2	57	1.28	n	1	19.13	e	94.5	3.3	ne	5	c	o	g	sb	n	SS
Glomar Supporter	02/08/2023	v	Ossie Stewart	12:25	13:51	f	57	1.28	n	1	19.13	e	94.5	57	2.83	n	1	27.64	e	96.0	3.5	ne	6	c	o	g	sb	n	FP, SOL 12:36
Glomar Supporter	02/08/2023	v	Ossie Stewart	13:51	14:50	f	57	2.83	n	1	27.64	e	96.0	57	3.86	n	1	33.66	e	94.4	3.5	e	5	c	o	g	vb	n	
Glomar Supporter	02/08/2023	v	Ossie Stewart	14:50	15:19	f	57	3.86	n	1	33.66	e	94.4	57	4.75	n	1	37.16	e	94.0	3.4	ne	5	c	o	g	sb	n	
Glomar Supporter	02/08/2023	v	Ossie Stewart	15:19	16:25	n	57	4.75	n	1	37.16	e	94.0	57	4.84	n	1	38.18	e	91.5	3.3	e	5	c	o	g	vb	n	EOL, all off
Glomar Supporter	02/08/2023	v	Ossie Stewart	16:25	16:48	s	57	4.84	n	1	38.18	e	91.5	57	3.71	n	1	37.07	e	92.4	4.0	ne	4	c	o	g	n	n	SS
Glomar Supporter	02/08/2023	v	David Melendez	16:48	17:08	f	57	3.71	n	1	37.07	e	92.4	57	13.25	n	1	35.04	e	93.9	4.0	ne	4	c	o	g	vf	n	FP, SOL 17:01
Glomar Supporter	02/08/2023	v	David Melendez	17:08	18:00	f	57	13.25	n	1	35.04	e	93.9	57	2.94	n	1	30.12	e	92.9	3.1	ne	4	c	o	g	vf	n	
Glomar Supporter	02/08/2023	v	David Melendez	18:00	19:00	f	57	2.94	n	1	30.12	e	92.9	57	1.45	n	1	24.50	e	95.2	3.3	n	4	c	o	g	sf	n	
Glomar Supporter	02/08/2023	v	David Melendez	19:00	19:12	f	57	1.45	n	1	24.50	e	95.2	57	1.32	n	1	23.67	e	96.3	3.1	n	5	c	o	g	n	n	
Glomar Supporter	02/08/2023	v	David Melendez	19:12	20:07	n	57	1.32	n	1	23.67	e	96.3	57	0.91	n	1	17.58	e	91.1	3.1	n	5	c	o	g	n	n	EOL all OFF

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	02/08/2023	v	David Melendez	20:07	20:30	s	57	0.91	n	1	17.58	e	91.1	57	1.50	n	1	18.74	e	91.3	3.4	n	4	c	o	g	n	n	FP @20:30; SOL @20:36; EOW Visual
Glomar Supporter	02/08/2023	p	David Melendez	20:54	21:54	f	57	2.07	n	1	24.49	e	98.0	57	3.14	n	1	27.95	e	94.0	3.7								SOW Acoustic
Glomar Supporter	02/08/2023	p	David Melendez	21:54	22:27	f	57	3.14	n	1	27.95	e	94.0	57	3.66	n	1	38.36	e	94.0	3.2								Break for supper
Glomar Supporter	02/08/2023	p	David Melendez	23:00	23:28	f	57	4.04	n	1	33.04	e	96.0	57	4.71	n	1	36.82	e	98.0	3.3								
Glomar Supporter	02/08/2023	p	David Melendez	23:29	23:48	r	57	4.71	n	1	36.82	e	98.0	57	4.07	n	1	36.70	e	98.3	3.4								EOL; RP line turn
Glomar Supporter	02/08/2023	p	David Melendez	23:48	24:48	f	57	4.07	n	1	36.70	e	98.3	57	3.03	n	1	30.45	e	100.0	3.4								FP
Glomar Supporter	03/08/2023	p	David Melendez	00:48	01:48	f	57	3.03	n	1	30.45	e	100.0	57	1.84	n	1	23.53	e	105.0	3.4								
Glomar Supporter	03/08/2023	p	David Melendez	01:48	02:22	f	57	1.84	n	1	23.53	e	105.0	57	1.33	n	1	20.76	e	104.0	3.5								
Glomar Supporter	03/08/2023	p	David Melendez	02:22	03:00	r	57	1.33	n	1	20.76	e	104.0	57	1.66	n	1	17.67	e	93.0	3.4								EOL; Sparker on mitigation
Glomar Supporter	03/08/2023	p	David Melendez	03:00	03:50	f	57	1.66	n	1	17.67	e	93.0	57	2.53	n	1	22.71	e	101.0	3.1								FP; EOW Acoustic
Glomar Supporter	03/08/2023	v	David Melendez	04:06	05:06	f	57	2.79	n	1	24.21	e	97.0	57	3.83	n	1	30.32	e	93.6	3.4	n	5	c	o	g	n	n	SOW Visual
Glomar Supporter	03/08/2023	v	Ossie Stewart	05:06	06:09	f	57	3.83	n	1	30.32	e	93.6	57	4.90	n	1	36.62	e	90.7	3.4	n	5	c	o	g	n	n	
Glomar Supporter	03/08/2023	v	Ossie Stewart	06:09	06:15	f	57	4.90	n	1	36.62	e	90.7	57	5.02	n	1	37.17	e	90.4	3.4	n	5	c	o	g	n	n	
Glomar Supporter	03/08/2023	v	Ossie Stewart	06:15	06:31	r	57	5.02	n	1	37.17	e	90.4	57	5.24	n	1	36.79	e	90.2	3.4	n	5	c	o	g	n	n	EOL, RP line turn
Glomar Supporter	03/08/2023	v	Ossie Stewart	06:31	07:36	f	57	5.24	n	1	36.79	e	90.2	57	4.14	n	1	30.55	e	92.5	3.3	n	5	c	o	g	n	n	SOL, FP
Glomar Supporter	03/08/2023	v	Ossie Stewart	07:36	08:30	f	57	4.14	n	1	30.55	e	92.5	57	3.26	n	1	25.50	e	93.7	3.2	n	5	c	o	g	n	n	
Glomar Supporter	03/08/2023	v	Ossie Stewart	08:30	09:00	f	57	3.26	n	1	25.50	e	93.7	57	2.61	n	1	21.76	e	91.0	3.3	n	5	c	o	g	n	n	
Glomar Supporter	03/08/2023	v	Ossie Stewart	09:00	09:25	f	57	2.61	n	1	21.76	e	91.0	57	2.32	n	1	20.07	e	95.7	3.4	n	5	c	o	m	n	m	weather change - rain and reduced vis
Glomar Supporter	03/08/2023	v	Ossie Stewart	09:25	09:50	f	57	2.32	n	1	20.07	e	95.7	57	1.99	n	1	17.99	e	88.7	3.3	n	5	c	o	g	n	n	Squall cleared, Loss of steering power off, recover UHR due to weather
Glomar Supporter	03/08/2023	v	Ossie Stewart	10:38	11:51	n	57	1.06	n	1	17.90	e	81.8	57	1.08	n	1	21.73	e	96.0	3.4	n	5	c	o	g	vf	l	
Glomar Supporter	03/08/2023	v	Ossie Stewart	11:51	12:12	s	57	1.08	n	1	21.73	e	96.0	57	1.31	n	1	22.81	e	91.2	3.9	n	5	c	o	g	n	m	SS SBP only
Glomar Supporter	03/08/2023	v	Ossie Stewart	12:12	13:12	r	57	1.31	n	1	22.81	e	91.2	57	2.56	n	1	30.09	e	93.6	3.9	n	5	c	o	g	n	m	RP online SBP only
Glomar Supporter	03/08/2023	v	Ossie Stewart	13:12	14:05	r	57	2.56	n	1	30.09	e	93.6	57	3.61	n	1	36.09	e	92.2	3.9	n	5	c	o	g	vb	n	
Glomar Supporter	03/08/2023	v	Ossie Stewart	14:05	14:29	r	57	3.61	n	1	36.09	e	92.2	57	3.47	n	1	35.60	e	94.1	4.2	n	5	c	o	g	vb	n	EOL, LT SBP only
Glomar Supporter	03/08/2023	v	Ossie Stewart	14:29	15:17	r	57	3.47	n	1	35.60	e	94.1	57	2.50	n	1	30.10	e	94.0	4.0	n	5	c	o	g	n	n	SOL, SBP only
Glomar Supporter	03/08/2023	v	Ossie Stewart	15:17	16:17	r	57	2.50	n	1	30.10	e	94.0	57	1.26	n	1	23.13	e	97.5	4.0	n	6	c	o	g	wf	l	
Glomar Supporter	03/08/2023	v	Ossie Stewart	16:17	16:36	r	57	1.26	n	1	23.13	e	97.5	57	1.45	n	1	22.69	e	97.1	4.2	n	6	c	o	g	n	n	EOL, SBP only,
Glomar Supporter	03/08/2023	v	Ossie Stewart	16:36	17:14	r	57	1.45	n	1	22.69	e	97.1	57	2.19	n	1	26.97	e	96.7	4.2	n	6	c	o	g	n	n	SOL, SBP only
Glomar Supporter	03/08/2023	v	David Melendez	17:14	18:00	r	57	2.19	n	1	26.97	e	96.7	57	3.15	n	1	32.67	e	92.0	4.0	n	6	c	o	g	n	n	
Glomar Supporter	03/08/2023	v	David Melendez	18:00	18:34	r	57	3.15	n	1	32.67	e	92.0	57	3.83	n	1	36.49	e	91.2	3.9	n	6	c	o	g	n	n	
Glomar Supporter	03/08/2023	v	David Melendez	18:34	18:55	r	57	3.83	n	1	36.49	e	91.2	57	3.80	n	1	35.71	e	92.2	4.2	nw	6	c	o	g	n	n	EOL
Glomar Supporter	03/08/2023	v	David Melendez	18:55	19:57	r	57	3.80	n	1	35.71	e	92.2	57	2.44	n	1	27.82	e	93.7	4.0	nw	6	c	o	g	n	n	SOL, SBP only; EOL @19:57; survey stopped for weather
Glomar Supporter	04/08/2023	v	David Melendez	04:02	05:02	n	57	2.55	n	1	27.17	e	96.2	57	2.56	n	1	27.35	e	96.2	0.6	n	6	c	o	g	n	n	WOW
Glomar Supporter	04/08/2023	v	Ossie Stewart	05:02	06:08	n	57	2.56	n	1	27.35	e	96.2	57	2.65	n	1	27.27	e	96.2	0.3	n	6	r	o	g	n	l	WOW
Glomar Supporter	04/08/2023	v	Ossie Stewart	06:08	07:00	n	57	2.65	n	1	27.27	e	96.2	57	2.82	n	1	27.29	e	96.4	0.8	nw	6	r	o	g	vb	n	WOW
Glomar Supporter	04/08/2023	v	Ossie Stewart	07:00	08:00	n	57	2.82	n	1	27.29	e	96.4	57	3.47	n	1	26.37	e	95.4	0.8	nw	6	r	o	g	n	m	WOW
Glomar Supporter	04/08/2023	v	Ossie Stewart	08:00	09:08	n	57	3.47	n	1	26.37	e	95.4	57	3.62	n	1	26.39	e	94.2	0.3	nw	6	r	o	m	n	m	WOW

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	04/08/2023	v	Ossie Stewart	09:08	09:55	n	57	3.62	n	1	26.39	e	94.2	57	4.82	n	1	25.52	e	94.3	0.3	nw	6	r	o	g	n	n	WOW
Glomar Supporter	04/08/2023	v	Ossie Stewart	10:50	11:50	n	57	5.31	n	1	25.83	e	94.2	57	5.51	n	1	25.97	e	92.4	0.1	nw	5	r	o	g	n	n	WOW
Glomar Supporter	04/08/2023	v	Ossie Stewart	11:50	12:50	n	57	5.51	n	1	25.97	e	92.4	57	5.71	n	1	26.45	e	92.3	0.2	nw	6	r	o	g	n	n	WOW
Glomar Supporter	04/08/2023	v	Ossie Stewart	12:50	13:50	n	57	5.71	n	1	26.45	e	92.3	57	5.76	n	1	26.56	e	93.5	0.4	nw	6	r	o	g	n	n	WOW
Glomar Supporter	04/08/2023	v	Ossie Stewart	13:50	14:50	n	57	5.76	n	1	26.56	e	93.5	57	5.67	n	1	26.34	e	94.0	0.2	nw	5	r	o	g	n	n	WOW
Glomar Supporter	04/08/2023	v	Ossie Stewart	14:50	15:50	n	57	5.67	n	1	26.34	e	94.0	57	5.57	n	1	26.08	e	93.5	0.2	nw	5	r	o	g	n	n	WOW
Glomar Supporter	04/08/2023	v	Ossie Stewart	15:50	17:00	n	57	5.57	n	1	26.08	e	93.5	57	5.58	n	1	26.13	e	93.5	0.1	nw	5	r	o	g	n	n	WOW
Glomar Supporter	04/08/2023	v	David Melendez	17:00	18:00	n	57	5.58	n	1	26.13	e	93.5	57	5.59	n	1	26.14	e	92.9	0.2	nw	5	c	o	g	n	n	WOW
Glomar Supporter	04/08/2023	v	David Melendez	18:00	19:00	n	57	5.59	n	1	26.14	e	92.9	57	5.72	n	1	26.54	e	93.5	0.1	nw	5	c	o	g	sf	n	WOW
Glomar Supporter	04/08/2023	v	David Melendez	19:00	20:11	n	57	5.72	n	1	26.54	e	93.5	57	5.87	n	1	27.02	e	90.5	0.8	nw	5	c	o	m	n	n	WOW
Glomar Supporter	05/08/2023	v	Ossie Stewart	05:00	06:12	n	57	4.34	n	1	24.30	e	95.0	57	4.21	n	1	23.93	e	95.5	0.3	nw	4	s	m	g	sb	n	WOW
Glomar Supporter	05/08/2023	v	Ossie Stewart	06:12	07:19	n	57	4.21	n	1	23.93	e	95.5	57	4.22	n	1	24.03	e	95.5	0.1	n	3	s	m	g	sb	n	WOW
Glomar Supporter	05/08/2023	v	Ossie Stewart	07:19	08:12	n	57	4.22	n	1	24.03	e	95.5	57	1.58	n	1	22.41	e	95.0	0.3	n	3	s	m	g	vb	n	WOW
Glomar Supporter	05/08/2023	v	Ossie Stewart	08:12	09:12	n	57	1.58	n	1	22.41	e	95.0	57	2.20	n	1	22.20	e	95.0	8.5	n	3	s	o	g	vf	n	transiting to beginning of SBP lines in array area
Glomar Supporter	05/08/2023	v	Ossie Stewart	09:12	09:32	n	57	2.20	n	1	22.20	e	95.0	57	1.75	n	1	19.67	e	96.3	3.5	n	4	s	o	g	sb	n	Deploying SSS
Glomar Supporter	05/08/2023	v	Ossie Stewart	09:32	09:52	s	57	1.75	n	1	19.67	e	96.3	57	1.20	n	1	17.58	e	80.0	3.5	n	3	s	o	g	sb	n	SS SBP only - log off after SS for meeting/lunch
Glomar Supporter	05/08/2023	v	Ossie Stewart	10:37	11:44	r	57	1.94	n	1	23.49	e	96.0	57	3.22	n	1	30.76	e	93.2	4.0	ne	3	s	o	g	n	n	SBP only
Glomar Supporter	05/08/2023	v	Ossie Stewart	11:44	12:34	r	57	3.22	n	1	30.76	e	93.2	57	4.29	n	1	37.03	e	91.0	4.0	n	3	s	o	g	sf	n	
Glomar Supporter	05/08/2023	v	Ossie Stewart	12:34	12:55	r	57	4.29	n	1	37.03	e	91.0	57	4.17	n	1	34.78	e	94.0	4.0	ne	3	s	o	g	sf	n	SBP LT
Glomar Supporter	05/08/2023	v	Ossie Stewart	12:55	13:55	r	57	4.17	n	1	34.78	e	94.0	57	3.26	n	1	29.44	e	94.1	4.2	n	4	c	o	g	n	n	SOL SBP only
Glomar Supporter	05/08/2023	v	Ossie Stewart	13:55	14:55	r	57	3.26	n	1	29.44	e	94.1	57	1.98	n	1	22.10	e	95.7	3.8	n	4	c	o	g	vf	n	
Glomar Supporter	05/08/2023	v	Ossie Stewart	14:55	15:25	r	57	1.98	n	1	22.10	e	95.7	57	1.41	n	1	18.72	e	90.1	3.8	n	4	c	o	g	sf	n	
Glomar Supporter	05/08/2023	v	Ossie Stewart	15:25	15:29	r	57	1.41	n	1	18.72	e	90.1	57	1.33	n	1	18.24	e	88.6	4.0	n	4	c	o	g	sf	n	EOL SBP only
Glomar Supporter	05/08/2023	v	Ossie Stewart	15:29	16:29	n	57	1.33	n	1	18.24	e	88.6	57	5.05	n	1	16.64	e	89.0	4.0	n	4	c	o	g	n	l	All off to trouble shoot winch
Glomar Supporter	05/08/2023	v	Ossie Stewart	16:29	16:41	n	57	5.05	n	1	16.64	e	89.0	57	4.24	n	1	16.74	e	89.5	4.5	n	4	c	o	g	n	n	transit to test site
Glomar Supporter	05/08/2023	v	Ossie Stewart	16:41	17:02	s	57	4.24	n	1	16.74	e	89.5	57	2.83	n	1	17.40	e	90.9	4.3	e	4	c	o	g	n	n	SS SBP TEST
Glomar Supporter	05/08/2023	v	David Melendez	17:02	18:03	r	57	2.83	n	1	17.40	e	90.9	57	2.79	n	1	18.04	e	92.0	4.3	e	5	c	o	g	n	n	
Glomar Supporter	05/08/2023	v	David Melendez	18:03	18:28	r	57	2.79	n	1	18.04	e	92.0	57	2.92	n	1	17.86	e	91.0	4.3	e	5	c	o	g	n	n	
Glomar Supporter	05/08/2023	v	David Melendez	18:28	19:38	n	57	2.92	n	1	17.86	e	91.0	57	6.06	n	1	26.26	e	91.4	4.6	n	5	c	o	g	n	n	
Glomar Supporter	05/08/2023	v	David Melendez	19:38	19:58	s	57	6.06	n	1	26.26	e	91.4	57	7.16	n	1	26.24	e	93.2	5.4	n	5	c	o	g	wb	n	SS SBP
Glomar Supporter	05/08/2023	v	David Melendez	19:58	20:21	r	57	7.16	n	1	26.24	e	93.2	57	7.95	n	1	25.64	e	92.3	3.9	n	5	c	o	g	n	n	EOW Visual
Glomar Supporter	05/08/2023	p	David Melendez	20:33	21:33	r	57	9.25	n	1	24.51	e	96.8	57	12.66	n	1	21.05	e	95.0	3.7								SOW Acoustic
Glomar Supporter	05/08/2023	p	David Melendez	21:33	22:33	r	57	12.66	n	1	21.05	e	95.0	57	15.92	n	1	17.74	e	90.0	4.1								
Glomar Supporter	05/08/2023	p	David Melendez	22:33	22:53	r	57	15.92	n	1	17.74	e	90.0	57	16.10	n	1	17.36	e	92.0	3.4								Log off for supper
Glomar Supporter	05/08/2023	p	David Melendez	23:28	24:00	r	57	17.40	n	1	14.38	e	92.0	57	18.69	n	1	11.40	e	97.0	4.0								Back to watch
Glomar Supporter	06/08/2023	p	David Melendez	00:00	01:00	r	57	18.69	n	1	11.40	e	97.0	57	21.00	n	1	5.58	e	96.0	4.1								Midnight UTC
Glomar Supporter	06/08/2023	p	David Melendez	01:00	02:00	r	57	21.00	n	1	5.58	e	96.0	57	23.10	n	0	59.84	w	96.0	4.3								
Glomar Supporter	06/08/2023	p	David Melendez	02:00	02:52	r	57	23.10	n	0	59.84	e	96.0	57	25.31	n	0	53.87	w	96.0	4.1								
Glomar Supporter	06/08/2023	p	David Melendez	02:52	03:28	r	57	25.31	n	0	53.87	e	96.0	57	25.28	n	0	54.16	w	98.0	4.1								
Glomar Supporter	06/08/2023	p	David Melendez	03:28	04:04	r	57	25.28	n	0	54.16	e	98.0	57	24.04	n	0	49.83	w	98.0	4.7								EOW Acoustic
Glomar Supporter	06/08/2023	v	David Melendez	04:20	05:05	r	57	23.37	n	0	47.64	e	86.2	57	21.79	n	0	42.06	w	88.8	4.5	n	4	c	o	g	n	n	SOW Visual
Glomar Supporter	06/08/2023	v	Ossie Stewart	05:05	05:43	r	57	21.79	n	0	42.06	e	88.8	57	20.51	n	0	37.38	w	84.0	4.5	n	4	c	o	g	sb	n	
Glomar Supporter	06/08/2023	v	Ossie Stewart	05:43	06:13	r	57	20.51	n	0	37.38	e	84.0	57	20.75	n	0	38.80	w	84.5	4.4	n	4	c	o	g	vb	n	

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	06/08/2023	v	Ossie Stewart	06:13	07:24	r	57	20.75	n	0	38.80	e	84.5	57	22.20	n	0	30.04	w	88.5	4.7	n	5	c	o	g	vb	n	SOL SBP
Glomar Supporter	06/08/2023	v	Ossie Stewart	07:24	07:28	r	57	22.20	n	0	30.04	e	78.5	57	22.30	n	0	29.17	w	88.4	4.5	n	5	c	o	g	vb	n	
Glomar Supporter	06/08/2023	v	Ossie Stewart	07:28	08:04	r	57	22.30	n	0	29.17	e	88.4	57	21.80	n	0	31.07	w	77.5	4.5	n	5	c	o	g	vb	n	EOL SBP FP LT
Glomar Supporter	06/08/2023	v	Ossie Stewart	08:04	09:00	r	57	21.80	n	0	31.07	e	77.5	57	24.68	n	0	26.67	w	78.6	4.6	n	5	c	o	g	sb	n	SOL
Glomar Supporter	06/08/2023	v	Ossie Stewart	09:00	09:05	r	57	24.68	n	0	26.67	e	78.6	57	25.15	n	0	25.88	w	80.0	4.6	n	5	c	o	g	vb	n	
Glomar Supporter	06/08/2023	v	Ossie Stewart	09:05	09:54	n	57	25.15	n	0	25.88	e	80.0	57	25.58	n	0	25.48	w	80.0	3.0	n	5	c	o	g	sf	n	EOL, recovering SSS for SVP
Glomar Supporter	06/08/2023	v	Ossie Stewart	09:54	10:14	s	57	25.58	n	0	25.48	e	80.0	57	25.01	n	0	26.34	w	79.1	3.1	n	5	c	o	g	vf	n	
Glomar Supporter	06/08/2023	v	Ossie Stewart	10:14	11:24	r	57	25.01	n	0	26.34	e	79.1	57	21.37	n	0	31.92	w	77.0	3.8	n	4	c	o	g	sf	n	
Glomar Supporter	06/08/2023	v	Ossie Stewart	11:24	11:29	r	57	21.37	n	0	31.92	e	77.0	57	21.06	n	0	22.03	w	77.0	3.8	n	4	c	o	g	sf	n	EOL for SBP. SBP turned off before EOL to avoid being operational outside of the consent area
Glomar Supporter	06/08/2023	v	Ossie Stewart	11:29	11:32	n	57	21.06	n	0	22.03	e	77.0	57	21.14	n	0	32.17	w	76.0	3.5	n	4	c	o	g	sb	n	
Glomar Supporter	06/08/2023	v	Ossie Stewart	11:32	11:48	s	57	21.14	n	0	32.17	e	76.0	57	21.92	n	0	31.22	w	76.0	3.5	n	4	c	o	g	sb	n	SS SBP, SS short as automatically started, could have just started FP again as <10mins off
Glomar Supporter	06/08/2023	v	Ossie Stewart	11:32	12:44	f	57	21.92	n	0	31.22	e	76.0	57	24.82	n	0	26.77	w	78.4	4.2	n	5	c	o	g	wb	n	
Glomar Supporter	06/08/2023	v	Ossie Stewart	12:44	14:00	n	57	24.82	n	0	26.77	e	78.4	57	24.60	n	0	24.63	w	80.4	3.7	n	5	c	o	g	n	n	EOL SBP, next lines are SSS and MBES only
Glomar Supporter	06/08/2023	v	Ossie Stewart	14:00	15:00	n	57	24.60	n	0	24.63	e	80.4	57	25.84	n	0	19.84	w	76.0	3.8	n	5	c	o	g	n	n	
Glomar Supporter	06/08/2023	v	Ossie Stewart	15:00	16:05	n	57	25.84	n	0	19.84	e	76.0	57	25.62	n	0	19.11	w	76.0	3.8	n	6	c	o	g	n	n	
Glomar Supporter	06/08/2023	v	Ossie Stewart	16:05	17:37	n	57	25.62	n	0	19.11	e	76.0	57	27.48	n	0	15.53	w	77.5	3.9	n	5	c	o	g	n	n	
Glomar Supporter	06/08/2023	v	David Melendez	17:37	18:00	n	57	27.48	n	0	15.53	e	77.5	57	27.61	n	0	12.12	w	83.0	3.8	n	5	c	o	g	sf	n	
Glomar Supporter	06/08/2023	v	David Melendez	18:00	19:00	n	57	27.61	n	0	12.12	e	83.0	57	28.68	n	0	12.24	w	84.0	3.9	n	5	c	o	g	sf	n	
Glomar Supporter	06/08/2023	v	David Melendez	19:00	20:00	n	57	28.68	n	0	12.24	e	84.0	57	59.08	n	0	12.07	w	84.3	3.9	n	5	c	o	g	sf	n	
Glomar Supporter	06/08/2023	v	David Melendez	20:00	20:15	n	57	59.08	n	0	12.07	e	84.3	57	29.37	n	0	10.78	w	86.4	4.3	n	5	c	o	g	wf	n	EOW Visual
Glomar Supporter	06/08/2023	p	David Melendez	20:30	21:00	n	57	29.93	n	0	8.36	e	90.0	57	30.55	n	0	9.90	w	92.0	4.1								SOW Acoustic
Glomar Supporter	06/08/2023	p	David Melendez	21:00	21:20	s	57	30.55	n	0	9.90	e	92.0	57	29.84	n	0	9.93	w	93.0	4.4								SS for SBP
Glomar Supporter	06/08/2023	p	David Melendez	21:20	22:20	r	57	29.84	n	0	9.93	e	93.0	57	29.87	n	0	2.61	w	90.0	4.0								SBP only
Glomar Supporter	06/08/2023	p	David Melendez	22:20	22:36	r	57	29.87	n	0	2.61	e	90.0	57	3.02	n	0	0.65	w	92.0	3.8								Break for supper
Glomar Supporter	06/08/2023	p	David Melendez	23:07	24:00	r	57	30.27	n	0	2.78	e	85.0	57	30.70	n	0	8.94	w	90.0	3.8								Midnight UTC
Glomar Supporter	07/08/2023	p	David Melendez	00:00	01:00	r	57	30.70	n	0	8.94	e	90.0	57	30.91	n	0	16.11	w	89.0	3.7								
Glomar Supporter	07/08/2023	p	David Melendez	01:00	02:00	r	57	30.91	n	0	16.11	e	89.0	57	31.17	n	0	21.30	w	98.0	4.0								
Glomar Supporter	07/08/2023	p	David Melendez	02:00	03:00	r	57	31.17	n	0	21.30	e	98.0	57	31.01	n	0	24.22	w	110.0	3.9								
Glomar Supporter	07/08/2023	p	David Melendez	03:00	04:00	r	57	31.01	n	0	24.22	e	110.0	57	31.07	n	0	30.68	w	97.0	3.5								EOW Acoustic
Glomar Supporter	07/08/2023	v	David Melendez	04:18	05:07	r	57	31.08	n	0	32.52	e	97.0	57	31.11	n	0	37.77	w	97.0	3.5	n	3	s	o	g	n	n	SOW Visual
Glomar Supporter	07/08/2023	v	Ossie Stewart	05:07	06:08	r	57	31.11	n	0	37.77	e	97.0	57	31.18	n	0	44.62	w	89.0	3.5	w	3	s	o	g	n	n	
Glomar Supporter	07/08/2023	v	Ossie Stewart	06:08	06:40	r	57	31.18	n	0	44.62	e	89.0	57	31.11	n	0	43.33	w	91.4	3.5	w	3	s	o	g	n	n	EOL, broke off from line. SBP FP LT
Glomar Supporter	07/08/2023	v	Ossie Stewart	06:40	07:40	r	57	31.11	n	0	43.33	e	91.4	57	31.20	n	0	49.95	w	91.5	3.5	w	4	s	o	g	sb	n	SOL SBP only
Glomar Supporter	07/08/2023	v	Ossie Stewart	07:40	08:40	r	57	31.20	n	0	49.95	w	91.5	57	31.50	n	0	56.17	w	82.0	3.5	w	4	s	o	g	sb	n	
Glomar Supporter	07/08/2023	v	Ossie Stewart	08:40	09:49	r	57	31.50	n	0	56.17	w	82.0	57	31.95	n	0	5.36	w	91.9	3.9	w	4	s	o	g	sb	n	

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	07/08/2023	v	Ossie Stewart	09:49	10:39	n	57	31.95	n	0	5.36	w	91.9	57	32.54	n	0	5.25	w	95.5	3.5	nw	5	c	o	g	sb	n	EOL SBP, all off for SVP
Glomar Supporter	07/08/2023	v	Ossie Stewart	10:39	10:59	s	57	32.54	n	0	5.25	w	95.5	57	31.57	n	0	4.03	w	90.3	2.7	nw	4	c	o	g	sf	n	SS SBP
Glomar Supporter	07/08/2023	v	Ossie Stewart	10:59	11:44	r	57	31.57	n	0	4.03	w	90.3	57	33.90	n	0	5.60	w	91.2	4.1	nw	5	c	o	g	sb	n	SOL SBP
Glomar Supporter	07/08/2023	v	Ossie Stewart	11:44	12:12	n	57	33.90	n	0	5.60	w	91.2	57	33.12	n	0	5.23	w	96.0	4.0	nw	5	c	o	g	sb	n	EOL SBP, all off LT
Glomar Supporter	07/08/2023	v	Ossie Stewart	12:12	12:32	s	57	33.12	n	0	5.23	w	96.0	57	33.39	n	0	4.36	w	96.0	3.9	nw	4	c	o	g	sf	n	SS SBP
Glomar Supporter	07/08/2023	v	Ossie Stewart	12:32	13:30	r	57	33.39	n	0	4.36	w	96.0	57	34.01	n	0	11.26	w	101.0	4.5	nw	4	c	o	g	sf	n	SOL SBP
Glomar Supporter	07/08/2023	v	Ossie Stewart	13:30	14:30	r	57	34.01	n	0	11.26	w	101.0	57	34.72	n	0	18.16	w	93.5	4.2	nw	4	c	o	g	sf	n	
Glomar Supporter	07/08/2023	v	Ossie Stewart	14:30	15:24	r	57	34.72	n	0	18.16	w	93.5	57	35.37	n	0	25.61	w	86.4	3.5	n	5	c	o	g	sf	n	
Glomar Supporter	07/08/2023	v	Ossie Stewart	15:24	16:11	n	57	35.37	n	0	25.61	w	86.4	57	35.20	n	1	22.19	w	86.5	4.0	n	4	c	o	g	sf	n	
Glomar Supporter	07/08/2023	v	Ossie Stewart	16:11	16:31	s	57	35.20	n	1	22.19	w	86.5	57	34.97	n	1	20.52	w	86.3	3.5	n	3	s	o	g	sb	n	SS SBP
Glomar Supporter	07/08/2023	v	Ossie Stewart	16:31	17:00	r	57	34.97	n	1	20.52	w	86.3	57	34.60	n	1	16.40	w	94.0	4.0	n	3	s	o	g	sb	n	FP SBP
Glomar Supporter	07/08/2023	v	David Melendez	17:00	18:00	r	57	34.60	n	1	16.40	w	94.0	57	33.98	n	1	9.72	w	101.0	4.0	n	3	s	o	g	sb	n	
Glomar Supporter	07/08/2023	v	David Melendez	18:49	19:20	r	57	33.98	n	1	9.72	w	101.0	57	33.17	n	1	4.92	w	97.5	3.9	n	3	s	o	g	sb	n	EOL @18:49
Glomar Supporter	07/08/2023	v	David Melendez	19:20	19:45	r	57	33.17	n	1	4.92	w	97.5	57	30.96	n	1	3.43	w	89.3	4.3	w	3	s	o	g	sb	n	SOL @19:12, SBP Line; EOL @19:45
Glomar Supporter	07/08/2023	v	David Melendez	19:45	20:38	n	57	30.96	n	1	3.43	w	89.3	57	31.77	n	1	3.95	w	90.6	3.1	nw	3	s	o	g	n	n	SBP OFF @19:45; SS @20:38; EOW Visual
Glomar Supporter	07/08/2023	p	David Melendez	21:00	22:00	r	57	33.23	n	1	4.87	w	102.0	57	33.78	n	1	7.80	w	104.0	4.1								SOW Acoustic; SS @20:38 only SBP; EOL @21:10
Glomar Supporter	07/08/2023	p	David Melendez	22:00	22:30	r	57	33.78	n	1	7.80	w	104.0	57	34.10	n	1	11.40	w	104.0	4.2								Break for supper
Glomar Supporter	07/08/2023	p	David Melendez	22:51	24:00	r	57	34.39	n	1	14.27	w	102.0	57	33.83	n	1	5.56	w	89.0	4.1								
Glomar Supporter	08/08/2023	p	David Melendez	00:00	00:19	r	57	33.83	n	1	5.56	w	89.0	57	35.44	n	1	25.38	w	98.0	4.8								SBP OFF; Line continued with SSS
Glomar Supporter	08/08/2023	p	David Melendez	00:19	00:46	n	57	35.44	n	1	25.38	w	98.0	57	36.20	n	1	28.31	w	95.0	4.5								PAM Cable recovery, heading to port
Glomar Supporter	08/08/2023	v	David Melendez	03:55	04:55	n	57	34.25		1	19.46	w	83.4	57	33.34	n	1	17.14	w	98.0	3.1	nw	6	r	m	g	n	n	SOW Visual
Glomar Supporter	08/08/2023	v	Ossie Stewart	04:55	05:55	n	57	33.34	n	1	17.14	w	98.0	57	31.73	n	1	27.88	w	73.7	1.5	nw	7	r	m	g	n	n	Standing by for entry to Peterhead
Glomar Supporter	08/08/2023	v	Ossie Stewart	05:55	07:10	n	57	31.73	n	1	27.88	w	73.7	57	29.16	n	1	45.10	w	25.0	7.5	nw	7	r	m	g	vb	m	transit to Peterhead
Glomar Supporter	08/08/2023	v	Ossie Stewart	07:10	07:35	n	57	29.16	n	1	45.10	w	25.0	57	29.76	n	1	47.28	w	6.0	0.0	nw	5	s	l	g	vb	n	transit to Peterhead, alongside 07:35
Glomar Supporter	10/08/2023	v	David Melendez	04:10	05:10	n	57	29.87	n	1	46.51	w	16.4	57	26.39	n	1	33.79	w	20.0	9.0	s	1	g	o	g	n	n	Departing from Peterhead port
Glomar Supporter	10/08/2023	v	Ossie Stewart	05:10	06:15	n	57	26.39	n	1	33.79	w	20.0	57	24.83	n	1	14.14	w	91.5	9.0	se	3	s	o	g	n	n	Transit
Glomar Supporter	10/08/2023	v	Ossie Stewart	06:15	07:15	n	57	24.83	n	1	14.14	w	91.5	57	23.24	n	0	58.41	w	57.7	9.3	se	3	s	o	g	n	n	Transit
Glomar Supporter	10/08/2023	v	Ossie Stewart	07:15	08:30	n	57	23.24	n	0	58.41	w	57.7	57	21.41	n	0	36.42	w	61.0	9.5	se	3	s	o	g	n	n	Transit
Glomar Supporter	10/08/2023	v	Ossie Stewart	08:30	09:30	n	57	21.41	n	0	36.42	w	61.0	57	19.86	n	0	19.26	w	70.0	9.5	se	3	s	o	g	n	n	Transit
Glomar Supporter	10/08/2023	v	Ossie Stewart	09:30	09:55	n	57	19.86	n	0	19.26	w	70.0	57	19.23	n	0	11.85	w	70.2	9.2	se	3	s	o	g	n	n	log off for meeting/lunch
Glomar Supporter	10/08/2023	v	Ossie Stewart	10:45	11:20	n	57	18.02	n	0	1.92	e	86.6	57	17.19	n	0	11.17	e	83.3	9.0	se	3	s	o	g	n	n	Transit
Glomar Supporter	10/08/2023	v	Jessica Riggs	11:20	12:20	n	57	17.19	n	0	11.17	e	83.3	57	15.82	n	0	28.22	e	83.0	9.0	se	3	s	o	g	n	n	Transit
Glomar Supporter	10/08/2023	v	Jessica Riggs	12:20	13:20	n	57	15.82	n	0	28.22	e	83.0	57	14.47	n	0	44.78	e	84.5	9.0	se	2	s	o	g	n	n	Transit
Glomar Supporter	10/08/2023	v	Jessica Riggs	13:20	14:00	n	57	14.47	n	0	44.78	e	84.5	57	13.70	n	0	55.84	e	92.6	9.2	se	2	s	o	g	n	n	Transit

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	10/08/2023	v	Ossie Stewart	14:00	15:00	n	57	13.70	n	0	55.84	e	92.6	57	8.52	n	1	8.70	e	78.0	9.0	se	2	s	o	g	sf	n	Transit
Glomar Supporter	10/08/2023	v	Ossie Stewart	15:00	16:00	n	57	8.52	n	1	8.70	e	78.0	57	1.60	n	1	17.57	e	83.3	8.7	se	2	s	o	g	sf	n	Transit, arrived on site 15:55, TBT for deployment
Glomar Supporter	10/08/2023	v	Ossie Stewart	16:00	16:30	n	57	1.60	n	1	17.57	e	83.3	57	1.82	n	1	17.66	e	87.0	0.6	se	2	s	o	g	sf	n	Survey gear deployment
Glomar Supporter	10/08/2023	v	Jessica Riggs	16:30	17:00	n	57	1.82	n	1	17.66	e	87.0	57	2.19	n	1	17.49	e	87.5	1.3	se	2	s	o	g	sf	n	Survey gear deployment
Glomar Supporter	10/08/2023	v	David Melendez	17:00	18:10	n	57	2.19	n	1	17.49	e	87.5	57	2.90	n	1	16.87	e	86.6	2.4	sw	2	s	o	g	sf	n	
Glomar Supporter	10/08/2023	v	David Melendez	18:10	18:55	n	57	2.90	n	1	16.87	e	86.6	57	4.70	n	1	16.30	e	88.7	2.4	sw	2	s	o	g	sf	n	Survey gear recovered; VD #10
Glomar Supporter	10/08/2023	v	David Melendez	18:55	19:57	n	57	4.70	n	1	16.30	e	88.7	57	7.06	n	1	16.86	e	88.4	2.4	sw	2	s	o	g	sf	n	VD #11
Glomar Supporter	10/08/2023	v	Jessica Riggs	19:57	20:32	n	57	7.06	n	1	16.86	e	88.4	57	8.75	n	1	17.42	e	88.9	2.7	se	2	s	o	g	n	n	EOW Visual
Glomar Supporter	10/08/2023	p	David Melendez	20:32	21:30	n	57	8.75	n	1	17.42	e	88.9	57	6.86	n	1	17.16	e	98.0	2.8								SOW Acoustic
Glomar Supporter	10/08/2023	p	David Melendez	21:30	22:30	n	57	6.86	n	1	17.16	e	98.0	57	4.55	n	1	16.92	e	95.0	2.6								
Glomar Supporter	10/08/2023	p	Jessica Riggs	22:30	22:57	n	57	4.55	n	1	16.92	e	95.0	57	3.52	n	1	16.78	e	85.0	2.4								
Glomar Supporter	10/08/2023	p	David Melendez	22:57	24:00	n	57	3.52	n	1	16.78	e	85.0	57	3.70	n	1	16.85	e	96.0	2.4								
Glomar Supporter	11/08/2023	p	David Melendez	00:00	01:00	n	57	3.70	n	1	16.85	e	96.0	57	6.95	n	1	16.96	e	95.0	3.2								Midnight UTC
Glomar Supporter	11/08/2023	p	David Melendez	01:00	02:00	n	57	6.95	n	1	16.96	e	95.0	57	5.72	n	1	17.34	e	96.0	3.7								
Glomar Supporter	11/08/2023	p	David Melendez	02:00	03:00	n	57	5.72	n	1	17.34	e	96.0	57	3.44	n	1	17.72	e	96.0	2.8								
Glomar Supporter	11/08/2023	p	David Melendez	03:00	04:00	n	57	3.44	n	1	17.72	e	96.0	57	6.47	n	1	17.70	e	90.0	2.6								EOW Acoustic
Glomar Supporter	11/08/2023	v	David Melendez	04:14	05:04	n	57	7.52	n	1	17.62	e	91.0	57	6.96	n	1	17.90	e	91.6	4.0								SOW Visual
Glomar Supporter	11/08/2023	v	Ossie Stewart	05:04	06:07	n	57	6.96	n	1	17.90	e	91.6	57	4.17	n	1	18.54	e	92.0	0.6	se	6	c	o	g	n	n	USBL issues waiting for ETO to get up
Glomar Supporter	11/08/2023	v	Ossie Stewart	06:07	07:15	n	57	4.17	n	1	18.54	e	92.0	57	2.36	n	1	19.18	e	96.0	2.7	se	6	c	o	g	n	n	Troubleshooting USBL
Glomar Supporter	11/08/2023	v	Ossie Stewart	07:15	08:24	n	57	2.36	n	1	19.18	e	96.0	57	6.83	n	1	17.34	e	90.0	4.0	se	5	c	o	g	n	n	Troubleshooting USBL
Glomar Supporter	11/08/2023	v	Ossie Stewart	08:24	09:24	n	57	6.83	n	1	17.34	e	90.0	57	7.61	n	1	17.33	e	98.0	4.0	se	5	c	o	g	n	n	Troubleshooting USBL
Glomar Supporter	11/08/2023	v	Ossie Stewart	09:24	10:28	n	57	7.61	n	1	17.33	e	98.0	57	3.19	n	1	16.55	e	87.1	2.9	se	5	c	o	g	sf	n	Troubleshooting USBL
Glomar Supporter	11/08/2023	v	Ossie Stewart	10:28	11:00	n	57	3.19	n	1	16.55	e	87.1	57	1.89	n	1	16.42	e	86.0	4.0	se	5	c	o	g	sf	n	Transit for SVP
Glomar Supporter	11/08/2023	v	Jessica Riggs	11:00	12:00	n	57	1.89	n	1	16.42	e	86.0	57	2.78	n	1	16.61	e	89.3	0.8	se	5	c	o	g	sf	n	
Glomar Supporter	11/08/2023	v	Jessica Riggs	12:00	13:00	n	57	2.78	n	1	16.61	e	89.3	57	2.57	n	1	17.64	e	94.3	2.9	sw	5	c	o	g	n	n	
Glomar Supporter	11/08/2023	v	Jessica Riggs	13:00	13:49	n	57	2.57	n	1	17.64	e	94.3	57	0.98	n	1	17.52	e	86.0	2.6	sw	5	c	o	g	n	n	
Glomar Supporter	11/08/2023	v	Jessica Riggs	13:49	13:55	s	57	0.98	n	1	17.52	e	86.0	57	1.18	n	1	17.30	e	86.8	3.3	sw	4	c	o	g	n	n	SS UHR & SBP - aborted tech issues
Glomar Supporter	11/08/2023	v	Jessica Riggs	13:55	14:07	n	57	1.18	n	1	17.30	e	86.8	57	1.53	n	1	16.55	e	80.6	2.4	sw	4	c	o	g	n	n	
Glomar Supporter	11/08/2023	v	Ossie Stewart	14:07	14:28	s	57	1.53	n	1	16.55	e	80.6	57	2.09	n	1	17.08	e	84.2	2.7	sw	4	c	o	g	sb	n	SS UHR & SBP
Glomar Supporter	11/08/2023	v	Ossie Stewart	14:28	15:37	f	57	2.09	n	1	17.08	e	84.2	57	3.52	n	1	25.29	e	96.4	3.5	sw	4	c	o	g	sb	n	FP UHR & SBP
Glomar Supporter	11/08/2023	v	Ossie Stewart	15:37	16:30	f	57	3.52	n	1	25.29	e	96.4	57	4.57	n	1	31.36	e	92.9	4.0	sw	4	c	o	g	sb	n	Qinsy crash
Glomar Supporter	11/08/2023	v	Jessica Riggs	16:30	17:00	f	57	4.57	n	1	31.36	e	92.9	57	5.14	n	1	34.65	e	93.0	4.0	sw	4	c	o	g	sb	n	
Glomar Supporter	11/08/2023	v	David Melendez	17:00	17:17	f	57	5.14	n	1	34.65	e	93.0	57	5.52	n	1	36.80	e	90.6	4.1	sw	5	c	o	g	sb	n	
Glomar Supporter	11/08/2023	v	David Melendez	17:17	17:30	r	57	5.52	n	1	36.80	e	90.6	57	5.54	n	1	35.21	e	97.0	3.9	sw	5	c	o	g	sb	n	Sparker in Mitigation shot;
Glomar Supporter	11/08/2023	v	Jessica Riggs	17:30	17:42	r	57	5.54	n	1	35.21	e	97.0	57	5.76	n	1	36.46	e	96.0	4.1	sw	5	c	o	g	sb	n	
Glomar Supporter	11/08/2023	v	Jessica Riggs	17:42	18:42	f	57	5.76	n	1	36.46	e	96.0	57	4.50	n	1	29.18	e	98.8	4.1	sw	5	c	o	g	sb	n	
Glomar Supporter	11/08/2023	v	Jessica Riggs	18:42	19:42	f	57	4.50	n	1	29.18	e	98.8	57	3.38	n	1	22.80	e	100.0	3.8	sw	4	c	o	g	sf	n	

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	11/08/2023	v	Jessica Riggs	19:42	20:18	f	57	3.38	n	1	22.80	e	100.0	57	2.72	n	1	18.85	e	101.0	4.0	sw	4	c	o	g	n	n	EOW Visual
Glomar Supporter	11/08/2023	p	David Melendez	20:18	20:37	f	57	2.72	n	1	18.85	e	101.0	57	2.34	n	1	16.76	e	87.0	4.0								SOW Acoustic
Glomar Supporter	11/08/2023	p	David Melendez	20:37	20:58	r	57	2.34	n	1	16.76	e	87.0	57	2.22	n	1	16.21	e	87.0	3.9								EOL;
Glomar Supporter	11/08/2023	p	David Melendez	20:58	22:00	f	57	2.22	n	1	16.21	e	87.0	57	3.88	n	1	23.97	e	101.0	3.9								
Glomar Supporter	11/08/2023	p	David Melendez	22:00	23:00	f	57	3.88	n	1	23.97	e	101.0	57	5.11	n	1	31.05	e	98.0	4.0								
Glomar Supporter	11/08/2023	p	David Melendez	23:00	23:48	f	57	5.11	n	1	31.05	e	98.0	57	6.08	n	1	36.75	e	96.0	4.0								
Glomar Supporter	11/08/2023	p	David Melendez	23:48	24:00	r	57	6.08	n	1	36.75	e	96.0	57	6.40	n	1	37.52	e	95.0	3.8								EOL;
Glomar Supporter	12/08/2023	p	David Melendez	00:00	00:10	f	57	6.40	n	1	37.52	e	95.0	57	6.34	n	1	36.54	e	96.0	3.0								Midnight UTC
Glomar Supporter	12/08/2023	p	David Melendez	00:10	01:10	f	57	6.34	n	1	36.54	e	96.0	57	5.14	n	1	29.63	e	98.0	4.2								SOL
Glomar Supporter	12/08/2023	p	David Melendez	01:10	02:10	f	57	5.14	n	1	29.63	e	98.0	57	3.92	n	1	22.60	e	100.0	4.1								
Glomar Supporter	12/08/2023	p	David Melendez	02:10	03:06	f	57	3.92	n	1	22.60	e	100.0	57	2.82	n	1	16.35	e	86.0	3.7								
Glomar Supporter	12/08/2023	p	David Melendez	03:06	03:24	r	57	2.82	n	1	16.35	e	86.0	57	3.11	n	1	16.43	e	90.0	4.0								EOL; USBL ON
Glomar Supporter	12/08/2023	p	David Melendez	03:24	03:57	f	57	3.11	n	1	16.43	e	90.0	57	3.75	n	1	20.15	e	101.0	3.6								SOL; EOW Acoustic
Glomar Supporter	12/08/2023	v	David Melendez	04:15	05:00	f	57	4.07	n	1	21.96	e	95.0	57	5.01	n	1	27.35	e	93.0	3.6	se	4	s	o	g	n	n	
Glomar Supporter	12/08/2023	v	Ossie Stewart	05:00	06:00	f	57	5.01	n	1	27.35	e	93.0	57	6.11	n	1	33.69	e	92.0	4.0	se	4	s	o	g	sf	n	
Glomar Supporter	12/08/2023	v	Ossie Stewart	06:00	06:23	f	57	6.11	n	1	33.69	e	92.0	57	6.64	n	1	36.76	e	92.0	4.0	se	4	s	o	g	sf	n	
Glomar Supporter	12/08/2023	v	Ossie Stewart	06:23	06:48	r	57	6.64	n	1	36.76	e	92.0	57	6.90	n	1	36.57	e	92.3	4.0	se	4	s	o	g	sb	n	EOL, RP LT
Glomar Supporter	12/08/2023	v	Ossie Stewart	06:48	07:50	f	57	6.90	n	1	36.57	e	92.3	57	5.86	n	1	30.53	e	93.0	3.5	sw	5	c	o	g	sb	n	SOL
Glomar Supporter	12/08/2023	v	Ossie Stewart	07:50	08:35	f	57	5.86	n	1	30.53	e	93.0	57	4.95	n	1	25.25	e	94.6	3.6	sw	5	c	o	g	sb	n	
Glomar Supporter	12/08/2023	v	Ossie Stewart	08:35	09:35	f	57	4.95	n	1	25.25	e	94.6	57	3.92	n	1	19.34	e	94.5	3.5	sw	5	c	o	g	sb	n	
Glomar Supporter	12/08/2023	v	Ossie Stewart	09:35	09:55	f	57	3.92	n	1	19.34	e	94.5	57	3.56	n	1	17.24	e	90.4	3.5	se	4	c	o	g	sb	n	Break for morning meeting EOL was 10:05
Glomar Supporter	12/08/2023	v	Ossie Stewart	10:15	10:30	r	57	3.52	n	1	14.95	e	80.0	57	3.64	n	1	16.15	e	93.2	3.5	se	4	c	o	g	n	n	RP LT
Glomar Supporter	12/08/2023	v	Ossie Stewart	10:30	11:00	f	57	3.64	n	1	16.15	e	93.2	57	4.32	n	1	19.96	e	99.0	3.7	se	4	c	o	g	vf	n	SOL
Glomar Supporter	12/08/2023	v	Jessica Riggs	11:00	12:00	f	57	4.32	n	1	19.96	e	99.0	57	5.26	n	1	25.38	e	99.3	3.3	se	4	c	o	g	vf	n	
Glomar Supporter	12/08/2023	v	Jessica Riggs	12:00	13:00	f	57	5.26	n	1	25.38	e	99.3	57	6.34	n	1	31.68	e	98.0	3.6	se	4	c	o	g	vb	n	
Glomar Supporter	12/08/2023	v	Jessica Riggs	13:00	13:52	f	57	6.34	n	1	31.68	e	98.0	57	7.22	n	1	36.82	e	98.0	3.5	se	4	c	o	g	vb	n	
Glomar Supporter	12/08/2023	v	Jessica Riggs	13:52	14:00	n	57	7.22	n	1	36.82	e	98.0	57	6.92	n	1	37.68	e	92.0	3.3	se	4	c	o	g	n	n	EOL, all off
Glomar Supporter	12/08/2023	v	Ossie Stewart	14:00	14:45	n	57	6.92	n	1	37.68	e	92.0	57	6.23	n	1	37.47	e	93.0	2.6	s	4	c	o	g	n	n	
Glomar Supporter	12/08/2023	v	Ossie Stewart	14:45	15:11	s	57	6.23	n	1	37.47	e	93.0	57	7.58	n	1	37.22	e	92.0	3.7	s	4	c	o	g	n	n	SS
Glomar Supporter	12/08/2023	v	Ossie Stewart	15:11	16:10	f	57	7.58	n	1	37.22	e	92.0	57	6.55	n	1	31.31	e	93.0	3.5	se	4	c	o	g	n	n	FP
Glomar Supporter	12/08/2023	v	Ossie Stewart	16:10	16:30	f	57	6.55	n	1	31.31	e	93.0	57	6.16	n	1	29.08	e	98.7	3.6	se	5	c	o	g	n	n	
Glomar Supporter	12/08/2023	v	Jessica Riggs	16:30	17:00	f	57	6.16	n	1	29.08	e	98.7	57	5.74	n	1	26.60	e	92.9	3.5	se	5	c	o	g	n	n	
Glomar Supporter	12/08/2023	v	David Melendez	17:00	17:30	f	57	5.74	n	1	26.60	e	92.9	57	5.05	n	1	22.57	e	99.5	3.6	s	4	c	o	g	n	n	
Glomar Supporter	12/08/2023	v	Jessica Riggs	17:30	18:30	f	57	5.05	n	1	22.57	e	99.5	57	4.11	n	1	17.23	e	95.7	3.4	se	4	c	o	g	sf	n	
Glomar Supporter	12/08/2023	v	Jessica Riggs	18:30	18:41	f	57	4.11	n	1	17.23	e	95.7	57	3.90	n	1	15.99	e	91.3	3.5	se	4	c	o	g	vf	n	
Glomar Supporter	12/08/2023	v	Jessica Riggs	18:41	19:01	r	57	3.90	n	1	15.99	e	91.3	57	4.30	n	1	16.69	e	95.0	3.4	se	4	c	o	g	sf	n	
Glomar Supporter	12/08/2023	v	Jessica Riggs	19:01	20:01	f	57	4.30	n	1	16.69	e	95.0	57	5.30	n	1	22.41	e	98.0	3.5	se	4	c	o	g	sb	n	
Glomar Supporter	12/08/2023	v	Jessica Riggs	20:01	20:19	f	57	5.30	n	1	22.41	e	98.0	57	5.58	n	1	24.00	e	92.0	3.3	se	5	c	o	g	wb	n	EOW Visual
Glomar Supporter	12/08/2023	p	David Melendez	20:19	21:19	f	57	5.58	n	1	24.00	e	92.0	57	6.73	n	1	30.33	e	98.0	3.4								SOW Acoustic
Glomar Supporter	12/08/2023	p	David Melendez	21:19	22:00	f	57	6.73	n	1	30.33	e	98.0	57	7.29	n	1	33.93	e	98.0	3.4								
Glomar Supporter	12/08/2023	p	David Melendez	22:00	22:25	f	57	7.29	n	1	33.93	e	98.0	57	7.81	n	1	36.91	e	98.0	3.6								
Glomar Supporter	12/08/2023	p	Jessica Riggs	22:25	22:49	r	57	7.81	n	1	36.91	e	98.0	57	5.87	n	1	24.63	e	96.0	3.5								EOL; USBL ON
Glomar Supporter	12/08/2023	p	Jessica Riggs	22:49	22:57	f	57	5.87	n	1	24.63	e	96.0	57	8.93	n	1	35.66	e	95.0	3.0								SOL
Glomar Supporter	12/08/2023	p	David Melendez	22:57	24:00	f	57	8.93	n	1	35.66	e	95.0	57	6.80	n	1	29.34	e	100.0	3.4								

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	13/08/2023	p	David Melendez	00:00	01:00	f	57	6.80	n	1	29.34	e	100.0	57	5.75	n	1	23.31	e	105.0	3.3								Midnight UTC
Glomar Supporter	13/08/2023	p	David Melendez	01:00	02:00	f	57	5.75	n	1	23.31	e	105.0	57	4.57	n	1	16.59	e	98.0	3.6								
Glomar Supporter	13/08/2023	p	David Melendez	02:00	02:10	f	57	4.57	n	1	16.59	e	98.0	57	4.48	n	1	16.11	e	98.0	3.6								
Glomar Supporter	13/08/2023	p	David Melendez	02:10	02:28	r	57	4.48	n	1	16.11	e	98.0	57	4.78	n	1	16.27	e	98.0	3.5								EOL; USBL ON
Glomar Supporter	13/08/2023	p	David Melendez	02:28	03:45	f	57	4.78	n	1	16.27	e	98.0	57	6.13	n	1	24.01	e	98.0	3.7								SOL @02:35
Glomar Supporter	13/08/2023	p	David Melendez	03:45	04:08	f	57	6.13	n	1	24.01	e	100.0	57	6.52	n	1	26.26	e	96.0	3.4								EOW Acoustic
Glomar Supporter	13/08/2023	v	David Melendez	04:21	05:00	f	57	6.72	n	1	6.72	e	100.0	57	7.44	n	1	31.70	e	96.0	3.4	s	4	c	o	g	n	n	SOW Visual
Glomar Supporter	13/08/2023	v	Ossie Stewart	05:00	05:53	f	57	7.44	n	1	31.70	e	96.8	57	8.34	n	1	36.83	e	95.0	3.3	s	4	c	o	g	n	n	EOL, issues with UHR, UHR off SBP on
Glomar Supporter	13/08/2023	v	Ossie Stewart	05:53	06:17	r	57	8.34	n	1	36.83	e	95.0	57	8.14	n	1	36.67	e	96.0	3.4	s	5	c	o	g	sb	n	RP LT
Glomar Supporter	13/08/2023	v	Ossie Stewart	06:17	07:20	r	57	8.14	n	1	36.67	e	96.0	57	6.92	n	1	29.47	e	95.5	4.0	s	5	c	o	g	sb	n	SOL SBP only
Glomar Supporter	13/08/2023	v	Ossie Stewart	07:20	08:20	r	57	6.92	n	1	29.47	e	95.5	57	5.80	n	1	22.99	e	96.0	3.5	s	6	c	o	g	sb	n	
Glomar Supporter	13/08/2023	v	Ossie Stewart	08:20	09:15	r	57	5.80	n	1	22.99	e	96.0	57	4.89	n	1	17.79	e	96.2	3.5	s	6	c	o	g	sb	n	
Glomar Supporter	13/08/2023	v	Ossie Stewart	09:15	09:20	v	57	4.89	n	1	17.79	e	96.2	57	4.81	n	1	17.31	e	95.0	3.3	s	5	c	o	g	sb	n	UHR test, SBP online still
Glomar Supporter	13/08/2023	v	Ossie Stewart	09:20	09:34	r	57	4.81	n	1	17.31	e	95.0	57	4.59	n	1	16.11	e	93.0	3.4	s	5	c	o	g	sb	n	SBP line continues
Glomar Supporter	13/08/2023	v	Ossie Stewart	09:34	09:56	r	57	4.59	n	1	16.11	e	93.0	57	4.72	n	1	16.40	e	94.0	3.5	s	5	c	o	g	sf	n	EOL RP SBP only - SOL 09:56, log off meeting
Glomar Supporter	13/08/2023	v	Ossie Stewart	10:14	11:00	r	57	5.05	n	1	18.33	e	97.0	57	5.99	n	1	23.75	e	105.0	4.0	s	5	c	o	g	sf	n	
Glomar Supporter	13/08/2023	v	Jessica Riggs	11:00	12:00	r	57	5.99	n	1	23.75	e	105.0	57	7.07	n	1	29.92	e	103.0	3.8	sw	4	c	o	g	sf	n	
Glomar Supporter	13/08/2023	v	Jessica Riggs	12:00	12:34	r	57	7.07	n	1	29.92	e	103.0	57	7.82	n	1	34.30	e	102.0	4.0	sw	4	c	o	g	sb	n	
Glomar Supporter	13/08/2023	v	Jessica Riggs	12:34	12:57	s	57	7.82	n	1	34.30	e	102.0	57	8.27	n	1	37.06	e	101.4	4.0	sw	4	c	o	g	wf	n	SS UHR test while on SBP line aborted
Glomar Supporter	13/08/2023	v	Jessica Riggs	12:57	13:04	r	57	8.33	n	1	37.32	e	100.7	57	7.42	n	1	37.53	e	101.0	4.0	sw	4	c	o	g	vb	n	SBP only, online
Glomar Supporter	13/08/2023	v	Jessica Riggs	13:04	13:55	n	57	7.42	n	1	37.53	e	101.0	4.0	6.45	n	1	37.67	e	102.0	3.0	sw	4	c	o	g	vb	n	all off
Glomar Supporter	13/08/2023	v	Ossie Stewart	13:55	14:12	s	57	6.45	n	1	37.67	e	102.0	57	5.69	n	1	37.68	e	96.4	2.5	sw	5	c	o	g	vb	n	UHR SS aborted - tech issues, all off
Glomar Supporter	13/08/2023	v	Ossie Stewart	14:12	14:38	n	57	5.69	n	1	37.68	e	96.4	57	5.21	n	1	37.28	e	96.7	3.3	sw	5	c	o	g	sf	n	
Glomar Supporter	13/08/2023	v	Ossie Stewart	14:38	15:05	s	57	5.21	n	1	37.28	e	96.7	57	4.65	n	1	36.82	e	96.4	3.7	sw	4	c	o	g	sb	n	SS SBP for acquisition UHR for test
Glomar Supporter	13/08/2023	v	Ossie Stewart	15:05	16:05	v	57	4.65	n	1	36.82	e	96.4	57	3.47	n	1	30.24	e	98.4	4.0	sw	4	c	o	g	sf	n	SBP FP while UHR Test
Glomar Supporter	13/08/2023	v	Ossie Stewart	16:05	16:36	v	57	3.47	n	1	30.24	e	98.4	57	2.94	n	1	27.10	e	105.0	3.5	sw	5	c	o	g	sf	n	
Glomar Supporter	13/08/2023	v	Jessica Riggs	16:36	16:57	v	57	2.94	n	1	27.10	e	105.0	57	2.58	n	1	25.03	e	101.0	3.2	sw	4	c	o	g	sf	n	
Glomar Supporter	13/08/2023	v	David Melendez	16:57	17:36	v	57	2.58	n	1	25.03	e	101.0	57	1.86	n	1	20.97	e	105.0	3.6	s	4	c	o	g	sf	n	
Glomar Supporter	13/08/2023	v	Jessica Riggs	17:36	18:27	v	57	1.86	n	1	20.97	e	105.0	57	1.49	n	1	18.17	e	98.5	3.8	sw	4	c	o	g	sf	n	
Glomar Supporter	13/08/2023	v	Jessica Riggs	18:27	19:27	r	57	1.49	n	1	18.17	e	98.5	57	2.70	n	1	25.18	e	106.0	4.0	se	4	c	o	g	sb	n	SBP Line
Glomar Supporter	13/08/2023	v	Jessica Riggs	19:27	19:37	r	57	2.70	n	1	25.18	e	106.0	57	2.85	n	1	25.90	e	105.0	4.0	se	4	c	o	g	sb	n	
Glomar Supporter	13/08/2023	v	Jessica Riggs	19:37	20:21	n	57	2.85	n	1	25.90	e	105.0	57	2.62	n	1	21.91	e	101.0	4.1	se	3	c	o	g	wb	n	EOL @19:37 All OFF; EOW Visual @20:21
Glomar Supporter	13/08/2023	p	David Melendez	20:21	20:57	n	57	2.62	n	1	21.91	e	101.0	57	1.56	n	1	18.80	e	94.0	4.2								SOW Acoustic
Glomar Supporter	13/08/2023	p	David Melendez	20:57	21:26	s	57	1.56	n	1	18.80	e	94.0	57	2.19	n	1	19.91	e	91.0	4.1								
Glomar Supporter	13/08/2023	p	David Melendez	21:26	21:33	n	57	2.19	n	1	19.91	e	91.0	57	1.68	n	1	19.98	e	90.0	4.3								SS aborted
Glomar Supporter	13/08/2023	p	David Melendez	21:33	21:53	s	57	1.68	n	1	19.98	e	90.0	57	1.90	n	1	16.61	e	90.0	4.1								

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	13/08/2023	p	David Melendez	21:53	21:55	v	57	1.90	n	1	16.61	e	90.0	57	1.98	n	1	16.72	e	91.0	4.1								Trigger test with Sparker
Glomar Supporter	13/08/2023	p	Jessica Riggs	21:55	23:00	f	57	1.98	n	1	16.72	e	91.0	57	3.22	n	1	23.37	e	106.0	4.0								FP; SOL @21:59
Glomar Supporter	13/08/2023	p	David Melendez	23:00	24:00	f	57	3.22	n	1	23.37	e	106.0	57	4.26	n	1	23.13	e	103.0	3.4								
Glomar Supporter	14/08/2023	p	David Melendez	00:00	01:14	f	57	4.26	n	1	23.13	e	103.0	57	5.11	n	1	36.69	e	101.0	3.3								Midnight UTC
Glomar Supporter	14/08/2023	p	David Melendez	01:14	01:29	r	57	5.11	n	1	36.69	e	101.0	57	5.80	n	1	36.59	e	100.0	3.6								EOL; UHR OFF
Glomar Supporter	14/08/2023	p	David Melendez	01:29	02:29	f	57	5.80	n	1	36.59	e	100.0	57	4.75	n	1	30.63	e	103.0	3.3								SOL
Glomar Supporter	14/08/2023	p	David Melendez	02:29	03:29	f	57	4.75	n	1	30.63	e	103.0	57	3.67	n	1	24.48	e	105.0	3.5								
Glomar Supporter	14/08/2023	p	David Melendez	03:29	03:51	f	57	3.67	n	1	24.48	e	105.0	57	3.28	n	1	22.16	e	96.0	3.4								EOW Acoustic
Glomar Supporter	14/08/2023	v	David Melendez	04:05	04:44	f	57	3.03	n	1	20.83	e	93.7	57	2.35	n	1	16.90	e	87.0	3.5	s	3	s	o	g	wb	n	SOW Visual
Glomar Supporter	14/08/2023	v	David Melendez	04:44	05:08	r	57	2.35	n	1	16.90	e	87.0	57	2.58	n	1	17.37	e	93.4	3.5	s	3	s	o	g	sb	n	EOL UHR off
Glomar Supporter	14/08/2023	v	Ossie Stewart	05:08	06:08	r	57	2.58	n	1	17.37	e	93.4	57	3.71	n	1	23.85	e	100.0	4.0	se	3	s	o	g	n	n	SOL SBP only
Glomar Supporter	14/08/2023	v	Ossie Stewart	06:08	06:15	r	57	3.71	n	1	23.85	e	100.0	57	3.83	n	1	24.55	e	99.3	4.0	se	3	s	o	g	sf	n	SBP only acquisition line
Glomar Supporter	14/08/2023	v	Ossie Stewart	06:15	06:37	s	57	3.83	n	1	24.55	e	99.3	57	0.19	n	1	27.22	e	97.9	3.9	se	3	s	o	g	sf	n	SS for UHR testing while SBP online
Glomar Supporter	14/08/2023	v	Ossie Stewart	06:37	07:57	f	57	0.19	n	1	27.22	e	97.9	57	5.74	n	1	35.55	e	96.6	3.9	se	3	s	o	g	vf	n	FP UHR testing while SBP line is underway
Glomar Supporter	14/08/2023	v	Ossie Stewart	07:57	08:10	f	57	5.74	n	1	35.55	e	96.6	57	5.93	n	1	36.66	e	95.0	3.5	se	3	s	o	g	sf	n	
Glomar Supporter	14/08/2023	v	Ossie Stewart	08:10	08:30	r	57	5.93	n	1	36.66	e	95.0	57	6.15	n	1	36.90	e	95.4	3.5	se	3	s	o	g	n	n	EOL UHR off SBP on
Glomar Supporter	14/08/2023	v	Ossie Stewart	08:30	08:52	s	57	6.15	n	1	36.90	e	95.4	57	5.77	n	1	34.71	e	95.8	3.3	se	4	s	o	g	n	n	SS UHR SBP line SOL 08:34
Glomar Supporter	14/08/2023	v	Ossie Stewart	08:52	09:55	f	57	5.77	n	1	34.71	e	95.8	57	4.76	n	1	28.76	e	98.4	3.7	se	4	s	o	g	n	n	UHR SOL on SBP line, log off for meeting
Glomar Supporter	14/08/2023	v	Ossie Stewart	10:16	11:07	f	57	4.32	n	1	26.21	e	96.4	57	3.40	n	1	20.86	e	103.0	3.6	s	4	s	o	g	n	n	
Glomar Supporter	14/08/2023	v	Jessica Riggs	11:07	11:45	f	57	3.40	n	1	20.86	e	103.0	57	2.65	n	1	16.43	e	90.0	4.1	sw	4	s	o	g	n	n	
Glomar Supporter	14/08/2023	v	Jessica Riggs	11:45	12:09	r	57	2.65	n	1	16.43	e	90.0	57	2.63	n	1	17.05	e	98.0	4.0	sw	4	s	o	g	n	n	EOL
Glomar Supporter	14/08/2023	v	Jessica Riggs	12:09	13:09	f	57	2.63	n	1	17.05	e	98.0	57	3.85	n	1	24.09	e	106.0	4.2	se	4	s	o	g	n	n	SOL
Glomar Supporter	14/08/2023	v	Jessica Riggs	13:09	14:00	f	57	3.85	n	1	24.09	e	106.0	57	4.90	n	1	30.24	e	98.0	3.9	se	4	s	o	g	n	l	
Glomar Supporter	14/08/2023	v	Ossie Stewart	14:00	15:01	f	57	4.90	n	1	30.24	e	98.0	57	6.03	n	1	36.84	e	96.0	3.7	se	4	s	o	g	n	m	
Glomar Supporter	14/08/2023	v	Ossie Stewart	15:01	16:02	n	57	6.03	n	1	36.84	e	96.0	57	4.91	n	1	37.30	e	96.0	4.0	se	4	s	o	g	n	m	EOL all off for SVP
Glomar Supporter	14/08/2023	v	Ossie Stewart	16:02	16:22	s	57	4.91	n	1	37.30	e	96.0	57	6.34	n	1	37.14	e	96.0	3.3	se	3	s	o	g	n	l	SS SBP and UHR
Glomar Supporter	14/08/2023	v	Ossie Stewart	16:22	16:35	f	57	6.34	n	1	37.14	e	96.0	57	6.20	n	1	36.48	e	100.7	4.0	se	3	s	o	g	n	n	FP SBP UHR
Glomar Supporter	14/08/2023	v	Jessica Riggs	16:35	17:35	f	57	6.20	n	1	36.48	e	100.7	57	4.92	n	1	29.12	e	98.9	4.0	se	3	s	o	g	n	n	SOL
Glomar Supporter	14/08/2023	v	Jessica Riggs	17:35	18:35	f	57	4.92	n	1	29.12	e	98.9	57	3.76	n	1	22.34	e	100.0	4.0	se	3	s	o	g	n	n	
Glomar Supporter	14/08/2023	v	Jessica Riggs	18:35	19:28	f	57	3.76	n	1	22.34	e	100.0	57	2.69	n	1	16.28	e	84.8	4.0	ne	3	s	o	g	n	l	
Glomar Supporter	14/08/2023	v	Jessica Riggs	19:28	19:56	r	57	2.69	n	1	16.28	e	84.8	57	3.03	n	1	17.24	e	95.0	3.7	ne	3	s	o	g	n	l	EOW Visual
Glomar Supporter	14/08/2023	p	David Melendez	19:56	21:00	f	57	3.03	n	1	17.24	e	95.0	57	5.42	n	1	30.96	e	98.0	3.7								SOW Acoustic
Glomar Supporter	14/08/2023	p	David Melendez	21:00	22:50	f	57	5.42	n	1	30.96	e	98.0	57	4.66	n	1	46.55	e	97.0	4.1								
Glomar Supporter	14/08/2023	p	David Melendez	22:50	23:12	r	57	4.66	n	1	46.55	e	97.0	57	6.50	n	1	36.60	e	96.0	3.7								
Glomar Supporter	14/08/2023	p	David Melendez	23:12	23:35	f	57	6.50	n	1	36.60	e	96.0	57	6.05	n	1	33.81	e	97.0	3.9								
Glomar Supporter	14/08/2023	p	David Melendez	23:35	23:37	f	57	6.05	n	1	33.81	e	97.0	57	6.00	n	1	33.51	e	97.0	57								Quincy crashed; UHR OFF
Glomar Supporter	14/08/2023	p	David Melendez	23:37	24:00	f	57	6.00	n	1	33.51	e	97.0	57	5.50	n	1	30.64	e	98.0	57								UHR ON, same line
Glomar Supporter	15/08/2023	p	David Melendez	00:00	01:16	f	57	5.50	n	1	30.64	e	98.0	57	3.94	n	1	21.63	e	99.0	57								Midnight UTC
Glomar Supporter	15/08/2023	p	David Melendez	01:16	02:07	f	57	3.94	n	1	21.63	e	99.0	57	2.89	n	1	16.18	e	87.0	57								

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	15/08/2023	p	David Melendez	02:07	02:27	r	57	2.89	n	1	16.18	e	87.0	57	3.15	n	1	16.22	e	89.0	57								EOL
Glomar Supporter	15/08/2023	p	David Melendez	02:27	03:27	f	57	3.15	n	1	16.22	e	89.0	57	4.34	n	1	23.12	e	100.0	3.8								SOL
Glomar Supporter	15/08/2023	p	David Melendez	03:27	04:07	f	57	4.34	n	1	23.12	e	100.0	57	5.15	n	1	27.80	e	93.0	3.9								EOW Acoustic
Glomar Supporter	15/08/2023	v	David Melendez	04:21	05:05	f	57	5.42	n	1	29.40	e	93.9	57	6.36	n	1	34.87	e	91.1	4.1	e	2	s	o	m	n	l	SOW Visual
Glomar Supporter	15/08/2023	v	Ossie Stewart	05:05	05:24	f	57	6.36	n	1	34.87	e	91.1	57	6.69	n	1	36.82	e	92.3	4.0	se	3	s	o	m	n	l	
Glomar Supporter	15/08/2023	v	Ossie Stewart	05:24	05:45	r	57	6.69	n	1	36.82	e	92.3	57	6.77	n	1	36.55	e	92.0	4.0	se	3	s	o	m	n	l	EOL, LT RP
Glomar Supporter	15/08/2023	v	Ossie Stewart	05:45	06:57	f	57	6.77	n	1	36.55	e	92.0	57	5.31	n	1	28.16	e	92.7	3.7	se	3	s	o	g	n	l	SOL
Glomar Supporter	15/08/2023	v	Ossie Stewart	06:57	08:00	f	57	5.31	n	1	28.16	e	92.7	57	4.01	n	1	20.64	e	93.9	3.9	se	3	s	o	g	n	n	
Glomar Supporter	15/08/2023	v	Ossie Stewart	08:00	08:40	f	57	4.01	n	1	20.64	e	93.9	57	3.20	n	1	16.04	e	81.4	4.0	sw	3	s	o	g	n	n	
Glomar Supporter	15/08/2023	v	Ossie Stewart	08:40	08:59	r	57	3.20	n	1	16.04	e	81.4	57	3.41	n	1	16.19	e	86.3	4.0	sw	3	s	o	g	n	n	EOL RP LT
Glomar Supporter	15/08/2023	v	Ossie Stewart	08:59	09:55	f	57	3.41	n	1	16.19	e	86.3	57	4.49	n	1	22.37	e	94.3	4.0	w	3	s	o	g	sf	n	SOL, log off for meeting
Glomar Supporter	15/08/2023	v	Ossie Stewart	10:15	11:06	f	57	4.97	n	1	25.12	e	94.0	57	5.97	n	1	30.87	e	98.2	4.0	nw	4	s	o	g	sf	n	
Glomar Supporter	15/08/2023	v	Jessica Riggs	11:06	11:57	f	57	5.97	n	1	30.87	e	98.2	57	7.01	n	1	36.89	e	97.3	4.0	ne	4	s	o	g	sf	n	
Glomar Supporter	15/08/2023	v	Jessica Riggs	11:57	12:02	n	57	7.01	n	1	36.89	e	97.3	57	7.05	n	1	37.26	e	97.5	3.3	nw	3	s	o	g	wf	n	EOL
Glomar Supporter	15/08/2023	v	Jessica Riggs	12:02	12:55	n	57	7.05	n	1	37.26	e	97.5	57	5.77	n	1	37.51	e	97.2	2.7	nw	3	s	o	g	wf	n	
Glomar Supporter	15/08/2023	v	Jessica Riggs	12:55	13:25	s	57	5.77	n	1	37.51	e	97.2	57	7.23	n	1	36.58	e	97.9	3.5	nw	4	c	o	g	vf	n	30mins soft start SVP 75%
Glomar Supporter	15/08/2023	v	Jessica Riggs	13:25	13:45	f	57	7.23	n	1	36.58	e	97.9	57	6.96	n	1	34.86	e	97.1	4.1	nw	4	c	o	g	n	n	
Glomar Supporter	15/08/2023	v	Jessica Riggs	13:45	14:00	f	57	6.96	n	1	34.86	e	97.1	57	6.39	n	1	31.56	e	93.8	4.0	nw	5	c	o	m	n	n	SOL
Glomar Supporter	15/08/2023	v	Ossie Stewart	14:00	14:21	f	57	6.39	n	1	31.56	e	93.8	57	6.15	n	1	30.16	e	94.7	4.0	nw	6	r	o	m	n	n	
Glomar Supporter	15/08/2023	v	Ossie Stewart	14:21	15:30	f	57	6.15	n	1	30.16	e	94.7	57	6.45	n	1	25.13	e	93.8	1.7	nw	7	r	o	g	n	m	
Glomar Supporter	15/08/2023	v	Ossie Stewart	15:30	16:30	n	57	6.45	n	1	25.13	e	93.8	57	7.58	n	1	22.79	e	93.7	2.2	nw	7	r	o	g	n	l	All off, wow
Glomar Supporter	15/08/2023	v	Jessica Riggs	16:30	17:00	n	57	7.58	n	1	22.79	e	93.7	57	8.36	n	1	21.54	e	93.2	2.0	nw	7	r	o	g	n	l	wow
Glomar Supporter	15/08/2023	v	David Melendez	17:00	17:30	n	57	8.36	n	1	21.54	e	93.2	57	11.06	n	1	17.62	e	94.1	1.8	nw	6	r	o	g	n	l	wow
Glomar Supporter	15/08/2023	v	Jessica Riggs	17:30	18:30	n	57	9.27	n	1	20.11	e	96.8	57	11.06	n	1	17.62	e	94.1	1.8	nw	7	r	o	g	n	l	wow
Glomar Supporter	15/08/2023	v	Jessica Riggs	18:30	19:30	n	57	11.06	n	1	17.62	e	94.1	57	7.10	n	1	21.29	e	97.9	4.1	nw	6	r	o	g	n	n	wow
Glomar Supporter	15/08/2023	v	Jessica Riggs	19:30	20:00	n	57	7.10	n	1	21.29	e	97.9	57	6.95	n	1	19.21		95.4	4.3	nw	6	r	o	g	n	n	wow
Glomar Supporter	16/08/2023	v	David Melendez	03:57	04:31	n	57	5.72	n	1	18.98	e	97.4	57	5.41	n	1	16.40	e	94.0	2.5	w	4	c	o	g	n	n	SOW Visual
Glomar Supporter	16/08/2023	v	David Melendez	04:31	04:56	s	57	5.41	n	1	16.40	e	94.0	57	4.46	n	1	15.22	e	90.4	2.8	nw	4	c	o	g	n	n	SS
Glomar Supporter	16/08/2023	v	Ossie Stewart	04:56	06:10	f	57	4.46	n	1	15.22	e	90.4	57	6.33	n	1	23.33	e	99.2	4.0	nw	4	c	o	g	n	n	FP
Glomar Supporter	16/08/2023	v	Ossie Stewart	06:10	07:10	f	57	6.33	n	1	23.33	e	99.2	57	7.49	n	1	29.97	e	97.4	4.0	nw	4	c	o	g	n	n	
Glomar Supporter	16/08/2023	v	Ossie Stewart	07:10	08:05	f	57	7.49	n	1	29.97	e	97.4	57	8.66	n	1	36.77	e	95.2	4.0	nw	3	s	o	g	n	n	
Glomar Supporter	16/08/2023	v	Ossie Stewart	08:05	08:27	r	57	8.66	n	1	36.77	e	95.2	57	8.61	n	1	36.66	e	95.3	3.5	nw	3	s	o	g	vb	n	EOL, RP LT
Glomar Supporter	16/08/2023	v	Ossie Stewart	08:27	09:30	f	57	8.61	n	1	36.66	e	95.3	57	7.33	n	1	29.27	e	97.4	4.0	nw	4	s	o	g	n	n	SOL
Glomar Supporter	16/08/2023	v	Ossie Stewart	09:30	09:55	f	57	7.33	n	1	29.27	e	97.4	57	6.84	n	1	26.40	e	97.3	4.0	nw	4	s	o	g	n	n	
Glomar Supporter	16/08/2023	v	Ossie Stewart	10:12	11:00	f	57	6.46	n	1	24.24	e	98.5	57	5.39	n	1	17.99	e	101.1	4.0	nw	4	s	o	g	n	n	
Glomar Supporter	16/08/2023	v	Jessica Riggs	11:00	11:24	f	57	5.39	n	1	17.99	e	101.1	57	5.03	n	1	15.75	e	97.5	4.0	nw	4	s	o	g	n	n	
Glomar Supporter	16/08/2023	v	Jessica Riggs	11:24	11:45	r	57	5.03	n	1	15.75	e	97.5	57	5.38	n	1	16.41	e	99.0	4.0	nw	3	s	o	g	n	n	EOL RP LT
Glomar Supporter	16/08/2023	v	Jessica Riggs	11:45	12:45	f	57	5.38	n	1	16.41	e	99.0	57	6.69	n	1	23.87	e	105.0	3.8	nw	3	s	o	g	n	n	SOL
Glomar Supporter	16/08/2023	v	Jessica Riggs	12:45	13:46	f	57	6.69	n	1	23.87	e	105.0	57	7.77	n	1	30.09	e	102.7	3.9	nw	3	s	o	g	n	n	
Glomar Supporter	16/08/2023	v	Jessica Riggs	13:46	14:03	f	57	7.77	n	1	30.09	e	102.7	57	8.11	n	1	32.07	e	97.3	3.9	nw	3	s	o	g	n	n	
Glomar Supporter	16/08/2023	v	Ossie Stewart	14:03	14:46	f	57	8.11	n	1	32.07	e	97.3	57	8.94	n	1	36.90	e	96.4	3.6	nw	3	s	o	g	n	n	
Glomar Supporter	16/08/2023	v	Ossie Stewart	14:46	15:34	n	57	8.94	n	1	36.90	e	96.4	57	7.88	n	1	37.60	e	96.4	3.4	n	3	s	o	g	vb	n	EOL, all off for SVP
Glomar Supporter	16/08/2023	v	Ossie Stewart	15:34	15:55	s	57	7.88	n	1	37.60	e	96.4	57	9.25	n	1	37.30	e	97.5	3.6	n	3	s	o	g	n	n	SS
Glomar Supporter	16/08/2023	v	Ossie Stewart	15:55	16:30	f	57	9.25	n	1	37.30	e	97.5	57	8.60	n	1	33.28	e	101.9	3.8	n	3	s	o	g	vf	n	SOL
Glomar Supporter	16/08/2023	v	Jessica Riggs	16:30	17:30	f	57	8.60	n	1	33.28	e	101.9	57	7.40	n	1	26.32	e	100.4	3.9	nw	3	s	o	g	vf	n	

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	16/08/2023	v	Jessica Riggs	17:30	18:30	f	57	7.40	n	1	26.32	e	100.4	57	6.25	n	1	19.86	e	101.8	3.9	sw	3	s	o	g	wf	n	
Glomar Supporter	16/08/2023	v	Jessica Riggs	18:30	19:07	f	57	6.25	n	1	19.86	e	101.8	57	5.56	n	1	15.85	e	97.0	3.8	sw	3	s	o	g	sf	n	EOL
Glomar Supporter	16/08/2023	v	Jessica Riggs	19:07	19:30	r	57	5.56	n	1	15.85	e	97.0	57	6.18	n	1	17.85	e	100.5	3.6	sw	2	s	o	g	sf	n	
Glomar Supporter	16/08/2023	v	Jessica Riggs	19:30	19:58	f	57	6.18	n	1	17.85	e	100.5	57	4.64	n	1	15.22	e	90.4	4.0	ne	2	s	o	g	vf	n	SOL 19:30
Glomar Supporter	16/08/2023	p	David Melendez	19:58	20:58	f	57	4.64	n	1	15.22	e	90.4	57	7.72	n	1	26.69	e	101.0	3.1								SOW Acoustic
Glomar Supporter	16/08/2023	p	David Melendez	20:58	22:00	f	57	7.72	n	1	26.69	e	101.0	57	8.90	n	1	33.51	e	101.0	3.8								
Glomar Supporter	16/08/2023	p	Jessica Riggs	22:00	22:28	f	57	8.90	n	1	33.51	e	101.0	57	9.46	n	1	36.77	e	103.0	3.8								
Glomar Supporter	16/08/2023	p	Jessica Riggs	22:28	22:53	r	57	9.46	n	1	36.77	e	103.0	57	9.63	n	1	35.86	e	103.0	3.5								EOL
Glomar Supporter	16/08/2023	p	Jessica Riggs	22:53	23:00	f	57	9.63	n	1	35.86	e	103.0	57	9.41	n	1	34.69	e	103.0	3.7								SOL OM111U
Glomar Supporter	16/08/2023	p	David Melendez	23:00	24:00	f	57	9.41	n	1	34.69	e	103.0	57	8.21	n	1	27.67	e	103.0	4.0								
Glomar Supporter	17/08/2023	p	David Melendez	00:00	01:14	f	57	8.21	n	1	27.67	e	103.0	57	6.70	n	1	18.88	e	103.0	4.2								Midnight UTC
Glomar Supporter	17/08/2023	p	David Melendez	01:14	01:38	f	57	6.70	n	1	18.88	e	103.0	57	6.20	n	1	16.06	e	98.0	4.0								
Glomar Supporter	17/08/2023	p	David Melendez	01:38	01:59	r	57	6.20	n	1	16.06	e	98.0	57	6.50	n	1	16.18	e	99.0	4.0								EOL
Glomar Supporter	17/08/2023	p	David Melendez	01:59	03:00	f	57	6.50	n	1	16.18	e	99.0	57	8.20	n	1	26.03	e	102.0	4.1								SOL
Glomar Supporter	17/08/2023	p	David Melendez	03:00	04:00	f	57	8.20	n	1	26.03	e	102.0	57	8.99	n	1	30.73	e	101.0	3.9								
Glomar Supporter	17/08/2023	p	David Melendez	04:00	04:09	f	57	8.99	n	1	30.73	e	101.0	57	9.91	n	1	31.48	e	101.0	3.9								EOW Acoustic
Glomar Supporter	17/08/2023	v	David Melendez	04:25	04:46	f	57	9.44	n	1	33.26	e	96.2	57	10.02	n	1	36.39	e	92.1	3.9	ne	2	s	o	g	n	n	SOW Visual; VD #13
Glomar Supporter	17/08/2023	v	Ossie Stewart	04:46	05:04	r	57	10.02	n	1	36.39	e	92.1	57	9.96	n	1	34.75	e	92.0	4.0	ne	3	s	o	g	n	n	EOL RP LT
Glomar Supporter	17/08/2023	v	Ossie Stewart	05:04	06:13	f	57	9.96	n	1	34.75	e	92.0	57	8.68	n	1	27.35	e	96.6	3.9	ne	3	s	o	g	n	n	SOL
Glomar Supporter	17/08/2023	v	Ossie Stewart	06:13	07:13	f	57	8.68	n	1	27.35	e	96.6	57	7.49	n	1	20.50	e	96.3	3.9	ne	2	s	o	g	n	n	GPS lost part way through, carry on
Glomar Supporter	17/08/2023	v	Ossie Stewart	07:13	07:58	f	57	7.49	n	1	20.50	e	96.3	57	6.71	n	1	16.06	e	92.6	3.7	ne	2	s	o	g	vb	n	
Glomar Supporter	17/08/2023	v	Ossie Stewart	07:58	08:15	r	57	6.71	n	1	16.06	e	92.6	57	7.02	n	1	16.30	e	93.0	3.9	ne	3	s	o	g	vb	n	EOL
Glomar Supporter	17/08/2023	v	Ossie Stewart	08:15	09:15	f	57	7.02	n	1	16.30	e	93.0	57	8.25	n	1	23.29	e	96.0	3.9	ne	3	s	o	g	vf	n	SOL
Glomar Supporter	17/08/2023	v	Ossie Stewart	09:15	09:55	f	57	8.25	n	1	23.29	e	96.0	57	8.99	n	1	27.47	e	96.0	4.0	ne	3	s	o	g	vf	n	log off for morning meeting
Glomar Supporter	17/08/2023	v	Ossie Stewart	10:18	11:01	f	57	9.47	n	1	30.23	e	96.4	57	10.37	n	1	35.47	e	100.0	4.0	ne	3	s	o	g	vf	n	
Glomar Supporter	17/08/2023	v	Jessica Riggs	11:01	11:24	r	57	10.37	n	1	35.47	e	100.0	57	10.45	n	1	34.14	e	101.5	3.6	ne	3	s	o	g	wf	n	EOL
Glomar Supporter	17/08/2023	v	Jessica Riggs	11:24	12:24	f	57	10.45	n	1	34.14	e	101.5	57	9.11	n	1	26.29	e	102.8	3.9	ne	3	s	o	g	n	n	SOL
Glomar Supporter	17/08/2023	v	Jessica Riggs	12:24	13:24	f	57	9.11	n	1	26.29	e	102.8	57	8.09	n	1	20.44	e	100.9	4.0	ne	2	s	o	g	n	n	
Glomar Supporter	17/08/2023	v	Jessica Riggs	13:24	14:02	f	57	8.09	n	1	20.44	e	100.9	57	7.31	n	1	15.96	e	101.0	4.0	ne	2	s	o	g	n	n	
Glomar Supporter	17/08/2023	v	Ossie Stewart	14:02	14:59	n	57	7.31	n	1	15.96	e	101.0	57	6.86	n	1	15.14	e	88.2	4.0	ne	2	s	o	g	wb	n	EOL, all off for SVP
Glomar Supporter	17/08/2023	v	Ossie Stewart	14:59	15:19	s	57	6.86	n	1	15.14	e	88.2	57	7.97	n	1	15.17	e	88.8	3.7	ne	3	s	o	g	wb	n	SS
Glomar Supporter	17/08/2023	v	Ossie Stewart	15:19	16:20	f	57	7.97	n	1	15.17	e	88.8	57	9.16	n	1	21.87	e	93.2	3.7	ne	3	s	o	g	n	n	SOL
Glomar Supporter	17/08/2023	v	Ossie Stewart	16:20	16:30	f	57	9.16	n	1	21.87	e	93.2	57	9.40	n	1	23.25	e	98.1	3.8	ne	3	s	o	g	n	n	
Glomar Supporter	17/08/2023	v	Jessica Riggs	16:30	16:54	f	57	9.40	n	1	23.25	e	98.1	57	9.89	n	1	26.12	e	98.1	4.0	ne	3	s	o	g	wf	n	
Glomar Supporter	17/08/2023	v	Jessica Riggs	16:54	17:03	r	57	9.89	n	1	26.12	e	98.1	57	10.22	n	1	28.20	e	96.5	3.9	ne	3	s	o	g	sb	n	EOL
Glomar Supporter	17/08/2023	v	David Melendez	17:03	17:30	f	57	10.22	n	1	28.20	e	96.5	57	10.83	n	1	31.56	e	96.4	4.0	ne	3	s	o	g	sb	n	SOL
Glomar Supporter	17/08/2023	v	Jessica Riggs	17:30	17:58	f	57	10.83	n	1	31.56	e	96.4	57	11.23	n	1	33.68	e	96.0	4.1	ne	3	s	o	g	wb	n	
Glomar Supporter	17/08/2023	v	Jessica Riggs	17:58	18:21	r	57	11.23	n	1	33.68	e	96.0	57	11.29	n	1	32.58	e	97.0	3.4	ne	3	s	o	g	wf	n	
Glomar Supporter	17/08/2023	v	Jessica Riggs	18:21	19:06	f	57	11.29	n	1	32.58	e	97.0	57	10.38	n	1	27.32	e	96.7	4.0	ne	2	s	o	g	n	n	
Glomar Supporter	17/08/2023	v	Jessica Riggs	19:06	19:25	r	57	10.38	n	1	27.32	e	96.7	57	10.04	n	1	25.36	e	97.9	3.9	ne	2	s	o	g	n	n	
Glomar Supporter	17/08/2023	v	Jessica Riggs	19:25	19:49	f	57	10.04	n	1	25.36	e	97.9	57	11.51	n	1	30.44	e	97.0	3.8	ne	2	s	o	g	n	n	
Glomar Supporter	17/08/2023	p	David Melendez	19:49	20:45	f	57	11.51	n	1	30.44	e	97.0	57	8.43	n	1	16.14	e	93.0	3.9								SOW Acoustic
Glomar Supporter	17/08/2023	p	David Melendez	20:45	21:09	r	57	8.43	n	1	16.14	e	93.0	57	8.80	n	1	16.64	e	93.0	4.0								EOL
Glomar Supporter	17/08/2023	p	David Melendez	21:09	22:00	f	57	8.80	n	1	16.64	e	93.0	57	9.89	n	1	22.84	e	98.0	3.5								SOL

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	17/08/2023	p	Jessica Riggs	22:00	22:32	f	57	9.89	n	1	22.84	e	98.0	57	8.38	n	1	15.59	e	98.0	3.9								
Glomar Supporter	17/08/2023	p	Jessica Riggs	22:32	22:53	r	57	8.38	n	1	15.59	e	98.0	57	10.80	n	1	28.74	e	95.0	3.9								EOL
Glomar Supporter	17/08/2023	p	David Melendez	22:53	23:26	f	57	10.80	n	1	28.74	e	95.0	57	11.58	n	1	32.45	e	97.0	3.8								SOL OM173U
Glomar Supporter	17/08/2023	p	David Melendez	23:26	23:46	r	57	11.58	n	1	32.45	e	97.0	57	11.76	n	1	31.88	e	97.0	3.8								EOL
Glomar Supporter	17/08/2023	p	David Melendez	23:46	24:00	f	57	11.76	n	1	31.88	e	97.0	57	11.51	n	1	30.44	e	97.0	3.6								SOL OM183U
Glomar Supporter	18/08/2023	p	David Melendez	00:00	00:10	f	57	11.51	n	1	30.44	e	97.0	57	11.32	n	1	29.33	e	97.0	3.9								Midnight UTC
Glomar Supporter	18/08/2023	p	David Melendez	00:10	00:33	r	57	11.32	n	1	29.33	e	97.0	57	10.86	n	1	26.66	e	97.0	3.9								EOL
Glomar Supporter	18/08/2023	p	David Melendez	00:33	02:04	f	57	10.86	n	1	26.66	e	97.0	57	9.13	n	1	16.63	e	97.0	4.0								SOL OM182U
Glomar Supporter	18/08/2023	p	David Melendez	02:04	02:22	r	57	9.13	n	1	16.63	e	97.0	57	9.48	n	1	17.05	e	97.0	3.8								EOL
Glomar Supporter	18/08/2023	p	David Melendez	02:22	03:22	f	57	9.48	n	1	17.05	e	97.0	57	10.59	n	1	23.47	e	98.0	3.8								SOL OM192U
Glomar Supporter	18/08/2023	p	David Melendez	03:22	03:56	f	57	10.59	n	1	23.47	e	98.0	57	11.31	n	1	27.70	e	97.0	4.0								
Glomar Supporter	18/08/2023	p	David Melendez	03:56	04:18	r	57	11.31	n	1	27.70	e	97.0	57	11.74	n	1	30.22	e	98.0	3.7								EOL
Glomar Supporter	18/08/2023	p	David Melendez	04:18	04:30	f	57	11.74	n	1	30.22	e	98.0	57	11.99	n	1	31.64	e	98.0	4.0								SOL OM193U;
Glomar Supporter	18/08/2023	p	David Melendez	04:30	04:41	r	57	11.99	n	1	31.64	e	98.0	57	12.29	n	1	31.64	e	98.0	3.8								EOL; EOW Acoustic
Glomar Supporter	18/08/2023	v	Ossie Stewart	04:41	05:08	r	57	12.29	n	1	31.64	e	98.0	57	11.70	n	1	28.39	e	90.0	3.8	ne	3	s	o	g	n	n	
Glomar Supporter	18/08/2023	v	Ossie Stewart	05:08	06:10	f	57	11.70	n	1	28.39	e	90.0	57	10.36	n	1	20.73	e	91.5	3.8	ne	3	s	o	g	n	n	SOL
Glomar Supporter	18/08/2023	v	Ossie Stewart	06:10	06:49	f	57	10.36	n	1	20.73	e	91.5	57	9.72	n	1	17.05	e	89.2	3.7	ne	3	s	o	g	n	n	
Glomar Supporter	18/08/2023	v	Ossie Stewart	06:49	07:12	r	57	9.72	n	1	17.05	e	89.2	57	10.10	n	1	17.61	e	89.0	3.7	ne	3	s	o	g	n	n	EOL, RP LT
Glomar Supporter	18/08/2023	v	Ossie Stewart	07:12	08:10	f	57	10.10	n	1	17.61	e	89.0	57	11.12	n	1	23.55	e	92.5	3.7	ne	3	s	o	g	n	n	
Glomar Supporter	18/08/2023	v	Ossie Stewart	08:10	08:59	f	57	11.12	n	1	23.55	e	92.5	57	12.15	n	1	29.46	e	91.8	3.4	ne	3	s	o	g	n	n	
Glomar Supporter	18/08/2023	v	Ossie Stewart	08:59	09:21	r	57	12.15	n	1	29.46	e	91.8	57	12.52	n	1	30.02	e	91.2	4.0	s	3	s	o	g	n	n	EOL, RP LT
Glomar Supporter	18/08/2023	v	Ossie Stewart	09:21	09:55	f	57	12.52	n	1	30.02	e	91.2	57	11.94	n	1	26.56	e	92.0	4.0	s	3	s	o	g	n	n	log off for meeting
Glomar Supporter	18/08/2023	v	Ossie Stewart	10:18	11:00	f	57	11.43	n	1	23.57	e	93.2	57	10.52	n	1	18.32	e	94.7	3.8	se	3	s	o	g	n	n	
Glomar Supporter	18/08/2023	v	Jessica Riggs	11:00	11:11	f	57	10.52	n	1	18.32	e	94.7	57	11.22	n	1	20.64	e	95.7	3.8	se	3	s	o	g	n	n	
Glomar Supporter	18/08/2023	v	Jessica Riggs	11:11	11:37	r	57	11.22	n	1	20.64	e	95.7	57	11.85	n	1	24.27	e	97.7	3.9	se	3	s	o	g	n	n	EOL
Glomar Supporter	18/08/2023	v	Jessica Riggs	11:37	12:37	f	57	11.85	n	1	24.27	e	97.7	57	12.07	n	1	25.49	e	97.7	3.7	se	3	s	o	g	n	n	SOL
Glomar Supporter	18/08/2023	v	Jessica Riggs	12:37	13:19	f	57	12.07	n	1	25.49	e	97.7	57	12.85	n	1	30.04	e	96.5	3.9	ne	4	s	o	g	vb	n	
Glomar Supporter	18/08/2023	v	Jessica Riggs	13:19	13:58	n	57	12.85	n	1	30.04	e	96.5	57	12.00	n	1	31.85	e	97.9	3.8	ne	4	s	o	g	n	n	EOL
Glomar Supporter	18/08/2023	v	Ossie Stewart	13:58	14:23	s	57	12.00	n	1	31.85	e	97.9	57	13.14	n	1	29.96	e	93.4	3.3	ne	4	s	o	g	n	n	SS
Glomar Supporter	18/08/2023	v	Ossie Stewart	14:23	15:23	f	57	13.14	n	1	29.96	e	93.4	57	11.92	n	1	22.99	e	93.6	4.1	se	4	s	o	g	n	n	SOL
Glomar Supporter	18/08/2023	v	Ossie Stewart	15:23	16:08	f	57	11.92	n	1	22.99	e	93.6	57	11.08	n	1	18.20	e	90.1	3.9	se	4	s	o	g	sf	n	
Glomar Supporter	18/08/2023	v	Ossie Stewart	16:08	16:33	r	57	11.08	n	1	18.20	e	90.1	57	11.42	n	1	18.62	e	95.1	3.9	se	4	s	o	g	sf	n	EOL RP LT
Glomar Supporter	18/08/2023	v	Jessica Riggs	16:33	17:33	f	57	11.42	n	1	18.62	e	95.1	57	13.00	n	1	27.78	e	96.8	4.0	e	5	s	o	g	n	n	SOL
Glomar Supporter	18/08/2023	v	Jessica Riggs	17:33	18:07	f	57	13.00	n	1	27.78	e	96.8	57	13.27	n	1	29.34	e	95.7	4.0	e	5	s	o	g	n	n	
Glomar Supporter	18/08/2023	v	Jessica Riggs	18:07	18:27	r	57	13.27	n	1	29.34	e	95.7	57	13.42	n	1	28.43	e	97.1	4.1	ne	5	s	o	g	n	n	EOL
Glomar Supporter	18/08/2023	v	Jessica Riggs	18:27	18:30	f	57	13.42	n	1	28.43	e	97.1	57	13.28	n	1	27.68	e	96.2	3.8	ne	4	s	o	g	sf	n	SOL
Glomar Supporter	18/08/2023	v	Jessica Riggs	18:30	18:40	r	57	13.28	n	1	27.68	e	96.2	57	13.09	n	1	27.35	e	96.4	4.0	ne	4	s	o	g	sf	n	Line aborted
Glomar Supporter	18/08/2023	v	Jessica Riggs	18:40	18:45	n	57	13.09	n	1	27.35	e	96.4	57	13.17	n	1	28.12	e	97.1	3.2	ne	5	s	o	g	sb	n	
Glomar Supporter	18/08/2023	v	Jessica Riggs	18:45	19:05	s	57	13.17	n	1	28.12	e	97.1	57	13.70	n	1	29.81	e	95.8	4.5	ne	5	s	o	g	sb	n	
Glomar Supporter	18/08/2023	v	Jessica Riggs	19:05	20:05	f	57	13.70	n	1	29.81	e	95.8	57	13.16	n	1	27.52	e	96.0	4.3	ne	4	s	o	g	wf	n	Gear recovered due to weather
Glomar Supporter	19/08/2023	v	David Melendez	04:40	05:20	n	57	13.16	n	1	27.52	e	96.0	57	13.62	n	1	28.94	e	91.7	2.2	e	6	r	o	m	n	n	WOW
Glomar Supporter	19/08/2023	v	Ossie Stewart	05:20	06:15	n	57	13.62	n	1	28.94	e	91.7	57	14.04	n	1	26.44	e	91.9	0.6	e	6	r	o	m	n	h	WOW
Glomar Supporter	19/08/2023	v	Ossie Stewart	06:15	07:20	n	57	14.04	n	1	26.44	e	91.9	57	14.24	n	1	15.84	e	92.0	5.3	e	6	r	m	m	n	h	WOW
Glomar Supporter	19/08/2023	v	Ossie Stewart	07:20	08:40	n	57	14.24	n	1	15.84	e	92.0	57	14.06	n	1	18.38	e	87.6	0.6	se	7	r	m	m	n	h	WOW

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	19/08/2023	v	Ossie Stewart	08:40	09:55	n	57	14.06	n	1	18.38	e	87.6	57	14.40	n	1	20.42	e	91.0	1.0	se	7	r	m	m	n	h	WOW
Glomar Supporter	19/08/2023	v	Ossie Stewart	10:07	11:00	n	57	14.57	n	1	20.90	e	91.0	57	14.70	n	1	26.52	e	94.0	1.0	se	7	r	m	m	n	l	WOW
Glomar Supporter	19/08/2023	v	Jessica Riggs	11:00	12:00	n	57	14.70	n	1	26.52	e	94.0	57	14.59	n	1	27.51	e	98.6	2.3	se	7	r	m	m	n	n	WOW
Glomar Supporter	19/08/2023	v	Jessica Riggs	12:00	13:00	n	57	14.59	n	1	27.51	e	98.6	57	14.02	n	1	31.65	e	94.8	2.1	se	6	r	m	m	n	n	WOW
Glomar Supporter	19/08/2023	v	Jessica Riggs	13:00	14:00	n	57	14.02	n	1	31.65	e	94.8	57	13.61	n	1	32.98	e	89.7	2.7	se	6	r	m	m	n	n	WOW
Glomar Supporter	19/08/2023	v	Ossie Stewart	14:00	15:00	n	57	13.61	n	1	32.98	e	89.7	57	13.93	n	1	27.78	e	92.4	3.5	sw	6	r	m	g	sf	n	WOW
Glomar Supporter	19/08/2023	v	Ossie Stewart	15:00	16:00	n	57	13.93	n	1	27.78	e	92.4	57	14.24	n	1	21.67	e	93.2	3.3	s	6	r	m	g	sf	n	WOW
Glomar Supporter	19/08/2023	v	Ossie Stewart	16:00	16:30	n	57	14.24	n	1	21.67	e	93.2	57	15.10	n	1	18.27	e	92.3	3.3	s	6	r	m	g	sf	n	WOW
Glomar Supporter	19/08/2023	v	Jessica Riggs	16:30	17:30	n	57	15.10	n	1	18.27	e	92.3	57	14.44	n	1	22.18	e	97.2	3.2	se	6	r	m	g	sf	n	WOW
Glomar Supporter	19/08/2023	v	Jessica Riggs	17:30	18:30	n	57	14.44	n	1	22.18	e	97.2	57	13.50	n	1	27.81	e	97.0	2.7	se	6	r	m	g	sb	n	WOW
Glomar Supporter	19/08/2023	v	Jessica Riggs	18:30	19:30	n	57	13.50	n	1	27.81	e	97.0	57	13.10	n	1	31.17	e	96.8	2.6	se	6	r	m	g	sb	n	WOW
Glomar Supporter	19/08/2023	v	Jessica Riggs	19:30	20:00	n	57	13.10	n	1	31.17	e	96.8	57	7.24	n	1	35.80	e	92.0	2.7	se	5	r	m	g	wb	n	WOW
Glomar Supporter	20/08/2023	v	David Melendez	04:10	04:55	n	57	7.24	n	1	35.80	e	92.0	57	7.80	n	1	34.28	e	92.9	2.7	s	3	s	o	g	n	n	WOW
Glomar Supporter	20/08/2023	v	Ossie Stewart	04:55	05:58	n	57	7.80	n	1	34.28	e	92.9	57	7.97	n	1	31.71	e	92.1	5.8	sw	3	s	o	g	n	n	TBT and deployment of survey gear
Glomar Supporter	20/08/2023	v	Ossie Stewart	05:58	06:35	n	57	7.97	n	1	31.71	e	92.1	57	7.85	n	1	29.89	e	92.6	2.4	sw	4	s	o	g	sb	n	
Glomar Supporter	20/08/2023	v	Ossie Stewart	06:35	06:56	s	57	7.85	n	1	29.89	e	92.6	57	8.04	n	1	31.71	e	92.5	3.6	sw	4	s	o	g	sf	n	SS
Glomar Supporter	20/08/2023	v	Ossie Stewart	06:56	07:39	f	57	8.04	n	1	31.71	e	92.5	57	8.90	n	1	36.84	e	105.0	3.5	sw	4	s	o	g	sf	n	SOL
Glomar Supporter	20/08/2023	v	Ossie Stewart	07:39	07:59	r	57	8.90	n	1	36.84	e	105.0	57	8.36	n	1	36.64	e	90.7	4.0	sw	4	c	o	g	sf	n	EOL RP LT
Glomar Supporter	20/08/2023	v	Ossie Stewart	07:59	08:59	f	57	8.36	n	1	36.64	e	90.7	57	7.28	n	1	30.36	e	92.5	4.0	sw	4	c	o	g	sb	n	SOL
Glomar Supporter	20/08/2023	v	Ossie Stewart	08:59	09:55	f	57	7.28	n	1	30.36	e	92.5	57	6.27	n	1	24.69	e	93.0	3.5	sw	5	c	o	g	sb	n	
Glomar Supporter	20/08/2023	v	Ossie Stewart	10:14	11:00	f	57	5.95	n	1	22.67	e	93.0	57	5.04	n	1	17.43	e	95.0	3.6	sw	5	c	o	g	vb	n	
Glomar Supporter	20/08/2023	v	Jessica Riggs	11:00	11:19	f	57	5.04	n	1	17.43	e	95.0	57	4.78	n	1	15.97	e	92.0	3.6	sw	5	c	o	g	n	n	
Glomar Supporter	20/08/2023	v	Jessica Riggs	11:19	11:39	r	57	4.78	n	1	15.97	e	92.0	57	5.35	n	1	16.27	e	93.6	3.6	sw	4	c	o	g	n	n	
Glomar Supporter	20/08/2023	v	Jessica Riggs	11:39	11:49	f	57	5.35	n	1	16.27	e	93.6	57	5.57	n	1	17.52	e	95.7	3.6	sw	3	c	o	g	n	n	
Glomar Supporter	20/08/2023	v	Jessica Riggs	11:49	12:13	n	57	5.57	n	1	17.52	e	95.7	57	5.45	n	1	20.43	e	98.0	3.8	sw	3	c	o	g	n	n	SVP all off
Glomar Supporter	20/08/2023	v	Jessica Riggs	12:13	12:33	s	57	5.45	n	1	20.43	e	98.0	57	5.11	n	1	22.63	e	99.0	4.1	sw	3	c	o	g	n	n	SS
Glomar Supporter	20/08/2023	v	Jessica Riggs	12:33	13:03	f	57	5.11	n	1	22.63	e	99.0	57	6.62	n	1	21.91	e	98.0	3.8	sw	3	c	o	g	n	n	SOL 12:44
Glomar Supporter	20/08/2023	v	Jessica Riggs	13:03	13:57	n	57	6.70	n	1	21.84	e	98.0	57	5.08	n	1	16.33	e	94.0	3.0	sw	3	s	o	g	n	n	EOL all off
Glomar Supporter	20/08/2023	v	Jessica Riggs	13:57	14:00	s	57	5.08	n	1	16.33	e	94.0	57	4.82	n	1	15.51	e	87.0	3.9	sw	3	s	o	g	sf	n	SS
Glomar Supporter	20/08/2023	v	Ossie Stewart	14:00	14:17	s	57	4.82	n	1	15.51	e	87.0	57	4.36	n	1	15.41	e	85.7	4.0	sw	3	s	o	g	sf	n	SS, change watch
Glomar Supporter	20/08/2023	v	Ossie Stewart	14:17	15:17	f	57	4.36	n	1	15.41	e	85.7	57	5.52	n	1	21.63	e	94.8	3.5	sw	3	s	o	g	sb	n	SOL
Glomar Supporter	20/08/2023	v	Ossie Stewart	15:17	16:17	f	57	5.52	n	1	21.63	e	94.8	57	6.67	n	1	28.30	e	94.3	3.6	sw	3	s	o	g	sb	n	
Glomar Supporter	20/08/2023	v	Ossie Stewart	16:17	16:30	f	57	6.67	n	1	28.30	e	94.3	57	6.94	n	1	29.86	e	98.6	3.8	sw	3	s	o	g	sb	n	
Glomar Supporter	20/08/2023	v	Jessica Riggs	16:30	17:30	f	57	6.94	n	1	29.86	e	98.6	57	8.06	n	1	36.44	e	97.1	3.7	s	3	s	o	g	sb	n	
Glomar Supporter	20/08/2023	v	Jessica Riggs	17:30	17:38	f	57	8.06	n	1	36.44	e	97.1	57	8.14	n	1	36.90	e	95.7	3.9	se	3	s	o	g	wb	n	
Glomar Supporter	20/08/2023	v	Jessica Riggs	17:38	18:03	r	57	8.14	n	1	36.90	e	95.7	57	7.79	n	1	36.48	e	97.9	3.9	se	3	s	o	g	wb	n	EOL
Glomar Supporter	20/08/2023	v	Jessica Riggs	18:03	19:03	f	57	7.79	n	1	36.48	e	97.9	57	6.44	n	1	28.70	e	99.0	3.8	sw	3	s	o	g	sf	n	SOL
Glomar Supporter	20/08/2023	v	Jessica Riggs	19:03	19:38	f	57	6.44	n	1	28.70	e	99.0	57	5.98	n	1	26.01	e	98.0	3.9	sw	4	s	o	g	sf	n	
Glomar Supporter	20/08/2023	p	David Melendez	19:38	20:30	f	57	5.98	n	1	26.01	e	98.0	57	4.91	n	1	19.94	e	99.0	3.6								SOW Acoustic
Glomar Supporter	20/08/2023	p	David Melendez	20:30	21:08	f	57	4.91	n	1	19.94	e	99.0	57	4.19	n	1	15.91	e	91.0	4.0								
Glomar Supporter	20/08/2023	p	David Melendez	21:08	21:32	r	57	4.19	n	1	15.91	e	91.0	57	3.99	n	1	16.25	e	94.0	3.9								EOL
Glomar Supporter	20/08/2023	p	David Melendez	21:32	22:06	f	57	3.99	n	1	16.25	e	94.0	57	4.67	n	1	20.27	e	94.0	4.5								SOL
Glomar Supporter	20/08/2023	p	Jessica Riggs	22:06	23:00	f	57	4.67	n	1	20.27	e	94.0	57	5.80	n	1	26.68	e	92.0	4.1								
Glomar Supporter	20/08/2023	p	David Melendez	23:00	24:00	f	57	5.80	n	1	26.68	e	92.0	57	7.01	n	1	33.68	e	96.0	4.0								
Glomar Supporter	21/08/2023	p	David Melendez	00:00	00:27	f	57	7.01	n	1	33.68	e	96.0	57	7.55	n	1	36.79	e	97.0	3.9								Midnight UTC

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	21/08/2023	p	David Melendez	00:27	00:46	r	57	7.55	n	1	36.79	e	97.0	57	7.26	n	1	36.63	e	97.0	4.0								EOL
Glomar Supporter	21/08/2023	p	David Melendez	00:46	01:46	f	57	7.26	n	1	36.63	e	97.0	57	5.87	n	1	28.50	e	98.0	3.8								SOL
Glomar Supporter	21/08/2023	p	David Melendez	01:46	02:46	f	57	5.87	n	1	28.50	e	98.0	57	4.91	n	1	22.91	e	100.0	3.9								
Glomar Supporter	21/08/2023	p	David Melendez	02:46	03:46	f	57	4.91	n	1	22.91	e	100.0	57	3.72	n	1	16.05	e	91.0	3.9								
Glomar Supporter	21/08/2023	p	David Melendez	03:46	04:02	n	57	3.72	n	1	16.05	e	91.0	57	3.15	n	1	16.99	e	94.0	3.9								EOL; All OFF
Glomar Supporter	21/08/2023	p	David Melendez	04:02	04:24	s	57	3.15	n	1	16.99	e	94.0	57	2.63	n	1	19.57	e	101.0	4.0								SS SBP & Sparker
Glomar Supporter	21/08/2023	p	David Melendez	04:24	04:35	r	57	2.63	n	1	19.57	e	101.0	57	2.29	n	1	19.74	e	101.0	3.8								After reaching FP, sparker was OFF from 04:24 -0435; EOW Acoustic
Glomar Supporter	21/08/2023	v	David Melendez	04:46	05:04	f	57	2.05	n	1	18.30	e	90.3	57	1.90	n	1	17.34	e	83.6	3.8	sw	4	s	o	g	n	n	SOW Visual
Glomar Supporter	21/08/2023	v	Ossie Stewart	05:04	05:19	r	57	1.90	n	1	17.34	e	83.6	57	1.93	n	1	17.37	e	85.0	3.9	sw	4	s	o	g	n	n	EOL RP LT
Glomar Supporter	21/08/2023	v	Ossie Stewart	05:19	06:30	f	57	1.93	n	1	17.37	e	85.0	57	3.39	n	1	25.84	e	85.9	4.0	sw	4	c	o	g	sf	n	SOL
Glomar Supporter	21/08/2023	v	Ossie Stewart	06:30	07:30	f	57	3.39	n	1	25.84	e	85.9	57	4.44	n	1	31.99	e	93.0	4.0	sw	4	c	o	g	sf	n	
Glomar Supporter	21/08/2023	v	Ossie Stewart	07:30	08:08	f	57	4.44	n	1	31.99	e	93.0	57	5.26	n	1	36.73	e	87.0	4.0	s	5	c	o	g	sf	n	
Glomar Supporter	21/08/2023	v	Ossie Stewart	08:08	08:38	r	57	5.26	n	1	36.73	e	87.0	57	6.11	n	1	36.62	e	90.4	4.0	sw	5	c	o	g	sf	n	EOL RP LT
Glomar Supporter	21/08/2023	v	Ossie Stewart	08:38	09:03	f	57	6.11	n	1	36.62	e	90.4	57	5.58	n	1	33.63	e	92.0	2.9	sw	5	c	o	g	sb	n	SOL
Glomar Supporter	21/08/2023	v	Ossie Stewart	09:03	09:42	n	57	5.58	n	1	33.63	e	92.0	57	5.61	n	1	35.94	e	91.3	3.5	sw	5	c	o	g	sb	n	EOL all off for SVP
Glomar Supporter	21/08/2023	v	Ossie Stewart	09:42	10:03	s	57	5.61	n	1	35.94	e	91.3	57	5.70	n	1	37.35	e	90.7	3.4	sw	4	c	o	g	sf	n	SS - FP log off for meeting
Glomar Supporter	21/08/2023	v	Ossie Stewart	10:15	11:13	f	57	4.98	n	1	36.72	e	92.0	57	3.88	n	1	30.28	e	93.3	3.7	sw	5	c	o	g	sb	n	SOL
Glomar Supporter	21/08/2023	v	Jessica Riggs	11:13	12:13	f	57	3.88	n	1	30.28	e	93.3	57	2.52	n	1	22.35	e	100.0	3.4	sw	5	c	o	g	vf	n	
Glomar Supporter	21/08/2023	v	Jessica Riggs	12:13	13:13	f	57	2.52	n	1	22.35	e	100.0	57	1.67	n	1	17.53	e	87.5	3.5	sw	4	c	o	g	vf	n	
Glomar Supporter	21/08/2023	v	Jessica Riggs	13:13	13:18	f	57	1.67	n	1	17.53	e	87.5	57	1.64	n	1	17.34	e	86.0	3.4	sw	5	c	o	g	vf	n	
Glomar Supporter	21/08/2023	v	Jessica Riggs	13:18	13:42	r	57	1.64	n	1	17.34	e	86.0	57	1.50	n	1	18.42	e	94.6	3.5	sw	5	c	o	g	vf	n	EOL
Glomar Supporter	21/08/2023	v	Jessica Riggs	13:42	14:00	f	57	1.50	n	1	18.42	e	94.6	57	1.80	n	1	20.19	e	100.0	3.5	sw	4	c	o	g	vf	n	SOL
Glomar Supporter	21/08/2023	v	Ossie Stewart	14:00	14:20	f	57	1.80	n	1	20.19	e	100.0	57	2.17	n	1	22.25	e	100.0	3.5	sw	5	c	o	g	sb	n	
Glomar Supporter	21/08/2023	v	Ossie Stewart	14:20	14:53	r	57	2.17	n	1	22.25	e	100.0	57	1.40	n	1	22.76	e	101.0	3.4	sw	5	c	o	g	sb	n	EOL RP LT
Glomar Supporter	21/08/2023	v	Ossie Stewart	14:53	15:53	f	57	1.40	n	1	22.76	e	101.0	57	2.55	n	1	29.32	e	99.0	3.8	sw	5	c	o	g	sb	n	SOL
Glomar Supporter	21/08/2023	v	Ossie Stewart	15:53	16:30	f	57	2.55	n	1	29.32	e	99.0	57	3.41	n	1	34.31	e	98.8	3.7	sw	5	c	o	g	sb	n	
Glomar Supporter	21/08/2023	v	Jessica Riggs	16:30	16:54	f	57	3.41	n	1	34.31	e	98.8	57	3.76	n	1	36.34	e	96.7	3.8	sw	4	c	o	g	sb	n	
Glomar Supporter	21/08/2023	v	Jessica Riggs	16:54	17:17	r	57	3.76	n	1	36.34	e	96.7	57	4.01	n	1	36.09	e	96.7	3.6	sw	4	c	o	g	sb	n	
Glomar Supporter	21/08/2023	v	David Melendez	17:17	17:35	f	57	4.01	n	1	36.09	e	96.7	57	3.63	n	1	34.14	e	98.9	4.0	s	5	c	o	g	sf	n	SOL
Glomar Supporter	21/08/2023	v	Jessica Riggs	17:35	17:38	f	57	3.63	n	1	34.14	e	98.9	57	3.57	n	1	33.68	e	98.6	3.6	s	5	c	o	g	sf	n	
Glomar Supporter	21/08/2023	v	Jessica Riggs	17:38	17:42	r	57	3.57	n	1	33.68	e	98.6	57	3.55	n	1	33.35	e	98.9	3.9	sw	5	c	o	g	sf	n	EOL
Glomar Supporter	21/08/2023	v	Jessica Riggs	17:42	18:42	n	57	3.55	n	1	33.35	e	98.9	57	1.99	n	1	29.40	e	98.2	3.9	sw	5	c	o	g	sf	n	All power sources off, 17:45 all equipment recovered
Glomar Supporter	21/08/2023	v	Jessica Riggs	18:42	19:42	n	57	1.99	n	1	29.40	e	98.2	57	4.22	n	1	29.37	e	98.2	1.7	sw	5	c	o	g	n	n	WOW
Glomar Supporter	21/08/2023	v	Jessica Riggs	19:42	20:30	n	57	4.22	n	1	29.37	e	98.2	57	3.75	n	1	34.92	e	98.1	4.3	sw	5	r	o	m	n	n	WOW
Glomar Supporter	22/08/2023	v	David Melendez	04:10	05:00	n	57	3.75	n	1	34.92	e	98.1	57	5.05	n	1	35.25	e	98.0	2.1	sw	5	c	o	g	n	n	SOW; SVP ops
Glomar Supporter	22/08/2023	v	Ossie Stewart	05:00	05:33	n	57	5.05	n	1	35.25	e	98.0	57	5.58	n	1	37.61	e	98.0	3.0	sw	4	c	o	g	n	n	change watch, carry on PW
Glomar Supporter	22/08/2023	v	Ossie Stewart	05:33	05:53	s	57	5.58	n	1	37.61	e	98.0	57	4.30	n	1	37.32	e	98.0	3.2	sw	5	c	o	g	sb	n	SS
Glomar Supporter	22/08/2023	v	Ossie Stewart	05:53	06:28	f	57	4.30	n	1	37.32	e	98.0	57	3.58	n	1	33.75	e	99.1	3.7	sw	5	c	o	g	sb	n	SOL - casual watch, data QC
Glomar Supporter	22/08/2023	v	Ossie Stewart	06:28	07:00	r	57	3.58	n	1	33.75	e	99.1	57	2.94	n	1	34.50	e	98.5	3.3	sw	6	c	o	g	sb	n	EOL - casual watch, data QC

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	22/08/2023	v	Ossie Stewart	07:00	08:00	f	57	2.94	n	1	34.50	e	98.5	57	6.23	n	1	32.60	e	97.1	4.0	sw	5	c	o	g	sb	n	SOL - casual watch, data QC
Glomar Supporter	22/08/2023	v	Ossie Stewart	08:00	09:10	f	57	6.23	n	1	32.60	e	97.1	57	10.22	n	1	30.24	e	94.2	3.5	sw	5	c	o	g	sb	n	Casual watch, data QC
Glomar Supporter	22/08/2023	v	Ossie Stewart	09:10	09:33	f	57	10.22	n	1	30.24	e	94.2	57	11.49	n	1	29.50	e	96.0	3.7	sw	5	c	o	g	sb	n	Casual watch, data QC
Glomar Supporter	22/08/2023	v	Ossie Stewart	09:33	09:43	r	57	11.49	n	1	29.50	e	96.0	57	12.03	n	1	29.18	e	96.2	3.5	sw	5	c	o	g	sb	n	EOL RP LT, casual watch data QC
Glomar Supporter	22/08/2023	v	Ossie Stewart	09:43	09:55	f	57	12.03	n	1	29.18	e	96.2	57	12.61	n	1	28.86	e	96.2	3.7	sw	5	c	o	g	sb	n	SOL, log off for meeting, casual watch data QC
Glomar Supporter	22/08/2023	v	Ossie Stewart	10:18	10:43	r	57	13.87	n	1	28.61	e	96.3	57	12.81	n	1	28.29	e	97.4	2.8	sw	5	c	o	g	sf	n	RP LT, back on active watch
Glomar Supporter	22/08/2023	v	Ossie Stewart	10:43	11:07	f	57	12.81	n	1	28.29	e	97.4	57	12.43	n	1	26.19	e	97.7	4.3	sw	5	c	o	g	sf	n	SOL
Glomar Supporter	22/08/2023	v	Jessica Riggs	11:07	11:31	n	57	12.43	n	1	26.19	e	97.7	57	11.87	n	1	23.07	e	97.5	2.9	sw	5	c	o	g	sf	n	EOL - UHR off for weather
Glomar Supporter	22/08/2023	v	Jessica Riggs	11:31	11:42	s	57	11.87	n	1	23.07	e	97.5	57	11.34	n	1	18.81	e	93.2	3.8	sw	5	c	o	g	vf	n	Aborted to just do side scan lines.
Glomar Supporter	22/08/2023	v	Jessica Riggs	11:42	12:08	n	57	11.34	n	1	18.81	e	93.2	57	11.34	n	1	18.64	e	94.4	4.0	sw	5	c	o	g	wb	n	
Glomar Supporter	22/08/2023	v	Jessica Riggs	12:08	12:28	s	57	11.34	n	1	18.64	e	94.4	57	10.80	n	1	17.63	e	93.9	4.0	sw	5	c	o	g	wb	n	Restart soft start SBP only
Glomar Supporter	22/08/2023	v	Jessica Riggs	12:28	13:28	r	57	10.80	n	1	17.63	e	93.9	57	11.90	n	1	23.94	e	97.5	3.9	sw	4	c	o	g	vf	n	SOL 12:40 SBP only
Glomar Supporter	22/08/2023	v	Jessica Riggs	13:28	14:05	r	57	11.90	n	1	23.94	e	97.5	57	12.65	n	1	28.31	e	96.8	3.9	sw	4	c	o	g	sb	n	
Glomar Supporter	22/08/2023	v	Ossie Stewart	14:05	14:19	r	57	12.65	n	1	28.31	e	96.8	57	12.94	n	1	30.01	e	72.1	4.0	sw	4	c	o	g	sb	n	
Glomar Supporter	22/08/2023	v	Ossie Stewart	14:19	14:30	r	57	12.94	n	1	30.01	e	72.1	57	13.12	n	1	31.13	e	97.5	3.8	sw	4	c	o	g	sb	n	EOL
Glomar Supporter	22/08/2023	v	Ossie Stewart	14:30	14:36	n	57	13.12	n	1	31.13	e	97.5	57	13.25	n	1	30.74	e	97.3	3.6	sw	4	c	o	g	sf	n	all off as vessel was coming out of survey site on LT
Glomar Supporter	22/08/2023	v	Ossie Stewart	14:36	14:56	s	57	13.25	n	1	30.74	e	97.3	57	13.33	n	1	28.90	e	97.4	3.8	sw	5	c	o	g	sf	n	SS SBP - started SS automatically although less than 10 mins off
Glomar Supporter	22/08/2023	v	Ossie Stewart	14:56	15:56	r	57	13.33	n	1	28.90	e	97.4	57	12.25	n	1	22.62	e	97.7	3.8	sw	5	c	o	g	sf	n	SOL
Glomar Supporter	22/08/2023	v	Ossie Stewart	15:56	16:34	r	57	12.25	n	1	22.62	e	97.7	57	11.55	n	1	10.53	e	95.3	3.8	sw	5	c	o	g	sf	n	
Glomar Supporter	22/08/2023	v	Jessica Riggs	16:34	16:46	n	57	11.55	n	1	10.53	e	95.3	57	11.29	n	1	19.05	e	95.1	4.0	sw	5	c	o	g	sf	n	EOL
Glomar Supporter	22/08/2023	v	Jessica Riggs	16:46	17:06	s	57	11.29	n	1	19.05	e	95.1	57	11.30	n	1	21.32	e	96.0	4.0	sw	4	c	o	g	sb	n	
Glomar Supporter	22/08/2023	v	David Melendez	17:06	17:23	f	57	11.30	n	1	21.32	e	96.0	57	10.40	n	1	21.89	e	87.9	3.6	s	4	c	o	g	wf	n	SOL at 17:13
Glomar Supporter	22/08/2023	v	David Melendez	17:23	17:30	n	57	10.40	n	1	21.89	e	87.9	57	10.02	n	1	21.85	e	98.9	3.3	s	4	c	o	g	vf	n	EOL
Glomar Supporter	22/08/2023	v	Jessica Riggs	17:30	18:16	n	57	10.02	n	1	21.85	e	98.9	57	10.29	n	1	17.83	e	95.3	4.0	sw	4	c	o	g	sf	n	
Glomar Supporter	22/08/2023	v	Jessica Riggs	18:16	18:36	s	57	10.29	n	1	17.83	e	95.3	57	11.50	n	1	17.66	e	94.6	3.4	sw	4	c	o	g	sf	n	
Glomar Supporter	22/08/2023	v	Jessica Riggs	18:36	19:32	f	57	11.50	n	1	17.66	e	94.6	57	12.60	n	1	23.72	e	104.0	3.1	sw	4	c	o	g	sb	n	
Glomar Supporter	22/08/2023	p	David Melendez	19:32	20:18	f	57	12.60	n	1	23.72	e	104.0	57	13.45	n	1	28.77	e	101.0	3.9								SOW Acoustic
Glomar Supporter	22/08/2023	p	David Melendez	20:18	20:34	r	57	13.45	n	1	28.77	e	101.0	57	13.16	n	1	28.00	e	93.0	3.8								EOL
Glomar Supporter	22/08/2023	p	David Melendez	20:34	21:34	f	57	13.16	n	1	28.00	e	93.0	57	12.57	n	1	21.69	e	101.0	3.4								SOL
Glomar Supporter	22/08/2023	p	David Melendez	21:34	21:57	f	57	12.57	n	1	21.69	e	101.0	57	12.07	n	1	19.08	e	99.0	3.7								
Glomar Supporter	22/08/2023	p	David Melendez	21:57	22:18	r	57	12.07	n	1	19.08	e	99.0	57	12.44	n	1	19.65	e	93.0	3.7								EOL
Glomar Supporter	22/08/2023	p	Jessica Riggs	22:18	23:00	f	57	12.44	n	1	19.65	e	93.0	57	13.32	n	1	24.72	e	100.0	4.0								SOL
Glomar Supporter	22/08/2023	p	David Melendez	23:00	23:39	f	57	13.32	n	1	24.72	e	100.0	57	13.87	n	1	27.92	e	97.0	3.9								
Glomar Supporter	22/08/2023	p	David Melendez	23:39	23:52	r	57	13.87	n	1	27.92	e	97.0	57	13.87	n	1	27.92	e	97.0	3.9								EOL
Glomar Supporter	22/08/2023	p	David Melendez	23:52	24:00	f	57	14.07	n	1	27.38	e	98.0	57	14.07	n	1	27.38	e	98.0	3.4								SOL

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	23/08/2023	p	David Melendez	00:00	01:00	f	57	13.93	n	1	26.55	e	98.0	57	13.93	n	1	26.55	e	98.0	3.9								Midnight UTC
Glomar Supporter	23/08/2023	p	David Melendez	01:00	01:18	r	57	12.75	n	1	19.66	e	93.0	57	12.75	n	1	19.66	e	93.0	3.9								EOL
Glomar Supporter	23/08/2023	p	David Melendez	01:18	02:16	f	57	13.10	n	1	20.09	e	95.0	57	13.10	n	1	20.09	e	95.0	4.1								SOL
Glomar Supporter	23/08/2023	p	David Melendez	02:16	02:36	r	57	14.31	n	1	27.07	e	97.0	57	14.31	n	1	7.07	e	97.0	4.1								EOL
Glomar Supporter	23/08/2023	p	David Melendez	02:36	03:29	f	57	14.52	n	1	26.52	e	94.0	57	14.52	n	1	26.52	e	94.0	3.9								SOL
Glomar Supporter	23/08/2023	p	David Melendez	03:29	03:47	r	57	13.42	n	1	20.20	e	98.0	57	13.78	n	1	20.60	e	98.0	4.3								EOL
Glomar Supporter	23/08/2023	p	David Melendez	03:47	04:39	f	57	13.78	n	1	20.60	e	98.0	57	14.74	n	1	26.21	e	95.0	4.6								SOL
Glomar Supporter	23/08/2023	p	David Melendez	04:39	04:57	r	57	14.74	n	1	26.21	e	95.0	57	14.94	n	1	25.72	e	91.4	4.0								EOL
Glomar Supporter	23/08/2023	v	Ossie Stewart	04:57	05:40	f	57	14.94	n	1	25.72	e	91.4	57	14.08	n	1	20.77	e	91.8	3.7	nw	5	c	o	g	n	n	SOL
Glomar Supporter	23/08/2023	v	Ossie Stewart	05:40	05:57	r	57	14.08	n	1	20.77	e	91.8	57	14.48	n	1	21.49	e	92.9	3.9	nw	4	c	o	g	n	n	EOL
Glomar Supporter	23/08/2023	v	Ossie Stewart	05:57	06:34	f	57	14.48	n	1	21.49	e	92.9	57	15.15	n	1	25.41	e	91.6	4.0	nw	4	s	o	g	n	n	SOL
Glomar Supporter	23/08/2023	v	Ossie Stewart	06:34	06:53	r	57	15.15	n	1	25.41	e	91.6	57	15.35	n	1	24.89	e	93.3	3.8	nw	3	s	o	g	n	n	EOL
Glomar Supporter	23/08/2023	v	Ossie Stewart	06:53	07:16	f	57	15.35	n	1	24.89	e	93.3	57	14.89	n	1	22.24	e	92.9	4.0	nw	3	s	o	g	n	n	SOL
Glomar Supporter	23/08/2023	v	Ossie Stewart	07:16	07:34	r	57	14.89	n	1	22.24	e	92.9	57	14.65	n	1	21.41	e	92.6	3.8	nw	3	s	o	g	sf	n	EOL
Glomar Supporter	23/08/2023	v	Ossie Stewart	07:34	08:35	f	57	14.65	n	1	21.41	e	92.6	57	10.72	n	1	23.75	e	95.0	3.8	nw	2	s	o	g	sf	n	SOL
Glomar Supporter	23/08/2023	v	Ossie Stewart	08:35	09:35	f	57	10.72	n	1	23.75	e	95.0	57	6.79	n	1	26.02	e	91.4	3.9	sw	3	s	o	g	sf	n	
Glomar Supporter	23/08/2023	v	Ossie Stewart	09:35	09:55	f	57	6.79	n	1	26.02	e	91.4	57	5.74	n	1	26.63	e	91.3	4.1	sw	2	s	o	g	sf	n	log off for meeting
Glomar Supporter	23/08/2023	v	Ossie Stewart	10:11	10:54	f	57	4.63	n	1	27.27	e	92.9	57	1.91	n	1	28.86	e	93.6	4.1	s	2	s	o	g	sf	n	
Glomar Supporter	23/08/2023	v	Ossie Stewart	10:54	11:00	r	57	1.91	n	1	28.86	e	93.6	57	1.75	n	1	30.32	e	93.6	4.2	s	2	s	o	g	sf	n	EOL
Glomar Supporter	23/08/2023	v	Jessica Riggs	11:00	11:22	r	57	1.75	n	1	30.32	e	93.6	57	2.42	n	1	30.62	e	92.9	4.5	se	1	s	o	g	vf	n	
Glomar Supporter	23/08/2023	v	Jessica Riggs	11:22	12:22	f	57	2.42	n	1	30.62	e	92.9	57	6.45	n	1	28.33	e	93.6	3.7	w	2	s	o	g	sb	n	SOL
Glomar Supporter	23/08/2023	v	Jessica Riggs	12:22	13:22	f	57	6.45	n	1	28.33	e	93.6	57	9.32	n	1	26.70	e	92.1	3.5	nw	2	s	o	g	vf	n	
Glomar Supporter	23/08/2023	v	Jessica Riggs	13:22	13:35	f	57	9.32	n	1	26.70	e	92.1	57	9.90	n	1	26.30	e	92.9	3.5	nw	2	s	o	g	vf	n	
Glomar Supporter	23/08/2023	v	Jessica Riggs	13:35	13:50	n	57	9.90	n	1	26.30	e	92.9	57	10.71	n	1	25.80	e	93.3	3.5	nw	2	s	o	g	wf	n	EOL - all off as UHR system mis-triggered
Glomar Supporter	23/08/2023	v	Jessica Riggs	13:50	14:00	s	57	10.71	n	1	25.80	e	93.3	57	10.14	n	1	26.07	e	93.0	3.0	sw	2	s	o	g	sf	n	SS
Glomar Supporter	23/08/2023	v	Ossie Stewart	14:00	14:12	s	57	10.14	n	1	26.07	e	93.0	57	10.34	n	1	26.03	e	93.2	3.6	nw	2	s	o	g	sb	n	SS - change watch
Glomar Supporter	23/08/2023	v	Ossie Stewart	14:12	15:23	f	57	10.34	n	1	26.03	e	93.2	57	14.15	n	1	23.81	e	94.3	3.4	w	2	s	o	g	n	n	SOL
Glomar Supporter	23/08/2023	v	Ossie Stewart	15:23	15:45	f	57	14.15	n	1	23.81	e	94.3	57	15.38	n	1	23.09	e	92.9	3.5	w	2	s	o	g	n	n	
Glomar Supporter	23/08/2023	v	Ossie Stewart	15:45	16:23	r	57	15.38	n	1	23.09	e	92.9	57	15.05	n	1	25.37	e	91.5	4.2	s	3	s	o	g	n	n	EOL
Glomar Supporter	23/08/2023	v	Ossie Stewart	16:23	16:30	f	57	15.05	n	1	25.37	e	91.5	57	14.40	n	1	25.76	e	90.0	4.0	s	3	s	o	g	n	n	SOL
Glomar Supporter	23/08/2023	v	Jessica Riggs	16:30	17:27	f	57	14.40	n	1	25.76	e	90.0	57	10.97	n	1	27.85	e	93.1	3.7	se	2	s	o	g	vf	n	
Glomar Supporter	23/08/2023	v	David Melendez	17:27	17:35	n	57	10.97	n	1	27.85	e	93.1	57	11.51	n	1	29.36	e	92.1	3.0	se	2	s	o	g	wb	n	EOL
Glomer Supporter	23/08/2023	v	Jessica Riggs	17:35	17:47	n	57	11.51	n	1	29.36	e	92.1	57	11.53	n	1	29.40	e	93.0	3.8	se	1	g	o	g	sb	n	
Glomer Supporter	23/08/2023	v	Jessica Riggs	17:47	18:07	s	57	11.53	n	1	29.40	e	93.0	57	12.44	n	1	30.91	e	93.6	3.9	se	2	g	o	g	sb	n	
Glomer Supporter	23/08/2023	v	Jessica Riggs	18:07	19:07	f	57	12.44	n	1	30.91	e	93.6	57	8.97	n	1	33.10	e	91.4	3.5	se	3	g	o	g	sb	n	
Glomer Supporter	23/08/2023	v	Jessica Riggs	19:07	19:32	f	57	8.97	n	1	33.10	e	91.4	57	7.66	n	1	33.89	e	98.0	3.5	se	3	g	o	g	n	n	
Glomer Supporter	23/08/2023	p	David Melendez	19:32	20:30	f	57	7.66	n	1	33.89	e	98.0	57	4.48	n	1	35.70	e	98.0	3.5								SOW Acoustic
Glomer Supporter	23/08/2023	p	David Melendez	20:30	20:43	f	57	4.48	n	1	35.70	e	98.0	57	3.72	n	1	3.13	e	98.0	3.5								EOL @20:43, all sources OFF; EOW Acoustic
Glomer Supporter	24/08/2023	v	David Melendez	04:30	05:00	n	57	3.80	n	1	33.16	e	93.0	57	3.79	n	1	33.13	e	92.9	0.1	se	3	s	o	g	n	l	SOW - TBT for enviro,
Glomer Supporter	24/08/2023	v	Ossie Stewart	05:00	06:00	n	57	3.79	n	1	33.13	e	92.9	57	3.90	n	1	33.25	e	92.8	0.2	s	4	s	o	g	n	l	Enviro.survey
Glomer Supporter	24/08/2023	v	Ossie Stewart	06:00	07:00	n	57	3.90	n	1	33.25	e	92.8	57	3.67	n	1	30.81	e	93.6	4.3	s	4	c	o	g	n	l	Enviro.survey
Glomer Supporter	24/08/2023	v	Ossie Stewart	07:00	08:00	n	57	3.67	n	1	30.81	e	93.6	57	3.52	n	1	29.75	e	95.0	0.0	se	4	c	o	g	n	n	Enviro.survey

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomer Supporter	24/08/2023	v	Ossie Stewart	08:00	09:00	n	57	3.52	n	1	29.75	e	95.0	57	3.46	n	1	29.77	e	94.3	0.1	se	5	c	o	m	n	l	Enviro.survey
Glomer Supporter	24/08/2023	v	Ossie Stewart	09:00	09:50	n	57	3.46	n	1	29.77	e	94.3	57	4.96	n	1	29.13	e	94.4	2.5	se	5	c	o	g	n	n	Enviro.survey
Glomer Supporter	24/08/2023	v	Ossie Stewart	10:15	11:00	n	57	5.06	n	1	29.13	e	94.4	57	5.06	n	1	29.16	e	93.6	0.2	se	4	c	o	g	wf	n	Enviro.survey
Glomer Supporter	24/08/2023	v	Jessica Riggs	11:00	12:00	n	57	5.06	n	1	29.16	e	93.6	57	5.06	n	1	29.17	e	93.6	0.0	sw	4	c	o	g	n	n	Enviro.survey
Glomer Supporter	24/08/2023	v	Jessica Riggs	12:00	13:00	n	57	5.06	n	1	29.17	e	93.6	57	5.25	n	1	29.49	e	110.0	0.0	sw	5	c	o	g	wf	n	Enviro.survey
Glomer Supporter	24/08/2023	v	Jessica Riggs	13:00	14:00	n	57	5.25	n	1	29.49	e	110.0	57	5.13	n	1	29.58	e	93.6	0.0	sw	5	c	o	g	wf	n	Enviro.survey
Glomer Supporter	24/08/2023	v	Ossie Stewart	14:00	15:00	n	57	5.13	n	1	29.58	e	93.6	57	5.59	n	1	31.26	e	92.9	0.1	sw	5	c	o	g	wf	n	Enviro.survey
Glomer Supporter	24/08/2023	v	Ossie Stewart	15:00	16:00	n	57	5.59	n	1	31.26	e	92.9	57	6.64	n	1	35.14	e	92.0	0.0	sw	4	s	o	g	sf	n	Enviro.survey
Glomer Supporter	24/08/2023	v	Ossie Stewart	16:00	16:30	n	57	6.64	n	1	35.14	e	92.0	57	6.57	n	1	35.31	e	92.2	0.4	sw	4	s	o	g	wf	n	Enviro.survey
Glomer Supporter	24/08/2023	v	Jessica Riggs	16:30	17:30	n	57	6.57	n	1	35.31	e	92.2	57	6.62	n	1	35.27	e	92.1	0.5	sw	4	s	o	g	wf	n	Enviro.survey
Glomer Supporter	24/08/2023	v	Jessica Riggs	17:30	18:30	n	57	6.62	n	1	35.27	e	92.1	57	6.49	n	1	32.07	e	92.9	0.0	sw	3	s	o	g	sf	n	Enviro.survey
Glomer Supporter	24/08/2023	v	Jessica Riggs	18:30	19:30	n	57	6.49	n	1	32.07	e	92.9	57	6.25	n	1	29.45	e	94.0	0.1	sw	3	s	o	g	sf	n	Enviro.survey
Glomer Supporter	25/08/2023	v	David Melendez	04:36	04:56	n	57	8.18	n	1	30.47	e	93.2	57	7.53	n	1	32.07	e	94.2	3.9	sw	3	s	o	g	n	n	SOW Visual
Glomer Supporter	25/08/2023	v	Ossie Stewart	04:56	05:56	n	57	7.53	n	1	32.07	e	94.2	57	7.60	n	1	32.43	e	94.1	0.0	sw	3	s	o	g	wf	n	Enviro. Survey
Glomer Supporter	25/08/2023	v	Ossie Stewart	05:56	06:56	n	57	7.60	n	1	32.43	e	94.1	57	8.89	n	1	34.98	e	93.1	0.1	sw	4	s	o	g	sf	n	Enviro. Survey
Glomer Supporter	25/08/2023	v	Ossie Stewart	06:56	07:56	n	57	8.89	n	1	34.98	e	93.1	57	10.39	n	1	33.01	e	92.1	1.9	sw	4	s	o	g	sf	n	Enviro. Survey
Glomer Supporter	25/08/2023	v	Ossie Stewart	07:56	09:20	n	57	10.39	n	1	33.01	e	92.1	57	10.47	n	1	32.70	e	91.9	0.5	sw	3	s	o	g	sb	n	Enviro. Survey
Glomer Supporter	25/08/2023	v	Ossie Stewart	09:20	09:55	n	57	10.47	n	1	32.70	e	91.9	57	10.05	n	1	31.88	e	92.0	3.9	sw	3	s	o	g	sb	n	Enviro. Survey
Glomer Supporter	25/08/2023	v	Ossie Stewart	10:08	11:00	n	57	9.58	n	1	30.74	e	90.7	57	9.55	n	1	30.64	e	91.1	0.1	sw	3	s	o	g	sb	n	Enviro. Survey
Glomer Supporter	25/08/2023	v	Jessica Riggs	11:00	12:00	n	57	9.55	n	1	30.64	e	91.1	57	9.55	n	1	30.39	e	92.1	0.0	sw	2	s	o	g	vf	n	Enviro. Survey
Glomer Supporter	25/08/2023	v	Jessica Riggs	12:00	13:00	n	57	9.55	n	1	30.39	e	92.1	57	9.47	n	1	28.67	e	92.1	4.5	sw	3	s	o	g	sf	n	Enviro. Survey
Glomer Supporter	25/08/2023	v	Jessica Riggs	13:00	14:00	n	57	9.47	n	1	28.67	e	92.1	57	9.96	n	1	28.35	e	92.2	0.1	sw	3	s	o	g	vf	n	Enviro. Survey
Glomer Supporter	25/08/2023	v	Ossie Stewart	14:00	15:08	n	57	9.96	n	1	28.35	e	92.2	57	10.00	n	1	28.31	e	92.5	0.5	sw	3	s	o	g	vf	n	Enviro. Survey
Glomer Supporter	25/08/2023	v	Ossie Stewart	15:08	16:00	n	57	10.00	n	1	28.31	e	92.5	57	11.82	n	1	27.57	e	90.7	0.0	sw	3	s	o	g	sb	n	Enviro. Survey
Glomer Supporter	25/08/2023	v	Ossie Stewart	16:00	16:30	n	57	11.82	n	1	27.57	e	90.7	57	11.87	n	1	27.55	e	90.9	0.0	sw	3	s	o	g	sb	n	Enviro. Survey
Glomer Supporter	25/08/2023	v	Jessica Riggs	16:30	17:30	n	57	11.87	n	1	27.55	e	90.9	57	13.09	n	1	26.78	e	91.4	0.0	sw	3	s	o	g	sb	n	Enviro. Survey
Glomer Supporter	25/08/2023	v	Jessica Riggs	17:30	18:30	n	57	13.09	n	1	26.78	e	91.4	57	13.12	n	1	26.78	e	91.9	0.5	sw	2	s	o	g	sb	n	Enviro. Survey
Glomar Supporter	26/08/2023	v	David Melendez	04:37	05:00	n	57	10.83	n	1	22.51	e	93.1	57	11.10	n	1	20.01	e	91.2	4.2	e	2	s	o	g	n	n	SOW Visual
Glomar Supporter	26/08/2023	v	Ossie Stewart	05:00	06:00	n	57	11.10	n	1	20.01	e	91.2	57	11.07	n	1	19.86	e	91.4	0.3	e	2	s	o	g	vb	n	Enviro. Survey, casual watch log QC
Glomar Supporter	26/08/2023	v	Ossie Stewart	06:00	07:00	n	57	11.07	n	1	19.86	e	91.4	57	10.37	n	1	19.31	e	90.0	0.0	e	3	s	o	g	vb	l	Enviro. Survey, casual watch log QC
Glomar Supporter	26/08/2023	v	Ossie Stewart	07:00	08:00	n	57	10.37	n	1	19.31	e	90.0	57	10.04	n	1	21.49	e	93.3	0.2	e	3	s	o	g	sb	n	Enviro. Survey, casual watch log QC
Glomar Supporter	26/08/2023	v	Ossie Stewart	08:00	09:00	n	57	10.04	n	1	21.49	e	93.3	57	10.05	n	1	22.06	e	94.0	3.8	e	3	s	o	g	sf	n	Enviro. Survey, casual watch log QC
Glomar Supporter	26/08/2023	v	Ossie Stewart	09:00	09:50	n	57	10.05	n	1	22.06	e	94.0	57	8.73	n	1	24.32	e	93.6	0.1	e	3	s	o	g	sf	n	Enviro. Survey - morning meeting
Glomar Supporter	26/08/2023	v	Ossie Stewart	10:14	11:00	n	57	8.80	n	1	24.63	e	93.6	57	8.77	n	1	24.44	e	93.6	0.0	e	2	s	o	g	sf	n	Enviro. Survey
Glomar Supporter	26/08/2023	v	Ossie Stewart	11:00	11:07	n	57	8.77	n	1	24.44	e	93.6	57	8.77	n	1	24.39	e	93.6	0.1	e	1	g	o	g	vf	n	Enviro. Survey
Glomar Supporter	26/08/2023	v	Jessica Riggs	11:07	12:00	n	57	8.77	n	1	24.39	e	93.6	57	8.04	n	1	22.21	e	93.6	2.9	se	2	g	o	g	vf	n	Enviro. Survey
Glomar Supporter	26/08/2023	v	Jessica Riggs	12:00	13:00	n	57	8.04	n	1	22.21	e	93.6	57	9.11	n	1	19.95	e	90.6	0.0	se	1	g	o	g	vf	n	Enviro. Survey
Glomar Supporter	26/08/2023	v	Jessica Riggs	13:00	14:00	n	57	9.11	n	1	19.95	e	90.6	57	8.43	n	1	18.60	e	91.9	0.6	ne	2	g	o	g	vb	n	Enviro. Survey
Glomar Supporter	26/08/2023	v	Ossie Stewart	14:00	15:00	n	57	8.43	n	1	18.60	e	91.9	57	7.57	n	1	18.07	e	92.1	4.7	ne	3	s	o	g	vf	n	Enviro. Survey
Glomar Supporter	26/08/2023	v	Ossie Stewart	15:00	16:00	n	57	7.57	n	1	18.07	e	92.1	57	7.63	n	1	17.92	e	91.8	0.0	ne	3	s	o	g	sb	n	Enviro. Survey

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	26/08/2023	v	Ossie Stewart	16:00	16:30	n	57	7.63	n	1	17.92	e	91.8	57	7.04	n	1	20.81	e	93.1	0.3	ne	3	s	o	g	sb	n	Enviro. Survey
Glomar Supporter	26/08/2023	v	Jessica Riggs	16:30	17:30	n	57	7.04	n	1	20.81	e	93.1	57	6.05	n	1	23.22	e	93.6	0.6	ne	3	s	o	g	sb	n	Enviro. Survey
Glomar Supporter	26/08/2023	v	Jessica Riggs	17:30	18:30	n	57	6.05	n	1	23.22	e	93.6	57	5.78	n	1	23.62	e	94.3	3.8	e	2	s	o	g	sb	n	Enviro. Survey
Glomar Supporter	26/08/2023	v	Jessica Riggs	18:30	19:30	n	57	5.78	n	1	23.62	e	94.3	57	2.69	n	1	20.48	e	93.6	0.1	se	2	s	o	g	sb	n	Enviro. Survey
Glomar Supporter	27/08/2023	v	David Melendez	04:32	04:57	n	57	2.69	n	1	20.48	e	93.6	57	2.72	n	1	20.63	e	94.0	0.4	nw	0	g	o	g	n	n	SOW Visual
Glomar Supporter	27/08/2023	v	Ossie Stewart	04:57	05:57	n	57	2.72	n	1	20.63	e	94.0	57	2.43	n	1	18.98	e	95.7	0.5	nw	1	g	o	g	wf	n	Enviro. Survey, casual watch log QC
Glomar Supporter	27/08/2023	v	Ossie Stewart	05:57	06:57	n	57	2.43	n	1	18.98	e	95.7	57	2.42	n	1	18.95	e	96.1	0.5	n	1	g	o	g	sb	n	Enviro. Survey, casual watch log QC
Glomar Supporter	27/08/2023	v	Ossie Stewart	06:57	07:57	n	57	2.42	n	1	18.95	e	96.1	57	3.32	n	1	17.63	e	91.4	0.0	n	2	s	o	g	sb	n	Enviro. Survey, casual watch log QC
Glomar Supporter	27/08/2023	v	Ossie Stewart	07:57	08:57	n	57	3.32	n	1	17.63	e	91.4	57	3.79	n	1	19.51	e	94.7	0.5	n	2	s	o	g	sb	n	Enviro. Survey, casual watch log QC
Glomar Supporter	27/08/2023	v	Ossie Stewart	08:57	09:55	n	57	3.79	n	1	19.51	e	94.7	57	3.91	n	1	22.57	e	95.7	0.5	nw	2	s	o	g	sf	n	Enviro. Survey - morning meeting
Glomar Supporter	27/08/2023	v	Ossie Stewart	10:10	11:00	n	57	3.94	n	1	22.82	e	95.6	57	4.64	n	1	22.16	e	95.0	0.5	nw	2	s	o	g	sf	n	Enviro. Survey
Glomar Supporter	27/08/2023	v	Jessica Riggs	11:00	12:00	n	57	4.64	n	1	22.16	e	95.0	57	4.65	n	1	21.99	e	95.0	0.0	nw	2	s	o	g	vf	n	Enviro. Survey
Glomar Supporter	27/08/2023	v	Jessica Riggs	12:00	13:00	n	57	4.65	n	1	21.99	e	95.0	57	5.50	n	1	20.66	e	93.8	3.1	nw	3	s	o	g	vb	n	Enviro. Survey
Glomar Supporter	27/08/2023	v	Jessica Riggs	13:00	14:00	n	57	5.50	n	1	20.66	e	93.8	57	5.69	n	1	19.84	e	93.5	4.6	se	3	g	o	g	vb	n	Enviro. Survey
Glomar Supporter	27/08/2023	v	Ossie Stewart	14:00	15:00	n	57	5.69	n	1	19.84	e	93.5	57	5.23	n	1	17.83	e	91.4	0.0	nw	3	s	o	g	sf	n	Enviro. Survey
Glomar Supporter	27/08/2023	v	Ossie Stewart	15:00	16:17	n	57	5.23	n	1	17.83	e	91.4	57	8.07	n	1	20.92	e	91.8	3.0	nw	3	s	o	g	sf	n	
Glomar Supporter	27/08/2023	v	Ossie Stewart	16:17	16:30	s	57	8.07	n	1	20.92	e	91.8	57	9.11	n	1	21.25	e	93.3	3.9	nw	3	s	o	g	sb	n	SS SBP
Glomar Supporter	27/08/2023	v	Jessica Riggs	16:30	16:37	s	57	9.11	n	1	21.25	e	93.3	57	9.27	n	1	20.90	e	92.9	4.0	nw	3	s	o	g	n	n	
Glomar Supporter	27/08/2023	v	Jessica Riggs	16:37	17:22	r	57	9.27	n	1	20.90	e	92.9	57	8.39	n	1	15.84	e	89.4	3.9	nw	3	s	o	g	sf	n	
Glomar Supporter	27/08/2023	v	David Melendez	17:22	17:30	n	57	8.39	n	1	15.84	e	89.4	57	8.98	n	1	16.16	e	89.3	3.6	nw	3	s	o	g	vf	n	EOL, SBP OFF
Glomar Supporter	27/08/2023	v	Jessica Riggs	17:30	18:30	n	57	8.98	n	1	16.16	e	89.3	57	9.88	n	1	19.24	e	89.7	3.2	nw	3	s	o	g	vf	n	
Glomar Supporter	27/08/2023	v	Jessica Riggs	18:30	19:30	n	57	9.88	n	1	19.24	e	89.7	57	18.25	n	1	12.48	e	84.2	0.0	nw	3	s	o	g	sb	n	
Glomar Supporter	28/08/2023	v	David Melendez	04:42	04:58	n	57	18.25	n	1	12.48	e	84.2	57	18.30	n	1	12.31	e	84.0	0.5	nw	3	s	o	g	n	n	SOW Visual
Glomar Supporter	28/08/2023	v	Ossie Stewart	04:58	06:00	n	57	18.30	n	1	12.31	e	84.0	57	19.05	n	1	10.30	e	84.4	0.0	nw	3	s	o	g	sb	n	Enviro. Survey, casual watch final report
Glomar Supporter	28/08/2023	v	Ossie Stewart	06:00	07:00	n	57	19.05	n	1	10.30	e	84.4	57	19.87	n	1	8.73	e	86.8	4.5	nw	3	s	o	g	vb	n	Enviro. Survey, casual watch final report
Glomar Supporter	28/08/2023	v	Ossie Stewart	07:00	08:07	n	57	19.87	n	1	8.73	e	86.8	57	20.98	n	1	5.47	e	90.0	0.5	nw	3	s	o	g	sb	n	Enviro. Survey
Glomar Supporter	28/08/2023	v	Ossie Stewart	08:07	09:05	n	57	20.98	n	1	5.47	e	90.0	57	22.28	n	1	1.99	e	99.1	0.5	w	4	c	o	g	sb	n	Enviro. Survey
Glomar Supporter	28/08/2023	v	Ossie Stewart	09:05	09:55	n	57	22.28	n	1	1.99	e	99.1	57	22.94	n	1	0.34	e	91.5	4.6	w	4	c	o	g	vb	n	Enviro. Survey
Glomar Supporter	28/08/2023	v	Ossie Stewart	10:15	11:00	n	57	23.36	n	0	59.24	e	92.1	57	23.40	n	0	59.14	e	92.4	0.0	w	4	c	o	g	n	l	Enviro. Survey
Glomar Supporter	28/08/2023	v	Jessica Riggs	11:00	12:00	n	57	23.40	n	0	59.14	e	92.4	57	24.83	n	0	53.65	e	91.1	0.0	w	4	c	o	g	sb	n	Enviro. Survey
Glomar Supporter	28/08/2023	v	Jessica Riggs	12:00	13:00	n	57	24.83	n	0	53.65	e	91.1	57	24.89	n	0	53.14	e	91.0	4.2	sw	4	c	o	g	vf	n	Enviro, Survey
Glomar Supporter	28/08/2023	v	Jessica Riggs	13:00	14:00	n	57	24.89	n	0	53.14	e	91.0	57	23.25	n	0	47.58	e	84.9	0.2	nw	4	c	o	g	n	n	Enviro, Survey
Glomar Supporter	28/08/2023	v	Ossie Stewart	14:00	15:00	n	57	23.25	n	0	47.58	e	84.9	57	22.89	n	0	45.80	e	81.3	5.6	w	5	c	o	g	n	n	Enviro, Survey
Glomar Supporter	28/08/2023	v	Ossie Stewart	15:00	16:00	n	57	22.89	n	0	45.80	e	81.3	57	22.88	n	0	45.88	e	81.4	0.1	w	5	c	o	g	n	n	Enviro, Survey
Glomar Supporter	28/08/2023	v	Ossie Stewart	16:00	16:30	n	57	22.88	n	0	45.88	e	81.4	57	22.87	n	0	45.97	e	81.4	0.0	w	4	c	o	g	sf	n	Enviro, Survey
Glomar Supporter	28/08/2023	v	Jessica Riggs	16:30	17:30	n	57	22.87	n	0	45.97	e	81.4	57	21.06	n	0	39.16	e	85.0	1.3	sw	3	c	o	g	sf	n	Enviro, Survey
Glomar Supporter	28/08/2023	v	Jessica Riggs	17:30	18:30	n	57	21.06	n	0	39.16	e	85.0	57	21.38	n	0	36.29	e	82.1	0.5	sw	3	c	o	g	n	n	Enviro, Survey

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	28/08/2023	v	Jessica Riggs	18:30	19:30	n	57	21.38	n	0	36.29	e	82.1	57	29.23	n	0	11.85	e	85.0	6.0	sw	3	c	o	g	n	n	Enviro, Survey
Glomar Supporter	29/08/2023	v	David Melendez	04:50	05:22	n	57	29.23	n	0	11.85	e	85.0	57	29.84	n	0	14.92	e	79.3	2.3	sw	4	c	o	g	n	l	SOW Visual, PW SBP
Glomar Supporter	29/08/2023	v	Ossie Stewart	05:22	05:42	s	57	29.84	n	0	14.92	e	79.3	57	29.79	n	0	12.70	e	83.8	3.6	sw	4	c	o	g	n	n	SS SBP
Glomar Supporter	29/08/2023	v	Ossie Stewart	05:42	06:46	r	57	29.79	n	0	12.70	e	83.8	57	29.80	n	0	4.97	e	82.9	3.9	sw	4	c	o	g	n	n	SBP FP, SOL
Glomar Supporter	29/08/2023	v	Ossie Stewart	06:46	06:53	r	57	29.80	n	0	4.97	e	82.9	57	29.87	n	0	4.29	e	82.2	3.8	sw	4	c	o	g	vb	n	
Glomar Supporter	29/08/2023	v	Ossie Stewart	06:53	07:31	r	57	29.87	n	0	4.29	e	82.2	57	29.86	n	0	6.22	e	85.0	3.3	sw	4	c	o	g	vb	n	stop logging, issue with nav, will circle back to where issue started and re-run
Glomar Supporter	29/08/2023	v	Ossie Stewart	07:31	08:30	r	57	29.86	n	0	6.22	e	85.0	57	30.15	n	0	0.80	w	85.7	3.9	sw	4	c	o	g	sb	n	SOL
Glomar Supporter	29/08/2023	v	Ossie Stewart	08:30	09:39	r	57	30.15	n	0	0.80	w	85.7	57	30.72	n	0	8.75	w	87.1	3.7	w	5	c	o	g	sb	n	
Glomar Supporter	29/08/2023	v	Ossie Stewart	09:39	09:55	r	57	30.72	n	0	8.75	w	87.1	57	30.84	n	0	10.49	w	85.7	3.8	w	4	c	o	g	sb	n	meeting
Glomar Supporter	29/08/2023	v	Ossie Stewart	10:09	11:00	r	57	30.89	n	0	12.42	w	83.5	57	30.96	n	0	19.08	w	92.1	4.0	w	4	c	o	g	sb	n	
Glomar Supporter	29/08/2023	v	Jessica Riggs	11:00	12:00	r	57	30.96	n	0	19.08	w	92.1	57	31.03	n	0	27.02	w	104.0	4.0	sw	4	c	o	g	sb	n	
Glomar Supporter	29/08/2023	v	Jessica Riggs	12:00	13:00	r	57	31.03	n	0	27.02	w	104.0	57	31.10	n	0	38.42	w	94.8	4.0	sw	4	c	o	g	vf	n	
Glomar Supporter	29/08/2023	v	Jessica Riggs	13:00	14:00	r	57	31.10	n	0	38.42	w	94.8	57	31.10	n	0	41.65	w	91.4	4.2	nw	3	c	o	g	vf	n	
Glomar Supporter	29/08/2023	v	Ossie Stewart	14:00	14:24	r	57	31.10	n	0	41.65	w	91.4	57	31.11	n	0	44.63	w	88.6	4.0	sw	4	c	o	g	sf	n	
Glomar Supporter	29/08/2023	v	Ossie Stewart	14:24	15:30	n	57	31.11	n	0	44.63	w	88.6	57	31.89	n	0	2.08	w	91.0	4.9	sw	4	c	o	g	n	n	EOL, all off to transit to start of next line
Glomar Supporter	29/08/2023	v	Ossie Stewart	15:30	15:46	n	57	31.89	n	0	2.08	w	91.0	57	32.97	n	0	5.75	w	97.1	10.0	sw	7	r	o	g	n	l	Squall - WOW before SS
Glomar Supporter	29/08/2023	v	Ossie Stewart	15:46	16:13	n	57	32.97	n	0	5.75	w	97.1	57	33.37	n	1	6.02	w	97.9	4.6	nw	5	c	o	g	n	n	Squall passed tbt for SSS deployment
Glomar Supporter	29/08/2023	v	Ossie Stewart	16:13	16:30	s	57	33.37	n	1	6.02	w	97.9	57	32.38	n	1	5.48	w	93.6	4.2	w	4	c	o	g	n	l	SS SBP
Glomar Supporter	29/08/2023	v	Jessica Riggs	16:30	16:33	s	57	32.38	n	1	5.48	w	93.6	57	32.11	n	1	5.24	w	92.9	4.1	sw	3	c	o	g	n	l	SS cont. watch change
Glomar Supporter	29/08/2023	v	Jessica Riggs	16:33	17:33	r	57	32.11	n	1	5.24	w	92.9	57	31.64	n	0	57.27	w	86.7	4.0	sw	2	c	o	g	n	m	
Glomar Supporter	29/08/2023	v	Jessica Riggs	17:33	18:33	r	57	31.64	n	0	57.27	w	86.7	57	31.31	n	0	51.05	w	85.7	3.4	se	2	c	o	g	sb	n	
Glomar Supporter	29/08/2023	v	Jessica Riggs	18:33	19:33	r	57	31.31	n	0	51.05	w	85.7	57	31.16	n	0	43.55	w	90.7	3.9	se	2	c	o	g	wf	n	
Glomar Supporter	29/08/2023	p	David Melendez	19:33	20:33	r	57	31.16	n	0	43.55	w	90.7	57	31.16	n	0	42.37	w	95.0	3.9								SOW Acoustic
Glomar Supporter	29/08/2023	p	David Melendez	20:33	21:33	r	57	31.16	n	0	42.37	w	95.0	57	31.08	n	0	28.56	w	107.0	4.3								
Glomar Supporter	29/08/2023	p	David Melendez	21:33	22:00	r	57	31.08	n	0	28.56	w	107.0	57	31.07	n	0	25.42	w	109.0	4.3								
Glomar Supporter	29/08/2023	p	Jessica Riggs	22:00	23:00	r	57	31.07	n	0	25.42	w	109.0	57	30.99	n	0	17.19	w	109.0	3.9								
Glomar Supporter	29/08/2023	p	David Melendez	23:00	24:00	r	57	30.99	n	0	17.19	w	103.0	57	30.94	n	0	11.51	w	90.0	3.6								Midnight UTC
Glomar Supporter	30/08/2023	p	David Melendez	00:00	01:00	r	57	30.94	n	0	11.51	w	90.0	57	30.52	n	0	5.04	w	100.0	3.6								
Glomar Supporter	30/08/2023	p	David Melendez	01:00	02:00	r	57	30.52	n	0	5.04	w	100.0	57	29.98	n	0	2.47	w	90.0	3.3								
Glomar Supporter	30/08/2023	p	David Melendez	02:00	03:08	r	57	29.98	n	0	2.47	w	90.0	57	29.86	n	0	1.01	w	103.0	3.8								EOL; Source OFF; EOW Acoustic
Glomar Supporter	30/08/2023	v	David Melendez	04:40	05:09	n	57	29.99	n	0	8.18	e	87.3	57	29.93	n	0	7.97	e	87.1	0.5	n	3	s	o	g	n	n	SOW Visual
Glomar Supporter	30/08/2023	v	Ossie Stewart	05:09	06:00	n	57	29.93	n	0	7.97	e	87.1	57	30.05	n	0	4.95	e	82.1	0.5	n	3	s	o	g	n	n	Enviro. survey
Glomar Supporter	30/08/2023	v	Ossie Stewart	06:00	07:03	n	57	30.05	n	0	4.95	e	82.1	57	30.10	n	0	0.30	e	87.9	4.3	ne	4	c	o	g	n	m	Enviro. survey
Glomar Supporter	30/08/2023	v	Ossie Stewart	07:03	08:11	n	57	30.10	n	0	0.30	e	87.9	57	30.61	n	0	7.16	w	86.4	0.5	ne	5	c	o	g	vb	n	Enviro. survey
Glomar Supporter	30/08/2023	v	Ossie Stewart	08:11	09:07	n	57	30.61	n	0	7.16	w	86.4	57	30.69	n	0	8.30	w	86.8	0.7	ne	5	c	o	g	sb	n	Enviro. survey
Glomar Supporter	30/08/2023	v	Ossie Stewart	09:07	09:50	n	57	30.69	n	0	8.30	w	86.8	57	30.95	n	0	14.91	w	86.8	4.1	ne	4	c	o	g	n	n	Enviro. survey
Glomar Supporter	30/08/2023	v	Ossie Stewart	10:08	11:00	n	57	30.96	n	0	14.90	w	87	57	30.96	n	0	15.26	w	88.3	0.1	n	4	c	o	g	sb	n	Enviro. survey
Glomar Supporter	30/08/2023	v	Jessica Riggs	11:00	12:00	n	57	30.96	n	0	15.26	w	88.3	57	31.03	n	0	19.79	w	97.0	0.1	ne	4	c	o	g	sb	n	Enviro. survey

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	30/08/2023	v	Jessica Riggs	12:00	13:00	n	57	31.03	n	0	19.79	w	97.0	57	31.03	n	0	22.96	w	103.0	6.6	nw	4	c	o	g	vf	n	Enviro. survey
Glomar Supporter	30/08/2023	v	Jessica Riggs	13:00	14:00	n	57	31.03	n	0	22.96	w	103.0	57	31.09	n	0	30.39	w	97.1	2.5	nw	4	c	o	g	vb	n	Enviro. survey
Glomar Supporter	30/08/2023	v	Ossie Stewart	14:00	15:00	n	57	31.09	n	0	30.39	w	97.1	57	31.15	n	0	32.92	w	96.4	0.1	nw	4	c	o	g	sb	n	Enviro. survey
Glomar Supporter	30/08/2023	v	Ossie Stewart	15:00	16:00	n	57	31.15	n	0	32.92	w	96.4	57	31.14	n	0	38.19	w	94.3	6.6	nw	4	c	o	g	sf	n	Enviro. survey
Glomar Supporter	30/08/2023	v	Ossie Stewart	16:00	16:30	n	57	31.14	n	0	38.19	w	94.3	57	31.12	n	0	38.25	w	93.6	0.1	nw	4	c	o	g	sf	n	Enviro. survey
Glomar Supporter	30/08/2023	v	Jessica Riggs	16:30	17:30	n	57	31.12	n	0	38.25	w	93.6	57	31.16	n	0	43.20	w	90.7	0.0	nw	4	c	o	g	sf	n	Enviro. survey
Glomar Supporter	30/08/2023	v	Jessica Riggs	17:30	18:30	n	57	31.16	n	0	43.20	w	90.7	57	31.23	n	0	47.40	w	88.6	0.0	nw	4	c	o	g	sf	n	Enviro. survey
Glomar Supporter	30/08/2023	v	Jessica Riggs	18:30	19:30	n	57	31.23	n	0	47.40	w	88.6	57	31.21	n	0	47.97	w	87.9	3.7	nw	3	c	o	g	sf	n	Enviro. survey
Glomar Supporter	31/08/2023	p	David Melendez	04:32	05:02	n	57	35.41	n	1	26.76	w	85.0	57	35.03	n	1	23.16	w	82.9	3.5								PAM PW
Glomar Supporter	31/08/2023	v	Ossie Stewart	05:02	05:22	s	57	35.03	n	1	23.16	w	82.9	57	34.75	n	1	20.80	w	83.8	4.4	n	3	s	o	g	n	n	SS SBP
Glomar Supporter	31/08/2023	v	Ossie Stewart	05:22	05:35	r	57	34.75	n	1	20.80	w	83.8	57	34.63	n	1	19.09	w	89.6	4.0	n	3	s	o	g	sf	n	SOL
Glomar Supporter	31/08/2023	v	Ossie Stewart	05:35	06:35	n	57	34.63	n	1	19.09	w	89.6	57	32.22	n	1	29.49	w	73.2	4.0	n	3	s	o	g	sf	n	EOL aborted as going into port, recover SSS
Glomar Supporter	31/08/2023	v	Ossie Stewart	06:35	07:35	n	57	32.22	n	1	29.49	w	73.2	57	28.82	n	1	42.87	w	53.3	9.0	w	3	s	o	g	sb	n	transit to Peterhead
Glomar Supporter	31/08/2023	v	Ossie Stewart	07:35	08:00	n	57	28.82	n	1	42.87	w	53.3	57	29.89	n	1	46.30	w	10.9	1.5	nw	3	s	o	g	sb	n	in Peterhead port N breakwater
Glomar Supporter	31/08/2023	v	Ossie Stewart	14:20	15:28	n	57	29.45	n	1	45.87	w	22.5	57	31.20	n	1	30.94	w	75.0	6.8	e	2	g	o	g	sf	n	Leave Peterhead port
Glomar Supporter	31/08/2023	v	Ossie Stewart	15:28	16:30	n	57	31.20	n	1	30.94	w	75.0	57	35.28	n	1	26.02	w	85.7	8.9	ne	4	s	o	g	sb	n	transit to site
Glomar Supporter	31/08/2023	v	Jessica Riggs	16:30	16:49	n	57	35.28	n	1	26.02	w	85.7	57	35.92	n	1	26.91	w	78.0	1.6	ne	2	s	o	g	vf	n	
Glomar Supporter	31/08/2023	v	Jessica Riggs	17:00	17:10	n	57	35.92	n	1	26.91	w	78.0	57	35.44	n	1	25.34	w	88.6	2.7	ne	1	s	o	g	sf	n	Line began only with SSS
Glomar Supporter	31/08/2023	v	David Melendez	17:10	17:30	s	57	35.44	n	1	25.34	w	88.6	57	35.19	n	1	22.50	w	83.2	4.1	e	1	s	o	g	sb	n	SS SBP
Glomar Supporter	31/08/2023	v	Jessica Riggs	17:30	18:30	r	57	35.19	n	1	22.50	w	83.2	57	34.52	n	1	15.48	w	93.6	4.4	e	2	s	o	g	sb	n	
Glomar Supporter	31/08/2023	v	Jessica Riggs	18:30	19:19	r	57	34.52	n	1	15.48	w	93.6	57	33.98	n	1	9.39	w	103.0	4.0	se	2	g	o	g	sb	n	
Glomar Supporter	31/08/2023	p	David Melendez	19:19	19:57	r	57	33.98	n	1	9.39	w	103.0	57	33.54	n	1	4.53	w	102.0	4.1								SOW Acoustic
Glomar Supporter	31/08/2023	p	David Melendez	19:57	20:06	r	57	33.54	n	1	4.53	w	102.0	57	33.51	n	1	3.57	w	140.0	4.0								EOL
Glomar Supporter	31/08/2023	p	David Melendez	20:06	20:09	n	57	33.51	n	1	3.57	w	140.0	57	33.39	n	1	3.54	w	140.0	2.7								SBP OFF - outside prospect <10 mins
Glomar Supporter	31/08/2023	p	David Melendez	20:09	20:18	r	57	33.39	n	1	3.54	w	140.0	57	33.32	n	1	4.57	w	102.0	3.0								SBP ON
Glomar Supporter	31/08/2023	p	David Melendez	20:18	21:18	r	57	33.32	n	1	4.57	w	102.0	57	34.10	n	1	12.23	w	98.3	4.0								SOL SBP
Glomar Supporter	31/08/2023	p	David Melendez	21:18	22:00	r	57	34.10	n	1	12.23	w	98.3	57	34.50	n	1	16.93	w	98.0	3.6								
Glomar Supporter	31/08/2023	p	Jessica Riggs	22:00	23:00	r	57	34.50	n	1	16.93	w	98.0	57	35.20	n	1	24.18	w	90.0	3.5								
Glomar Supporter	31/08/2023	p	David Melendez	23:00	23:13	r	57	35.20	n	1	24.18	w	90.0	57	35.37	n	1	25.82	w	93.0	4.2								
Glomar Supporter	31/08/2023	p	David Melendez	23:13	23:15	n	57	35.37	n	1	25.82	w	93.0	57	35.39	n	1	26.02	w	93.0	4.4								EOL @23:13; EOW Acoustic
Glomar Supporter	01/09/2023	v	David Melendez	04:48	05:05	n	57	34.88	n	1	20.77	w	84.5	57	34.89	n	1	20.77	w	84.3	0.1	w	0	g	o	g	n	n	SOW Visual
Glomar Supporter	01/09/2023	v	Ossie Stewart	05:05	06:09	n	57	34.89	n	1	20.77	w	84.3	57	34.81	n	1	18.63	w	91.6	0.0	nw	1	g	o	g	n	n	Enviro. Survey
Glomar Supporter	01/09/2023	v	Ossie Stewart	06:09	07:05	n	57	34.81	n	1	18.63	w	91.6	57	34.46	n	1	16.05	w	92.9	0.1	nw	2	s	o	g	n	n	Enviro. Survey
Glomar Supporter	01/09/2023	v	Ossie Stewart	07:05	08:00	n	57	34.46	n	1	16.05	w	92.9	57	34.51	n	1	15.70	w	92.1	0.0	nw	2	s	o	g	sf	n	Enviro. Survey
Glomar Supporter	01/09/2023	v	Ossie Stewart	08:00	09:00	n	57	34.51	n	1	15.70	w	92.1	57	34.42	n	1	14.85	w	95.0	0.0	nw	3	s	o	g	sf	n	Enviro. Survey
Glomar Supporter	01/09/2023	v	Ossie Stewart	09:00	09:55	n	57	34.42	n	1	14.85	w	95.0	57	34.28	n	1	13.84	w	99.3	0.4	nw	3	s	o	g	sf	n	Enviro. Survey
Glomar Supporter	01/09/2023	v	Ossie Stewart	10:08	11:00	n	57	34.24	n	1	13.83	w	100.0	57	34.30	n	1	13.82	w	100.0	0.1	nw	3	s	o	g	sf	n	Enviro. Survey
Glomar Supporter	01/09/2023	v	Jessica Riggs	11:00	12:00	n	57	34.30	n	1	13.82	w	100.0	57	34.07	n	1	10.86	w	101.0	0.0	nw	2	s	o	g	vf	n	Enviro. Survey
Glomar Supporter	01/09/2023	v	Jessica Riggs	12:00	13:00	n	57	34.07	n	1	10.86	w	101.0	57	33.60	n	1	6.33	w	100.0	0.1	ne	2	s	o	g	sb	n	Enviro. Survey
Glomar Supporter	01/09/2023	v	Jessica Riggs	13:00	13:57	n	57	33.60	n	1	6.33	w	100.0	57	33.29	n	1	5.08	w	98.6	0.2	ne	2	s	o	g	sb	n	Enviro. Survey
Glomar Supporter	01/09/2023	v	Ossie Stewart	13:57	15:10	n	57	33.29	n	1	5.08	w	98.6	57	31.92	n	1	2.65	w	91.4	0.4	ne	2	s	o	g	sb	n	Enviro. Survey

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	01/09/2023	v	Ossie Stewart	15:10	16:10	n	57	31.92	n	1	2.65	w	91.4	57	31.88	n	1	2.69	w	91.4	0.0	ne	2	s	o	g	sb	n	Enviro. Survey
Glomar Supporter	01/09/2023	v	Ossie Stewart	16:10	16:30	n	57	31.88	n	1	2.69	w	91.4	57	31.84	n	1	0.08	w	92.1	0.0	ne	2	s	o	g	sb	n	Enviro. Survey
Glomar Supporter	01/09/2023	v	Jessica Riggs	16:30	17:30	n	57	31.84	n	1	0.08	w	92.1	57	31.54	n	0	57.85	w	88.2	6.0	ne	2	s	o	g	sb	n	Enviro. Survey
Glomar Supporter	01/09/2023	v	Jessica Riggs	17:30	18:30	n	57	31.54	n	0	57.85	w	88.2	57	31.46	n	0	53.07	w	85.0	0.0	ne	2	s	o	g	sb	n	Enviro. Survey
Glomar Supporter	01/09/2023	v	Jessica Riggs	18:30	19:30	n	57	31.46	n	0	53.07	w	85.0	57	31.37	n	0	51.36	w	85.0	0.1	ne	3	s	o	g	sb	n	Enviro. Survey
Glomar Supporter	01/09/2023	p	David Melendez	23:11	23:44	n	57	32.54	n	1	2.38	w	97.0	57	33.16	n	1	5.63	w	104.0	2.6								SOW Acoustic
Glomar Supporter	01/09/2023	p	David Melendez	23:44	24:00	s	57	33.16	n	1	5.63	w	104.0	57	33.78	n	1	6.43	w	101.0	3.4								SS
Glomar Supporter	02/09/2023	p	David Melendez	00:00	00:06	s	57	33.78	n	1	6.43	w	101.0	57	34.12	n	1	6.32	w	108.0	3.6								Midnight UTC
Glomar Supporter	02/09/2023	p	David Melendez	00:06	00:14	n	57	34.12	n	1	6.32	w	108.0	57	34.42	n	1	6.37	w	108.0	3.0								SS Aborted, vessel crossing ahead
Glomar Supporter	02/09/2023	p	David Melendez	00:14	00:35	s	57	34.42	n	1	6.37	w	108.0	57	37.87	n	1	6.23	w	107.0	3.0								SS
Glomar Supporter	02/09/2023	p	David Melendez	00:35	00:49	r	57	37.87	n	1	6.23	w	107.0	57	31.68	n	1	3.62	w	98.0	3.8								
Glomar Supporter	02/09/2023	p	David Melendez	00:49	01:18	r	57	31.68	n	1	3.62	w	98.0	57	31.68	n	1	3.62	w	98.0	4.0								SOL
Glomar Supporter	02/09/2023	p	David Melendez	01:18	01:49	r	57	31.68	n	1	3.62	w	98.0	57	22.13	n	1	4.60	w	104.0	4.0								EOL
Glomar Supporter	02/09/2023	p	David Melendez	01:49	02:49	r	57	22.13	n	1	4.60	w	104.0	57	31.78	n	0	57.37	w	97.0	3.9								SOL
Glomar Supporter	02/09/2023	p	David Melendez	02:49	03:49	r	57	31.78	n	0	57.37	w	97.0	57	31.37	n	0	49.47	w	95.0	4.0								
Glomar Supporter	02/09/2023	p	David Melendez	03:49	04:49	r	57	31.37	n	0	49.47	w	95.0	57	31.25	n	0	41.94	w	99.0	4.1								EOW Acoustic
Glomar Supporter	02/09/2023	v	Ossie Stewart	04:50	05:50	r	57	31.23	n	0	40.69	w	92.9	57	31.17	n	0	34.59	w	95.7	4.1	e	3	s	o	g	n	n	SBP FP visual watch starts
Glomar Supporter	02/09/2023	v	Ossie Stewart	05:50	06:54	r	57	31.17	n	0	34.59	w	95.7	57	31.09	n	0	26.75	w	102.0	4.0	e	3	s	o	g	sf	n	
Glomar Supporter	02/09/2023	v	Ossie Stewart	06:54	07:54	r	57	31.09	n	0	26.75	w	102.0	57	31.02	n	0	19.62	w	92.8	4.0	e	3	s	o	g	sf	n	
Glomar Supporter	02/09/2023	v	Ossie Stewart	07:54	08:57	r	57	31.02	n	0	19.62	w	92.8	57	30.97	n	0	11.53	w	82.9	3.9	e	3	s	o	g	sf	n	
Glomar Supporter	02/09/2023	v	Ossie Stewart	08:57	09:52	r	57	30.97	n	0	11.53	w	82.9	57	30.59	n	0	5.36	w	84.0	3.9	se	3	s	o	g	sf	n	log off morning meeting
Glomar Supporter	02/09/2023	v	Ossie Stewart	10:10	11:00	r	57	30.44	n	0	3.03	w	82.7	57	30.04	n	0	3.32	w	82.9	4.0	se	4	s	o	g	sf	n	
Glomar Supporter	02/09/2023	v	Jessica Riggs	11:00	11:48	r	57	30.04	n	0	3.32	w	82.9	57	30.00	n	0	9.52	e	88.8	3.9	se	3	s	o	g	vf	n	
Glomar Supporter	02/09/2023	v	Jessica Riggs	11:48	12:21	r	57	30.00	n	0	9.52	e	88.8	57	29.94	n	0	8.69	e	88.7	4.1	se	4	s	o	g	vf	n	EOL
Glomar Supporter	02/09/2023	v	Jessica Riggs	12:21	12:59	r	57	29.94	n	0	8.69	e	88.7	57	28.94	n	0	13.11	e	82.1	3.5	se	4	s	o	g	vf	n	SOL
Glomar Supporter	02/09/2023	v	Jessica Riggs	12:59	13:01	r	57	28.94	n	0	13.11	e	82.1	57	28.84	n	0	13.53	e	80.7	4.0	se	4	s	o	g	n	n	EOL
Glomar Supporter	02/09/2023	v	Jessica Riggs	13:01	14:00	n	57	28.84	n	0	13.53	e	80.7	57	29.19	n	0	11.84	e	86.4	4.1	se	4	s	o	g	n	n	
Glomar Supporter	02/09/2023	v	Ossie Stewart	14:00	15:00	n	57	29.19	n	0	11.84	e	86.4	57	27.80	n	0	12.66	e	82.1	0.0	se	4	s	o	g	sf	n	
Glomar Supporter	02/09/2023	v	Ossie Stewart	15:00	16:00	n	57	27.80	n	0	12.66	e	82.1	57	27.69	n	0	12.54	e	82.5	4.3	sw	4	c	o	g	vf	n	
Glomar Supporter	02/09/2023	v	Ossie Stewart	16:00	16:10	n	57	27.69	n	0	12.54	e	82.5	57	27.76	n	0	12.42	e	82.9	0.0	sw	4	c	o	g	n	n	
Glomar Supporter	02/09/2023	v	Ossie Stewart	16:10	16:30	s	57	27.76	n	0	12.42	e	82.9	57	27.04	n	0	11.80	e	83.6	3.4	sw	4	c	o	g	n	n	SS SBP
Glomar Supporter	02/09/2023	v	Jessica Riggs	16:30	17:14	r	57	27.04	n	0	11.80	e	83.6	57	29.32	n	0	12.46	e	84.4	4.0	sw	4	c	o	g	n	n	
Glomar Supporter	02/09/2023	v	David Melendez	17:14	17:30	r	57	29.32	n	0	12.46	e	84.4	57	29.33	n	0	12.35	e	84.3	4.1	s	3	s	o	g	n	n	EOL
Glomar Supporter	02/09/2023	v	Jessica Riggs	17:30	17:45	r	57	29.33	n	0	12.35	e	84.3	57	29.32	n	0	12.34	e	84.5	3.8	sw	4	s	o	g	n	n	
Glomar Supporter	02/09/2023	v	Jessica Riggs	17:45	18:18	r	57	29.32	n	0	12.34	e	84.5	57	27.27	n	0	12.32	e	81.4	3.6	sw	4	s	o	g	n	n	
Glomar Supporter	02/09/2023	v	Jessica Riggs	18:18	18:40	r	57	27.27	n	0	12.32	e	81.4	57	27.68	n	0	12.01	e	82.5	3.6	sw	5	s	o	g	n	n	
Glomar Supporter	02/09/2023	v	Jessica Riggs	18:40	19:11	r	57	27.68	n	0	12.01	e	82.5	57	27.48	n	0	15.67	e	80.0	3.5	se	4	s	o	g	n	n	
Glomar Supporter	02/09/2023	v	Jessica Riggs	19:11	19:48	r	57	27.48	n	0	15.67	e	80.0	57	27.32	n	0	91.78	e	85.0	3.9								SOW Acoustic
Glomar Supporter	02/09/2023	p	David Melendez	19:48	20:19	r	57	27.32	n	0	91.78	e	85.0	57	27.61	n	0	19.09	e	80.0	3.8								EOL
Glomar Supporter	02/09/2023	p	David Melendez	20:19	20:49	r	57	27.61	n	0	19.09	e	80.0	57	25.60	n	0	19.24	e	82.0	4.0								SOL
Glomar Supporter	02/09/2023	p	David Melendez	20:49	21:23	r	57	25.60	n	0	19.24	e	82.0	57	26.12	n	0	18.90	e	81.0	4.2								EOL
Glomar Supporter	02/09/2023	p	David Melendez	21:23	22:00	r	57	26.12	n	0	18.90	e	81.0	57	25.26	n	0	22.98	e	84.0	3.8								SOL
Glomar Supporter	02/09/2023	p	Jessica Riggs	22:00	22:40	r	57	25.26	n	0	22.98	e	84.0	57	24.15	n	0	28.32	e	85.0	3.8								
Glomar Supporter	02/09/2023	p	Jessica Riggs	22:40	23:00	r	57	24.15	n	0	28.32	e	85.0	57	24.61	n	0	27.90	e	85.0	3.8								EOL

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	02/09/2023	p	David Melendez	23:00	23:17	r	57	24.61	n	0	27.90	e	85.0	57	24.63	n	0	26.84	e	86.0	4.2								
Glomar Supporter	02/09/2023	p	David Melendez	23:17	24:00	r	57	24.63	n	0	26.84	e	86.0	57	22.47	n	0	30.18	e	85.0	3.6								SOL
Glomar Supporter	03/09/2023	p	David Melendez	00:00	00:12	r	57	22.47	n	0	30.18	e	85.0	57	22.19	n	0	31.15	e	86.0	4.2								Midnight UTC
Glomar Supporter	03/09/2023	p	David Melendez	00:12	00:46	r	57	22.19	n	0	31.15	e	86.0	57	22.24	n	0	30.22	e	86.0	4.2								EOL
Glomar Supporter	03/09/2023	p	David Melendez	00:46	01:46	r	57	22.24	n	0	30.22	e	86.0	57	21.00	n	0	37.81	e	92.0	4.1								SOL
Glomar Supporter	03/09/2023	p	David Melendez	01:46	01:58	r	57	21.00	n	0	37.81	e	92.0	57	20.79	n	0	39.13	e	93.0	4.1								
Glomar Supporter	03/09/2023	p	David Melendez	01:58	02:01	n	57	20.79	n	0	39.13	e	93.0	57	20.27	n	0	39.54	e	93.0	4.1								EOL; PAM Cable recovered @02:01
Glomar Supporter	03/09/2023	p	David Melendez	03:50	04:21	n	57	21.10	n	0	37.70	e	92.0	57	20.64	n	0	35.41	e	90.0	3.0								PW
Glomar Supporter	03/09/2023	p	David Melendez	04:21	04:41	s	57	20.64	n	0	35.41	e	90.0	57	20.34	n	0	37.28	e	90.0	4.0								SS
Glomar Supporter	03/09/2023	p	David Melendez	04:41	04:52	r	57	20.34	n	0	37.28	e	90.0	57	20.76	n	0	37.96	e	92.0	3.1								SOL; EOW Acoustic
Glomar Supporter	03/09/2023	v	Ossie Stewart	04:55	05:55	r	57	21.09	n	0	39.22	e	86.4	57	22.53	n	0	44.78	e	81.5	4.0	sw	4	c	o	g	n	n	SOW visual
Glomar Supporter	03/09/2023	v	Ossie Stewart	05:55	06:55	r	57	22.53	n	0	44.78	e	81.5	57	24.48	n	0	51.45	e	90.7	4.0	sw	4	c	o	g	n	n	
Glomar Supporter	03/09/2023	v	Ossie Stewart	06:55	07:26	r	57	24.48	n	0	51.45	e	90.7	57	25.44	n	0	54.69	e	90.6	4.0	sw	4	c	o	g	n	l	
Glomar Supporter	03/09/2023	v	Ossie Stewart	07:26	07:54	r	57	25.44	n	0	54.69	e	90.6	57	25.43	n	0	53.61	e	89.2	4.0	sw	5	c	o	g	n	n	EOL
Glomar Supporter	03/09/2023	v	Ossie Stewart	07:54	09:00	r	57	25.43	n	0	53.61	e	89.2	57	22.91	n	0	0.36	e	90.7	4.0	sw	4	c	o	g	n	n	SOL
Glomar Supporter	03/09/2023	v	Ossie Stewart	09:00	09:55	r	57	22.91	n	0	0.36	e	90.7	57	20.86	n	0	5.99	e	90.0	4.0	sw	5	c	o	g	n	n	
Glomar Supporter	03/09/2023	v	Ossie Stewart	10:12	11:03	r	57	20.15	n	0	7.92	e	87.0	57	18.08	n	1	12.92	e	84.6	4.3	sw	5	c	o	g	n	n	
Glomar Supporter	03/09/2023	v	Jessica Riggs	11:03	12:04	r	57	18.08	n	1	12.92	e	84.6	57	15.54	n	1	18.91	e	86.3	4.2	sw	5	c	o	g	n	n	
Glomar Supporter	03/09/2023	v	Jessica Riggs	12:04	12:39	n	57	15.54	n	1	18.91	e	86.3	57	16.08	n	1	17.67	e	86.5	4.0	sw	5	c	o	g	n	n	EOL Side scan winched in
Glomar Supporter	03/09/2023	v	Jessica Riggs	12:39	13:39	r	57	16.08	n	1	17.67	e	86.5	57	12.76	n	1	21.11	e	92.8	3.9	sw	5	c	o	g	vf	n	SOL
Glomar Supporter	03/09/2023	v	Jessica Riggs	13:39	14:00	r	57	12.76	n	1	21.11	e	92.8	57	11.30	n	1	22.57	e	92.9	4.0	se	5	c	o	g	sf	n	
Glomar Supporter	03/09/2023	v	Ossie Stewart	14:00	15:00	r	57	11.30	n	1	22.57	e	92.9	57	7.83	n	1	25.89	e	92.6	4.2	sw	5	c	o	g	sf	n	
Glomar Supporter	03/09/2023	v	Ossie Stewart	15:00	15:13	r	57	7.83	n	1	25.89	e	92.6	57	7.08	n	1	26.49	e	91.4	4.1	sw	5	c	o	g	sf	n	
Glomar Supporter	03/09/2023	v	Ossie Stewart	15:13	16:13	n	57	7.08	n	1	26.49	e	91.4	57	4.67	n	1	25.22	e	95.7	4.0	sw	5	c	o	g	sf	n	EOL
Glomar Supporter	03/09/2023	v	Ossie Stewart	16:13	16:30	n	57	4.67	n	1	25.22	e	95.7	57	4.08	n	1	23.48	e	95.7	4.0	sw	6	r	o	g	sf	n	
Glomar Supporter	03/09/2023	v	Jessica Riggs	16:30	17:30	n	57	4.08	n	1	23.48	e	95.7	57	2.67	n	1	17.71	e	89.9	3.0	sw	6	r	m	g	sf	n	
Glomar Supporter	03/09/2023	v	Jessica Riggs	17:30	18:30	n	57	2.67	n	1	17.71	e	89.9	57	3.34	n	1	18.75	e	94.7	3.2	sw	5	r	o	g	sf	n	
Glomar Supporter	03/09/2023	v	Jessica Riggs	18:30	19:30	n	57	3.34	n	1	18.75	e	94.7	57	4.73	n	1	23.37	e	94.9	3.7	sw	4	c	o	g	sf	n	
Glomar Supporter	03/09/2023	p	David Melendez	20:21	21:00	n	57	4.09	n	1	22.03	e	98.0	57	2.52	n	1	18.03	e	98.0	3.1								SOW Acoustic
Glomar Supporter	03/09/2023	p	David Melendez	21:00	21:21	s	57	2.52	n	1	18.03	e	98.0	57	2.28	n	1	15.45	e	86.0	3.3								SS
Glomar Supporter	03/09/2023	p	David Melendez	21:21	21:32	r	57	2.28	n	1	15.45	e	86.0	57	2.24	n	1	16.46	e	83.0	3.0								
Glomar Supporter	03/09/2023	p	David Melendez	21:32	22:00	r	57	2.24	n	1	16.46	e	83.0	57	2.59	n	1	20.18	e	98.0	3.9								SOL
Glomar Supporter	03/09/2023	p	Jessica Riggs	22:00	23:00	r	57	2.59	n	1	20.18	e	98.0	57	4.11	n	1	27.12	e	100.0	4.4								
Glomar Supporter	03/09/2023	p	David Melendez	23:00	24:00	r	57	4.11	n	1	27.12	e	100.0	57	5.23	n	1	34.43	e	98.0	4.2								
Glomar Supporter	04/09/2023	p	David Melendez	00:00	00:16	r	57	5.23	n	1	34.43	e	98.0	57	5.57	n	1	36.43	e	98.0	4.0								Midnight UTC
Glomar Supporter	04/09/2023	p	David Melendez	00:16	00:47	r	57	5.57	n	1	36.43	e	98.0	57	5.54	n	1	36.40	e	98.0	4.0								EOL
Glomar Supporter	04/09/2023	p	David Melendez	00:47	01:47	r	57	5.54	n	1	36.40	e	98.0	57	4.32	n	1	28.37	e	100.0	4.2								SOL
Glomar Supporter	04/09/2023	p	David Melendez	01:47	02:47	r	57	4.32	n	1	28.37	e	100.0	57	3.00	n	1	22.13	e	102.0	4.3								
Glomar Supporter	04/09/2023	p	David Melendez	02:47	03:33	r	57	3.00	n	1	22.13	e	102.0	57	2.28	n	1	16.46	e	90.0	4.3								
Glomar Supporter	04/09/2023	p	David Melendez	03:33	03:49	r	57	2.28	n	1	16.46	e	90.0	57	2.42	n	1	16.34	e	92.0	3.8								EOL
Glomar Supporter	04/09/2023	p	David Melendez	03:49	04:47	r	57	2.42	n	1	16.34	e	92.0	57	3.51	n	1	23.09	e	101.0	4.1								SOL
Glomar Supporter	04/09/2023	v	Ossie Stewart	04:47	05:45	r	57	3.51	n	1	23.09	e	101.0	57	5.03	n	1	30.00	e	93.7	3.8	sw	4	s	o	g	n	n	
Glomar Supporter	04/09/2023	v	Ossie Stewart	05:45	06:45	r	57	5.03	n	1	30.00	e	93.7	57	6.14	n	1	36.61	e	91.4	3.8	sw	4	c	o	g	sf	n	
Glomar Supporter	04/09/2023	v	Ossie Stewart	06:45	07:02	r	57	6.14	n	1	36.61	e	91.4	57	6.29	n	1	36.72	e	91.4	3.8	sw	4	c	o	g	sf	n	EOL

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	04/09/2023	v	Ossie Stewart	07:02	08:00	r	57	6.29	n	1	36.72	e	91.4	57	5.19	n	1	39.40	e	92.2	3.9	sw	5	c	o	g	sb	n	SOL
Glomar Supporter	04/09/2023	v	Ossie Stewart	08:00	09:00	r	57	5.19	n	1	39.40	e	92.2	57	4.04	n	1	23.78	e	94.4	4.0	sw	5	c	o	g	sb	n	
Glomar Supporter	04/09/2023	v	Ossie Stewart	09:00	09:55	r	57	4.04	n	1	23.78	e	94.4	57	3.05	n	1	18.18	e	78.0	3.7	sw	4	c	o	g	sb	n	log off morning meeting
Glomar Supporter	04/09/2023	v	Ossie Stewart	10:06	10:22	r	57	2.66	n	1	16.08	e	78.0	57	2.94	n	1	16.36	e	83.9	3.7	sw	4	c	o	g	sb	n	EOL
Glomar Supporter	04/09/2023	v	Ossie Stewart	10:22	11:00	r	57	2.94	n	1	16.36	e	83.9	57	3.67	n	1	20.71	e	93.6	4.1	sw	4	c	o	g	sf	n	SOL
Glomar Supporter	04/09/2023	v	Jessica Riggs	11:00	12:00	r	57	3.67	n	1	20.71	e	93.6	57	5.02	n	1	28.44	e	93.2	4.3	sw	4	c	o	g	sf	n	
Glomar Supporter	04/09/2023	v	Jessica Riggs	12:00	13:00	r	57	5.02	n	1	28.44	e	93.2	57	6.26	n	1	35.53	e	92.6	4.2	sw	4	c	o	g	vf	n	
Glomar Supporter	04/09/2023	v	Jessica Riggs	13:00	13:13	r	57	6.26	n	1	35.53	e	92.6	57	6.50	n	1	36.91	e	91.7	4.0	sw	3	c	o	g	vf	n	Winching in
Glomar Supporter	04/09/2023	v	Jessica Riggs	13:13	13:47	n	57	6.50	n	1	36.91	e	91.7	57	5.95	n	1	36.69	e	90.8	3.2	sw	4	c	o	g	vf	n	SBP turned off at 13:13
Glomar Supporter	04/09/2023	v	Jessica Riggs	13:47	14:00	s	57	5.95	n	1	36.69	e	90.8	57	6.22	n	1	37.09	e	91.4	1.8	sw	4	c	o	g	sf	n	SS
Glomar Supporter	04/09/2023	v	Ossie Stewart	14:00	14:08	s	57	6.22	n	1	37.09	e	91.4	57	6.61	n	1	37.43	e	92.9	3.8	sw	4	c	o	g	sb	n	SS - watch change
Glomar Supporter	04/09/2023	v	Ossie Stewart	14:08	15:20	r	57	6.61	n	1	37.43	e	92.9	57	5.32	n	1	29.28	e	92.5	3.8	sw	4	c	o	g	sf	n	SOL @ 14:16
Glomar Supporter	04/09/2023	v	Ossie Stewart	15:20	16:30	r	57	5.32	n	1	29.28	e	92.5	57	3.84	n	1	20.72	e	94.3	3.9	sw	5	c	o	g	sf	n	
Glomar Supporter	04/09/2023	v	Jessica Riggs	16:30	17:25	r	57	3.84	n	1	20.72	e	94.3	57	30.09	n	1	16.07	e	85.9	4.0	sw	4	s	o	g	sf	n	
Glomar Supporter	04/09/2023	v	David Melendez	17:25	17:29	r	57	30.09	n	1	16.07	e	85.9	57	3.33	n	1	16.87	e	89.3	3.9	s	4	c	o	g	sf	n	EOL, aborted line due SSS issues
Glomar Supporter	04/09/2023	v	Jessica Riggs	17:29	17:52	r	57	3.33	n	1	16.87	e	89.3	57	3.57	n	1	18.30	e	93.6	3.9	se	3	c	o	g	sb	n	SOL
Glomar Supporter	04/09/2023	v	Jessica Riggs	17:52	18:28	n	57	3.57	n	1	18.30	e	93.6	57	3.57	n	1	16.71	e	89.0	4.0	se	3	c	o	g	sb	n	SBP recovered and turned off
Glomar Supporter	04/09/2023	v	Jessica Riggs	18:28	18:52	s	57	3.57	n	1	16.71	e	89.0	57	3.16	n	1	15.86	e	81.8	4.3	sw	4	c	o	g	sf	n	
Glomar Supporter	04/09/2023	v	Jessica Riggs	18:52	19:03	r	57	3.16	n	1	15.86	e	81.8	57	3.32	n	1	17.08	e	95.0	4.3	se	3	s	o	g	sb	n	
Glomar Supporter	04/09/2023	p	David Melendez	19:03	20:03	r	57	3.32	n	1	17.08	e	95.0	57	4.76	n	1	25.27	e	98.0	4.0								SOW Acoustic
Glomar Supporter	04/09/2023	p	David Melendez	20:03	21:00	r	57	4.76	n	1	25.27	e	98.0	57	5.82	n	1	31.47	e	96.0	4.1								
Glomar Supporter	04/09/2023	p	David Melendez	21:00	21:44	r	57	5.82	n	1	31.47	e	96.0	57	6.74	n	1	36.78	e	96.0	4.2								
Glomar Supporter	04/09/2023	p	David Melendez	21:44	22:00	r	57	6.74	n	1	36.78	e	96.0	57	7.00	n	1	37.23	e	95.0	4.3								EOL
Glomar Supporter	04/09/2023	p	Jessica Riggs	22:00	22:05	r	57	7.00	n	1	37.23	e	95.0	57	6.49	n	1	36.27	e	97.0	4.3								
Glomar Supporter	04/09/2023	p	Jessica Riggs	22:05	23:00	r	57	6.49	n	1	36.27	e	97.0	57	5.71	n	1	30.04	e	100.0	4.6								SOL
Glomar Supporter	04/09/2023	p	David Melendez	23:00	24:00	r	57	5.71	n	1	30.04	e	100.0	57	4.53	n	1	23.24	e	101.0	4.0								
Glomar Supporter	05/09/2023	p	David Melendez	00:00	01:00	r	57	4.53	n	1	23.24	e	101.0	57	3.30	n	1	15.98	e	90.0	4.0								
Glomar Supporter	05/09/2023	p	David Melendez	01:00	01:19	r	57	3.30	n	1	15.98	e	90.0	57	3.45	n	1	15.99	e	91.0	4.0								EOL
Glomar Supporter	05/09/2023	p	David Melendez	01:19	02:19	r	57	3.45	n	1	15.99	e	91.0	57	4.92	n	1	24.40	e	101.0	4.2								SOL
Glomar Supporter	05/09/2023	p	David Melendez	02:19	03:19	r	57	4.92	n	1	24.40	e	101.0	57	6.13	n	1	31.34	e	100.0	4.1								
Glomar Supporter	05/09/2023	p	David Melendez	03:19	04:20	r	57	6.13	n	1	31.34	e	100.0	57	7.01	n	1	36.82	e	100.0	3.8								
Glomar Supporter	05/09/2023	p	David Melendez	04:20	04:41	r	57	7.01	n	1	36.82	e	100.0	57	7.29	n	1	36.69	e	100.0	3.7								EOL
Glomar Supporter	05/09/2023	p	David Melendez	04:41	04:45	r	57	7.29	n	1	36.69	e	100.0	57	7.05	n	1	36.26	e	100.0	4.2								SOL at 04:41; at 04:45 EOW Acoustic
Glomar Supporter	05/09/2023	v	Ossie Stewart	04:50	06:05	r	57	6.90	n	1	35.45	e	92.7	57	5.29	n	1	26.18	e	94.3	4.1	sw	3	s	o	g	n	n	
Glomar Supporter	05/09/2023	v	Ossie Stewart	06:05	07:00	r	57	5.29	n	1	26.18	e	94.3	57	4.11	n	1	19.47	e	95.0	4.1	w	3	s	o	g	sb	n	
Glomar Supporter	05/09/2023	v	Ossie Stewart	07:00	07:31	r	57	4.11	n	1	19.47	e	95.0	57	3.46	n	1	16.04	e	84.6	4.3	w	3	s	o	g	sb	n	
Glomar Supporter	05/09/2023	v	Ossie Stewart	07:31	07:50	r	57	3.46	n	1	16.04	e	84.6	57	3.59	n	1	16.17	e	82.1	3.9	w	3	s	o	g	sb	n	EOL
Glomar Supporter	05/09/2023	v	Ossie Stewart	07:50	08:50	r	57	3.59	n	1	16.17	e	82.1	57	4.77	n	1	23.15	e	95.0	4.1	w	3	s	o	g	sf	n	SOL casual watch log QC
Glomar Supporter	05/09/2023	v	Ossie Stewart	08:50	09:50	r	57	4.77	n	1	23.15	e	95.0	57	5.98	n	1	30.11	e	92.9	4.1	ne	3	s	o	g	sf	n	casual watch log QC, log off morning meeting

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	05/09/2023	v	Ossie Stewart	10:13	10:44	r	57	6.49	n	1	33.06	e	92.1	57	7.12	n	1	36.84	e	91.4	4.2	ne	3	s	o	g	sf	n	casual watch log QC
Glomar Supporter	05/09/2023	v	Ossie Stewart	10:44	11:01	r	57	7.12	n	1	36.84	e	91.4	57	7.21	n	1	36.20	e	91.4	3.5	ne	3	s	o	g	sf	n	EOL
Glomar Supporter	05/09/2023	v	Jessica Riggs	11:01	12:00	r	57	7.21	n	1	36.20	e	91.4	57	5.94	n	1	28.79	e	93.2	4.3	nw	2	s	o	g	vf	n	SOL 11:01
Glomar Supporter	05/09/2023	v	Jessica Riggs	12:00	13:00	r	57	5.94	n	1	28.79	e	93.2	57	4.63	n	1	21.19	e	92.9	4.2	ne	2	s	o	g	vf	n	
Glomar Supporter	05/09/2023	v	Jessica Riggs	13:00	14:00	r	57	4.63	n	1	21.19	e	92.9	57	3.50	n	1	15.21	e	80.0	4.3	ne	2	s	o	g	vf	n	EOL 13:50
Glomar Supporter	05/09/2023	v	Ossie Stewart	14:00	14:14	r	57	3.50	n	1	15.21	e	80.0	57	3.82	n	1	16.26	e	88.0	3.8	ne	4	s	o	g	sb	n	
Glomar Supporter	05/09/2023	v	Ossie Stewart	14:14	15:18	r	57	3.82	n	1	16.26	e	88.0	57	5.16	n	1	23.84	e	94.3	4.1	ne	4	s	o	g	sb	n	SOL
Glomar Supporter	05/09/2023	v	Ossie Stewart	15:18	16:15	r	57	5.16	n	1	23.84	e	94.3	57	6.27	n	1	30.26	e	92.9	3.9	ne	4	s	o	g	n	n	
Glomar Supporter	05/09/2023	v	Ossie Stewart	16:15	16:30	r	57	6.27	n	1	30.26	e	92.9	57	6.27	n	1	30.26	e	92.9	3.9	ne	5	c	o	g	n	n	
Glomar Supporter	05/09/2023	v	Jessica Riggs	16:30	17:09	r	57	6.70	n	1	32.73	e	91.8	57	6.70	n	1	32.73	e	91.8	4.1	ne	5	c	o	g	n	n	
Glomar Supporter	05/09/2023	v	David Melendez	17:09	17:27	r	57	7.39	n	1	36.81	e	92.9	57	7.39	n	1	36.81	e	92.9	4.0	ne	4	c	o	g	n	n	EOL
Glomar Supporter	05/09/2023	v	David Melendez	17:27	17:30	r	57	7.42	n	1	36.63	e	92.9	57	7.42	n	1	36.63	e	92.9	4.1	ne	4	c	o	g	n	n	SOL
Glomar Supporter	05/09/2023	v	Jessica Riggs	17:30	18:30	r	57	7.35	n	1	36.02	e	92.1	57	5.95	n	1	28.07	e	92.5	4.0	ne	4	c	o	g	n	n	
Glomar Supporter	05/09/2023	v	Jessica Riggs	18:30	18:41	r	57	5.95	n	1	28.07	e	92.5	57	5.93	n	1	27.96	e	100.0	3.9	ne	3	c	o	g	n	n	
Glomar Supporter	05/09/2023	p	David Melendez	18:41	19:41	r	57	5.93	n	1	27.96	e	100.0	57	4.45	n	1	19.47	e	97.0	3.9								SOW Acoustic
Glomar Supporter	05/09/2023	p	David Melendez	19:41	20:25	r	57	4.45	n	1	19.47	e	97.0	57	3.39	n	1	15.98	e	90.0	3.7								
Glomar Supporter	05/09/2023	p	David Melendez	20:25	20:28	n	57	3.39	n	1	15.98	e	90.0	57	3.84	n	1	15.77	e	90.0	4.1								EOL; SBP OFF; EOW @20:28
Glomar Supporter	06/09/2023	p	David Melendez	22:23	23:43	n	57	35.62	n	1	25.10	e	88.0	57	35.30	n	1	25.20	w	89.0	1.7								SOW Acoustic
Glomar Supporter	06/09/2023	p	David Melendez	23:43	24:00	s	57	35.30	n	1	25.20	e	89.0	57	35.26	n	1	23.21	w	83.6	3.6								SOL @23:44 with the SBP Soft-Start starting
Glomar Supporter	07/09/2023	p	David Melendez	00:00	00:10	s	57	35.26	n	1	23.21	e	83.6	57	35.11	n	1	21.58	w	83.6	3.5								Midnight UTC
Glomar Supporter	07/09/2023	p	David Melendez	00:10	01:10	r	57	35.11	n	1	21.58	e	83.6	57	34.59	n	1	15.65	w	93.0	3.5								End of SS
Glomar Supporter	07/09/2023	p	David Melendez	01:10	02:10	r	57	34.59	n	1	15.65	e	93.0	57	34.00	n	1	9.25	w	99.0	3.5								
Glomar Supporter	07/09/2023	p	David Melendez	02:10	02:57	r	57	34.00	n	1	9.25	e	99.0	57	33.57	n	1	4.57	w	97.0	3.4								
Glomar Supporter	07/09/2023	p	David Melendez	02:57	03:34	r	57	33.57	n	1	4.57	e	97.0	57	33.41	n	1	5.29	w	98.0	3.9								EOL
Glomar Supporter	07/09/2023	p	David Melendez	03:34	04:05	r	57	33.41	n	1	5.29	e	98.0	57	31.70	n	1	4.10	w	96.0	3.8								SOL
Glomar Supporter	07/09/2023	p	David Melendez	04:05	04:35	r	57	31.70	n	1	4.10	e	96.0	57	32.03	n	1	3.94	w	92.0	4.0								EOL
Glomar Supporter	07/09/2023	p	David Melendez	04:35	04:48	r	57	32.03	n	1	3.94	e	92.0	57	31.97	n	1	2.55	w	90.0	2.7								SOL
Glomar Supporter	07/09/2023	v	Boglarka Baksay	04:48	04:48	r	57	31.97	n	1	2.55	e	90.0	57	31.97	n	1	2.55	w	90.0	2.7								Shift change but signing off to deal with lost PAM cable & send DPR
Glomar Supporter	07/09/2023	v	Boglarka Baksay	06:03	07:03	r	57	31.57	n	0	54.39	e	70.4	57	31.15	n	0	47.33	w	39.1	3.3	ne	0	s	o	p	n	n	Mist came in, poor visibility but staying on visual until PW is needed
Glomar Supporter	07/09/2023	v	Boglarka Baksay	07:03	07:05	r	57	31.15	n	0	47.33	e	39.1	57	31.14	n	0	47.24	w	30.0	3.4	e	0	s	o	p	n	n	
Glomar Supporter	07/09/2023	v	Boglarka Baksay	07:05	07:39	r	57	31.14	n	0	47.24	e	30.0	57	31.25	n	0	48.47	w	66.9	3.4	e	1	s	o	p	n	l	EOL
Glomar Supporter	07/09/2023	v	Boglarka Baksay	07:39	08:32	r	57	31.25	n	0	48.47	e	66.9	57	28.68	n	0	45.03	w	68.3	3.5	ne	2	s	o	p	n	l	SOL
Glomar Supporter	07/09/2023	v	Boglarka Baksay	08:32	08:58	r	57	28.68	n	0	45.03	e	68.3	57	28.80	n	0	45.50	w	67.2	3.2	ne	2	s	o	p	n	l	EOL
Glomar Supporter	07/09/2023	v	Boglarka Baksay	08:58	09:58	r	57	28.80	n	0	45.50	e	67.2	57	31.67	n	0	49.29	w	69.1	3.7	nw	2	s	o	p	n	n	SOL. Wind dir. Changes
Glomar Supporter	07/09/2023	v	Boglarka Baksay	09:58	10:00	r	57	31.67		0	49.29	e	69.1	57	31.75	n	0	49.41	w	70.4	3.7	nw	2	s	o	p	n	n	
Glomar Supporter	07/09/2023	v	Boglarka Baksay	10:00	10:15	r	57	31.75		0	49.41	e	70.4	57	31.69	n	0	49.55	w	71.3	3.7	nw	2	s	o	p	n	n	

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	07/09/2023	v	Boglarka Baksay	10:15	10:15	r	57	31.69		0	49.55	e	71.3	57	31.69	n	0	49.55	w	71.3	3.7	nw	2	s	o	p	n	n	Effort closed due to Crew Familiarisation
Glomar Supporter	07/09/2023	v	Camila Azevedo	11:20	11:27	r	57	28.34	n	0	45.29	e	73.2	57	28.10	n	0	44.59	w	22.3	3.6	sw	2	s	o	m	n	n	SOW. Wind dir. Changes
Glomar Supporter	07/09/2023	v	Camila Azevedo	11:27	11:46	r	57	28.10	n	0	44.59	e	72.3	57	28.71	n	0	45.29	w	74.1	3.6	sw	2	s	o	g	n	n	EOL
Glomar Supporter	07/09/2023	v	Camila Azevedo	11:46	12:18	r	57	28.71	n	0	45.29	e	74.1	57	30.22	n	0	47.27	w	76.2	3.9	sw	2	s	o	p	n	n	SOL. Fog at 11:55
Glomar Supporter	07/09/2023	v	Camila Azevedo	12:18	12:50	r	57	30.22	n	0	47.27	e	76.2	57	31.84	n	0	49.34	w	77.6	3.5	sw	2	s	o	g	n	n	Clear horizon
Glomar Supporter	07/09/2023	v	Camila Azevedo	12:50	13:07	r	57	31.84	n	0	49.34	e	77.6	57	31.42	n	0	49.09	w	79.0	3.8	sw	2	s	o	g	sf	n	EOL
Glomar Supporter	07/09/2023	v	Camila Azevedo	13:07	13:58	r	57	31.42	n	0	49.09	e	79.0	57	29.03	n	0	45.94	w	74.3	3.8	sw	3	s	o	g	n	n	SOL
Glomar Supporter	07/09/2023	v	Boglarka Baksay	13:58	14:12	r	57	29.03	n	0	45.94	e	74.3	57	28.89	n	0	45.09	w	54.4	3.4	se	2	s	o	g	vf	n	shift change
Glomar Supporter	07/09/2023	v	Boglarka Baksay	14:12	15:12	n	57	28.89	n	0	45.09	e	54.4	57	29.62	n	0	46.72	w	0.0	3.7	se	2	s	o	g	vf	n	EOL, all off for SVP dip
Glomar Supporter	07/09/2023	v	Boglarka Baksay	15:12	16:12	n	57	29.62	n	0	46.72	e	0.0	57	31.32	n	0	49.33	w	0.0	0.8	se	2	s	o	g	wf	n	Still off due to technical issues. Depth measurement not possible
Glomar Supporter	07/09/2023	v	Boglarka Baksay	16:12	17:08	n	57	31.32	n	0	49.33	e	0.0	57	31.45	n	0	53.15	w	83.2	0.1	se	2	s	o	g	n	n	PW from 16:24
Glomar Supporter	07/09/2023	v	Camila Azevedo	17:08	17:36	n	57	31.45	n	0	53.15	e	83.2	57	31.52	n	0	53.62	w	76.3	3.9	se	2	s	o	g	n	n	Line change
Glomar Supporter	07/09/2023	v	Camila Azevedo	17:36	17:39	s	57	31.52	n	0	53.62	e	76.3	57	31.24	n	0	46.23	e	80.3	3.6	se	2	s	o	m	n	n	Survey activated SBP at 17:36. SOL at 17:39.
Glomar Supporter	07/09/2023	v	Camila Azevedo	17:39	18:39	r	57	31.52	n	0	53.48	e	76.6	57	31.25	n	0	47.12	e	81.0	3.6	se	2	s	o	m	n	n	
Glomar Supporter	07/09/2023	v	Camila Azevedo	18:39	18:48	r	57	31.25	n	0	47.12	e	81.0	57	31.24	n	0	46.23	e	80.3	3.6	se	2	s	o	m	n	n	EOL
Glomar Supporter	07/09/2023	v	Camila Azevedo	18:48	18:59	r	57	31.24	n	0	46.23	e	80.3	57	31.25	n	0	44.88	w	79.6	3.6	e	2	s	o	m	n	n	PAMS deployed at 18:53. EOW Visual.
Glomar Supporter	07/09/2023	p	David Melendez	18:53	19:53	r	57	31.40	n	0	45.00	e	94.0	57	31.19	n	0	39.08	w	101.0	3.6								SOW Acoustic
Glomar Supporter	07/09/2023	p	David Melendez	19:53	20:53	r	57	31.19	n	0	39.08	e	101.0	57	31.15	n	0	32.48	w	102.0	3.9								
Glomar Supporter	07/09/2023	p	David Melendez	20:53	21:53	r	57	31.15	n	0	32.48	e	102.0	57	31.08	n	0	5.78	w	108.0	3.5								
Glomar Supporter	07/09/2023	p	David Melendez	21:53	00:00	r	57	31.08	n	0	5.78	e	108.0	57	30.93	n	0	10.95	w	80.0	3.7								
Glomar Supporter	08/09/2023	p	David Melendez	00:00	01:00	r	57	30.93	n	0	10.95	e	80.0	57	30.44	n	0	3.91	w	82.0	3.8								Midnight UTC
Glomar Supporter	08/09/2023	p	David Melendez	01:00	02:00	r	57	30.44	n	0	3.91	e	82.0	57	29.98	n	0	2.83	e	85.0	3.6								
Glomar Supporter	08/09/2023	p	David Melendez	02:00	03:00	r	57	29.98	n	0	2.83	e	85.0	57	29.94	n	0	9.28	e	87.0	3.7								
Glomar Supporter	08/09/2023	p	David Melendez	03:00	03:45	r	57	29.94	n	0	9.28	e	87.0	57	29.86	n	0	13.15	e	83.0	3.4								EOL @03:14
Glomar Supporter	08/09/2023	p	David Melendez	03:45	04:00	n	57	29.86	n	0	13.15	e	83.0	57	30.15	n	0	12.90	e	83.8	4.1								SBP OFF
Glomar Supporter	08/09/2023	p	David Melendez	04:00	04:28	n	57	30.15	n	0	12.90	e	83.8	57	30.27	n	0	10.04	e	81.0	4.1								
Glomar Supporter	08/09/2023	p	David Melendez	04:28	04:48	s	57	30.27	n	0	10.04	e	81.0	57	29.86	n	0	9.34	e	87.0	3.5								SS
Glomar Supporter	08/09/2023	p	David Melendez	04:48	04:55	r	57	29.86	n	0	9.34	e	87.0	57.0	29.77	n	0	9.69	e	87.0	3.5								SOL 04:53
Glomar Supporter	08/09/2023	v	Boglarka Baksay	04:55	05:28	r	57.0	29.77	n	0	9.69	e	87.0	57	28.89	n	0	13.50	e	69.6	3.8	sw	2	s	o	g	n	n	Shift change, visual watch
Glomar Supporter	08/09/2023	v	Boglarka Baksay	05:28	05:56	r	57	28.89	n	0	13.50	e	69.6	57	29.07	n	0	12.54	e	75.0	4.1	sw	2	s	o	m	vf	n	Mist on the horizon but doesn't affect excl. zone
Glomar Supporter	08/09/2023	v	Boglarka Baksay	05:56	06:25	r	57	29.07	n	0	12.54	e	75.0	57	27.00	n	0	12.51	e	29.7	3.9	sw	2	s	o	m	sf	n	SOL
Glomar Supporter	08/09/2023	v	Boglarka Baksay	06:25	06:58	r	57	27.00	n	0	12.51	e	29.7	57	27.71	n	0	12.62	e	72.2	4.1	sw	2	s	o	m	n	n	EOL
Glomar Supporter	08/09/2023	v	Boglarka Baksay	06:58	07:58	r	57	27.71	n	0	12.62	e	72.2	57	27.42	n	0	19.78	e	68.9	3.9	sw	2	s	o	m	n	n	SOL
Glomar Supporter	08/09/2023	v	Boglarka Baksay	07:58	08:00	r	57	27.42	n	0	19.78	e	68.9	57	27.39	n	0	19.70	e	68.6	3.8	ne	2	s	o	p	n	n	Wind changed, fog coming in

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	08/09/2023	v	Boglarka Baksay	08:00	08:30	r	57	27.39	n	0	19.70	e	68.6	57	27.24	n	0	19.16	e	68.3	4.0	e	1	g	o	p	n	n	EOL
Glomar Supporter	08/09/2023	v	Boglarka Baksay	08:30	09:28	r	57	27.24	n	0	19.16	e	68.3	57	26.10	n	0	19.10	e	69.3	3.9	se	1	g	o	p	sf	n	SOL. Deploying PAM as thick fog is consistent now. EOL 09:00
Glomar Supporter	08/09/2023	p	Boglarka Baksay	09:28	09:54	r	57	26.10	n	0	19.10	e	69.3	57	27.60	n	0	19.08	e	70.1	3.8								SOL
Glomar Supporter	08/09/2023	p	Boglarka Baksay	09:54	09:54	r	57	27.60	n	0	19.08	e	70.1								4.0								EOL. Logging off for morning meeting & paperwork
Glomar Supporter	08/09/2023	p	Boglarka Baksay	10:53	10:56	r	57	25.35	n	0	19.39	e		57	25.27	n	0	19.40	e	79.3	4.0								SOL
Glomar Supporter	08/09/2023	p	Camila Azevedo	10:56	11:36	r	57	25.27	n	0	19.40	e	79.3	57	25.96	n	0	19.48	e	80.0	3.4								Hardware issue in hydrophone arrays. Monitoring capabilities impaired. Building new configurations did not work as fix.
Glomar Supporter	08/09/2023	p	Camila Azevedo	11:36	11:53	r	57	25.96	n	0	19.48	e	80.0	57	25.91	n	0	20.95	e	82.0	2.8								EOL.
Glomar Supporter	08/09/2023	p	Camila Azevedo	11:53	11:53	n	57	25.91	n	0	20.95	e	82.0	57	25.91	n	0	20.95	e	82.0	2.9								EOW Acoustic. PAMS array recovered for SVP
Glomar Supporter	08/09/2023	v	Camila Azevedo	11:53	13:15	n	57	25.91	n	0	20.95	e	82.0	57	25.99	n	0	16.13	e	81.9	0.9	sw	2	s	o	m	vf	n	SOW Visual.
Glomar Supporter	08/09/2023	p	Camila Azevedo	13:15	13:15	n	57	25.99	n	0	16.13	e	81.9	57	25.99	n	0	16.13	e	81.9	1.0								SOW Acoustic due to fog. PAM troubleshooting
Glomar Supporter	08/09/2023	p	Boglarka Baksay	15:38	16:08	n	57	28.12	n	0	13.23	e	84.1	57	27.90	n	0	11.36	e	86.0	3.5		1	s	o			n	PAM fixed (broken connector pin), acoustic PW as thick fog
Glomar Supporter	08/09/2023	p	Boglarka Baksay	16:08	16:28	s	57	27.90	n	0	11.36	e	86.0	57	27.65	n	0	12.05	e	84.9	3.5		1	s	o			n	SS for SBP line
Glomar Supporter	08/09/2023	p	Boglarka Baksay	16:28	17:35	r	57	27.65	n	0	12.05	e	84.9	57	27.46	n	0	16.81	e	83.0	4.1		1	s	o			n	SS complete, SOL
Glomar Supporter	08/09/2023	p	Camila Azevedo	17:35	18:08	r	57	27.46	n	0	16.81	e	83.0	57	27.80	n	0	19.45	e	83.2	3.9								EOL
Glomar Supporter	08/09/2023	p	Camila Azevedo	18:08	18:12	r	57	27.80	n	0	19.45	e	81.2	57	28.49	n	0	18.27	e	83.6	3.5								SOL
Glomar Supporter	08/09/2023	p	Camila Azevedo	18:12	18:34	r	57	28.49	n	0	18.27	e	81.6	57	27.58	n	0	19.26	e	80	3.6								EOL
Glomar Supporter	08/09/2023	p	Camila Azevedo	18:34	18:50	r	57	27.58	n	0	19.26	e	80	57	26.57	n	0	19.27	e	83.2	3.2								SOL
Glomar Supporter	08/09/2023	p	Camila Azevedo	18:50	19:22	r	57	26.57	n	0	19.27	e	81.1	57	26.17	n	0	18.65	e	79.7	3.6								EOL
Glomar Supporter	08/09/2023	p	Camila Azevedo	19:22	20:00	r	57	26.17	n	0	18.65	e	79.7	57	25.30	n	0	23.20	e	84.3	3.8								SOL
Glomar Supporter	08/09/2023	p	David Melendez	20:00	20:44	r	57	25.30	n	0	23.20	e	84.3	57	24.43	n	0	27.71	e	84.0	3.7								
Glomar Supporter	08/09/2023	p	David Melendez	20:44	21:23	r	57	24.43	n	0	27.71	e	84.0	57	24.91	n	0	26.14	e	84.0	3.9								EOL
Glomar Supporter	08/09/2023	p	David Melendez	21:23	22:26	r	57	24.91	n	0	26.14	e	84.0	57	21.91	n	0	30.81	e	82.0	3.6								SOL
Glomar Supporter	08/09/2023	p	David Melendez	22:26	22:59	r	57	21.91	n	0	30.81	e	82.0	57	22.25	n	0	30.49	e	82.1	3.8								EOL
Glomar Supporter	08/09/2023	p	Camila Azevedo	22:59	00:00	r	57	22.25	n	0	30.49	e	82.1	57	21.19	n	0	36.79	e	89.3	3.8								SOL
Glomar Supporter	09/09/2023	p	David Melendez	00:00	00:20	r	57	21.19	n	0	36.79	e	89.3	57	20.79	n	0	39.19	e	87.2	4.0								Midnight UTC, shift change
Glomar Supporter	09/09/2023	p	David Melendez	00:20	00:35	r	57	20.79	n	0	39.19	e	87.2	57	20.37	n	0	38.91	e	88.6	4.1								EOL
Glomar Supporter	09/09/2023	p	David Melendez	00:35	00:45	n	57	20.37	n	0	38.91	e	88.6	57	20.33	n	0	37.71	e	82.4	4.3								SBP OFF
Glomar Supporter	09/09/2023	p	David Melendez	00:45	01:05	s	57	20.33	n	0	37.71	e	82.4	57	20.82	n	0	38.03	e	88.0	4.3								SS for SBP

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	09/09/2023	p	David Melendez	01:05	02:05	r	57	20.82	n	0	38.03	e	88.0	57	22.55	n	0	44.61	e	88.0	3.6								SOL. 5 minutes late due to variation in vessel speed
Glomar Supporter	09/09/2023	p	David Melendez	02:05	03:05	r	57	22.55	n	0	44.61	e	88.0	57	24.69	n	0	51.86	e	94.6	4.3								
Glomar Supporter	09/09/2023	p	David Melendez	03:05	03:35	r	57	24.69	n	0	51.86	e	94.6	57	25.45	n	0	54.50	e	94.4	4.1								
Glomar Supporter	09/09/2023	p	David Melendez	03:35	04:10	r	57	25.45	n	0	54.50	e	94.4	57	25.45	n	0	53.66	e	93.1	4.0								EOL
Glomar Supporter	09/09/2023	p	David Melendez	04:10	05:00	r	57	25.45	n	0	53.66	e	93.1	57	23.52	n	0	58.99	e	95.7	4.0								SOL
Glomar Supporter	09/09/2023	p	Boglarka Baksay	05:55	06:55	r	57	21.28	n	1	4.35	e	81.6	57	19.21	n	1	10.58	e	84.1	3.9	s	3	c				n	Shift change at 05:00; caught up on deliverables. Line continues
Glomar Supporter	09/09/2023	p	Boglarka Baksay	06:55	07:55	r	57	19.21	n	1	10.58	e	84.1	57	16.74	n	1	16.17	e	85.7	4.0	s	3	c				n	
Glomar Supporter	09/09/2023	p	Boglarka Baksay	07:55	08:22	r	57	16.74	n	1	16.17	e	85.7	57	15.55	n	1	18.87	e	85.4	4.1	s	3	c				n	
Glomar Supporter	09/09/2023	p	Boglarka Baksay	08:22	08:35	r	57	15.55	n	1	18.87	e	85.4	57	15.78	n	1	19.12	e	86.0	4.0								EOL
Glomar Supporter	09/09/2023	p	Boglarka Baksay	08:35	08:45	n	57	15.78	n	1	19.12	e	86.0	57	16.24	n	0	18.26	e	83.9	4.1								SBP off as longer LT expected. Vis still poor (fog), staying on PAM
Glomar Supporter	09/09/2023	p	Boglarka Baksay	08:45	09:05	s	57	16.24	n	1	18.26	e	83.9	57	16.54	n	1	17.32	e	84.2	4.1								SS SBP
Glomar Supporter	09/09/2023	p	Boglarka Baksay	09:05	09:55	r	57	16.54	n	1	17.32	e	84.2	57	13.78	n	1	20.16	e	89.3	4.2								FP SBP. SOL 09:13
Glomar Supporter	09/09/2023	p	Boglarka Baksay	09:55	09:55	r	57	13.78	n	1	20.16	e	89.3	57	13.78	n	1	20.16	e	89.3	4.1								Logging off for morning meeting
Glomar Supporter	09/09/2023	p	Boglarka Baksay	10:24	10:55	r	57	11.98	n	1	21.98	e	91.6	57	10.17	n	1	23.79	e	97.5	4.1								Back on watch
Glomar Supporter	09/09/2023	p	Camila Azevedo	10:55	11:00	r	57	10.17	n	1	23.79	e	97.5	57	9.77	n	1	24.57	e	97.3	4.0								
Glomar Supporter	09/09/2023	p	Camila Azevedo	11:00	11:31	r	57	9.77	n	1	24.57	e	97.3	57	10.02	n	1	24.14	e	97.4	3.9								EOL
Glomar Supporter	09/09/2023	p	Camila Azevedo	11:31	12:21	r	57	10.02	n	1	24.14	e	97.4	57	6.87	n	1	26.68	e	94.8	4.2								SOL
Glomar Supporter	09/09/2023	p	Camila Azevedo	12:21	12:21	n	57	6.87	n	1	26.68	e	94.8	57	6.87	n	1	26.68	e	94.8	4.2								EOL. EOW PAMS recovered due to VSP.
Glomar Supporter	09/09/2023	v	Camila Azevedo	12:45	13:45	n	57	5.89	n	1	26.41	e	71.0	57	5.02	n	1	20.66	e	76.8	0.9	sw	3	s	o	g	vf	n	SOW Visual. PW
Glomar Supporter	09/09/2023	v	Camila Azevedo	13:45	14:00	n	57	5.02	n	1	92.70	e	76.8	57	4.76	n	1	18.44	e	79.1	4.5	w	3	s	o	g	sf	n	Shift change
Glomar Supporter	09/09/2023	v	Boglarka Baksay	14:00	14:08	n	57	4.79	n	1	18.65	e	79.1	57	4.68	n	1	17.73	e	85.5	4.1	w	4	s	o	g	sf	n	PW continues
Glomar Supporter	09/09/2023	v	Boglarka Baksay	14:08	14:28	s	57	4.68	n	1	17.73	e	85.5	57	4.11	n	1	15.25	e	83.2	4.2	w	4	s	o	g	sf	n	SBP SS
Glomar Supporter	09/09/2023	v	Boglarka Baksay	14:28	15:28	r	57	4.11	n	1	15.25	e	83.2	57	5.04	n	1	22.08	e	84.0	3.9	sw	4	s	o	g	sb	n	FP. SOL 14:37
Glomar Supporter	09/09/2023	v	Boglarka Baksay	15:28	16:28	r	57	5.04	n	1	22.08	e	84.0	57	18.40	n	1	29.13	e	84.3	3.8	sw	3	s	o	g	sb	n	
Glomar Supporter	09/09/2023	v	Boglarka Baksay	16:28	16:36	r	57	6.16	n	1	29.08	e	84.3	57	6.19	n	1	29.16	e	86.3	3.9	sw	3	s	o	g	sb	n	
Glomar Supporter	09/09/2023	v	Boglarka Baksay	16:36	16:59	r	57	6.19	n	1	29.16	e	86.3	57	6.27	n	1	28.11	e	89.6	4.0	sw	3	s	o	g	sb	n	Abandoned due to system crash, turning around to SOL
Glomar Supporter	09/09/2023	v	Camila Azevedo	16:59	17:10	r	57	6.27	n	1	28.11	e	89.6	57	6.27	n	1	28.02	e	88.8	4.5	sw	3	s	o	g	vf	n	Shift change
Glomar Supporter	09/09/2023	v	Camila Azevedo	17:10	18:00	r	57	6.27	n	1	28.02	e	88.8	57	7.21	n	1	34.46	e	87.2	4.5	s	2	s	o	g	wb	n	SBP line continues
Glomar Supporter	09/09/2023	v	Camila Azevedo	18:00	18:21	r	57	7.21	n	1	34.46	e	87.2	57	7.62	n	1	36.90	e	86.5	4.1	se	2	s	o	g	wb	n	SBP line continues
Glomar Supporter	09/09/2023	v	Camila Azevedo	18:21	18:30	r	57	7.62	n	1	36.90	e	86.5	57	7.63	n	1	37.54	e	97.2	4.2	s	2	s	o	g	n	n	EOL. EOW Visual
Glomar Supporter	09/09/2023	p	David Melendez	18:22	19:22	r	57	6.62	n	1	36.88	e	97.3	57	6.75	n	1	31.21	e	97.5	3.3								SOW Acoustic; SOL @18:37
Glomar Supporter	09/09/2023	p	David Melendez	19:22	20:22	r	57	6.75	n	1	31.21	e	97.5	57	5.49	n	1	24.02	e	99.0	3.9								
Glomar Supporter	09/09/2023	p	David Melendez	20:22	21:22	r	57	5.49	n	1	24.02	e	99.0	57	4.41	n	1	17.99	e	95.9	3.9								
Glomar Supporter	09/09/2023	p	David Melendez	21:22	21:40	r	57	4.41	n	1	17.99	e	95.9	57	4.12	n	1	16.14	e	91.2	3.9								
Glomar Supporter	09/09/2023	p	David Melendez	21:40	21:54	r	57	4.12	n	1	16.14	e	91.2	57	4.25	n	1	16.74	e	93.8	3.9								EOL

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	09/09/2023	p	David Melendez	21:54	22:30	r	57	4.25	n	1	16.74	e	93.8	57	4.73	n	1	19.47	e	97.2	3.5								SOL
Glomar Supporter	09/09/2023	p	Camila Azevedo	22:30	23:30	r	57	4.73	n	1	19.47	e	97.2	57	5.92	n	1	26.34	e	97.0	3.9								
Glomar Supporter	09/09/2023	p	David Melendez	23:30	00:00	r	57	5.92	n	1	26.34	e	97.0	57	6.60	n	1	30.24	e	96.9	3.9								
Glomar Supporter	10/09/2023	p	David Melendez	00:00	00:58	r	57	6.60	n	1	30.24	e	96.9	57	7.70	n	1	36.78	e	96.4	4.0								Midnight UTC
Glomar Supporter	10/09/2023	p	David Melendez	00:58	01:19	r	57	7.70	n	1	36.78	e	96.4	57	7.90	n	1	36.77	e	96.3	4.1								EOL
Glomar Supporter	10/09/2023	p	David Melendez	01:19	02:20	r	57	7.90	n	1	36.77	e	96.3	57	6.71	n	1	29.92	e	97.5	3.9								SOL
Glomar Supporter	10/09/2023	p	David Melendez	02:20	03:20	r	57	6.71	n	1	29.92	e	97.5	57	5.50	n	1	22.91	e	97.9	3.9								
Glomar Supporter	10/09/2023	p	David Melendez	03:20	04:21	r	57	5.50	n	1	22.91	e	97.9	57	4.29	n	1	16.07	e	91.2	3.9								AD #03
Glomar Supporter	10/09/2023	p	David Melendez	04:21	04:42	r	57	4.29	n	1	16.07	e	91.2	57	4.69	n	1	16.13	e	91.9	4.1								EOL
Glomar Supporter	10/09/2023	p	David Melendez	04:42	05:00	r	57	4.69	n	1	16.13	e	91.9	57	5.08	n	1	18.42	e	91.2	4.5								SOL; EOW
Glomar Supporter	10/09/2023	v	Boglarka Baksay	05:00	06:00	r	57	5.08	n	1	18.42	e	91.2	57	6.22	n	1	25.46	e	82.2	4.0	sw	2	s	o	g	n	n	Shift change. Visual watch
Glomar Supporter	10/09/2023	v	Boglarka Baksay	06:00	07:00	r	57	6.22	n	1	25.46	e	82.2	57	28.52	n	1	32.05	e	82.6	3.9	sw	2	s	o	g	n	n	PAM recovered at 06:45
Glomar Supporter	10/09/2023	v	Boglarka Baksay	07:00	07:15	r	57	7.28	n	1	32.05	e	82.6	57	7.75	n	1	33.71	e	90.1	3.8	sw	2	s	o	g	sf	n	
Glomar Supporter	10/09/2023	v	Boglarka Baksay	07:15	07:39	r	57	7.75	n	1	33.71	e	90.1	57	8.09	n	1	34.33	e	87.4	2.9	sw	2	s	o	g	sf	n	EOL. Abandoned due to technical issues, back to SOL
Glomar Supporter	10/09/2023	v	Boglarka Baksay	07:39	07:45	r	57	8.09	n	1	34.33	e	87.4	57	8.02	n	1	33.84	e	79.2	4.4	sw	2	s	o	g	sb	n	All off as longer LT expected
Glomar Supporter	10/09/2023	v	Boglarka Baksay	07:45	08:05	s	57	8.02	n	1	33.84	e	79.2	57	7.57	n	1	32.47	e	90.1	4.5	sw	2	s	o	g	sb	n	SBP SS
Glomar Supporter	10/09/2023	v	Boglarka Baksay	08:05	08:43	r	57	7.57	n	1	32.47	e	90.1	57	8.11	n	1	37.08	e	86.3	2.3	sw	2	s	o	g	sf	n	SBP FP, SOL 08:13
Glomar Supporter	10/09/2023	v	Boglarka Baksay	08:43	08:58	r	57	8.11	n	1	37.08	e	86.3	57	7.56	n	1	37.03	e	81.4	3.8	sw	3	s	o	g	sb	n	EOL
Glomar Supporter	10/09/2023	v	Boglarka Baksay	08:58	09:58	r	57	7.56	n	1	37.03	e	81.4	57	6.48	n	1	30.01	e	83.8	4.0	sw	3	c	o	g	sb	n	SOL
Glomar Supporter	10/09/2023	v	Boglarka Baksay	09:58	10:58	r	57	6.48	n	1	30.01	e	83.8	57	5.46	n	1	22.63	e	92.6	3.9	sw	4	c	o	g	sb	n	
Glomar Supporter	10/09/2023	v	Camila Azevedo	10:58	11:58	r	57	5.46	n	1	22.63	e	92.6	57	4.29	n	1	15.93	e	91.4	4.3	sw	4	s	o	g	sb	n	Shift change. line cont.
Glomar Supporter	10/09/2023	v	Camila Azevedo	11:58	12:14	r	57	4.29	n	1	15.93	e	91.4	57	4.34	n	1	15.92	e	95.1	4.1	sw	4	s	o	g	sf	n	EOL
Glomar Supporter	10/09/2023	v	Camila Azevedo	12:14	13:00	r	57	4.34	n	1	15.92	e	95.1	57	5.21	n	1	20.98	e	97.6	4.1	sw	2	s	o	g	sb	n	SOL
Glomar Supporter	10/09/2023	v	Camila Azevedo	13:00	13:54	r	57	5.21	n	1	20.98	e	97.6	57	6.35	n	1	27.54	e	95.1	4.3	sw	2	s	o	g	sb	n	SBP line continues
Glomar Supporter	10/09/2023	v	Boglarka Baksay	13:54	14:54	r	57	6.35	n	1	27.54	e	95.1	57	4.56	n	1	34.57	e	83.1	4.4	s	2	s	o	g	sb	n	Shift change. Line cont.
Glomar Supporter	10/09/2023	v	Boglarka Baksay	14:54	15:13	r	57	4.56	n	1	34.57	e	83.1	57	7.57	n	1	36.59	e	82.1	4.2	s	2	s	o	g	sb	n	
Glomar Supporter	10/09/2023	v	Boglarka Baksay	15:13	15:26	r	57	7.57	n	1	36.59	e	82.1	57	8.02	n	1	37.54	e	80.8	4.1	s	2	s	o	g	sb	n	EOL
Glomar Supporter	10/09/2023	v	Boglarka Baksay	15:26	16:26	r	57	8.02	n	1	37.54	e	80.8	57	6.53	n	1	30.20	e	83.4	4.0	sw	3	s	o	g	sf	n	SOL
Glomar Supporter	10/09/2023	v	Boglarka Baksay	16:26	16:54	r	57	6.53	n	1	30.20	e	83.4	57	6.18	n	1	26.57	e	90.7	4.0	sw	3	s	o	g	n	n	
Glomar Supporter	10/09/2023	v	Camila Azevedo	16:54	18:00	r	57	6.18	n	1	26.57	e	90.7	57	4.93	n	1	19.06	e	96.5	4.1	s	3	s	o	g	n	l	Shift change. SBP Line continues
Glomar Supporter	10/09/2023	v	Camila Azevedo	18:00	18:27	r	57	4.93	n	1	19.06	e	96.5	57	4.04	n	1	15.94	e	89.6	4.5	s	2	s	o	g	n	l	SBP line continues
Glomar Supporter	10/09/2023	v	Camila Azevedo	18:27	18:35	r	57	4.04	n	1	15.94	e	89.6	57	4.40	n	1	15.25	e	88.5	3.1	s	2	s	o	g	n	m	EOL. EOW Visual
Glomar Supporter	10/09/2023	p	David Melendez	18:07	18:12	r	57	4.81	n	1	18.33	e	95.4	57	4.10	n	1	4.72	e	94.9	4.0								SOW Acoustic @18:07; Cable recovery @18:12 for SVP
Glomar Supporter	10/09/2023	p	David Melendez	18:57	19:52	r	57	4.25	n	1	15.93	e	91.9	57	5.64	n	1	21.38	e	97.9	3.8								SOW Acoustic @18:57; SOL @19:09 43 Minutes after EOL
Glomar Supporter	10/09/2023	p	David Melendez	19:52	20:27	n	57	5.64	n	1	21.38	e	97.9	57	4.96	n	1	18.08	e	95.9	3.4								Line aborted
Glomar Supporter	10/09/2023	p	David Melendez	20:27	20:48	s	57	4.96	n	1	18.08	e	95.9	57	4.47	n	1	15.34	e	89.1	3.4								SS

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	10/09/2023	p	David Melendez	20:48	20:57	r	57	4.47	n	1	15.34	e	89.1	57	4.82	n	1	15.85	e	91.5	4.0								
Glomar Supporter	10/09/2023	p	David Melendez	20:57	21:57	r	57	4.82	n	1	15.85	e	91.5	57	6.01	n	1	22.60	e	97.9	4.3								SOL
Glomar Supporter	10/09/2023	p	David Melendez	21:57	22:25	r	57	6.01	n	1	22.60	e	97.9	57	6.54	n	1	25.54	e	95.7	3.8								
Glomar Supporter	10/09/2023	p	Camila Azevedo	22:25	23:14	r	57	6.54	n	1	25.54	e	95.7	57	7.49	n	1	31.17	e	98.0	3.8								
Glomar Supporter	10/09/2023	p	David Melendez	23:14	00:00	r	57	7.49	n	1	31.17	e	98.0	57	8.40	n	1	36.44	e	95.0	3.9								
Glomar Supporter	11/09/2023	p	David Melendez	00:00	00:02	r	57	8.40	n	1	36.44	e	95.0	57	8.78	n	1	36.76	e	95.0	3.8								Midnight UTC
Glomar Supporter	11/09/2023	p	David Melendez	00:02	00:20	r	57	8.78	n	1	36.76	e	95.0	57	8.56	n	1	36.97	e	95.0	3.8								EOL
Glomar Supporter	11/09/2023	p	David Melendez	00:20	01:20	r	57	8.56	n	1	36.97	e	95.0	57	7.32	n	1	29.69	e	97.2	3.8								SOL
Glomar Supporter	11/09/2023	p	David Melendez	01:20	02:20	r	57	7.32	n	1	29.69	e	97.2	57	6.21	n	1	23.45	e	98.2	3.8								
Glomar Supporter	11/09/2023	p	David Melendez	02:20	03:20	r	57	6.21	n	1	23.45	e	98.2	57	5.10	n	1	17.08	e	93.7	3.6								
Glomar Supporter	11/09/2023	p	David Melendez	03:20	03:32	r	57	5.10	n	1	17.08	e	93.7	57	4.93		1	16.08	e	91.8	3.6								
Glomar Supporter	11/09/2023	p	David Melendez	03:32	03:51	r	57	4.93	n	1	16.08	e	91.8	57	4.96		1	16.09	e	92.1	3.2								EOL
Glomar Supporter	11/09/2023	p	David Melendez	03:51	04:51	r	57	4.96	n	1	16.09	e	92.1	57	6.17		1	23.11		97.4	3.9								SOL
Glomar Supporter	11/09/2023	p	Boglarka Baksay	04:51	05:51	r	57	6.17	n	1	23.11	e	97.4	57	7.32	n	1	29.80	e	90.8	3.9	s	4	r	o			n	shift change. Staying on PAM as mist coming in + foamy waves
Glomar Supporter	11/09/2023	p	Boglarka Baksay	05:51	06:51	r	57	7.32	n	1	29.80	e	90.8	57	8.45	n	1	36.27	e	90.1	4.0	s	4	r	o			n	
Glomar Supporter	11/09/2023	p	Boglarka Baksay	06:51	06:56	r	57	8.45	n	1	36.27	e	90.1	57	8.53	n	1	36.85	e	89.3	3.8	s	5	r	o			n	
Glomar Supporter	11/09/2023	p	Boglarka Baksay	06:56	07:14	r	57	8.53	n	1	36.85	e	89.3	57	8.77	n	1	36.96	e	92.6	4.1	sw	5	r	o			n	EOL
Glomar Supporter	11/09/2023	v	Boglarka Baksay	07:14	08:13	r	57	8.77	n	1	36.96	e	92.6	57	7.55	n	1	29.85	e	88.2	4.0	sw	5	c	o	g	sb	n	SOL. Visual watch
Glomar Supporter	11/09/2023	v	Boglarka Baksay	08:13	09:13	r	57	7.55	n	1	29.85	e	88.2	57	6.43	n	1	23.36	e	91.3	3.9	sw	5	c	o	g	n	n	
Glomar Supporter	11/09/2023	v	Boglarka Baksay	09:13	09:53	r	57	6.43	n	1	23.36	e	91.3	57	5.62	n	1	18.70	e	89.6	4.0	sw	5	r	o	g	n	n	
Glomar Supporter	11/09/2023	v	Boglarka Baksay	09:53	10:29	r	57	5.62	n	1	18.70	e	89.6	57	5.10	n	1	15.49	e	90.1	4.1	sw	5	r	o	g	n	n	Logging off for morning meeting. EOL 10:15
Glomar Supporter	11/09/2023	v	Boglarka Baksay	10:29	10:34	r	57	5.10	n	1	15.49	e	90.1	57	5.22	n	1	16.06	e	91.4	3.4	sw	4	c	o	g	n	n	Back on watch
Glomar Supporter	11/09/2023	v	Boglarka Baksay	10:34	10:53	r	57	5.22	n	1	16.06	e	91.4	57	5.57	n	1	18.08	e	85.8	3.6	sw	4	c	o	g	n	n	SOL
Glomar Supporter	11/09/2023	v	Camila Azevedo	10:53	11:53	r	57	5.57	n	1	18.08	e	85.8	57	6.77	n	1	24.98	e	96.4	3.7	sw	4	c	o	g	n	n	Shift change. SBP Line continues
Glomar Supporter	11/09/2023	v	Camila Azevedo	11:53	13:00	n	57	6.77	n	1	24.98	e	96.4	57	6.67	n	1	25.63	e	96.1	3.8	sw	4	c	o	g	n	n	EOL. Source offline due to technical issues
Glomar Supporter	11/09/2023	v	Camila Azevedo	13:00	13:05	n	57	6.67	n	1	25.63	e	96.1	57	6.49	n	1	24.78	e	96.1	4.9	w	3	s	o	g	n	n	No source.
Glomar Supporter	11/09/2023	v	Camila Azevedo	13:05	13:26	s	57	6.49	n	1	24.78	e	96.1	57	6.65	n	1	24.29	e	96.1	4.8	w	3	s	o	g	n	n	SS for SBP Line OM094_G
Glomar Supporter	11/09/2023	v	Camila Azevedo	13:26	13:53	r	57	6.65	n	1	24.29	e	96.1	57	7.12	n	1	27.06	e	96.1	4.1	nw	3	s	o	g	n	n	FV 13:26. SOL 13:26.
Glomar Supporter	11/09/2023	v	Boglarka Baksay	13:53	14:53	r	57	7.12	n	1	27.06	e	96.1	57	8.26	n	1	33.69	e	91.7	4.2	nw	3	c	o	g	n	n	Shift change. SBP Line continues
Glomar Supporter	11/09/2023	v	Boglarka Baksay	14:53	15:23	r	57	8.26	n	1	33.69	e	91.7	57	8.78	n	1	36.85	e	92.4	3.7	nw	4	c	o	g	n	l	
Glomar Supporter	11/09/2023	v	Boglarka Baksay	15:23	15:40	r	57	8.78	n	1	36.85	e	92.4	57	8.88	n	1	36.91	e	90.3	3.8	nw	5	c	o	g	n	m	EOL
Glomar Supporter	11/09/2023	v	Boglarka Baksay	15:40	16:40	r	57	8.88	n	1	36.91	e	90.3	57	7.62	n	1	29.65	e	91.9	4.0	nw	4	c	o	g	n	l	SOL
Glomar Supporter	11/09/2023	v	Boglarka Baksay	16:40	16:55	r	57	7.62	n	1	29.65	e	91.9	57	7.36	n	1	28.14	e	95.8	4.1	nw	4	c	o	g	n	n	
Glomar Supporter	11/09/2023	v	Camila Azevedo	16:55	17:50	r	57	7.36	n	1	28.14	e	95.8	57	6.18	n	1	21.38	e	97.7	4.1	nw	4	c	o	g	n	l	Shift change. SBP Line continues
Glomar Supporter	11/09/2023	v	Camila Azevedo	17:50	18:42	r	57	6.18	n	1	21.38	e	97.7	57	5.24	n	1	15.93	e	91.4	4.1	nw	4	c	o	g	wf	n	SBP line continues
Glomar Supporter	11/09/2023	v	Camila Azevedo	18:42	19:00	n	57	5.24	n	1	15.93	e	91.4	57	4.54	n	1	15.24	e	88.9	4.0	nw	4	c	o	g	n	n	EOL. PAMS and SBP recovered for SVP

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	11/09/2023	v	Camila Azevedo	19:00	19:07	n	57	4.54	n	1	15.24	e	88.9	57	4.65	n	1	15.50	e	90.3	2	nw	4	c	o	g	n	n	SS for SBP Line
Glomar Supporter	11/09/2023	v	Camila Azevedo	19:07	19:10	s	57	4.65	n	1	15.50	e	90.3	57	4.69	n	1	15.48	e	90.2	2.7	nw	4	c	o	m	n	n	EOW Visual.
Glomar Supporter	11/09/2023	p	David Melendez	19:15	19:27	s	57	4.88	n	1	15.28	e	90.1	57	5.36	n	1	15.92	e	91.8	2.7								SOW Acoustic
Glomar Supporter	11/09/2023	p	David Melendez	19:27	20:27	r	57	5.36	n	1	15.92	e	91.8	57	6.46	n	1	22.30	e	98.0	3.6								SOL
Glomar Supporter	11/09/2023	p	David Melendez	20:27	21:27	r	57	6.46	n	1	22.30	e	98.0	57	7.55	n	1	29.84	e	93.0	3.0								
Glomar Supporter	11/09/2023	p	David Melendez	21:27	22:20	r	57	7.55	n	1	29.84	e	93.0	57	8.36	n	1	33.25	e	95.8	3.0								
Glomar Supporter	11/09/2023	p	Camila Azevedo	22:20	22:55	r	57	8.36	n	1	33.25	e	95.8	57	8.98	n	1	36.84	e	91.5	3.0								
Glomar Supporter	11/09/2023	p	Camila Azevedo	22:55	23:09	r	57	8.98	n	1	36.84	e	91.5	57	8.90	n	1	35.95	e	95.6	3.5								EOL
Glomar Supporter	11/09/2023	p	David Melendez	23:09	00:00	r	57	8.90	n	1	35.95	e	95.6	57	8.04	n	1	30.60	e	97.5	3.7								SOL
Glomar Supporter	12/09/2023	p	David Melendez	00:00	00:27	r	57	8.04	n	1	30.60	e	97.5	57	7.49	n	1	27.80	e	97.1	3.8								Midnight UTC
Glomar Supporter	12/09/2023	p	David Melendez	00:27	00:50	n	57	7.49	n	1	27.80	e	97.1	57	7.10	n	1	28.99	e	97.3	4.1								Line Aborted
Glomar Supporter	12/09/2023	p	David Melendez	00:50	01:12	s	57	7.10	n	1	28.99	e	97.3	57	7.67	n	1	28.81	e	97.6	3.9								SS for SBP Line
Glomar Supporter	12/09/2023	p	David Melendez	01:12	01:22	r	57	7.67	n	1	28.81	e	97.6	57	7.46	n	1	21.59	e	96.8	4.1								SOL
Glomar Supporter	12/09/2023	p	David Melendez	01:22	01:34	r	57	7.46	n	1	21.59	e	96.8	57	7.12	n	1	21.73	e	97.6	4.1								Line Aborted
Glomar Supporter	12/09/2023	p	David Melendez	01:34	01:35	n	57	7.12	n	1	27.55	e	97.6	57	7.15	n	1	21.73	e	97.2	3.8								SBP Off
Glomar Supporter	12/09/2023	p	David Melendez	01:35	02:14	s	57	7.15	n	1	21.73	e	97.2	57	8.03	n	1	30.88	e	97.6	4.1								SS for SBP Line
Glomar Supporter	12/09/2023	p	David Melendez	02:14	02:22	r	57	8.03	n	1	30.88	e	97.6	57	7.85	n	1	31.00	e	96.6	3.5								SOL
Glomar Supporter	12/09/2023	p	David Melendez	02:22	02:37	r	57	7.85	n	1	31.00	e	96.6	57	7.66	n	1	28.59	e	97.0	3.8								Line Aborted
Glomar Supporter	12/09/2023	p	David Melendez	02:37	03:22	n	57	7.66	n	1	28.59	e	97.0	57	7.53	n	1	29.47	e	97.8	3.1								SBP Off
Glomar Supporter	12/09/2023	p	David Melendez	03:22	03:43	s	57	7.53	n	1	29.47	e	97.8	57	7.75	n	1	29.50	e	96.5	3.5								SS for SBP Line
Glomar Supporter	12/09/2023	p	David Melendez	03:43	03:49	r	57	7.75	n	1	29.50	e	96.5	57	7.64	n	1	28.69	e	96.8	3.2								
Glomar Supporter	12/09/2023	p	David Melendez	03:49	04:49	r	57	7.64	n	1	28.69	e	96.8	57	6.42	n	1	21.69	e	97.3	4.5								SOL
Glomar Supporter	12/09/2023	p	David Melendez	04:49	04:56	r	57	6.42	n	1	21.69	e	97.3	57	6.24	n	1	20.66	e	92.2	4.3								
Glomar Supporter	12/09/2023	p	Boglarka Baksay	04:56	05:33	r	57	6.24	n	1	20.66	e	92.2	57	5.50	n	1	16.53	e	94.7	4.0								shift change
Glomar Supporter	12/09/2023	v	Boglarka Baksay	05:33	05:38	r	57	5.50	n	1	16.53	e	94.7	57	5.40	n	1	16.01	e	96.2	4.0	nw	5	c	o	g	wb	n	Visual watch
Glomar Supporter	12/09/2023	v	Boglarka Baksay	05:38	05:58	r	57	5.40	n	1	16.01	e	96.2	57	5.47	n	1	16.05	e	89.1	3.7	nw	5	c	o	g	n	n	EOL
Glomar Supporter	12/09/2023	v	Boglarka Baksay	05:58	06:58	r	57	5.47	n	1	16.05	e	89.1	57	6.77	n	1	23.01	e	91.4	3.9	nw	5	c	o	g	n	n	SOL. Recovering PAM to check for signs of damage after sharp turn (bridge couldn't keep speed). No damage
Glomar Supporter	12/09/2023	v	Boglarka Baksay	06:58	07:58	r	57	6.77	n	1	22.89	e	91.4	57	7.89	n	1	29.87	e	92.7	3.8	nw	4	c	o	g	vf	n	
Glomar Supporter	12/09/2023	v	Boglarka Baksay	07:58	08:58	r	57	7.89	n	1	29.87	e	92.7	57	9.06	n	1	36.90	e	90.7	3.9	nw	4	c	o	g	sf	n	
Glomar Supporter	12/09/2023	v	Boglarka Baksay	08:58	09:03	r	57	9.06	n	1	36.90	e	90.7	57	9.08	n	1	36.98	e	89.9	3.8	nw	4	c	o	g	sf	n	
Glomar Supporter	12/09/2023	v	Boglarka Baksay	09:03	09:21	r	57	9.08	n	1	36.98	e	89.9	57	9.16	n	1	36.85	e	91.2	3.8	nw	4	c	o	g	sf	n	EOL
Glomar Supporter	12/09/2023	v	Boglarka Baksay	09:21	09:53	r	57	9.16	n	1	36.85	e	91.2	57	8.51	n	1	33.09	e	91.8	4.4	nw	5	c	o	g	sb	n	SOL
Glomar Supporter	12/09/2023	v	Boglarka Baksay	09:53	09:53	r	57	8.51	n	1	33.09	e	91.8	57	8.51	n	1	33.09	e	91.8	4.1	nw	5	c	o	g	sb	n	Logging off for meeting
Glomar Supporter	12/09/2023	v	Boglarka Baksay	10:24	10:55	r	57	7.86	n	1	29.30	e	94.7	57	7.27	n	1	25.83	e	91.7	4.1	nw	5	c	o	g	sb	n	Back on watch
Glomar Supporter	12/09/2023	v	Camila Azevedo	10:55	12:00	r	57	7.27	n	1	25.83	e	91.7	57	5.84	n	1	17.61	e	94.5	4.0	nw	5	c	o	g	sb	n	Shift change. SBP Line continues
Glomar Supporter	12/09/2023	v	Camila Azevedo	12:00	12:23	r	57	5.84	n	1	17.61	e	94.5	57	5.51	n	1	15.67	e	92.6	4.1	nw	4	c	o	g	sb	n	SBP line continues
Glomar Supporter	12/09/2023	v	Camila Azevedo	12:23	12:35	n	57	5.51	n	1	15.67	e	92.6	57	5.58	n	1	15.44	e	91.9	3.4	nw	4	c	o	g	sb	n	EOL. Source stop for SVP. PW 12:05
Glomar Supporter	12/09/2023	v	Camila Azevedo	12:35	12:55	s	57	5.58	n	1	15.44	e	91.9	57	5.29	n	1	15.57	e	92.1	3.5	nw	4	c	o	g	sb	n	SS

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	12/09/2023	v	Camila Azevedo	12:55	13:50	r	57	5.29	n	1	15.57	e	92.1	57	6.16	n	1	18.91	e	96.7	4.2	nw	4	c	o	g	sb	n	FV 12:35 SOL 13:23. SS-SOL longer than 40' d/t Technical issues
Glomar Supporter	12/09/2023	v	Boglarka Baksay	13:50	14:50	r	57	6.16	n	1	18.91	e	96.7	57	7.27	n	1	25.32	e	91.4	3.8	nw	5	c	o	g	sb	n	Shift change. SBP Line continues
Glomar Supporter	12/09/2023	v	Boglarka Baksay	14:50	15:50	r	57	7.27	n	1	25.32	e	91.4	57	8.44	n	1	32.10	e	94.7	3.6	n	5	c	o	g	sb	n	
Glomar Supporter	12/09/2023	v	Boglarka Baksay	15:50	16:35	r	57	8.44	n	1	32.10	e	94.7	57	8.44	n	1	32.01	e	91.6	3.7	n	5	c	o	g	sb	n	
Glomar Supporter	12/09/2023	v	Boglarka Baksay	16:35	16:52	r	57	8.44	n	1	32.01	e	91.6	57	8.44	n	1	32.10	e	92.4	3.8	nw	5	c	o	g	n	n	EOL
Glomar Supporter	12/09/2023	v	Camila Azevedo	16:52	18:00	r	57	8.44	n	1	32.10	e	92.4	57	7.95	n	1	28.95	e	96.1	3.9	nw	5	c	o	g	n	n	SOL. Shift change
Glomar Supporter	12/09/2023	v	Camila Azevedo	18:00	18:00	r	57	7.95	n	1	28.95	e	96.1	57	7.95	n	1	28.95	e	96.1	4.1	nw	5	c	o	g	n	n	
Glomar Supporter	12/09/2023	v	Camila Azevedo	18:00	19:00	r	57	7.95	n	1	28.95	e	96.1	57	6.88	n	1	22.76	e	96.4	4.4	nw	5	c	o	g	n	n	SBP line continues. EOW Visual
Glomar Supporter	12/09/2023	p	David Melendez	18:16	19:16	r	57	7.72	n	1	27.60	e	96.8	57	6.37	n	1	19.79	e	96.0	4.6								SOW Acoustic
Glomar Supporter	12/09/2023	p	David Melendez	19:16	20:00	r	57	6.37	n	1	19.79	e	96.0	57	5.71	n	1	16.08	e	92.2	3.9								
Glomar Supporter	12/09/2023	p	David Melendez	20:00	20:14	r	57	5.71	n	1	16.08	e	92.2	57	5.70	n	1	15.72	e	93.5	3.9								EOL
Glomar Supporter	12/09/2023	p	David Melendez	20:14	21:23	r	57	5.70	n	1	15.72	e	93.5	57	7.18	n	1	24.21	e	96.5	3.8								SOL
Glomar Supporter	12/09/2023	p	David Melendez	21:23	22:23	r	57	7.18	n	1	24.21	e	96.5	57	8.28	n	1	30.43	e	97.0	4.1								
Glomar Supporter	12/09/2023	p	David Melendez	22:23	23:23	r	57	8.28	n	1	30.43	e	97.0	57	9.37	n	1	36.74	e	97.0	3.4								EOW @23:23; EOL @23:23, SBP OFF; Waiting on weather
Glomar Supporter	13/09/2023	p	Boglarka Baksay	07:11	07:50	r	57	10.23	n	1	35.88	e	92.6	57	8.95	n	1	36.84	e	91.9	2.6	n	5	r	o			n	PAM PW
Glomar Supporter	13/09/2023	p	Boglarka Baksay	07:50	08:10	s	57	8.95	n	1	36.84	e	91.9	57	7.86	n	1	36.76	e	92.0	3.0	n	5	r	o			n	SS SBP
Glomar Supporter	13/09/2023	p	Boglarka Baksay	08:10	08:14	n	57	7.86	n	1	36.76	e	92.0	57	7.58	n	1	36.53	e	91.3	3.7	n	5	r	o			n	SS abandoned due to technical issues
Glomar Supporter	13/09/2023	p	Boglarka Baksay	08:14	08:38	s	57	7.58	n	1	36.53	e	91.3	57	6.69	n	1	35.39	e	89.9	3.9	n	5	r	o			n	SS restarted
Glomar Supporter	13/09/2023	p	Boglarka Baksay	08:38	08:43	r	57	6.69	n	1	35.39	e	89.9	57	6.62	n	1	34.81	e	90.6	3.8	n	5	r	o			n	SOL
Glomar Supporter	13/09/2023	p	Boglarka Baksay	08:43	08:43	n	57	6.62	n	1	34.81	e	90.6	57	6.62	n	1	34.81	e	90.6	3.0	n	5	r	o			n	EOL (aborted due to weather). All off, back on weather standby
Glomar Supporter	13/09/2023	v	Camila Azevedo	11:00	12:00	n	57	9.01	n	1	31.01	e	93.9	57	10.13	n	1	29.85	e	94.5	3.9	nw	4	c	o	g	vf	n	SOW Visual
Glomar Supporter	13/09/2023	v	Camila Azevedo	12:00	13:00	n	57	10.13	n	1	29.85	e	94.5	57	8.58	n	1	36.13	e	95.7	4.2	nw	4	c	o	g	vf	n	
Glomar Supporter	13/09/2023	v	Camila Azevedo	13:00	13:54	n	57	8.58	n	1	36.13	e	95.7	57	7.32	n	1	31.62	e	96.9	4.0	nw	4	c	o	g	sb	n	
Glomar Supporter	13/09/2023	v	Boglarka Baksay	13:54	13:54	n	57	7.32	n	1	31.62	e	96.9	57	7.32	n	1	31.62	e	96.9	1.8	nw	3	c	o	g	vf	n	Weather standby, keeping a casual watch while doing office work
Glomar Supporter	14/09/2023	p	Camila Azevedo	22:45	23:15	n	57	4.91	n	1	17.95	e	95.3	57	5.41	n	1	16.68	e	93.6	3.6								PW
Glomar Supporter	14/09/2023	p	Camila Azevedo	23:15	23:35	s	57	5.41	n	1	16.68	e	93.6	57	5.93	n	1	15.61	e	92.5	3.5								SS
Glomar Supporter	14/09/2023	p	David Melendez	23:35	00:00	r	57	5.93	n	1	15.61	e	92.5	57	6.45	n	1	18.42	e	91.3	3.2								SOL @23:41
Glomar Supporter	15/09/2023	p	David Melendez	00:00	01:00	r	57	6.45	n	1	18.42	e	91.3	57	7.51	n	1	24.49	e	96.1	3.9								Midnight UTC
Glomar Supporter	15/09/2023	p	David Melendez	01:00	02:00	r	57	7.51	n	1	24.49	e	96.1	57	8.54	n	1	30.43	e	97.3	3.4								
Glomar Supporter	15/09/2023	p	David Melendez	02:00	02:59	r	57	8.54	n	1	30.43	e	97.3	57	9.57	n	1	36.59	e	96.7	3.7								
Glomar Supporter	15/09/2023	p	David Melendez	02:59	03:24	r	57	9.57	n	1	36.59	e	96.7	57	9.75	n	1	35.85	e	96.7	3.7								EOL
Glomar Supporter	15/09/2023	p	David Melendez	03:24	04:24	r	57	9.75	n	1	35.85	e	96.7	57	8.75	n	1	30.21	e	97.2	3.7								SOL; AD #03
Glomar Supporter	15/09/2023	p	David Melendez	04:24	04:55	r	57	8.75	n	1	30.21	e	97.2	57	8.37	n	1	27.18	e	94.9	3.7								

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	15/09/2023	p	Boglarka Baksay	04:55	05:55	r	57	8.37	n	1	27.18	e	94.9	57	6.92	n	1	19.50	e	91.5	3.8								shift change
Glomar Supporter	15/09/2023	v	Boglarka Baksay	05:55	06:28	r	57	6.92	n	1	19.50	e	91.5	57	6.27	n	1	15.88	e	90.8	3.9	w	3	s	o	g	n	l	visual watch
Glomar Supporter	15/09/2023	v	Boglarka Baksay	06:28	06:47	r	57	6.27	n	1	15.88	e	90.8	57	6.57	n	1	15.91	e	89.4	3.9	nw	3	s	o	g	n	l	
Glomar Supporter	15/09/2023	v	Boglarka Baksay	06:47	07:47	r	57	6.57	n	1	15.91	e	89.4	57	7.77	n	1	22.78	e	94.2	3.8	nw	2	s	o	g	n	l	SOL
Glomar Supporter	15/09/2023	v	Boglarka Baksay	07:47	08:47	r	57	7.77	n	1	22.78	e	94.2	57	8.86	n	1	29.10	e	92.5	3.8	n	2	s	o	g	n	l	
Glomar Supporter	15/09/2023	v	Boglarka Baksay	08:47	09:47	r	57	8.86	n	1	29.10	e	92.5	57	9.96	n	1	35.51	e	94.0	3.6	n	2	s	o	g	n	l	
Glomar Supporter	15/09/2023	v	Boglarka Baksay	09:47	09:51	r	57	9.96	n	1	35.51	e	94.0	57	9.99	n	1	35.75	e	93.8	3.6	n	2	s	o	g	n	l	Line continues. PAM recovered 09:41
Glomar Supporter	15/09/2023	v	Boglarka Baksay	09:51	10:33	n	57	9.99	n	1	35.75	e	93.8	57	10.17	n	1	35.79	e	94.8	3.7	n	2	s	o	g	n	l	EOL, all off for SVP. PW
Glomar Supporter	15/09/2023	v	Boglarka Baksay	10:33	10:53	s	57	10.17	n	1	35.79	e	94.8	57	8.86	n	1	29.10	e	93.2	3.3	ne	2	s	o	g	n	l	SS
Glomar Supporter	15/09/2023	v	Camila Azevedo	10:53	11:54	r	57	8.86	n	1	29.10	e	93.2	57	9.19	n	1	29.37	e	94.2	3.7	n	2	s	o	g	n	m	shift change. SOL 11:03
Glomar Supporter	15/09/2023	v	Camila Azevedo	11:54	12:00	r	57	9.19	n	1	29.37	e	94.2	57	9.15	n	1	29.15	e	95.3	3.8	nw	3	s	o	g	n	m	SBP Line continues
Glomar Supporter	15/09/2023	v	Camila Azevedo	12:00	13:00	r	57	9.15	n	1	29.15	e	95.3	57	7.85	n	1	21.62	e	97.3	4.4	nw	3	s	o	g	n	m	SBP Line continues
Glomar Supporter	15/09/2023	v	Camila Azevedo	13:00	13:54	r	57	7.85	n	1	21.62	e	97.3	57	6.87	n	1	16.06	e	96.3	4.5	n	4	s	o	g	n	m	SBP Line continues
Glomar Supporter	15/09/2023	v	Boglarka Baksay	13:54	14:15	r	57	6.80	n	1	15.65	e	96.3	57	7.18	n	1	16.15	e	94.2	4.2	n	5	c	o	g	n	m	Shift change. EOL
Glomar Supporter	15/09/2023	v	Boglarka Baksay	14:15	15:15	r	57	7.18	n	1	16.15	e	94.2	57	8.36	n	1	22.96	e	93.4	4.0	nw	5	c	o	g	n	m	SOL
Glomar Supporter	15/09/2023	v	Boglarka Baksay	15:15	16:15	r	57	8.36	n	1	22.96	e	93.4	57	9.54	n	1	29.91	e	94.7	3.9	n	6	c	o	g	n	l	
Glomar Supporter	15/09/2023	v	Boglarka Baksay	16:15	16:40	r	57	9.54	n	1	29.91	e	94.7	57	10.01	n	1	32.49	e	96.6	3.7	n	5	c	o	g	n	l	Shift change. SBP Line continues
Glomar Supporter	15/09/2023	v	Camila Azevedo	16:40	17:00	r	57	10.01	n	1	32.49	e	96.6	57	10.35	n	1	34.47	e	96.0	4.3	ne	4	c	o	g	n	l	SBP Line continues
Glomar Supporter	15/09/2023	v	Camila Azevedo	17:00	17:05	r	57	10.35	n	1	34.47	e	96.0	57	10.40	n	1	34.75	e	95.7	4.3	ne	4	c	o	m	n	m	SBP Line continues
Glomar Supporter	15/09/2023	v	Camila Azevedo	17:05	17:23	r	57	10.40	n	1	34.75	e	95.7	57	10.06	n	1	34.07	e	95.8	3.9	ne	4	c	o	m	n	m	EOL
Glomar Supporter	15/09/2023	v	Camila Azevedo	17:23	18:00	r	57	10.06	n	1	34.07	e	95.8	57	9.89	n	1	30.18	e	96.6	4.0	ne	4	c	o	m	n	m	SOL
Glomar Supporter	15/09/2023	v	Camila Azevedo	18:00	18:30	r	57	9.89	n	1	30.18	e	96.6	57	9.39	n	1	27.20	e	96.1	4.0	ne	4	c	o	m	n	m	EOW Visual.
Glomar Supporter	15/09/2023	p	David Melendez	18:12	19:12	r	57	9.75	n	1	26.26	e	96.0	57	7.44	n	1	15.99	e	92.5	3.9								SOW Acoustic
Glomar Supporter	15/09/2023	p	David Melendez	19:12	20:12	r	57	7.44	n	1	15.99	e	92.5	57	7.44	n	1	15.99	e	92.5	3.8								
Glomar Supporter	15/09/2023	p	David Melendez	20:12	20:31	r	57	7.44	n	1	15.99	e	92.5	57	7.68	n	1	15.81	e	93.0	3.8								EOL
Glomar Supporter	15/09/2023	p	David Melendez	20:31	21:39	r	57	7.68	n	1	15.81	e	93.0	57	8.91	n	1	23.46	e	96.3	3.4								SOL
Glomar Supporter	15/09/2023	p	David Melendez	21:39	21:45	r	57	8.91	n	1	23.46	e	96.3	57	9.07	n	1	23.85	e	97.0	3.9								PAM cable recovery @21:45, transit near to manifold
Glomar Supporter	15/09/2023	p	Camila Azevedo	21:45	22:13	r	57	9.07	n	1	23.85	e	97.0	57	9.58	n	1	26.70	e	95.0	4.0								
Glomar Supporter	15/09/2023	p	Camila Azevedo	22:13	22:18	r	57	9.58	n	1	26.70	e	95.0	57	9.83	n	1	26.52	e	94.8	3.8								
Glomar Supporter	15/09/2023	p	Camila Azevedo	22:18	23:18	r	57	9.83	n	1	26.52	e	94.8	57	8.67	n	1	16.72	e	95.7	3.9								PAM cable deploy @22:18
Glomar Supporter	15/09/2023	p	David Melendez	23:18	23:56	r	57	8.67	n	1	16.72	e	95.7	57	8.01	n	1	16.02	e	94.1	3.8								
Glomar Supporter	15/09/2023	p	David Melendez	23:56	00:00	r	57	8.01	n	1	16.02	e	94.1	57	8.89	n	1	15.48	e	93.7	3.7								EOL
Glomar Supporter	16/09/2023	p	David Melendez	00:00	00:15	r	57	8.89	n	1	15.48	e	93.7	57	8.23	n	1	15.79	e	93.8	3.0								Midnight UTC
Glomar Supporter	16/09/2023	p	David Melendez	00:15	01:00	r	57	8.23	n	1	15.79	e	93.8	57	9.04	n	1	20.45	e	96.8	3.6								SOL; Break in watch for TBT
Glomar Supporter	16/09/2023	p	David Melendez	01:10	02:10	r	57	9.21	n	1	21.38	e	98.0	57	10.28	n	1	27.66	e	92.6	3.4								Resume watch
Glomar Supporter	16/09/2023	p	David Melendez	02:10	03:06	r	57	10.28	n	1	27.66	e	92.6	57	11.12	n	1	32.42	e	96.9	3.1								

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	16/09/2023	p	David Melendez	03:06	03:12	r	57	11.12	n	1	32.42	e	96.9	57	11.23	n	1	33.05	e	97.1	3.7								
Glomar Supporter	16/09/2023	p	David Melendez	03:16	03:31	r	57	11.32	n	1	33.55	e	95.6	57	10.87	n	1	34.32	e	95.7	3.5								EOL
Glomar Supporter	16/09/2023	p	David Melendez	03:31	04:21	r	57	10.87	n	1	34.32	e	95.7	57	10.02	n	1	29.27	e	96.6	4.1								SOL; PAM cable recovery @04:21, transit near to manifold
Glomar Supporter	16/09/2023	p	David Melendez	04:43	04:53	r	57	10.24	n	1	28.90	e	96.6	57	10.40	n	1	29.83	e	95.0	3.0								Resume watch
Glomar Supporter	16/09/2023	p	Boglarka Baksay	04:53	05:32	r	57	10.40	n	1	29.83	e	95.0	57	11.08	n	1	33.89	e	90.1	3.9	n	6	r	o			n	shift change
Glomar Supporter	16/09/2023	p	Boglarka Baksay	05:32	05:49	r	57	11.08	n	1	33.89	e	90.1	57	11.49	n	1	32.84	e	91.3	3.3	n	6	r	o			n	EOL
Glomar Supporter	16/09/2023	p	Boglarka Baksay	05:49	06:49	r	57	11.49	n	1	32.84	e	91.3	57	10.33	n	1	26.15	e	91.5	3.6	n	6	r	o			n	SOL
Glomar Supporter	16/09/2023	p	Boglarka Baksay	06:49	07:49	r	57	10.33	n	1	26.15	e	91.5	57	9.25	n	1	19.63	e	90.8	3.6	n	6	r	o			n	
Glomar Supporter	16/09/2023	p	Boglarka Baksay	07:49	08:30	r	57	9.25	n	1	19.63	e	90.8	57	8.48	n	1	15.45	e	92.1	3.7	n	6	r	o			n	
Glomar Supporter	16/09/2023	p	Boglarka Baksay	08:30	08:52	r	57	8.48	n	1	15.45	e	92.1	57	8.91	n	1	16.44	e	91.0	3.8	n	6	r	o			n	EOL
Glomar Supporter	16/09/2023	p	Boglarka Baksay	08:52	09:52	r	57	8.91	n	1	16.44	e	91.0	57	9.99	n	1	22.64	e	90.6	3.8	n	6	r	o			n	SOL
Glomar Supporter	16/09/2023	p	Boglarka Baksay	09:52	09:56	r	57	9.99	n	1	22.64	e	90.6	57	10.03	n	1	23.01	e	91.8	3.7	n	6	r	o			n	
Glomar Supporter	16/09/2023	p	Boglarka Baksay	09:56	09:56	n	57	10.03	n	1	23.01	e	91.8	57	10.03	n	1	23.01	e	91.8	3.3	n	6	r	o			n	Logging off for morning meeting
Glomar Supporter	16/09/2023	p	Boglarka Baksay	10:29	10:56	n	57	10.89	n	1	24.90	e	92.1	57	10.39	n	1	22.94	e	90.6	3.4	n	6	r	o			n	EOL, abandoned and all off as beacon signal off. PAM recovery + redeployment. PW
Glomar Supporter	16/09/2023	p	Camila Azevedo	10:56	11:00	n	57	10.39	n	1	22.94	e	90.6	57	10.30	n	1	22.63	e	95.9	3.7								shift change, PW on 10:30
Glomar Supporter	16/09/2023	p	Camila Azevedo	11:00	11:20	s	57	10.30	n	1	22.63	e	95.9	57	9.74	n	1	19.80	e	95.1	3.4								SS
Glomar Supporter	16/09/2023	p	Camila Azevedo	11:20	12:00	r	57	9.74	n	1	19.80	e	95.1	57	10.13	n	1	23.50	e	97.6	3.9								FV, SOL 11:31
Glomar Supporter	16/09/2023	p	Camila Azevedo	12:00	13:00	r	57	10.13	n	1	23.50	e	96.5	57	11.25	n	1	30.14	e	97.8	3.8								SBP Line continues
Glomar Supporter	16/09/2023	p	Camila Azevedo	13:00	13:21	r	57	11.25	n	1	30.14	e	97.8	57	11.67	n	1	32.53	e	96.7	3.7								SBP Line continues
Glomar Supporter	16/09/2023	p	Camila Azevedo	13:21	13:37	r	57	11.67	n	1	32.53	e	96.7	57	11.85	n	1	31.95	e	97.0	3.8								EOL
Glomar Supporter	16/09/2023	p	Camila Azevedo	13:37	13:54	r	57	11.85	n	1	31.95	e	97.0	57	11.53	n	1	30.05	e	97.4	3.7								SOL
Glomar Supporter	16/09/2023	p	Boglarka Baksay	13:54	14:54	r	57	11.53	n	1	30.05	e	97.4	57	10.41	n	1	23.10	e	93.4	3.8								Shift change. SBP Line continues
Glomar Supporter	16/09/2023	p	Boglarka Baksay	14:54	15:54	r	57	10.41	n	1	23.10	e	93.4	57	9.27	n	1	16.76	e	90.2	3.7								
Glomar Supporter	16/09/2023	p	Boglarka Baksay	15:54	15:57	r	57	9.27	n	1	16.76	e	90.2	57	9.19	n	1	16.27	e	89.1	3.6								
Glomar Supporter	16/09/2023	p	Boglarka Baksay	15:57	16:11	r	57	9.19	n	1	16.27	e	89.1	57	9.53	n	1	16.72	e	93.4	3.3								EOL
Glomar Supporter	16/09/2023	p	Boglarka Baksay	16:11	16:57	r	57	9.53	n	1	16.72	e	93.4	57	10.43	n	1	21.83	e	92.2	3.9								SOL
Glomar Supporter	16/09/2023	v	Camila Azevedo	16:57	17:37	r	57	10.43	n	1	21.83	e	97.2	57	11.23	n	1	26.47	e	96.8	4.0	ne	4	c	o	g	sb	n	Shift change. SBP Line continues
Glomar Supporter	16/09/2023	v	Camila Azevedo	17:37	17:52	r	57	11.23	n	1	26.47	e	96.8	57	11.42	n	1	25.91	e	96.9	4.0	ne	4	c	o	g	sb	n	EOL
Glomar Supporter	16/09/2023	v	Camila Azevedo	17:52	18:40	r	57	11.42	n	1	25.91	e	96.9	57	10.55	n	1	20.90	e	95.3	4.1	nw	3	s	o	g	n	n	SOL. EOW Visual
Glomar Supporter	16/09/2023	p	David Melendez	18:15	19:15	r	57	11.08	n	1	23.81	e	97.2	57	9.92	n	1	23.89	e	93.3	3.7								SOW Acoustic
Glomar Supporter	16/09/2023	p	David Melendez	19:15	19:29	r	57	9.92	n	1	23.89	e	93.3	57	10.17	n	1	17.15	e	93.1	3.7								EOL
Glomar Supporter	16/09/2023	p	David Melendez	19:29	20:29	r	57	10.17	n	1	17.15	e	93.1	57	11.31	n	1	23.69	e	96.7	4.1								SOL; AD #04
Glomar Supporter	16/09/2023	p	David Melendez	20:29	20:48	r	57	11.31	n	1	23.69	e	96.7	57	11.70	n	1	25.93	e	97.2	3.8								
Glomar Supporter	16/09/2023	p	David Melendez	20:48	21:05	r	57	11.70	n	1	25.93	e	97.2	57	11.95	n	1	25.61	e	96.5	3.8								EOL
Glomar Supporter	16/09/2023	p	David Melendez	21:05	21:57	r	57	11.95	n	1	25.61	e	96.5	57	10.90	n	1	19.77	e	94.4	3.7								SOL; PAM cable recovery @21:57; EOL @22:15

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	16/09/2023	p	Camila Azevedo	22:55	23:25	n	57	8.20	n	1	28.85	e	96.8	57	8.50	n	1	24.75	e	97.1	4.1								PW
Glomar Supporter	16/09/2023	p	David Melendez	23:25	23:45	s	57	8.50	n	1	24.75	e	97.1	57	8.17	n	1	24.25	e	95.6	3.7								SS
Glomar Supporter	16/09/2023	p	David Melendez	23:45	00:00	r	57	8.17	n	1	24.25	e	95.6	57	7.86	n	1	22.54	e	97.6	4.1								SOL @23:49
Glomar Supporter	17/09/2023	p	David Melendez	00:00	00:21	r	57	7.86	n	1	22.54	e	97.6	57	6.86	n	1	20.66	e	97.0	3.9								Midnight UTC
Glomar Supporter	17/09/2023	p	David Melendez	00:21	01:04	r	57	6.86	n	1	20.66	e	97.0	57	6.09	n	1	16.20	e	93.3	3.6								SOL
Glomar Supporter	17/09/2023	p	David Melendez	01:04	01:24	r	57	6.09	n	1	16.20	e	93.3	57	5.94	n	1	16.08	e	93.1	3.6								EOL
Glomar Supporter	17/09/2023	p	David Melendez	01:24	02:24	r	57	5.94	n	1	16.08	e	93.1	57	7.06	n	1	22.49	e	97.9	3.6								SOL
Glomar Supporter	17/09/2023	p	David Melendez	02:24	03:24	r	57	7.06	n	1	22.49	e	97.9	57	8.27	n	1	19.46	e	97.4	3.7								
Glomar Supporter	17/09/2023	p	David Melendez	03:24	04:24	r	57	8.27	n	1	19.46	e	97.4	57	9.30	n	1	35.49	e	96.0	4.0								AD #05
Glomar Supporter	17/09/2023	p	David Melendez	04:24	04:34	r	57	9.30	n	1	35.49	e	96.0	57	9.47	n	1	36.49	e	96.8	3.9								
Glomar Supporter	17/09/2023	p	David Melendez	04:34	04:54	r	57	9.47	n	1	36.49	e	96.8	57	9.42	n	1	36.74	e	95.0	4.0								EOL
Glomar Supporter	17/09/2023	p	Boglarka Baksay	04:54	05:20	r	57	9.42	n	1	36.74	e	95.0	57	9.08	n	1	33.87	e	94.3	3.9								SOL
Glomar Supporter	17/09/2023	p	Boglarka Baksay	05:20	05:50	n	57	9.08	n	1	33.87	e	94.3	57	6.95	n	1	32.74	e	91.6	3.8								EOL, recovering PAM and transit to next site
Glomar Supporter	17/09/2023	v	Boglarka Baksay	05:50	06:20	n	57	6.95	n	1	32.74	e	91.6	57	6.24	n	1	32.93	e	91.3	6.3	ne	3	s	o	g	n	n	PW
Glomar Supporter	17/09/2023	v	Boglarka Baksay	06:20	06:41	s	57	6.24	n	1	32.93	e	91.3	57	6.44	n	1	33.86	e	92.1	3.5	ne	3	s	o	g	sf	n	SS
Glomar Supporter	17/09/2023	v	Boglarka Baksay	06:41	06:57	r	57	6.44	n	1	33.86	e	92.1	57	6.74	n	1	35.67	e	90.8	4.3	ne	4	s	o	g	sf	n	FP, SOL: 06:46
Glomar Supporter	17/09/2023	v	Boglarka Baksay	06:57	07:18	r	57	6.74	n	1	35.67	e	90.8	57	7.11	n	1	36.07	e	92.6	3.7	ne	4	s	o	g	sf	n	EOL
Glomar Supporter	17/09/2023	v	Boglarka Baksay	07:18	07:24	n	57	7.11	n	1	36.07	e	85.3	57	6.83	n	1	36.44	e	81.9	1.6	ne	4	s	o	g	sf	n	SBP off while deploying gear
Glomar Supporter	17/09/2023	v	Boglarka Baksay	07:24	07:45	s	57	6.83	n	1	36.44	e	88.9	57	5.73	n	1	37.01	e	92.7	3.8	e	3	s	o	g	sb	n	Restarting SS
Glomar Supporter	17/09/2023	v	Boglarka Baksay	07:45	08:45	r	57	5.73	n	1	37.01	e	92.7	57	4.63	n	1	30.65	e	93.5	4.1	e	2	s	o	g	sb	n	FP. SOL 07:51
Glomar Supporter	17/09/2023	v	Boglarka Baksay	08:45	09:45	r	57	4.63	n	1	30.65	e	93.5	57	3.54	n	1	24.34	e	95.7	3.9	e	2	s	o	g	sb	n	
Glomar Supporter	17/09/2023	v	Boglarka Baksay	09:45	09:52	r	57	3.54	n	1	24.34	e	95.7	57	3.45	n	1	23.84	e	94.8	3.7	e	2	c	o	g	sb	n	
Glomar Supporter	17/09/2023	v	Boglarka Baksay	09:52	10:43	r	57	3.45	n	1	23.84	e	94.8	57	2.43	n	1	17.99	e	92.9	3.7	e	2	c	o	g	sb	n	Logging off for morning meeting
Glomar Supporter	17/09/2023	v	Boglarka Baksay	10:43	10:52	r	57	2.43	n	1	17.99	e	92.9	57	2.23	n	1	16.79	e	93.4	3.9	e	2	c	o	g	sb	n	
Glomar Supporter	17/09/2023	v	Camila Azevedo	10:52	11:11	r	57	2.23	n	1	16.79	e	93.4	57	2.20	n	1	16.96	e	94.0	4.0	e	4	s	o	g	sb	n	EOL. Shift change
Glomar Supporter	17/09/2023	v	Camila Azevedo	11:11	12:00	r	57	2.20	n	1	16.96	e	94.0	57	3.19	n	1	22.68	e	99.1	4.4	e	4	s	o	g	sb	n	SOL
Glomar Supporter	17/09/2023	v	Camila Azevedo	12:00	13:00	r	57	3.19	n	1	22.68	e	99.1	57	4.38	n	1	29.52	e	98.1	4.4	ne	3	s	o	g	sb	n	SBP Line continues
Glomar Supporter	17/09/2023	v	Camila Azevedo	13:00	13:27	r	57	4.38	n	1	29.52	e	98.1	57	4.74	n	1	32.13	e	97.4	4.5	ne	3	s	o	g	sb	n	SBP Line continues
Glomar Supporter	17/09/2023	v	Camila Azevedo	13:27	13:52	r	57	4.74	n	1	32.13	e	97.4	57	4.70	n	1	31.42	e	97.2	4.1	ne	3	s	o	g	sb	n	EOL due to technical problems
Glomar Supporter	17/09/2023	v	Camila Azevedo	13:52	13:56	r	57	4.70	n	1	31.42	e	97.2	57	4.78	n	1	31.71	e	99.8	4.5	ne	3	s	o	g	sb	n	SOL OM038G
Glomar Supporter	17/09/2023	v	Boglarka Baksay	13:56	14:43	r	57	4.78	n	1	31.71	e	99.8	57	5.64	n	1	36.84	e	98.1	4.0	e	3	s	o	g	vb	n	Shift change. SBP Line continues
Glomar Supporter	17/09/2023	v	Boglarka Baksay	14:43	15:43	n	57	5.64	n	1	36.84	e	98.1	57	6.98	n	1	28.53	e	100.5	3.8	e	3	s	o	g	n	n	
Glomar Supporter	17/09/2023	v	Boglarka Baksay	15:43	16:28	n	57	6.98	n	1	28.53	e	100.5	57	6.13	n	1	23.33	e	102.7	3.6	se	3	s	o	g	sf	n	PW
Glomar Supporter	17/09/2023	v	Boglarka Baksay	16:28	16:48	s	57	6.13	n	1	23.33	e	102.7	57	5.98	n	1	21.42	e	102.3	3.7	se	3	s	o	g	wf	n	SS
Glomar Supporter	17/09/2023	v	Camila Azevedo	16:48	17:14	r	57	5.98	n	1	21.42	e	102.3	57	6.66	n	1	24.07	e	98.7	3.3	se	4	s	o	g	wf	n	FP SBP. Shift change. SOL 16:54
Glomar Supporter	17/09/2023	v	Camila Azevedo	17:14	17:40	r	57	6.66	n	1	24.07	e	98.7	57	6.25	n	1	23.09	e	98.6	3.7	se	4	s	o	g	n	n	EOL
Glomar Supporter	17/09/2023	v	Camila Azevedo	17:40	18:00	r	57	6.25	n	1	23.09	e	98.6	57	6.58	n	1	25.06	e	97.4	3.9	se	4	s	o	g	n	n	SOL
Glomar Supporter	17/09/2023	v	Camila Azevedo	18:00	18:22	r	57	6.58	n	1	25.06	e	97.4	57	7.03	n	1	27.67	e	95.9	4.1	se	4	s	o	g	n	n	SBP Line continues
Glomar Supporter	17/09/2023	v	Camila Azevedo	18:22	18:41	r	57	7.03	n	1	27.67	e	95.9	57	6.87	n	1	26.37	e	95.5	3.5	se	3	s	o	m	n	n	EOL

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	17/09/2023	v	Camila Azevedo	18:41	18:41	r	57	6.87	n	1	26.37	e	95.5	57	6.87	n	1	26.37	e	95.5	4.5	se	3	s	o	p	n	n	EOW Visual.
Glomar Supporter	17/09/2023	p	David Melendez	18:23	19:15	r	57	7.28	n	1	27.56	e	95.9	57	9.01	n	1	24.57	e	96.7	3.8								SOW Acoustic
Glomar Supporter	17/09/2023	p	David Melendez	19:15	19:29	r	57	9.01	n	1	24.57	e	96.7	57	9.40	n	1	25.25	e	97.0	3.4								EOL
Glomar Supporter	17/09/2023	p	David Melendez	19:29	20:39	r	57	9.40	n	1	25.25	e	97.0	57	12.62	n	1	21.02	e	95.3	4.5								SOL
Glomar Supporter	17/09/2023	p	David Melendez	20:39	21:39	r	57	12.62	n	1	21.02	e	95.3	57	16.05	n	1	17.50	e	90.4	4.8								
Glomar Supporter	17/09/2023	p	David Melendez	21:39	21:46	r	57	16.05	n	1	17.50	e	90.4	57	16.54	n	1	17.02	e	89.4	5.0								
Glomar Supporter	17/09/2023	p	David Melendez	21:46	22:01	r	57	16.54	n	1	17.02	e	89.4	57	17.04	n	1	17.13	e	88.4	4.4								EOL?
Glomar Supporter	17/09/2023	p	David Melendez	22:01	22:35	r	57	17.04	n	1	17.13	e	88.4	57	15.15	n	1	19.37	e	89.2	4.4								SOL ABORTED LINE?
Glomar Supporter	17/09/2023	p	Camila Azevedo	22:35	23:00	r	57	15.15	n	1	19.37	e	89.2	57	16.18	n	1	17.01	e	90.8	5.1								SOL
Glomar Supporter	17/09/2023	p	David Melendez	23:00	00:00	r	57	16.18	n	1	17.01	e	90.8	57	19.78	n	1	11.05	e	89.2	4.7								
Glomar Supporter	18/09/2023	p	David Melendez	00:00	01:00	r	57	19.78	n	1	11.05	e	89.2	57	21.11	n	1	5.04	e	95.9	4.0								Midnight UTC
Glomar Supporter	18/09/2023	p	David Melendez	01:00	02:00	r	57	21.11	n	1	5.04	e	95.9	57	23.49	n	0	58.60	e	95.7	4.2								
Glomar Supporter	18/09/2023	p	David Melendez	02:00	02:47	r	57	23.49	n	0	58.60	e	95.7	57	25.44	n	0	53.20	e	93.9	4.6								
Glomar Supporter	18/09/2023	p	David Melendez	02:47	03:05	r	57	25.44	n	0	53.20	e	93.9	57	25.56	n	0	53.38	e	95.1	4.8								EOL
Glomar Supporter	18/09/2023	p	David Melendez	03:05	04:05	r	57	25.56	n	0	53.38	e	95.1	57	23.27	n	0	59.72	e	95.2	4.5								SOL
Glomar Supporter	18/09/2023	p	David Melendez	04:05	04:54	r	57	23.27	n	0	59.72	e	95.2	57	21.28	n	1	5.15	e	95.0	4.3								
Glomar Supporter	18/09/2023	p	Boglarka Baksay	04:54	05:54	r	57	21.28	n	1	5.15	e	95.0	57	18.78	n	1	11.56	e	88.9	4.2								shift change
Glomar Supporter	18/09/2023	p	Boglarka Baksay	05:54	06:22	r	57	18.78	n	1	11.56	e	88.9	57	17.66	n	1	14.08	e	89.5	3.9								
Glomar Supporter	18/09/2023	v	Boglarka Baksay	06:22	07:00	n	57	17.66	n	1	14.08	e	89.5	57	17.49	n	1	15.91	e	89.1	4.2	se	4	c	o	g	n	n	EOL, all off for SVP. PAM recovery
Glomar Supporter	18/09/2023	p	Boglarka Baksay	07:00	08:00	n	57	17.49	n	1	15.91	e	89.1	57	20.02	n	1	7.89	e	96.4	4.5	se	4	c	o	m	n	l	PAM redeployed for PW. PW abandoned as SBP taken off the spread for next line (weather+SBP affecting MBES)
Glomar Supporter	18/09/2023	v	Boglarka Baksay	08:00	09:00	n	57	20.02	n	1	7.89	e	96.4	57	21.83	n	1	3.62	e	95.8	3.8	se	4	c	o	m	n	m	Keeping casual watch during MBES+SSS infills
Glomar Supporter	18/09/2023	v	Boglarka Baksay	09:00	10:00	n	57	21.83	n	1	3.62	e	95.8	57	23.56	n	0	58.88	e	92.7	3.6	se	4	c	o	m	n	h	Heavy rain, mist on the horizon
Glomar Supporter	18/09/2023	v	Boglarka Baksay	10:00	10:00	n	57	23.56	n	0	58.88	e	92.7	57	23.56	n	0	58.88	e	92.7	3.7	se	4	c	o	m	n	h	Logging off for morning meeting and PAM deployment for PW
Glomar Supporter	18/09/2023	p	Camila Azevedo	11:00	11:30	n	57	25.70	n	0	52.93	e	93.6	57	25.12	n	0	55.86	e	95.9	3.9								Shift change. SOW Acoustic.
Glomar Supporter	18/09/2023	p	Camila Azevedo	11:30	11:50	s	57	25.12	n	0	55.86	e	95.9	57	25.61	n	0	54.72	e	94.6	4.1								SS
Glomar Supporter	18/09/2023	p	Camila Azevedo	11:50	12:00	r	57	25.61	n	0	54.72	e	94.6	57	25.30	n	0	53.62	e	94.2	3.8								FV, SOL 11:52
Glomar Supporter	18/09/2023	p	Camila Azevedo	12:00	13:00	r	57	25.30	n	0	53.62	e	94.2	57	23.48	n	0	47.35	e	89.6	3.5								SBP Line continues
Glomar Supporter	18/09/2023	p	Camila Azevedo	13:00	13:58	r	57	23.48	n	0	47.35	e	89.6	57	21.82	n	0	41.39	e	92.5	3.7								SBP Line continues
Glomar Supporter	18/09/2023	p	Boglarka Baksay	13:58	14:38	r	57	21.82	n	0	41.39	e	92.5	57	20.66	n	0	37.30	e	88.7	4.0								Shift change. SBP Line continues
Glomar Supporter	18/09/2023	p	Boglarka Baksay	14:38	15:04	r	57	20.66	n	0	37.30	e	88.7	57	20.65	n	0	39.11	e	89.2	4.2								EOL
Glomar Supporter	18/09/2023	p	Boglarka Baksay	15:04	16:04	r	57	20.65	n	0	39.11	e	89.2	57	21.71	n	0	32.75	e	84.9	3.9								SOL
Glomar Supporter	18/09/2023	p	Boglarka Baksay	16:04	16:28	r	57	21.71	n	0	32.75	e	84.9	57	22.15	n	0	29.82	e	82.6	4.0								

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	18/09/2023	p	Camila Azevedo	16:28	16:57	r	57	22.15	n	0	29.82	e	82.6	57	21.60	n	0	31.67	e	82.8	4.2								EOL. Shift change.
Glomar Supporter	18/09/2023	p	Camila Azevedo	16:57	18:00	r	57	21.60	n	0	31.67	e	82.8	57	24.67	n	0	26.90	e	84.2	4.1								SOL
Glomar Supporter	18/09/2023	p	Camila Azevedo	18:00	18:05	r	57	24.67	n	0	26.90	e	84.2	57	25.04	n	0	26.36	e	79.0	4.2								SBP Line continues
Glomar Supporter	18/09/2023	p	Camila Azevedo	18:05	18:36	r	57	25.04	n	0	26.36	e	79.0	57	24.23	n	0	28.24	e	84.0	3.8								EOL
Glomar Supporter	18/09/2023	p	Camila Azevedo	18:36	19:00	r	57	24.23	n	0	28.24	e	84.0	57	24.78	n	0	25.55	e	83.4	4.0								SOL
Glomar Supporter	18/09/2023	p	David Melendez	19:00	19:34	r	57	24.78	n	0	25.55	e	83.4	57	25.54	n	0	24.64	e	83.8	3.4								SBP Line continues
Glomar Supporter	18/09/2023	p	David Melendez	19:34	20:03	r	57	25.54	n	0	24.64	e	83.8	57	26.08	n	0	18.78	e	89.3	3.4								
Glomar Supporter	18/09/2023	p	David Melendez	20:03	20:27	r	57	26.08	n	0	18.78	e	89.3	57	25.53	n	0	19.12	e	79.3	3.1								EOL
Glomar Supporter	18/09/2023	p	David Melendez	20:27	21:01	r	57	25.53	n	0	19.12	e	79.3	57	27.61	n	0	18.97	e	79.8	4.0								SOL
Glomar Supporter	18/09/2023	p	David Melendez	21:01	21:07	n	57	27.61	n	0	18.97	e	79.8	57	28.02	n	0	18.96	e	82.9	3.0								EOW Acoustic; WOW
Glomar Supporter	23/09/2023	v	Boglarka Baksay	15:45	16:30	n	57	33.18	n	1	7.11	w	91.7	57	32.05	n	1	5.44	w	94.6	6.0	e	2	s	l	g	wb	n	PW
Glomar Supporter	23/09/2023	v	Boglarka Baksay	16:30	16:50	s	57	32.05	n	1	5.44	w	94.6	57	31.94	n	1	2.56	w	92.3	2.0	se	2	s	l	g	sb	n	SS for SBP
Glomar Supporter	23/09/2023	v	Boglarka Baksay	16:50	16:58	r	57	31.94	n	1	2.56	w	92.3	57	31.89	n	1	1.55	w	91.6	4.2	se	2	s	l	g	vb	n	SBP FP, SOL
Glomar Supporter	23/09/2023	v	Camila Azevedo	16:58	18:00	r	57	31.89	n	1	1.55	w	91.6	57	31.52	n	0	53.93	w	92.1	4.0	se	2	s	o	g	sb	n	shift change
Glomar Supporter	23/09/2023	v	Camila Azevedo	18:00	18:08	r	57	31.52	n	0	53.93	w	92.1	57	31.30	n	0	52.79	w	94.3	3.8	se	3	s	o	g	n	n	SBP line continues
Glomar Supporter	23/09/2023	v	Camila Azevedo	18:08	18:40	r	57	31.30	n	0	52.79	w	94.3	57	31.11	n	0	49.09	w	93.0	4.1	se	3	s	o	g	n	n	SOL
Glomar Supporter	23/09/2023	v	Camila Azevedo	18:40	18:40	r	57	31.11	n	0	49.09	w	93.0	57	31.11	n	0	49.09	w	93.0	4.2	se	3	s	o	m	n	n	EOW Visual.
Glomar Supporter	26/09/2023	p	David Melendez	21:55	22:27	n	57	22.82	n	0	29.24	e	84.0	57	22.67	n	0	30.72	e	83.0	3.5								PAM deployed, SOW Acoustic
Glomar Supporter	26/09/2023	p	Camila Azevedo	22:27	22:48	s	57	22.67	n	0	30.72	e	83.0	57	23.41	n	0	30.16	e	83.3	1.7								SS
Glomar Supporter	26/09/2023	p	Camila Azevedo	22:48	23:20	r	57	23.41	n	0	30.16	e	83.3	57	24.22	n	0	27.93	e	85.0	2.4								SOL @23:03
Glomar Supporter	26/09/2023	p	David Melendez	23:20	00:00	r	57	24.22	n	0	27.93	e	85.0	57	26.06	n	0	23.60	e	84.7	3.4								
Glomar Supporter	27/09/2023	p	David Melendez	00:00	00:45	r	57	26.06	n	0	23.60	e	84.7	57	26.05	n	0	18.85	e	83.7	3.8								Midnight UTC
Glomar Supporter	27/09/2023	p	David Melendez	00:45	01:11	r	57	26.05	n	0	18.85	e	83.7	57	25.55	n	0	19.05	e	80.7	3.0								EOL
Glomar Supporter	27/09/2023	p	David Melendez	01:11	01:26	r	57	25.55	n	0	19.05	e	80.7	57	26.17	n	0	18.81	e	80.4	4.5								SOL
Glomar Supporter	27/09/2023	p	David Melendez	01:26	01:50	r	57	26.17	n	0	18.81	e	80.4	57	26.61	n	0	19.06	e	80.0	4.3								EOL
Glomar Supporter	27/09/2023	p	David Melendez	01:50	02:24	r	57	26.61	n	0	19.06	e	80.0	57	27.88	n	0	18.99	e	81.7	4.1								SOL
Glomar Supporter	27/09/2023	p	David Melendez	02:24	02:54	r	57	27.88	n	0	18.99	e	81.7	57	27.24	n	0	20.19	e	80.0	4.3								EOL
Glomar Supporter	27/09/2023	p	David Melendez	02:54	03:55	r	57	27.24	n	0	20.19	e	80.0	57	27.55	n	0	12.24	e	86.0	3.6								SOL
Glomar Supporter	27/09/2023	p	David Melendez	03:55	04:05	r	57	27.55	n	0	12.24	e	86.0	57	27.57	n	0	11.60	e	87.6	3.4								
Glomar Supporter	27/09/2023	p	David Melendez	04:05	04:34	r	57	27.57	n	0	11.60	e	87.6	57	27.69	n	0	13.87	e	84.3	3.9								EOL
Glomar Supporter	27/09/2023	p	David Melendez	04:34	04:57	n	57	27.69	n	0	13.87	e	84.3	57	27.50	n	0	15.63	e	80.9	3.9								SBP OFF, survey system crashed
Glomar Supporter	27/09/2023	p	Boglarka Baksay	04:57	05:06	n	57	27.50	n	0	15.63	e	80.9	57	27.46	n	0	14.97	e	81.6	3.8								PW
Glomar Supporter	27/09/2023	p	Boglarka Baksay	05:06	05:27	s	57	27.46	n	0	14.97	e	81.6	57	27.33	n	0	12.46	e	85.8	4.0								SS
Glomar Supporter	27/09/2023	p	Boglarka Baksay	05:27	06:03	r	57	27.33	n	0	12.46	e	85.8	57	29.56	n	0	12.14	e	87.9	4.0								FP. SOL 05:34
Glomar Supporter	27/09/2023	p	Boglarka Baksay	06:03	06:31	r	57	29.56	n	0	12.14	e	87.9	57	29.81	n	0	11.24	e	83.9	3.4								EOL
Glomar Supporter	27/09/2023	p	Boglarka Baksay	06:31	07:24	r	57	29.81	n	0	11.24	e	83.9	57	30.09	n	0	7.46	e	88.1	3.8								SOL
Glomar Supporter	27/09/2023	p	Boglarka Baksay	07:24	07:24	n	57	30.09	n	0	7.46	e	88.1	57	30.09	n	0	7.46	e	88.1	3.4								EOL, all off for transit to next site
Glomar Supporter	27/09/2023	v	Camila Azevedo	10:50	11:55	n	57	32.84	n	0	42.10	w	84.3	57	33.68	n	0	59.40	w	95.0	10.1	w	3	s	o	g	sb	n	SOW Visual
Glomar Supporter	27/09/2023	v	Camila Azevedo	11:55	12:55	n	57	33.68	n	0	59.40	w	95.0	57	34.57	n	1	6.95	w	101.0	3.6	se	4	s	o	g	sb	n	PW

Ship/ platform name	Date	Visual watch or PAM?	Observer's / operator's name(s)	Time of start of section of watch (UTC)	Time of end of section of watch (UTC)	Source activity	Start position - degrees latitude	Start position - minutes latitude	Start position - north/ south	Start position - degrees longitude	Start position - minutes longitude	Start position - east/ west	Depth of water at start position (metres)	End position - degrees latitude	End position - minutes latitude	End position - north/ south	End position - degrees longitude	End position - minutes longitude	End position - east/ west	Depth of water at end position (metres)	Speed of vessel (knots)	Wind direction	Wind force (Beaufort)	Sea state	Swell	Visibility (visual watch only)	Sun glare (visual watch only)	Precipitation	Comments
Glomar Supporter	27/09/2023	v	Camila Azevedo	12:55	13:50	n	57	34.57	n	1	6.95	w	101.0	57	34.00	n	1	12.53	w	101.0	10.3	se	4	s	o	g	n	n	Shift change. Technical issues, acquisition abandoned. End of survey

Appendix III – Marine Mammal Recording Form: Effort Log

Provided as a separate MS Excel file and copied below.

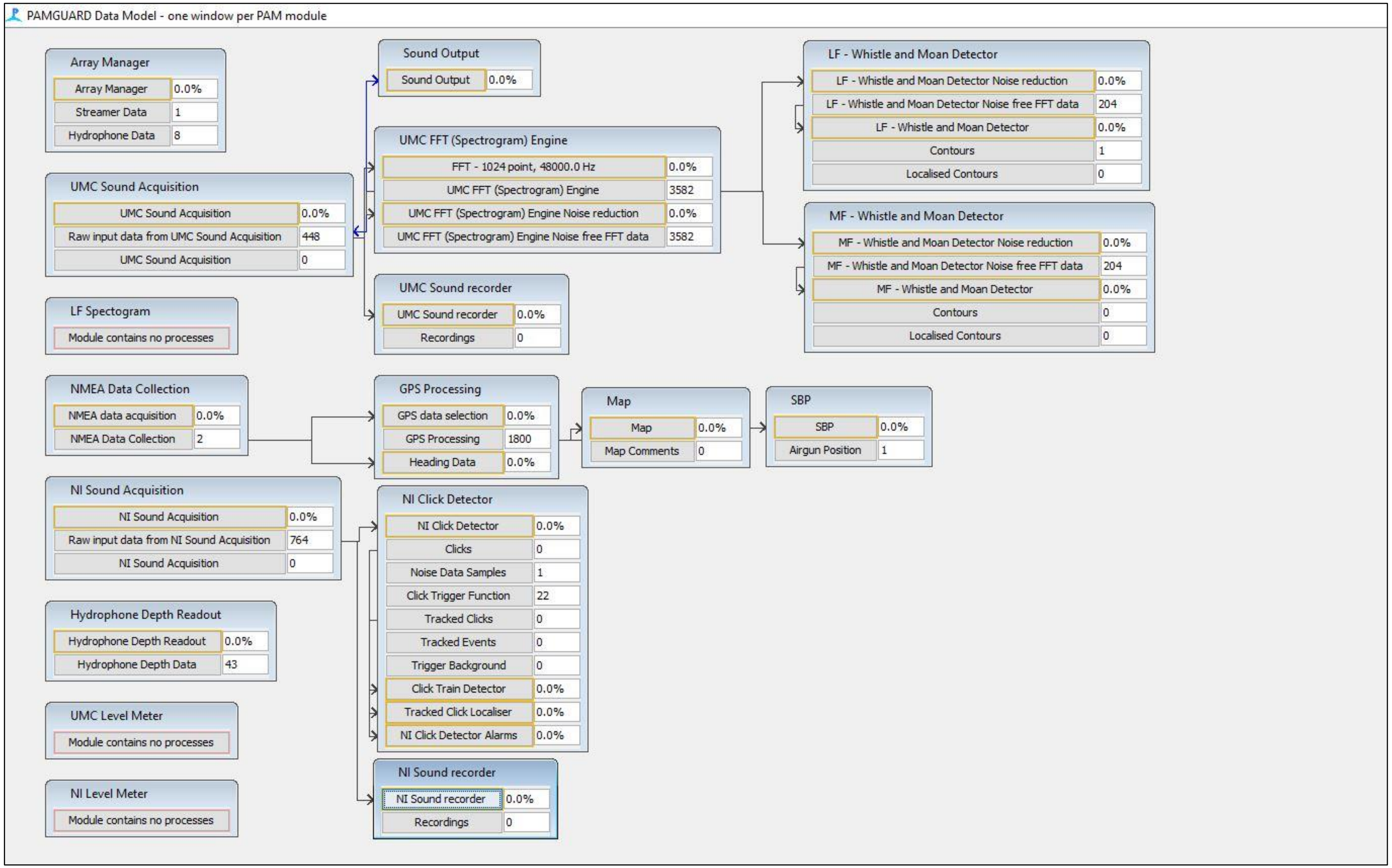
Appendix IV – Marine Mammal Recording Form: Sightings Log

Provided as a separate MS Excel file and copied below.

Ship/ platform name	Sighting number	Acoustic detection number	Date	Time at star of encounte (UTC)	Time at end of encounte (UTC)	Were animals detected visually and/ or acoustically	How were the animals first detected?	Observer's/ operator's name	Position - degrees latitude	Position - minutes latitude	Position - north/ south	Position - degrees longitude	Position - minutes longitude	Position - east/ wes	Water depth (metres)	Species or species group	Description	Bearing to animal	Range of animal (metres)	Total number	Number of adults (visual sightings only)	Number of juveniles (visual sightings only)	Number of calves (visual sightings only)	Photograph taken	Behaviour (visua sightings only)	Direction o travel (relative to ship)	Direction o travel (compass points)	Airgun/ source activity when animals first detected	Closest distance o animals from airguns/ source (metres)	Time of closest approach (UTC)	First observed distance during soft start (if relevant) (metres)	Closest observed distance during soft start (if relevant) (metres)	Last observed distance during soft start (if relevant) (metres)	What action was taken?	Length of power- down and/ or shut- down (if relevant)	Estimated loss of production (i relevant) due to mitigating actions (km)	Comments
Glomar Supporter	0		23/07/2023	10:20	10:25	v	v	Harley Bailey								Unidentified odontocete (*Odontocetis*	Small dark cetacean, suspected harbour porpoise			2	2			n	porpoising	NO		n	n				10:20				n
Glomar Supporter	1		25/07/2023	20:15	20:16	v	v	David Melendez/Br dge	57	13.79	n	1	3.44	e	90.0	Minke whale *(Balaenopter a acutorostrat)*	Narrow head, very dark grey colour on dorsal side, short narrow flippers with brilliant white band	260	30	1	1			n	swimming near to the surface, variable direction	CB	N	n	n				20:15				n
Glomar Supporter	2		26/07/2023	19:11	19:13	v	v	David Melendez	57	11.2	n	1	19.34	e	91.0	Grey seal *(Halichoerus gryphus)*	Grey seal with robust body, large wide muzzle	110	200	1	1			y	breathing breach, slow travel	PO	NNW	n	n				19:11				n
Glomar Supporter	3		31/07/2023	07:49	09:06	v	v	Ossie Stewar	57	2.93	n	1	22.18	e	92.0	White beake dolphin (*Lagenorhyn hus albirostris*)	Robust, approx. 3m, white markings on side and under head with white saddle. Stubby, short beak with tall and falcate dorsal fin	73	700	25	22	3		y	Fast travel, suspected feeding due to bird activity around them, ignored vessel	cb	se	f	f				07:53				n
Glomar Supporter	4		04/08/2023	13:23	13:23	v	v	Ossie Stewart/Surv ey	57	5.74	n	1	26.51	e	94.0	Minke whale *(Balaenopter a acutorostrat)*	dark dorsal area with swept back fin	273	100	1	1			n	briefly surfaced before diving	ps	nw	n	n	13:23	13:23	100	13:23				n
Glomar Supporter	5		07/08/2023	16:47	16:50	v	v	Ossie Stewart/FLO	57	35.40	n	1	25.61	w	86.5	Minke whale *(Balaenopter a acutorostrat)*	dark dorsal area with swept back fin	102	100	1	1			n	Breached in front of vessel then dove, dorsal seen briefly once more on the stbd side of the vessel, before dive	po	e	n	n	16:47	16:50	100	16:47				delay
Glomar Supporter	6		10/08/2023	07:35	07:45	v	v	Ossie Stewar	57	22.59	n	0	50.43	w	90.0	White beake dolphin (*Lagenorhyn hus albirostris*)	Robust, approx. 3m, white markings on side and under head with white saddle. Stubby, short beak with tall and falcate dorsal fin	95	350	2	1			y	Slow travel, low profile (not much seen), brief surfacing with longer periods underwater while travelling	po	w	n	n	07:35	07:45	350	07:40				n
Glomar Supporter	7		10/08/2023	08:49	09:00	v	v	Ossie Stewar	57	20.67	n	0	28.44	w	79.0	White beake dolphin (*Lagenorhyn hus albirostris*)	Robust, approx. 3m, white markings on side and under head with white saddle. Stubby, short beak with tall and falcate dorsal fin	30	100	15	13	2		y	slow travel towards vessel then change of direction to parallel opposite	po	w	n	n	08:50	09:00	100	08:55				n
Glomar Supporter	8		10/08/2023	12:26	12:47	v	v	Jessica Riggs/Ossie Stewart	57	15.56	n	0	31.16	e	82.5	White beake dolphin (*Lagenorhyn hus albirostris*)	Robust, approx. 3m, white markings on side and under head with white saddle. Stubby, short beak with tall and falcate dorsal fin	30	100	50	47	3		y	Breached in front of vessel, bow riding	u	w	n	n	12:26	12:47	100	12:32				n
Glomar Supporter	9		10/08/2023	12:46	12:48	v	v	Jessica Riggs	57	15.23	n	0	35.36	w	81.0	Unidentified Seal (*Phocidae sp*	Head surfacing, robust body.	110	50	1	1			n	Surfacing to breath and diving	u	w	n	n	12:46	12:48	100	12:46				n
Glomar Supporter	10		10/08/2023	18:55	19:16	v	v	David Melendez/Je ssica Riggs	57	2.90	n	1	16.87	e	88.7	White beake dolphin (*Lagenorhyn hus albirostris*)	Robust body; tall dark, falcate dorsal fin; dark grey uppermost with clear grey band on the sides along the body; short thick beak	340	900	6	6			y	Breaching and porpoising	VR	var	n	n	19:03	19:16		19:15				n
Glomar Supporter	11		10/08/2023	19:57	19:59	v	v	David Melendez	57	7.06	n	1	16.86	e	88.4	White beake dolphin (*Lagenorhyn hus albirostris*)	Tall dark, falcate dorsal fin; clear grey band on the sides along the body	260	400	2	2			n	Porpoising, fast transit	CS	NW	n	n	19:57	19:59		19:57				n
Glomar Supporter	12		12/08/2023	08:33	08:36	v	v	Ossie Stewar	57	4.95	n	1	25.25	e	94.6	White beake dolphin (*Lagenorhyn hus albirostris*)	Robust, approx. 3m, white markings on side and under head with white saddle. Stubby, short beak with tall and falcate dorsal fin	170	650	3	3			y	breaching, jumping	no	var	f	f			650	08:33				n

Ship/ platform name	Sighting number	Acoustic detection number	Date	Time at start of encounter (UTC)	Time at end of encounter (UTC)	Were animals detected visually and/ or acoustically	How were the animals first detected?	Observer's/ operator's name	Position - degrees latitude	Position - minutes latitude	Position - north/ south	Position - degrees longitude	Position - minutes longitude	Position - east/ west	Water depth (metres)	Species or species group	Description	Bearing to animal	Range of animal (metres)	Total number	Number of adults (visual sightings only)	Number of juveniles (visual sightings only)	Number of calves (visual sightings only)	Photograph taken	Behaviour (visual sightings only)	Direction of travel (relative to ship)	Direction of travel (compass points)	Airgun/ source activity when animals first detected	Closest distance of animals from airguns/ source (metres)	Time of closest approach (UTC)	First observed distance during soft start (if relevant) (metres)	Closest observed distance during soft start (if relevant) (metres)	Last observed distance during soft start (if relevant) (metres)	What action was taken?	Length of power-down and/ or shut-down (if relevant)	Estimated loss of production (if relevant) due to mitigating actions (km)	Comments
Glomar Supporter	13		17/08/2023	04:42	04:45	v	v	David Melendez	57	9.87	n	1	35.95	e	91.8	White beaked dolphin (*Lagenorhynchus albirostris*)	Robust body; tall dark, falcate dorsal fin; clear grey band on the sides along the body	80	600	6	6			y	Milling, porpoising with low speed transit the pod kept relatively same position,	MI	SW	f	f			600	04:44				n
Glomar Supporter	14		18/08/2023	13:30	13:39	v	v	Jessica Riggs	57	12.54	n	1	31.42	e	97.9	Unidentified Dolphins	Outline of body when jumping	30	1000	8	8			n	Breaching and jumping	VR	ne	f	f			1000	13:31				n
Glomar Supporter	15		20/08/2023	08:40	08:40	v	v	Party Chief	57	7.60	n	1	32.24	e	91.2	Unidentified Dolphins	top of body seen	47	50	1	1			n	briefly seen surfacing by the vessel	no	un	f	f	08:40	08:40	50	08:40				n
Glomar Supporter	16		26/08/2023	13:20	13:25	v	v	Jessica Riggs	57	9.10	n	1	19.94	e	90.6	Unidentified Dolphins	Head surfacing, robust body.	300	650	6	6			n	Porpoising and Breaching	VR	w	n	n			600	13:20				n
Glomar Supporter	17		31/08/2023	17:28	17:28	v	v	David Melendez	57	55.19	n	1	22.54	e	80	Grey seal (*Halichoerus gryphus)*	Grey seal with dark grey black head, large muzzle	0	120	1	1			n	breathing breach	NO		n	s	00:01	00:01	80	17:28	80	80	80	n
Glomar Supporter		1	09/09/2023	10:57	11:02	a	a	Camila Azevedo	57	9.91	n	1	24.07	e	97.5	Delphinidae	High frequency echolocation clicks and click trains on MF and HF Click Detectors and HF/MF Spectrogram. The clicks reached 157dB re 1μPa and a peak frequency of 42kHz with initial and final frequencies between 18-60kHz.	90-270	200					n		vr	var	r	r	10:57	11:02	200	10:57				n
Glomar Supporter		2	10/09/2023	22:30	22:58	a	a	Camila Azevedo/David Melendez	57	6.64	n	1	26.24	e	96.5	Delphinidae	High frequency echolocation clicks and click trains on MF and HF Click Detectors and HF/MF Spectrogram. The clicks reached 146dB re 1μPa and a peak frequency of 38kHz with initial and final frequencies between 28-80kHz.	0-180	100					n		vr	var	r	r	22:30	22:58	103	22:43				n
Glomar Supporter	18		13/09/2023	15:18	15:20	v	v	Boglarka Baksay/Bridge Crew	57	8.49	n	1	26.51	e	95.3	Minke whale (*Balaenoptera acutorostrata*)	Large, dark body and small dorsal fin	320	600	1	1			n	breathing breach twice then diving	vr	un	n	n			600	15:18				n
Glomar Supporter	19		13/09/2023	17:38	18:26	v	v	Camila Azevedo/David Melendez	57	25.66	n	0	55.14	e	68	Delphinidae, Possible White beaked Dolphin (*Lagenorhynchus albirostris*)	Robust, approx. 3m. Stubby, short beak with tall and falcate dorsal fin	180	600	6				y	Breaching, Milling. Fast swimming	s	n	n	n			600	17:55				n
Glomar Supporter	20		13/09/2023	18:00	18:10	v	v	Camila Azevedo/David Melendez	57	24.94	n	0	52.68	e	65	Small Cetacean, Possible Ziphiidae	Carcass state 3 to 4, approx. 5m, Bloating, Scaling	180	600	1				y	Drifting	s	n	n	n			400	18:00				n
Glomar Supporter	21		14/09/2023	09:30	10:15	v	v	Boglarka Baksay/Camila Azevedo	57	30.10	n	1	46.66	w	9	Grey seal (*Halichoerus grypus)*	Grey seal with robust body, large wide muzzle	90	200	4	4			y	surfacing, breathing, breaching, diving	var	var	n	n			200	10:00				n
Glomar Supporter		3	15/09/2023	03:24	03:27	a	a	David Melendez	57	9.75	n	1	35.85	e	96.7	Delphinidae	Medium frequency click trains on the MF Click detector and echolocation clicks on the HF Click detector. (~3sec length, frequency peak ranges ~36kHz - ~44kHz, up to ~163dB re 1μPa)	0-180	150	1				n		NO	un	r	r	03:24	03:27	150	03:24				n
Glomar Supporter		4	16/09/2023	19:36	19:36	a	a	David Melendez	57	10.27	n	1	17.70	e	93.7	Delphinidae	Medium frequency click train on the MF and HF Click detector (~5sec length, frequency peak ranges ~43kHz in MF, ~85kHz in HF, up to ~163dB re 1μPa)	27 - 121	160	1				n		CS	var	r	r	19:36	19:36	160	19:36				n
Glomar Supporter		5	17/09/2023	04:05	04:36	a	a	David Melendez	57	8.95	n	1	33.45	e	96.8	Delphinidae	Medium and high frequency click train on MF and HF Click detector and Spectrogram (~5sec length, frequency peak ranges *4kHz to ~43kHz in MF, ~114kHz in HF, up to ~163dB re 1μPa)	44 - 104	150	2				n		PS	var	r	r	04:05	04:36	85	04:19				n
Glomar Supporter		6	17/09/2023	05:08	05:08	a	a	Boglarka Baksay	57	9.20	n	1	35.19	e	92.1	Delphinidae	Several scattered medium frequency echolocation clicks on the MF Click Detector at 45-48 kHz, over 30 sec		250	1				n		u	un	r	r								n

Appendix V – PAMGuard Details



PAMGuard Data Model

Appendix VI – Service Warranty

This report, with its associated works and services, has been designed solely to meet the requirements of the contract agreed with you, our client. If used in other circumstances, some or all of the results may not be valid and we can accept no liability for such use. Such circumstances include different or changed objectives, use by third parties, or changes to, for example, site conditions or legislation occurring after completion of the work. In case of doubt, please consult Benthic Solutions Limited.

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Appendix 19A: Human Health Effects

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1. HUMAN HEALTH EFFECTS

1.1 Introduction

1.1.1.1 This appendix of the Scoping Report details the potential effects of the Project on Human Health.

1.1.1.2 The World Health Organisation (WHO) defines health as a state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity (WHO, 1946). In EIA, public health is considered in terms of both potential positive and negative impact on the health of a population.

1.1.1.3 Scoping of health aspects has been informed by the IEMA Guide to Effective Scoping of Human Health in EIA (IEMA, 2022). This guidance proposes a list of determinants of health to be considered when undertaking scoping, and steps to take to identify whether any determinants should be included within the EIA.

1.1.1.4 The first exercise is to determine whether there is a source – pathway – receptor linkage which makes an impact likely. Where an impact is likely, then the magnitude of the change (positive or negative) introduced will determine whether it could be significant.

1.1.1.5 **Table 1-1** provides a list of health determinants, identifying whether an effect is likely, and considers the potential significance to inform the scoping in or out of each determinant. This table draws on the table from the 2023 Scoping Report (Table 16-1), with amendments to scope additional determinants of health into the Socio-economic assessment.

1.1.1.6 This appendix should be read alongside **Chapter 19: Socio-Economics**.

Table 1-1: Consideration of Potential Human Health Effects

Categories	Wider Determinants of Health	Likelihood (Source, Pathway, Receptor)	Comments	Significance (Positive or Negative)	Committed Mitigation / Enhancements	Scoped In / Out
Health Related Behaviours	Physical activity	None	The Project itself is unlikely to affect physical activity levels within the population. There could, however, be impacts to leisure and play activities which are covered below.	N/A	N/A	Scoped Out
	Risk taking behaviour	None	The Project does not have any elements which are likely to give rise to changes in health-related behaviours of the population, particularly due to its offshore nature.	N/A	N/A	Scoped Out
	Diet and nutrition	None		N/A	N/A	Scoped Out
Social Environment	Housing / accommodation	Potential during construction and demolition phases	It is anticipated that there would be an influx of workers for the Project, which could impact on the availability of accommodation. This could reduce the availability of housing options and/or impact tourism related businesses.	Negative, potentially significant. Significance will depend on local baselines, size of the workforce requiring accommodation, and construction phasing/timescales.	Mitigation will be identified through further assessment.	Scoped In
	Relocation	None	The Project will not lead to the relocation of local residents.	N/A	N/A	Scoped Out

Categories	Wider Determinants of Health	Likelihood (Source, Pathway, Receptor)	Comments	Significance (Positive or Negative)	Committed Mitigation / Enhancements	Scoped In / Out
	Open space, leisure and play	Potential during construction and demolition phases.	It is anticipated that the Project could impact on leisure activities due to a loss of amenity and loss of availability of recreational space.	Negative, potentially significant. Significance will depend on the local baseline and construction/demolition programme.	Disruption to recreational routes will be limited where possible. Mitigation measures will be identified through further assessment and secured through the submission of a Construction Environmental Management Plan (CEMP).	Scoped In
	Transport modes, access and connections	None	No connectivity foreseen.	N/A	N/A	Scoped Out
	Community safety	None	No linkages from the Project to these determinants have been identified.	N/A	N/A	Scoped Out
	Social participation, interaction and support	None		N/A	N/A	Scoped Out
	Community identity, culture,	Potential, particularly	It is anticipated that there would be an influx of workers	Negative, potentially significant.	Engagement with local stakeholders will occur	Scoped In

Categories	Wider Determinants of Health	Likelihood (Source, Pathway, Receptor)	Comments	Significance (Positive or Negative)	Committed Mitigation / Enhancements	Scoped In / Out
	resilience and influence	during the construction and demolition phases.	for the Project, which could impact on the community.	Significance will depend on local baselines, composition of the workforce, and construction phasing/timescales.	regularly to understand concerns about the Project. A point of contact will be provided to the local community enabling them to raise complaints. A workers Code of Conduct (CoC) will be implemented to ensure employees understand expectations in terms of behaviour.	
Economic Environment	Education and training	Potential at all phases of the development.	It is anticipated that there will be training opportunities arising as a result of the Project. There are potential mental health benefits from improved self-esteem that can come from personal development and increased skills.	Positive, potentially significant. Significance will depend on specific local baselines.	Creation of education and training opportunities will be maximised through project procurement and implementation of enhancements identified in the socio-economic assessment.	Scoped In
	Employment and income	Potential at all phases of the development.	There will be direct, indirect and induced employment opportunities as a result of	Positive, potentially significant.	Creation of employment opportunities will be	Scoped In

Categories	Wider Determinants of Health	Likelihood (Source, Pathway, Receptor)	Comments	Significance (Positive or Negative)	Committed Mitigation / Enhancements	Scoped In / Out
			the Project. There are potential health benefits associated with increased income.	Significance will depend on specific local baselines.	maximised through project procurement and implementation of enhancements identified in the Socio-economic assessment.	
Bio-physical Environment	Climate change mitigation and adaptation	Potential	The projects operational contribution towards minimising climate change is considered in **Chapter 22: Climate Change and Resilience**. This will help to minimise the effects of climate change on population health.	Positive, contributes towards population health however this is unlikely to be significant when considered in isolation.	N/A	Scoped Out
	Air quality	None	Effects arising from air quality are unlikely due to the offshore nature of the proposal, therefore no health effects associated with impacts on air quality are expected.	N/A	N/A	Scoped Out
	Water quality or availability	None	Due to the offshore nature of the Project, effects on fresh water are not anticipated, therefore no health effects associated with fresh water	N/A	N/A	Scoped Out

Categories	Wider Determinants of Health	Likelihood (Source, Pathway, Receptor)	Comments	Significance (Positive or Negative)	Committed Mitigation / Enhancements	Scoped In / Out
			quality and availability have been identified.			
	Land quality	None	Geology and sediments are considered in **Chapter 7: Marine and Coastal Processes** and **Chapter 8: Marine Water and Sediment Quality**. Effects are all associated with the marine environment and hence will not affect human health.	N/A	N/A	Scoped Out

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Chapter 21A: Major Accidents and Disasters

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1. MAJOR ACCIDENTS AND DISASTERS LONG LIST

1.1 Introduction

1.1.1.1 A long list of Major Accident and Disaster (MA&D) categories and types was developed and subsequently pre-screened to exclude those MA&D types which are not considered to be relevant due to the type and location of the Project, in a developed country in an offshore environment. The following MA&D types were therefore screened out:

- Flooding: fluvial, pluvial and groundwater;
- Avalanches;
- Drought;
- Severe space weather: solar energetic particles;
- Wildfires: forest fire, bush / brush, pasture;
- Disease epidemics: viral, bacterial, parasitic, fungal, and prion;
- Animal Diseases: avian influenza, West Nile virus, rabies, foot and mouth and swine fever;
- Widespread damage to societies and economies;
- The need for large-scale multi-faceted humanitarian assistance;
- The hindrance or prevention of humanitarian assistance by political and military constraints;
- Significant security risks for humanitarian relief workers in some areas;
- Famine;
- Displaced population;
- Dam breaches;
- Mines and storage caverns;
- Transport accidents: road and rail;
- Pollution accidents: land;
- Utilities failures: water supply and sewage system;
- Malicious attacks: chemical, biological, radiological, nuclear; transport systems and crowded places;
- Bridge failure;
- Flood defence failure;
- Property or bridge demolition accidents; and
- Tunnel failure / fire.

1.2 Elements scoped in or out of further assessment

1.2.1.1 **Table 1-1** presents the remaining MA&D types which have been assessed in the 2024 Scoping Report to determine the potential vulnerability of the Project to the risk of a MA&D. Justification is provided for scoping each MA&D type in or out of further assessment during both the construction and the operation phase. The phases are indicated in the table as "C" for construction and "O" for operation.

Table 1-1: Elements scoped in or out of further assessment

MA&D group	MA&D category	MA&D type	Basis of decision to scope in / out	Embedded mitigation	Scope in?
Natural Hazards	Geophysical	Earthquakes	The BGS identifies that on average, a magnitude 4 earthquake happens in Britain roughly every two years and a magnitude 5 earthquake occurs around every 10 to 20 years. As such the Cabinet Office National Risk Register[1] states that "*Earthquakes in the UK are moderately frequent but rarely result in large amounts of damage. An earthquake of sufficient intensity (determined on the basis of the earthquake's local effect on people and the environment) to inflict severe damage is unlikely*". The North Sea experiences low to moderate seismic activity which can add strain to mooring systems, increasing the risk of turbines breaking free and colliding with vessels or oil and gas assets. However, the design of the anchoring system will take into account the low to moderate seismic activity associated with the local area. Therefore, it is considered that this MA&D event type can be scoped out and does not require further assessment in the EIAR.	N/A	No
Natural Hazards	Geophysical	Volcanic Activity	The Project is not in an active volcanic area and it is highly unlikely that an ash cloud could significantly impact on any aspect of the Project. At the time of the ash cloud, produced by the eruption of a sub-glacial volcano in Iceland in April 2010, the wind power industry did not expect that cold volcanic dust on wind turbines would cause any problems and there are no records of impacts on windfarms as a result of the ash cloud. Therefore, it is considered that	N/A	No

MA&D group	MA&D category	MA&D type	Basis of decision to scope in / out	Embedded mitigation	Scope in?
			this MA&D event type can be scoped out and does not require further assessment in the EIAR.		
Natural Hazards	Geophysical	Landslides	This MA&D event type can be excluded from further assessment in the Environmental Impact Assessment Report (EIAR) since there are no onshore works involved in the Project. The potential significant effects at this location have already been evaluated in the EIA Report submitted for NorthConnect and were deemed acceptable during the consenting process for NorthConnect's onshore grid connection cable	N/A	No
Natural Hazards	Geophysical	Sinkholes	See above for 'Landslides'.	N/A	No
Natural Hazards	Geophysical	Tsunamis	The UK is located away from the plate boundaries that create large earthquakes. Thus, tsunami hazard is classified as low in the North Sea and in the Grampian region of Scotland. Therefore, it is considered that this MA&D event type can be scoped out and does not require further assessment in the EIAR.	N/A	No
Natural Hazards	Hydrological	Coastal Flooding	All of the construction works associated with the Project will take place within the marine environment and will not impact on coastal flooding. Therefore, it is considered that this MA&D event type can be scoped out and does not require further assessment in the EIAR.	N/A	No
Natural Hazards	Climatological and Meteorological	Cyclones, hurricanes, typhoons, storms and gales	Cyclones, hurricanes and typhoons do not occur in the UK. Eastern Scotland is one of the windier parts of the UK, being relatively close to the track of Atlantic depressions. In general, the strongest winds are associated with the passage of deep depressions across or close to the UK. The frequency and strength of these depressions is greatest in the winter half of the year, especially from December to February, and	N/A	No

MA&D group	MA&D category	MA&D type	Basis of decision to scope in / out	Embedded mitigation	Scope in?
			this is when mean speeds and gusts (short duration peak values) are strongest. The average monthly mean wind speed in knots was 8.75, compared to the regional average of 10.3 knots and UK average of 9.3 knots. Due to the location of the Project severe storms are expected, the frequency and severity of which could be exacerbated by climate change. During the construction phase, works would be paused during storm conditions and it would be ensured that all equipment is secured safely. This requirement will be included in the Code of Construction Practice. During the operational phase storms may add strain to mooring systems, increasing the risk of turbines breaking free and colliding with vessels or oil and gas assets. However, the design of the anchoring system will take into account the weather conditions associated with the local area. In November 2023 Storm Ciarán severely affected parts of Europe. However, the WindFloat Atlantic semi-submersible floating offshore windfarm was not affected by the extreme weather conditions experienced (including significant wave heights exceeding 10 metres, with a maximum wave height of 20 metres and wind speeds of 38.8 metres per second). Wind turbines have a cut-out speed at which the turbine automatically shuts down to prevent unnecessary strain on the rotor. In addition, built-in mechanisms lock and feather the blades (twisting them so that they no longer catch the wind and rotate) when wind speeds exceed this cut-out speed. Once		

MA&D group	MA&D category	MA&D type	Basis of decision to scope in / out	Embedded mitigation	Scope in?
			the storm has subsided, the turbine returns to full functionality. It is therefore considered that this MA&D event type can be scoped out and does not require further assessment in the EIAR.		
Natural Hazards	Climatological and Meteorological	Thunderstorms	Due to the location of the Project, thunderstorms are expected, the frequency and severity of which could be exacerbated by climate change. During the construction phase, works would be paused during thunderstorms and it would be ensured that all equipment was secured safely. This requirement will be included in the Code of Construction Practice. During the operational phase thunderstorms may add strain to mooring systems, increasing the risk of turbines breaking free and colliding with vessels or oil and gas assets. However, the design of the anchoring system will take into account the weather conditions associated with the local area. The wind turbines will be fitted with lightning protection systems, grounding mechanisms and surge protectors to prevent damage to the turbine's electrical systems and control mechanisms. In addition, regular inspections and maintenance will be undertaken to assess and repair any lightning-related damage. It is therefore considered that this MA&D event type can be scoped out and does not require further assessment in the EIAR.	N/A	No
Natural Hazards	Climatological and Meteorological	Wave surges	The North Sea is at risk of future sea level rise. Sea level projections at the closest marine projections data point, approximately 100 km west of the Project, just off the coast of Aberdeen, range from 0.11 m in the 2030s to 0.59m in the 2080s. Sea level rise over the	N/A	No

MA&D group	MA&D category	MA&D type	Basis of decision to scope in / out	Embedded mitigation	Scope in?
			considered time periods of the Project is expected to affect tidal characteristics substantially, however there is no specific evidence for significant changes in future storm surges. The marine projections also consider that there is no significant additional increase in the statistics of extreme water levels associated with atmospheric storminess only. The projections for the 21st century suggest a general reduction in wave heights and extreme waves in the order of 10-20%, however this is specific to the location and some coastal regions may remain dominated by local weather variability. During the construction phase, works would be paused during storm conditions (including wave surges) and it would be ensured that all equipment was secured safely. This requirement will be included in the Code of Construction Practice. During the operational phase storms may add strain to mooring systems, increasing the risk of turbines breaking free and colliding with vessels or oil and gas assets. However, the design of the anchoring system will take into account the weather conditions associated with the local area and will consider the varying aerodynamic and hydrodynamic loads to which the turbines may be subjected to. It is therefore considered that this MA&D event type can be scoped out and does not require further assessment in the EIAR.		
Natural Hazards	Climatological and Meteorological	Extreme temperatures: Heatwaves	The Project will be vulnerable to extreme temperatures. High temperature records are being broken with increasing frequency. On 3rd August 1990, a record high of 37.1°C was reached in Cheltenham. This was	N/A	No

MA&D group	MA&D category	MA&D type	Basis of decision to scope in / out	Embedded mitigation	Scope in?
		Low (sub-zero) temperatures and heavy snow	broken in 2003, when 38.5ºC was reached in Faversham, Kent, then again in 2019, when Cambridge reached 38.7ºC, and most recently on 19th July 2022, when the current record of 40.3ºC was recorded in Coningsby, Lincolnshire and the Met Office declared its first ever red alert for heat and declared a national emergency. Widespread transport disruption occurred, and the increased electricity demand almost led to a blackout in London, which was averted by the emergency purchase of electricity. The most widespread and prolonged low temperatures and heavy snow in recent years occurred from December 2009 to January 2010. Daytime temperatures were mostly sub-zero across the UK. Snowfall across the UK lasted for some time, allowing 20 cm to 30 cm of snow to build up, closing schools and making it very difficult to travel. During the construction phase, works would be paused during extreme weather conditions. During the operational phase the potential impact of extreme temperatures on the Project will be managed through the design of the Project. The Wind Turbine Generators will be designed in accordance with appropriate standards, fitted with appropriate control systems and will be subject to regular inspection and preventative maintenance. The design of the Wind Turbine Generators will include, for example, de-icing systems / coatings to minimise ice formation and accumulation and ice shedding from the blades which may pose a risk to both workers and nearby infrastructure; weather monitoring; and insulation / heating or cooling mechanisms.		

MA&D group	MA&D category	MA&D type	Basis of decision to scope in / out	Embedded mitigation	Scope in?
			In addition, safety zones will be defined around the Array Area to reduce the risk of impact to a third party vessel / infrastructure. It is therefore considered that this MA&D event type can be scoped out and does not require further assessment in the EIAR.		
Natural Hazards	Climatological and Meteorological	Severe Space Weather: Solar Flares	Solar flare events are known to interrupt radio and other electronic communications. Records from solar storms in 1921 and 1960 describe widespread radio disruption. The Project is unlikely to be impacted by a solar flare event as it does not rely upon high frequency electronic communications. Therefore, it is considered that this MA&D event type can be scoped out and does not require further assessment in the EIAR.	N/A	No
Natural Hazards	Climatological and Meteorological	Severe Space Weather: Coronal Mass Ejections	Coronal mass ejections (CME) cause geomagnetic storms. A geomagnetic storm in 1989 induced electric currents in transformers at the Hydro-Quebec power plant, melting transformer coils. Voltage instability subsequently caused a widespread power loss during the Canadian winter. In 2003, a geomagnetic storm impacted several power lines and transformers in Scandinavia and caused permanent damage to infrastructure in South Africa. In the UK, it caused the aviation sector to lose some GPS functions for a day. There is no known significant impact on wind turbine infrastructure however, the transformers associated with the HVDC convertor station may be vulnerable to CME. It is considered that the impact associated with a CME is likely to be damage to infrastructure with localised power disruptions and is unlikely to cause a MA&D. Therefore, it is considered that this MA&D	N/A	No

MA&D group	MA&D category	MA&D type	Basis of decision to scope in / out	Embedded mitigation	Scope in?
			event type can be scoped out and does not require further assessment in the EIAR.		
Natural Hazards	Climatological and Meteorological	Fog	Fog is one of the most common weather conditions in the UK and can dramatically reduce visibility. **Chapter 14: Shipping and Navigation** states that Safety Zones will be defined around the Array Area to reduce the likelihood of a third party vessel colliding with the Floating Turbine Units and the Offshore Substation and Converter Platform. These zones will be defined for both the construction phase and the operation phase. **Chapter 18: Military and Civil Aviation** states that appropriate marker buoys and lighting will be installed to meet the requirements of the Civil Aviation Authority (CAA), Northern Lighthouse Board (NLB) and the Maritime and Coastguard Agency (MCA). During the construction phase, works would be paused during poor visibility conditions. Therefore, it is considered that this MA&D event type can be scoped out and does not require further assessment in the EIAR.	N/A	No
Natural Hazards	Climatological and Meteorological	Poor Air Quality	Although air quality is not monitored routinely at offshore sites, regular air quality monitoring is carried out by local authorities in coastal areas adjacent to each Regional Sea. There are three Air Quality Management Areas (AQMA) in Aberdeen City associated with the City Centre, Wellington Road and Anderson Drive. All of which are designated due to high levels of nitrogen dioxide and Particulate Matter (PM_{10}) associated with road transport. There are no AQMA in Aberdeenshire or Angus, this would suggest that air pollution	N/A	No

MA&D group	MA&D category	MA&D type	Basis of decision to scope in / out	Embedded mitigation	Scope in?
			associated with marine activities is not having a detrimental effect onshore. MARPOL (The International Convention for the Prevention of Pollution from Ships) compliant vessels will be utilised for all works during the construction and operational phases of the Project in order to minimise potential impacts on air quality. The construction and operation of the Project is not considered likely to impact air quality and therefore, it is considered that this MA&D event type can be scoped out and does not require further assessment in the EIAR.		
Natural Hazards	Biological	Plants	The potential for effects associated with non-native species on benthic species and habitats and their potential significance will be assessed in the Benthic Ecology chapter of the EIAR. **Chapter 9: Benthic Ecology** states that "*Embedded mitigation, such as the development and employment of an Environmental Management Plan (EMP), including a Marine Pollution Contingency and Control Plan and an Invasive Non-Native Species (INNS) management plan, will be implemented by the Applicant.*" Therefore, it is considered that this MA&D event type can be scoped out and does not require further assessment in the MA&D chapter of the EIAR.	N/A	No
Technological or Manmade Hazards	Societal	Extensive public demonstrations which could lead to violence and loss of life.	The Project is not considered to be highly controversial and should not lead to high profile public demonstrations. Therefore, it is considered that this MA&D event type can be scoped out and does not require further assessment in the EIAR.	N/A	No
Technological or Manmade Hazards	Industrial and Urban Accidents	Major Accident Hazard Chemical sites	There are no COMAH sites within a 5 km radius of the Project. Therefore, it is considered that this MA&D	N/A	No

MA&D group	MA&D category	MA&D type	Basis of decision to scope in / out	Embedded mitigation	Scope in?
			event type can be scoped out and does not require further assessment in the EIAR.		
Technological or Manmade Hazards	Industrial and Urban Accidents	Major Accident Hazard Pipelines	There are no Major Accident Hazard Pipelines within a 1 km radius of the Project. Therefore, it is considered that this MA&D event type can be scoped out and does not require further assessment in the EIAR.	N/A	No
Technological or Manmade Hazards	Industrial and Urban Accidents	Oil and Gas Platforms	As required by The Offshore Installations (Offshore Safety Directive) (Safety Case etc) Regulations 2015, all offshore installations have a 500m Safety Zone to protect the safety of people working on or in the immediate vicinity of the installation, and the installation itself, against damage which may be incurred by vessel impact. There are no oil and gas platforms within a 500m radius of the WTGs. The closest oil and gas platform is 13.6 km from the WTGs. Therefore, it is considered that this MA&D event type can be scoped out and does not require further assessment in the EIAR.	N/A	No
Technological or Manmade Hazards	Industrial and Urban Accidents	Nuclear	There are no nuclear sites within a 5 km radius of the Project. Therefore, it is considered that this MA&D event type can be scoped out and does not require further assessment in the EIAR.	N/A	No
Technological or Manmade Hazards	Industrial and Urban Accidents	Fuel storage	There will be no bulk fuel storage associated with the Project. Therefore, it is considered that this MA&D event type can be scoped out and does not require further assessment in the EIAR.	N/A	No
Technological or Manmade Hazards	Industrial and Urban Accidents	Fires	During the construction phase the risk of fires will be managed through the implementation of the OCoCP which will also identify measures to be taken in the event of a fire. In the event of a fire in the operational phase, The Maritime and Coastguard Agency will issue a local	N/A	No

MA&D group	MA&D category	MA&D type	Basis of decision to scope in / out	Embedded mitigation	Scope in?
			navigation warning to keep vessels away from the affected area. In addition, in accordance with industry standards, the wind turbines will be designed to include fire suppression systems. Therefore, it is considered that this MA&D event type can be scoped out and does not require further assessment in the EIAR.		
Technological or Manmade Hazards	Transport accidents	Waterways	**Chapter 14: Shipping and Navigation** identifies that an average of 20 vessels per day were recorded within the Study Area, and approximately six per day intersecting the Array Area. There are records of mooring systems on Floating Production Storage and Offloading (FPSO) and Floating Storage and Offloading (FSO) vessels failing leading to vessel drift. In 2011, the Gryphon Alpha came off station during storm events in the UK North Sea on two occasions due to mooring line failure. These events resulted in damage to equipment but the vessel did not collide with any other infrastructure. **Chapter 14: Shipping and Navigation** scopes in the risk of vessel collisions for further assessment in the EIAR therefore, it is considered that the risk of transport accidents can be scoped out from further assessment in the MA&D EIAR chapter.	N/A	No
Technological or Manmade Hazards	Transport accidents	Aviation	Due to the height of the WTGs there is the potential to interact with low flying aircraft such as helicopters. The Array Area has been located away from the oil and gas platforms to minimise the potential impact associated with helicopter access to the platforms. In line with Civil Aviation Authority (CAA) and Search and Rescue (SAR) requirements a single red aviation hazard light will be fitted on top of each nacelle on the WTGs at the perimeter of the array there will also be a	N/A	No

MA&D group	MA&D category	MA&D type	Basis of decision to scope in / out	Embedded mitigation	Scope in?
			flashing Morse "W" in unison with all other perimeter WTG hazard lights (assuming that WTGs are more than 900m apart). All other WTGs will be fitted with a single steady red aviation hazard light. As defined in CAP437, during the construction phase there will be a low-intensity green status light to indicate when it is safe to commence winching operations and floodlighting is required for any night operations (if permitted). As **Chapter 18: Military and Civil Aviation** scopes in potential risks associated with civil aviation and as such appropriate mitigation measures will be implemented therefore, it is considered that it can be scoped out from further assessment in the MA&D EIAR chapter. **Chapter 18: Military and Civil Aviation** identifies that the Project lies in proximity to Ministry of Defence (MOD) Air-to Air Refuelling Area 3, which extends from 10,000ft –29,000ft above mean sea level. Based on the maximum height parameters of the WTGs and offshore platforms, it is unlikely that the Project will have any impact on MOD low flying activities. Therefore, low flying MOD activities can be scoped out from further assessment in the MA&D EIAR chapter.		
Technological or Manmade Hazards	Pollution accidents	Air	The Project will not produce any emissions to air other than those associated with construction and maintenance vessels. MARPOL (The International Convention for the Prevention of Pollution from Ships) compliant vessels will be utilised for all works during the construction and operational phases of the Project in order to minimise potential impacts on air quality. The construction and operation of the Project is not considered likely to impact air quality and therefore, it	N/A	No

MA&D group	MA&D category	MA&D type	Basis of decision to scope in / out	Embedded mitigation	Scope in?
			is considered that this MA&D event type can be scoped out and does not require further assessment in the EIAR.		
Technological or Manmade Hazards	Pollution accidents	Water	There is a risk of pollution being accidently released during the construction and operation phases from sources including vessels and equipment. There is also a risk that gearbox oil could be released, in the event of a vessel or aircraft colliding with multiple WTGs. However, accidental pollution events are not considered to result in a significant effect on Marine water and sediment quality features. The magnitude of an accidental spill will be limited by the size of chemical or oil inventory on construction vessels. In addition, release of hydrocarbons would be subject to rapid dilution, weathering and dispersion and would be unlikely to persist in the marine environment. The likelihood of an incident will be reduced as all vessels on the Project will be required to comply with strict environmental controls with the implementation of EMP and Marine Pollution Contingency Plan, which will be approved by the relevant stakeholders and secured through s.36 conditions, marine licence conditions and CEMP. These plans include planning for accidental spills, address all potential contaminant release and include key emergency contact details. It will also set out industry good practice and OSPAR and International Convention for the Prevention of Pollution from Ships (MARPOL) guidelines for preventing pollution at sea. Due to the implementation of control measures and small quantities of hydrocarbons and chemicals it is considered that this MA&D event type can be scoped out and does not require further assessment in the EIAR.	N/A	No

MA&D group	MA&D category	MA&D type	Basis of decision to scope in / out	Embedded mitigation	Scope in?
Technological or Manmade Hazards	Utilities failures	Electricity	The construction of the Project is within the marine environment and therefore does not involve the use of electricity from the national grid. The Project will be self sufficient. The Project involves the installation of an Export / Import Cable which from the windfarm to the landfall is 278km. During the Operational phase the WTGs will use electricity from the Export / Import Cable to start the turbines, in the event of electricity failure the turbines will not operate. Therefore, it is considered that this MA&D event type can be scoped out and does not require further assessment in the EIAR.	N/A	No
Technological or Manmade Hazards	Utilities failures	Gas	Underground and above-ground gas transmission pipelines are not present across the Project area. There is no gas use associated with the Project. Therefore, it is considered that this MA&D event type can be scoped out and does not require further assessment in the EIAR.	N/A	No
Technological or Manmade Hazards	Malicious Attacks	Unexploded Ordnance	Items of unexploded ordnance (UXO) are regularly encountered in the North Sea. The installation of the Array Area infrastructure, import/export cables and nearshore cables could cause an inadvertent detonation of sensitive UXO. Prior to the installation of any infrastructure UXO clearance would be undertaken. Measures would be undertaken during construction to brief operatives to raise awareness of this issue, and to define appropriate response strategies should UXO be discovered during the works.	N/A	No

MA&D group	MA&D category	MA&D type	Basis of decision to scope in / out	Embedded mitigation	Scope in?
			There would be a limited risk of UXO affecting the Project, once operational but no greater than similar schemes. Therefore, it is considered that this MA&D event type can be scoped out and does not require further assessment in the EIAR.		
Technological or Manmade Hazards	Malicious Attacks	Cyber	Cyber attacks occur almost constantly on key national and commercial electronic information, control systems and digital industries. The offshore windfarm will be managed, monitored, and operated from an onshore facility which will have remote access to the offshore electricity hub and individual wind turbines. The Project will be vulnerable to cyber attack however, the risk is no different to other windfarms operating offshore around the UK. Therefore, it is considered that this MA&D event type can be scoped out and does not require further assessment in the EIAR.	N/A	No
Technological or Manmade Hazards	Malicious Attacks	Infrastructure	Malicious attacks have previously been planned or undertaken on UK national infrastructure. Attempts were made to attack electricity substations in the 1990s. Bishopsgate, in the City of London, was attacked in 1993 and South Quay in London's Docklands in 1996. These attacks resulted in significant damage and disruption but relatively few casualties. The Project would have minimal impact on local infrastructure and is unlikely to be considered a high profile target. In addition, it is not considered to be more vulnerable to attack than other similar infrastructure in the UK. Therefore, it is considered that this MA&D event type can be scoped out and does not require further assessment in the EIAR.	N/A	No

MA&D group	MA&D category	MA&D type	Basis of decision to scope in / out	Embedded mitigation	Scope in?
Technological or Manmade Hazards	Engineering accidents and failures	Mast and tower collapse	There are no masts or towers within 500m of the Project. Safety zones will be defined around the Array Area to reduce the risk of impact to a third party vessel / infrastructure. Therefore, it is considered that this MA&D event type can be scoped out and does not require further assessment in the EIAR.	N/A	No

[1] HM Government, (2023). *National Risk Register 2023 edition*. Available at: https://assets.publishing.service.gov.uk/media/64ca1dfe19f5622669f3c1b1/2023_NATIONAL_RISK_REGISTER_NRR.pdf (Accessed: 1 February 2024).

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Appendix 22A: Climate Resilience Vulnerability Assessment

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1 CLIMATE RESILIENCE VULNERABILITY ASSESSMENT

1.1 Introduction

1.1.1.1 This appendix of the Scoping Report should be read in conjunction with **Chapter 22: Climate Change Resilience**.

1.1.1.2 This appendix contains the vulnerability assessment, which includes the scoring of exposure and sensitivity, as the basis to the scoping in or out of aspects of the Climate Change Resilience (CCR) assessment. The scoring of exposure and sensitivity takes into account embedded mitigation measures as described in **Chapter 22: Climate Change Resilience**.

1.2 Methodology

1.2.1.1 In order to identify the vulnerable Project elements, a sensitivity and exposure assessment has been undertaken. The vulnerability of receptors to climate variables is considered to be a function of sensitivity and exposure, using the matrix shown in **Table 1-1**. The typical sensitivity of receptors to climate variables considers the impact of the climate on the specific receptors, based on literature review and professional judgement and sensitivity is rated as high, medium or low.

1.2.1.2 The exposure of receptors to projected change in climate variables is based on the current climate and the future projections identified in the baseline information presented in **Chapter 22: Climate Change Resilience** and rated as high, medium or low.

1.2.1.3 Both the assignment of sensitivity and exposure takes into account any preliminary design measures which have been embedded into the design.

Table 1-1: Sensitivity matrix

Sensitivity	Exposure		
	Low	**Medium**	**High**
Low	Low vulnerability	Low vulnerability	Low vulnerability
Moderate	Low vulnerability	Medium vulnerability	Medium vulnerability
High	Low vulnerability	Medium vulnerability	High vulnerability

1.3 Vulnerability Assessment

1.3.1 Construction

1.3.1.1 **Table 1-2** presents the assessment of vulnerability for the Project during the construction phase. The exposure assessment takes into account climate change projections as part of the future baseline for the 2030s (2020 – 2049).

Table 1-2: Vulnerability assessment for the construction phase

Trend	Receptor	Effect	Sensitivity	Exposure	Vulnerability
Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells.	Human health	Increased heat stress or heat exhaustion experienced by the construction workforce.	Low	Low	Low
Increased frequency and intensity of storm events and wave heights.	Human health	Extreme storminess and wave heights leading to increased unsafe working environments and delays to construction programme.	Low	Low	Low
	Building and infrastructure assets	Increased risk of disruption to construction work, such as cranes unable to operate in high winds, reduced accessibility, and an increased safety risk.	Low	Low	Low

1.3.2 Operation

1.3.2.1 **Table 1-3** presents the assessment of vulnerability for the Project during the operational phase. The exposure assessment takes into account climate change projections as part of the future baseline for the 2050s (2040 – 2069) and 2080s (2070 – 2099).

Table 1-3: Vulnerability assessment for the operation phase

Trend	Receptor	Effect	Sensitivity	Exposure	Vulnerability
Increased frequency and intensity of storm events	Buildings and infrastructure.	Destabilisation or degradation of Wind Turbine Generators (WTG)	Low	Medium	Low

Trend	Receptor	Effect	Sensitivity	Exposure	Vulnerability
and wave heights.		mechanical systems, facilities and structures.			
		Increased turbulence can hinder WTG's performance and power production and increases wear on the turbines.	Low	Medium	Low
		More energetic and/or more frequent thunderstorms/torrential rainstorms - high level of water particles continuously striking the turbine blades increasing leading edge erosion. This is compounded in fog, mist, high humidity conditions.	Low	Medium	Low
		High wind speeds over operating limits can cause damage or failures.	Low	Medium	Low
		Loading and sediment transport across seabed leading to loss of integrity of foundations and cabling systems from scour and exposure.	Low	Medium	Low
		Change in wave loading may	Low	Medium	Low

Trend	Receptor	Effect	Sensitivity	Exposure	Vulnerability
		dramatically affect the overall fatigue life of electrical cable systems and mooring lines.			
	Human health	Impeded access for maintenance and inspection leading to safety concerns for the operational and maintenance workforce.	Low	Medium	Low
Decrease in wind speed and wave height in the North Sea.	Buildings and infrastructure	Decrease in wind speeds could result in a reduced power production and increased idle time.	Low	Medium	Low
Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells.	Buildings and infrastructure	Overheating of mechanical and electrical (M&E) assets such as offshore substations, leading to a decrease in asset performance and rating and/or requiring additional electricity demand for mechanical cooling units.	Low	High	Low
		Higher temperatures effect air density, reducing wind turbine power output.	Low	High	Low
		Increased biofouling of mooring lines	Low	High	Low

Trend	Receptor	Effect	Sensitivity	Exposure	Vulnerability
		and substructures due to favourable environment for microorganisms.			
	Human health	Increased heat stress or heat exhaustion experienced by the operation and maintenance workforce.	Low	High	Low
Low temperatures and cold snaps could still occur.	Buildings and infrastructure	Build up of ice on the leading edge of the wind turbine blades and damage tower bottoms and cabling.	Low	Low	Low
Increase sea surface temperatures and ocean acidification.	Buildings and infrastructure	Increased corrosion of the structures.	Low	Medium	Low
Sea level rise.	Buildings and infrastructure Buildings and infrastructure	Sea Level Rise (SLR) impacting upon mooring line or tether tension limits which may be exceeded due to the increase in elevation. The impact less noticeable for floating turbine units (FTU).	Low	High	Low
		SLR may also affect the corrosion rate of offshore turbine foundations by exceeding the height of the corrosion-resistant section	Low	High	Low

Trend	Receptor	Effect	Sensitivity	Exposure	Vulnerability
		of the foundation.			

1.3.3 Decommissioning

1.3.3.1 **Table 1-4** presents the assessment of vulnerability for the Project during the decommissioning phase. This takes into account the exposure (based on current and future baseline conditions) and sensitivity and any design, mitigation and enhancement measures addressed above.

Table 1-4: Vulnerability assessment for the decommissioning phase

Trend	Receptor	Effect	Sensitivity	Exposure	Vulnerability
Increased annual mean temperatures, especially in the summer months, and an increase in the frequency and intensity of hot spells.	Human health	Increased heat stress or heat exhaustion experienced by the construction workforce.	Low	High	Low
Increased frequency and intensity of storm events and wave heights.	Human health	Extreme storminess and wave height leading to increased unsafe working environments and delays to construction programme.	Low	Medium	Low
	Building and infrastructure assets	There is an increased risk of disruption to construction work, such as cranes unable to operate in high winds, reduced accessibility, and an increased safety risk.	Low	Medium	Low

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