Galahad Decommissioning Programme

Topsides and Monopod Removal

Environmental Appraisal

15th January 2025

Consultation Draft

Prepared by Petrodec BV on behalf of Perenco Gas (UK) Ltd.

Review and Approval

Petrodec Prepared by	Petrodec Reviewed by	PUK Reviewed by	PUK Approved by
Environmental Advisor	Sr. Environmental Advisor	Lead Decommissioning Engineer	Decommissioning Manager
A. Gleeson	M. Masterson	S. Onaiwi	O. Felmingham

Amendment Summary

Revision Date	Revision Number	Amendment	Prepared By
15-01-2025	02	Consultation Draft	N. Mearns
04-10-2024	01	Updated to include OPRED Comments	C. Fowler
29-07-2024	00	Finalise for issue to OPRED	M. Masterson
10-07-2024	00A	Initial draft for internal review	M. Masterson

Contents

Review and Approval ... 1
Amendment Summary ... 2
Contents ... 3
List of Figures ... 4
List of Tables ... 5
Abbreviations ... 6
Non-Technical Summary ... 8
1 Introduction ... 9
1.1 Scope ... 9
1.2 Document Structure ... 9
1.3 Policy and Regulatory Context ... 9
1.4 Perenco Gas (UK) Limited ... 10
2 Stakeholder Consultation ... 10
3 Decommissioning Activities ... 11
3.1 Location ... 11
3.2 Asset Description ... 11
3.3 Planned Decommissioning Activity ... 15
4 Environmental and Societal Baseline ... 16
4.1 Physical Environment ... 16
4.1.1 Site Location and Nearest UK Coastline ... 16
4.1.2 Bathymetry ... 16
4.1.3 Seabed Sediments and Habitat Classification ... 17
4.1.4 Seabed Chemistry ... 19
4.1.5 Oceanography ... 27
4.2 Biological Environment ... 28
4.2.1 Plankton ... 28
4.2.2 Benthic Biodiversity ... 28
4.2.3 Fish and Shellfish ... 31
4.2.4 Seabirds ... 33
4.2.5 Marine Mammals ... 37
4.3 Offshore Conservation Management and Marine Planning ... 42
4.3.1 Conservation Areas ... 42
4.3.2 Marine Planning ... 45
4.4 Socio-Economical Environment ... 47
4.4.1 Commercial Fisheries ... 47

4.4.2 Oil and Gas Activities 48
4.4.3 Shipping and Ports 48
4.4.4 Telecommunication and Power Cables 48
4.4.5 Marine Aggregates 49
4.4.6 Offshore Wind Farms 49
4.4.7 Military Activity 49
4.4.8 Archaeology 49
4.4.9 Tourism and Leisure 49
5 Environmental Issues Identification 51
6 Environmental and Social Assessment 52
6.1 Assessment Methodology 52
6.1.1 Introduction 52
6.1.2 Identification of Impacts 52
6.1.3 Evaluation of Impact Significance 53
6.2 Insignificant Impacts 57
6.2.1 Physical Presence 57
6.2.2 Noise Emissions 58
6.2.3 Marine Discharges 59
6.2.4 Atmospheric Emissions 59
6.2.5 Solid Waste Generation 59
6.2.6 Seabed Disturbance 60
6.2.7 Accidental Events – Loss of Containment 60
6.3 Potential Significant Impacts Assessment 61
6.4 Cumulative and Transboundary Impacts 61
7 EA Conclusions 61
References 63
Appendix 1 - Environmental Management 67
Appendix 2 - Quantifying GHG Emissions 70

List of Figures

Figure 3.1. Galahad topside and monopod. 12
Figure 3.2. Galahad with adjacent fields, installations and pipelines with insert showing pipelines....13
Figure 3.3. Galahad location relative to the adjacent fields and UK coastline. 14
Figure 4.1. Bathymetry at Galahad. 17
Figure 4.2. EMODnet habitat type for Galahad and surrounding area....18

Figure 4.3. Example images of circalittoral coarse sediment (A5.14) habitat....19
Figure 4.4. Benthic survey stations....21
Figure 4.5. Major residual current flows....27
Figure 4.6. Fish sensitivities for Galahad and surrounding areas....32
Figure 4.7. Seabird density surface maps for the species identified as frequently occurring in Block 48/12 (Kober et al, 2010)....34
Figure 4.8. Density of grey seals in the vicinity of Galahad....41
Figure 4.9. Harbour seal density in the vicinity of Galahad....41
Figure 4.10. Marine protected areas within the vicinity of Galahad....44
Figure 4.11. Total fishing effort for ICES Rectangle 36F1....48
Figure 4.12. Subsea cables, aggregates, and wind farms within the vicinity of Galahad....50

List of Tables

Table 1.1. Environmental appraisal overview....9
Table 3.1. Galahad structure information....11
Table 3.2. Galahad well status....11
Table 4.1. Total Organic Matter/Carbon and Moisture Content....20
Table 4.2. Hydrocarbon Concentrations....22
Table 4.3. Total Heavy and Trace Metal Concentrations ($mg.kg^{-1}$ or ppm)....25
Table 4.4. Normalised Total Heavy and Trace Metal Concentrations ($mg.kg^{-1}$ or ppm)....26
Table 4.5. Habitat Assessment Summary....29
Table 4.6. Species utilising ICES Rectangle 36F1 as spawning and nursery grounds (Coull *et al.,* 1998; Ellis *et al.,* 2012[1])....31
Table 4.7. Elasmobranch Species Likely to be found in Block 48/12....33
Table 4.8. Seabird Oil Sensitivity Index (SOSI) for Block 48/12....37
Table 4.9. SCANS IV Cetacean abundance and density NS-C and Total Survey Area....38
Table 4.10. Estimates of Cetacean Abundance in the Relevant Marine Mammal MUs (IAMMWG, 2015[1], 2022[2])....39
Table 4.11. Cetaceans Sightings within ICES Rectangle 36F1....39
Table 4.12. Seal count in Southeast England 2021....40
Table 4.13. Marine Protected Areas within 40 kilometres of Galahad....43
Table 4.14. Marine Planning Objectives and Policies Relevant to the Proposed Galahad Decommissioning....45
Table 5.1. Environmental Hazard Identification (ENVID)....51
Table 6.1. Impact Category Definitions....53
Table 6.2. Determining Sensitivity Matrix....54
Table 6.3. Determining Magnitude of Impact....54
Table 6.4. Significance Evaluation Matrix (Planned Activities)....55
Table 6.5. Petrodec Risk Assessment Matrix....56

Table A2.7. 1. Fuel consumption and GHG emissions from the HVL deployment at Galahad....70
Table A2.7. 2. UK Carbon Budgets (HM Government, 2021)....70
Table A2.7. 3. Comparison of Galahad GHG Emissions and Decommissioning project to Industry and UK Total Emissions....71

Abbreviations

Abbreviation	Explanation	Abbreviation	Explanation
AWMP	Active Waste Management Plan	**MOD**	Ministry of Defence
BACs	Background Assessment Concentrations	**MOD DEA**	Ministry of Defence Danger and Exercise Area
BCs	Background Concentrations	**MPA**	Marine Protected Area
BEIS	Business, Energy, and Industrial Strategy	**MU**	Marine Mammal Management Units
BGS	British Geological Survey	**NAO**	North Atlantic Oscillation
BOEPD	Barrels of Oil Equivalent per day	**NFFO**	National Federation of Fishermen's Organisations
CCS	Carbon Capture Storage	**NM**	Nautical Miles
CEFAS	Centre for Environment, Fisheries and Aquaculture Science	**NMPi**	National Marine Plan Interactive
CEMP	Coordinated Environmental Monitoring Programme	**NORM**	Naturally Occurring Radioactive Material
COMOPS	Combined Operations Notification	**NSTA**	North Sea Transition Authority
COP	Cessation of Production	**NUI**	Normally Unattended Installation
CV	Coefficient of Variation	**OEUK**	Offshore Energies UK
DESNZ	Department of Energy Security and Net Zero	**OIW**	Oil In Water
DP	Decommissioning Programme	**OPEP**	Oil Pollution Emergency Plan
EA	Environmental Appraisal	**OPOL**	The Offshore Pollution Liability Association Ltd
EC	European Commission	**OPRED**	Offshore Petroleum Regulator for Environment & Decommissioning
EEGR	East of England Energy Group	**OSPAR**	Oslo and Paris Convention
EL	Elevation	**OSRL**	Oil Spill Response Limited
EMODnet	European Marine Observation and Data Network	**P & A**	Plug and Abandonment
EMT	Environmental Management Team	**PAHs**	Polycyclic Aromatic Hydrocarbons (PAH)
ENVID	Environmental Impacts Identification	**PERENCO**	Perenco Gas (UK) Limited
EPS	European Protected Species	**PL**	Pipeline
ERL	Effect Range Low	**POB**	Personnel on Board
ERM	Effect Range Medium	**PPM**	Parts per million
ESAS	European Seabird at Sea	**PWA**	Pipeline Works Authorisation
ESDV	Emergency Shutdown Valve	**ROV**	Remotely Operated Vehicle
EU	European Union	**SAC**	Special Area of Conservation
EUNIS	European Nature Information System	**SAT**	Subsidiary Application Template
GC-MS	Gas Chromatography-Mass Spectrometry	**SCANS**	Small Cetacean Abundance of the North Sea
GHG	Greenhouse Gases	**SCAP**	Supply Chain Action Plan
HAB	Harmful Algal Blooms	**SCI**	Sites of Community Importance
HAZMAT	Hazardous Materials	**SD**	Standard Deviation
HCS	Hydrocarbon Safe	**SEMS**	Safety and Environment Management System
HLV	Heavy Lift Vessel	**SIC**	Single Ion Current
HSEx	Health and Safety Executive	**SLV**	Sheer Leg Vessels
IAMMWG	Inter-Agency Marine Mammal Working Group	**SMRU**	Sea Mammal Research Unit
ICES	International Council for the Exploration of the Sea	**SNS**	Southern North Sea
ISO	International Organisation for Standardisation	**SOPEP**	Shipboard Oil Pollution Emergency Plan

IUCN	International Union for Conservation of Nature	**SOSI**	Seabird Oil Sensitivity Index
JNCC	Joint Nature Conservation Committee	**SPA**	Special Protection Areas
km	Kilometres	**SPCS**	Subsea Production Control System
LAPS	Lancelot Area Pipeline System	**SSS**	Side Scan Sonar
LAT	Lowest Astronomical Tide	**SSSI**	Sites of Special Scientific Interest
LSA	Low Specific Activity	**Te**	Tonne
m	Metres	**TELECOM**	Telecommunications
MARPOL	International Convention for the Prevention of Pollution from Ships	**TFSW**	Transfrontier Shipment of Waste
MAT	Master Application Template	**THC**	Total Hydrocarbon Content
MBES	Multibeam Echo Sounder	**TOC**	Total Organic Carbon
MCZ	Marine Conservation Zone	**UKCS**	UK Continental Shelf
MMO	Marine Management Organisation	**UKHO**	UK Hydrographic Office
		UKOOA	UK Offshore Operations Association

Non-Technical Summary

In accordance with Section 29 of the Petroleum Act 1998, notice holders of the Galahad and Mordred installation are applying to the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED) to obtain approval of the Decommissioning Programme (DP) for the decommissioning of the topsides and monopod of the Galahad installation.

The Galahad installation, part of the Lancelot Area Pipeline System (LAPS), is located in the Southern Basin of the United Kingdom Continental Shelf (UKCS) in licence block 48/12a. Galahad was designed and operated as a normally unattended satellite installation, consisting of a topside and a monopod. The wells began production in 1995. The Cessation of Operations was approved in 2021 and the plug and abandonment (P&A) of all three wells, and making the topside hydrocarbon safe, occurred in the summer of 2021.

This Environmental Appraisal (EA) report has been produced to support the Galahad Installation Decommissioning Programme (DP) by assessing the potentially significant impacts associated with the preferred decommissioning option of removal of the infrastructure employing a heavy lift vessel.

This EA report sets out to describe, proportionately, the potential environmental impacts of the proposed activities associated with Galahad decommissioning and demonstrate the extent to which these will be mitigated and controlled to an acceptable level.

Galahad is in an area that does not have any significant environmental features. It is not located within a Marine Protected Area and no protected habitats or species were noted within the area during benthic habitat survey. The planned activities for topside and monopod removal are relatively benign in comparison to P&A works, which have already been completed.

PUK appointed an ornithologist to undertake seabird surveys of Galahad in 2023 and 2024. No nesting birds were encountered on the installation on both occasions.

While metals and hydrocarbon concentrations were elevated in some sediment samples of the Galahad survey area, the concentrations are consistent with other studies in the region.

There are limited sources of a hydrocarbon spill, with the only potential source being from fuel bunkering incident, which would not constitute a potential for a Major Environmental Incident (MEI).

The Environmental Identification (ENVID) and the subsequent impact assessment determined that all planned identified activities would have insignificant impacts, when all standard mitigation measures, including permitting, are taken into consideration.

1 Introduction

This Environmental Appraisal (EA) report was produced to support the Galahad Installation Decommissioning Programme (DP) by assessing the potentially significant impacts associated with the preferred decommissioning option of removal of the infrastructure utilizing a heavy lift vessel.

Following the acceptance of the Cessation of Production request by OGA on 10th March 2021, the Galahad wells were plugged and abandoned (P&A) and the topside was made hydrocarbon safe (HCS) in the summer of 2021.

1.1 Scope

The scope of this Environmental Appraisal Report is the offshore decommissioning activities associated with the removal of the Galahad topside and monopod.

1.2 Document Structure

The EA has been prepared to align with Chapter 12 of the *Environmental Considerations* of the *Decommissioning of Offshore Oil and Gas Installations and Pipelines Guidance Notes* (BEIS, 2018) and has the structure and sections presented in Table 1.1.

Table 1.1. Environmental appraisal overview.

Section	Description
Non-technical summary	A high-level non-technical summary of the EA.
1. Introduction	Introduction to the Galahad decommissioning project and a description of the EA report scope and structure. It includes the regulatory context and guidance for undertaking a decommissioning EA.
2. Stakeholder Consultation	A summary of the stakeholder engagement process and activities carried out by PUK to date.
3. Decommissioning Activities	Describes the location, asset and planned decommissioning activities.
4. Environmental Baseline	A description of the environmental and societal sensitivities relevant to the proposed activities, utilising available information.
5. Issues Identification	Drawing on the information described in sections 3 and 4, a preliminary scoping exercise is conducted to identify potential environmental and social issues and impacts.
6. Environmental Assessment	The impact assessment methodology is presented, followed by a review of the potential impacts from the proposed decommissioning activities and justification for scoping potential impacts in or out of assessment in this EA Report.
7. EA conclusions	A conclusion of the EA process is presented.
References	References
Appendix 1	PUK Environmental Management System description
Appendix 2	GHG calculations

1.3 Policy and Regulatory Context

The decommissioning of offshore oil and gas installations and pipelines on the United Kingdom Continental Shelf (UKCS) is controlled through the Petroleum Act 1998, as amended by the subsequent Energy Act. The United Kingdom's international obligations concerning decommissioning are based on the 1992 Oslo Paris Convention for the Protection of the Marine Environment of the Northeast Atlantic (OSPAR Convention).

The responsibility for ensuring that the requirements of the Petroleum Act 1998 and international obligations complied with the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED) which sits within the Department for Energy Security and Net Zero (DESNZ), formerly the Department for Business, Energy, and Industrial Strategy (BEIS) and the Department for Energy and Climate Change. OPRED is also the competent authority on decommissioning in the UK for OSPAR (international regulations) purposes.

The main guidance for this document is the *Decommissioning of Offshore Oil and Gas Installations and Pipelines Guidance Notes* (BEIS, 2018).

1.4 Perenco Gas (UK) Limited

Perenco Gas (UK) Limited (PUK) is part of the Perenco Group, an independent oil and gas company with operations in 13 countries across the world, ranging from Northern Europe to Africa and from South America to Southeast Asia. Perenco currently produces approximately 450,000 barrels of oil equivalent per day (BOEPD), of which 250,000 BOEPD is net to the company.

In the Southern North Sea gas basin, PUK operates 17 offshore fields, along with associated pipelines and onshore processing facilities including the Bacton and Dimlington Terminals. PUK’s gas production in the North Sea is around 72,000 BOEPD. PUK operates under a Safety and Environmental Management System (SEMS) which is certified to conform to the International Organisation for Standardisation (ISO) 14001 for environmental management systems. SEMS provides the framework for PUK to achieve safe and reliable operations and ensures compliance with PUK’s Health, Safety, Security and Environment (HSSE) Policy.

2 Stakeholder Consultation

Perenco Gas (UK) Limited, as part of the Installation DP consultation process, plans to include the following statutory stakeholders of the DP:

- NSTA – North Sea Transition Authority
- NFFO - National Federation of Fishermen's Organisations
- SFF - Scottish Fishermen's Federation
- NIFPO - Northern Ireland Fish Producers Organisation
- Global Marine Systems
- Public

3 Decommissioning Activities

3.1 Location

The Galahad installation is part of the Lancelot Area Production System (LAPS) and located in the Southern Basin of the United Kingdom Continental Shelf (UKCS) Block 48/12a, approximately 76km from the nearest UK coastline, and approximately 106 km from the UK/Netherlands transboundary line. The nearest installations are the Malory platform, located 8km west of Galahad, and the Excalibur platform, located 9km south of Galahad. Refer to Figure 3.2 and Figure 3.3.

3.2 Asset Description

Galahad is a normally unattended (satellite) installation in 19m of water. The installation consists of a topside on a monopod. The Galahad topside is an integrated deck with three levels comprising a production deck, an intermediate deck, a mezzanine deck, and a helideck. The topside rests on a monopod, which has four piles. Refer to Table 3.1 and Figure 3.1.

Table 3.1. Galahad structure information.

Structure	Location (WGS84)	Weight (Te)	Number
Topside	53° 32' 47.7893" N 01° 21' 37.9614" E	466.4	1
Monopod Structure		540.3	1
Piles		165.4 (41.3te for each pie)	4
Drilling Template		5.3	1

The Galahad field was discovered in 1975 but not developed until the 1990s, with the first gas produced in November 1995. Wells 48/12a-G1 and 48/12a-G2 were completed in 1994 and 1995, respectively. In 1996 a third producer was drilled, 48/12a-G3, into the neighbouring Mordred field.

By the 2020s, it was considered that the Galahad field had been developed to its full potential and was no longer economic. A COP was approved by the Oil and Gas Authority (now NSTA) on the 10th March 2021.

Its three wells were plugged and abandoned during the topside hydrocarbon safe campaign in the summer of 2021. The well status is presented in Table 3.2.

Table 3.2. Galahad well status.

Well number	Designation	Status	Category of Well
48/12-2	Exploration	AB3	PL-0-0-0
48/12a-7	Appraisal	AB3	PL-0-0-0
48/12a-7Y	Gas Production	AB3	PL-0-0-0
48/12a-7Z	Gas Production	AB3	PL-0-0-0
48/12a-G2	Gas Production	AB3	PL-0-0-0
48/12a-G3	Gas Production	AB3	PL-0-0-0

Galahad was used to export wet gas from its three wells and the Mordred well via a 10-inch (”) flowline PL 1627, passing through the Galahad Tee where gas from the Malory field was mixed and onto the Lancelot Subsea Isolation Valve (SSIV). At the Lancelot SSIV, the Galahad, Malory, and Mordred gas was injected into the 20” LAPS pipeline system to the Bacton Gas Terminal.

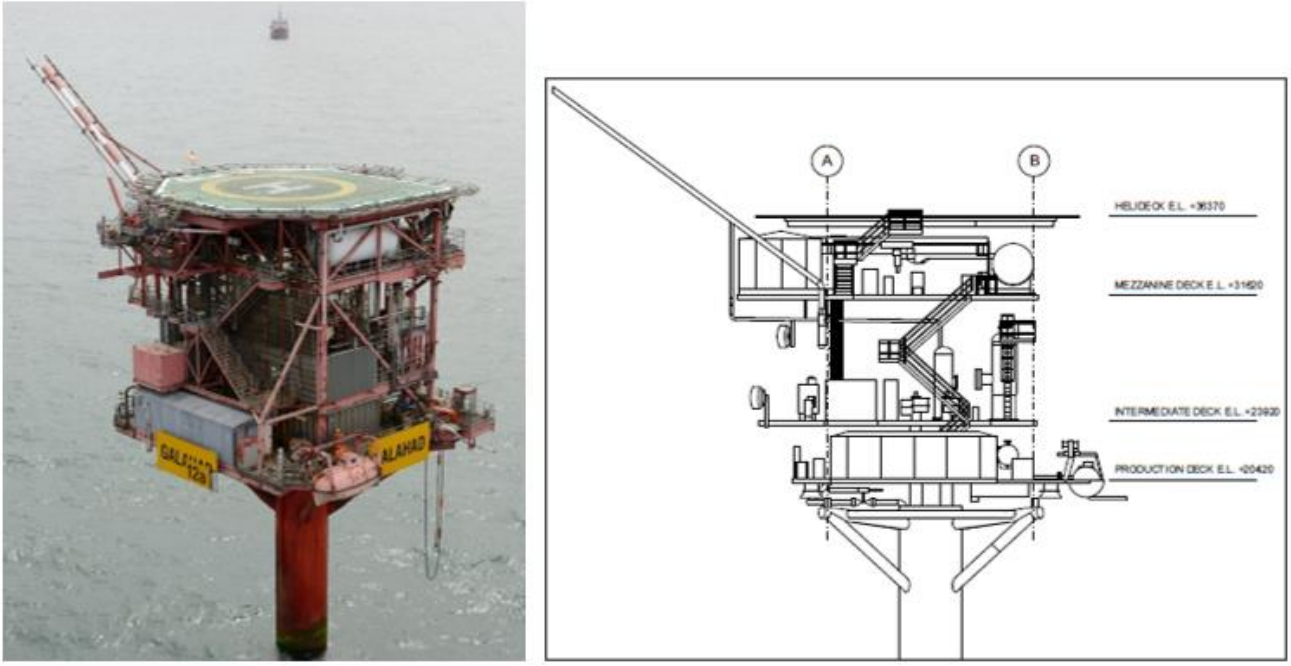


Figure 3.1. Galahad topside and monopod.

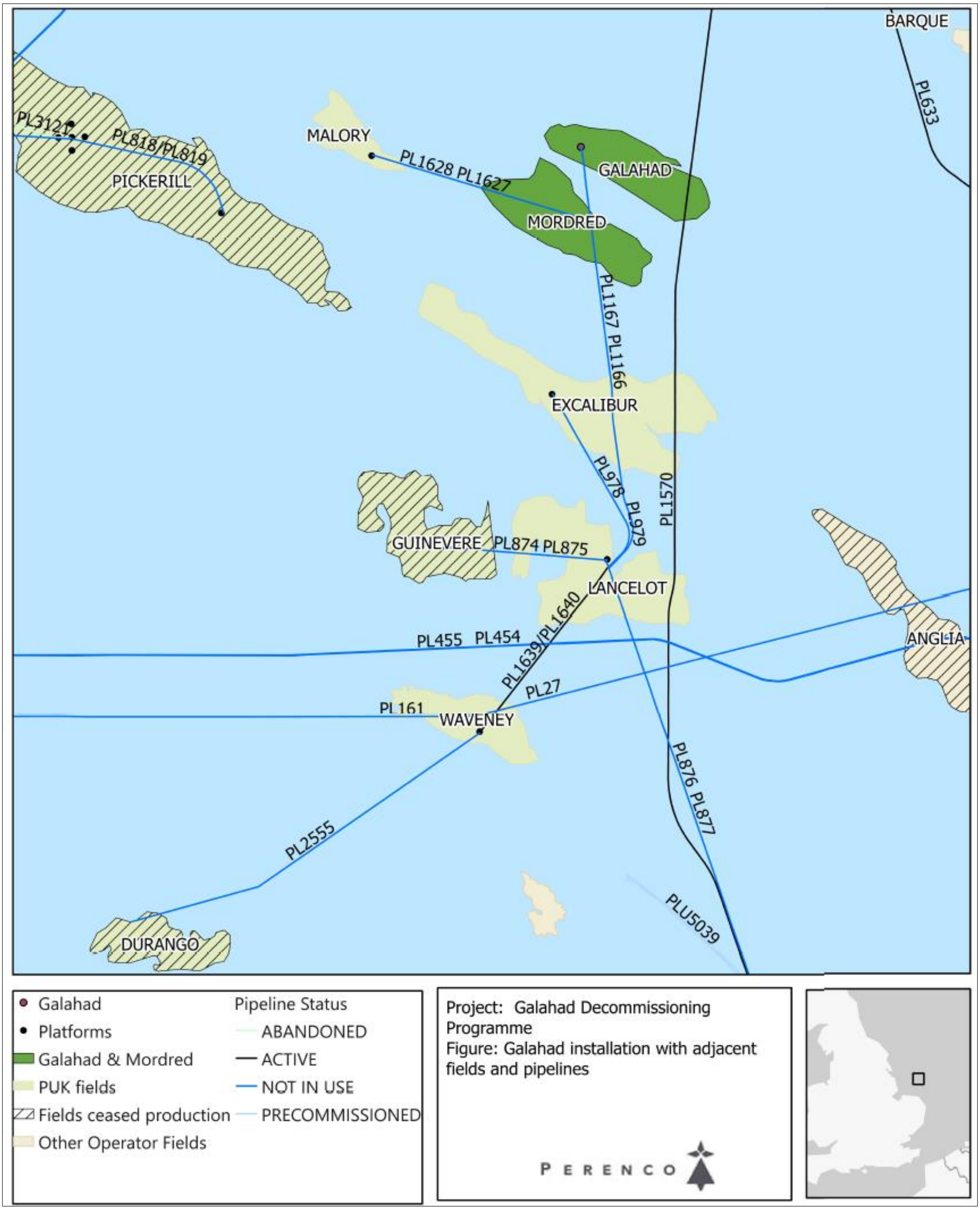


Figure 3.2. Galahad with adjacent fields, installations and pipelines with insert showing pipelines.

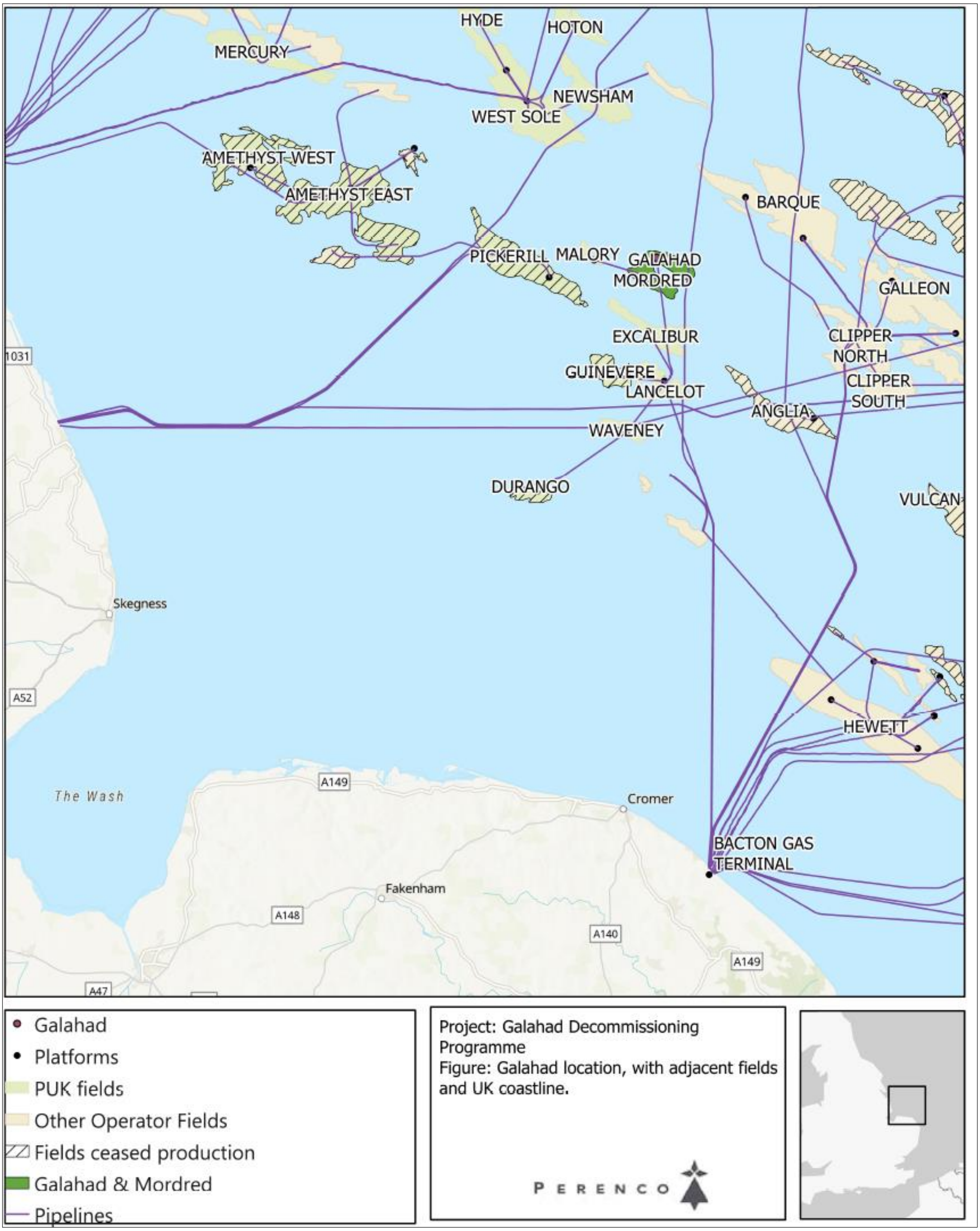


Figure 3.3. Galahad location relative to the adjacent fields and UK coastline.

3.3 Planned Decommissioning Activity

Galahad topside and the monopod will each be removed in a single lift removal option using a suitable Heavy Lift Vessel (HLV) and transportation ashore for cleaning, break up and recycling and is considered the most likely removal methodology at this time. A high-level description of this removal option is presented below.

The riser sections and the protection frame attached to the monopod structure will likely be removed with the monopod, an assessment will be completed as part of the detailed design to confirm they can remain in place during removal.

The pile cuts will be made -3 metres below the seabed level at such a depth to ensure that any remains are unlikely to become uncovered. The means of cutting will be an industry standard technique such as internal high-pressure abrasive water jetting.

The steps presented below provide a high-level chronological summary of the key stages of the Galahad topside and monopod structure dismantling as a single lift using a heavy lift vessel:

- Mobilisation of equipment and personnel to Heavy Lift Vessel.
- Transit of Vessel to Galahad Field.
- Arrive at 500m safety zone and complete pre-entry checks.
- Move into position next to the structure.
- Launch a Remotely Operated Vehicle (ROV) to inspect the structure.
- Transfer topside team to prepare topside for removal (stabbing guides cut).
- Connect rigging to the main crane.
- Connect rigging to topside padeyes.
- Lift topside to the deck of the vessel and seafasten in place.
- Deploy an internal cutting tool to cut all four skirt piles below the seabed (optional 2 lots of cuts per pile to prevent stick-up on HLV).
- Connect rigging to the main crane.
- Connect rigging to the monopod.
- Lift the monopod to the deck of the vessel and seafasten in place.
- Recover any remaining piles sticking out of the seabed.
- Execute as-left survey.
- Clear seabed verification.
- Complete safety checks in preparation for leaving the field and move out of the 500m safety zone.
- Transport monopod to disposal yard for onshore disposal and recycling.

4 Environmental and Societal Baseline

This section describes the physical, environmental, and socio-economic sensitivities of the receiving environment, which could be affected by the decommissioning of the Galahad installation.

The environmental baseline draws upon a number of data sources including published papers on scientific research in the area, the Offshore Energy Strategic Environmental Assessment (BEIS, 2022) and the site-specific surveys, namely a Pre-decommissioning Habitat Assessment & Environmental Baseline Survey (Benthic Solutions, 2021) and a Geophysical Survey (N-Sea, 2020). Seabird nesting surveys of Galahad have been conducted in 2023 and 2024 (Biocensus, 2023; Xodus, 2024).

The survey area lies within 'Region Sea 2' as defined within the Offshore Energy SEA3 (BEIS, 2022).

4.1 Physical Environment

4.1.1 Site Location and Nearest UK Coastline

The Galahad is located within UKCS Block 48/12. At its closest point, the survey area is located approximately 106 km west of the UK/Netherlands median and 68 km from the Lincolnshire coastline.

The chalk cliffs of Flamborough Head fall away to the flatter Holderness coast, characterised by generally low sand and glacial till cliffs which are being quickly eroded. The area has fragmented, remnant semi-natural carr, swamp, and moist grassland environments, and is lightly settled. Holderness terminates at the Spurn peninsula (which is also a Heritage Coast), which comprises a low sand and shingle spit, inland and south of which the Humber Estuary opens, containing internationally important mudflats, wetland, and coastal habitats, but also the industrial influences around Hull and the south bank. The Lincolnshire coast to the south of the Humber contains vast areas of mudflats, major dune systems (such as at Gibraltar Point), but also extensive lengths of artificial sea defences, with larger settlements concentrated on the coast which include resort towns and caravan parks. Both onshore and offshore wind farms are visible in this area of the coast.

The area of the Fens and The Wash are low-lying, the former often below sea level, being largely reclaimed peatland drained between the 17th and 19th centuries. The Wash contains significant salt marsh and mudflats, along with internationally important populations of seals, waders, and wildfowl. On the south side of The Wash, cliffs provide views across to Skegness in the Lincolnshire Coast and Marshes. A distinctive scarp slope separates a low west-east trending chalk escarpment from the coast and inland the landscape is rolling and arable with remnant heath and mixed woodland. This landscape continues along the North Norfolk Coast, where low-lying intertidal sand and mudflats, sand dunes, shingle beaches, saltmarsh, reed beds, tidal creeks and harbours are backed by rural, arable land, but with a significant tourist industry (BEIS, 2022).

Offshore, the seascapes range from open expansive areas with few surface features such as Dogger Bank, to areas which are characterised by human activities and include gas field infrastructure and associated vessel movements, and more recently, offshore wind farms. There are strong associations with the fishing industry including around the Dogger Bank and the potting which takes place off Holderness, and almost every coast is influenced by a relatively dense concentration of shipping, which in some areas such as the Thames, is formalised into designated routes. The area also has strong historical associations going back to the prehistoric occupation of the southern North Sea, to the more recent defence of Britain during World Wars 1 and 2, and the associated coastal defence structures and aviation and maritime losses (BEIS, 2022).

4.1.2 Bathymetry

Across northern and central areas of the survey area, the seabed was generally flat, while the southeastern side was characterised by a slight bathymetric increase, where the shallowest depths were recorded. Water depth was consistent across the Galahad survey area and ranged between approximately 18.4m and 19.8m below LAT. The seabed was mostly covered with irregular ripples and the water depth at the Galahad platform was 19.0m below LAT (N-Sea, 2020). Refer to Figure 4.1.

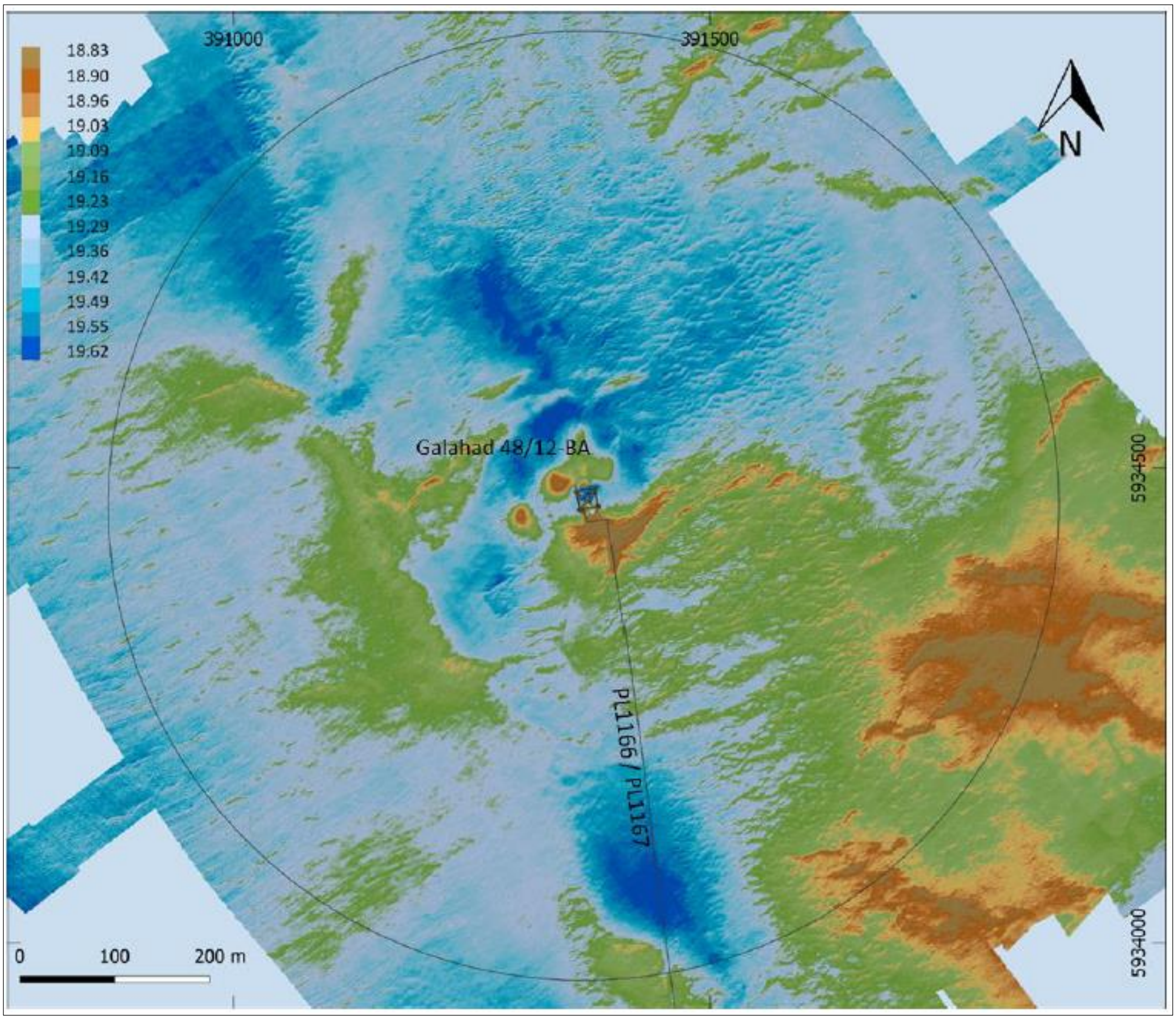


Figure 4.1. Bathymetry at Galahad.

4.1.3 Seabed Sediments and Habitat Classification

4.1.3.1 Seabed Sediment and Bedrock Classification

Seabed mapping conducted by the British Geological Survey (BGS) shows that the seabed sediments at Galahad comprise Holocene **sandy gravel,** overlaying a Mudstone and Limestone bedrock (BGS, 2024).

The habitat survey (Benthic Solutions, 2021) included sediment sampling and particle size analysis, confirming the BGS mapping, by identifying that sediment within the survey area around Galahad was dominated by gravelly sand.

4.1.3.2 EMODnet Predictive Benthic Habitat

The European Marine Observation and Data Network (EMODnet) Seabed Habitats is a broad-scale seabed habitat map for Europe and is a predictive model that maps and classifies intertidal and subtidal habitats according to the European Nature Information Systems (EUNIS) classification criteria (EMODnet, 2024).

Based on EUSeaMap, the EUNIS seabed classification identified at Galahad is **A5.14: Circalittoral Coarse Sediment** (Figure 4.2).

A5.14 - Circalittoral coarse sediment is defined as tide-swept circalittoral coarse sands, gravel, and shingles generally in depths of over 15-20m. This habitat may be found in tidal channels of marine inlets, along exposed coasts and offshore. This habitat, as with shallower coarse sediments, may be characterised by robust infaunal polychaetes, mobile crustacea and bivalves.

Certain species of sea cucumber (e.g., *Neopentadactyla*) may also be prevalent in these areas along with the lancelet *Branchiostoma lanceolatum* (EUNIS, 2021).

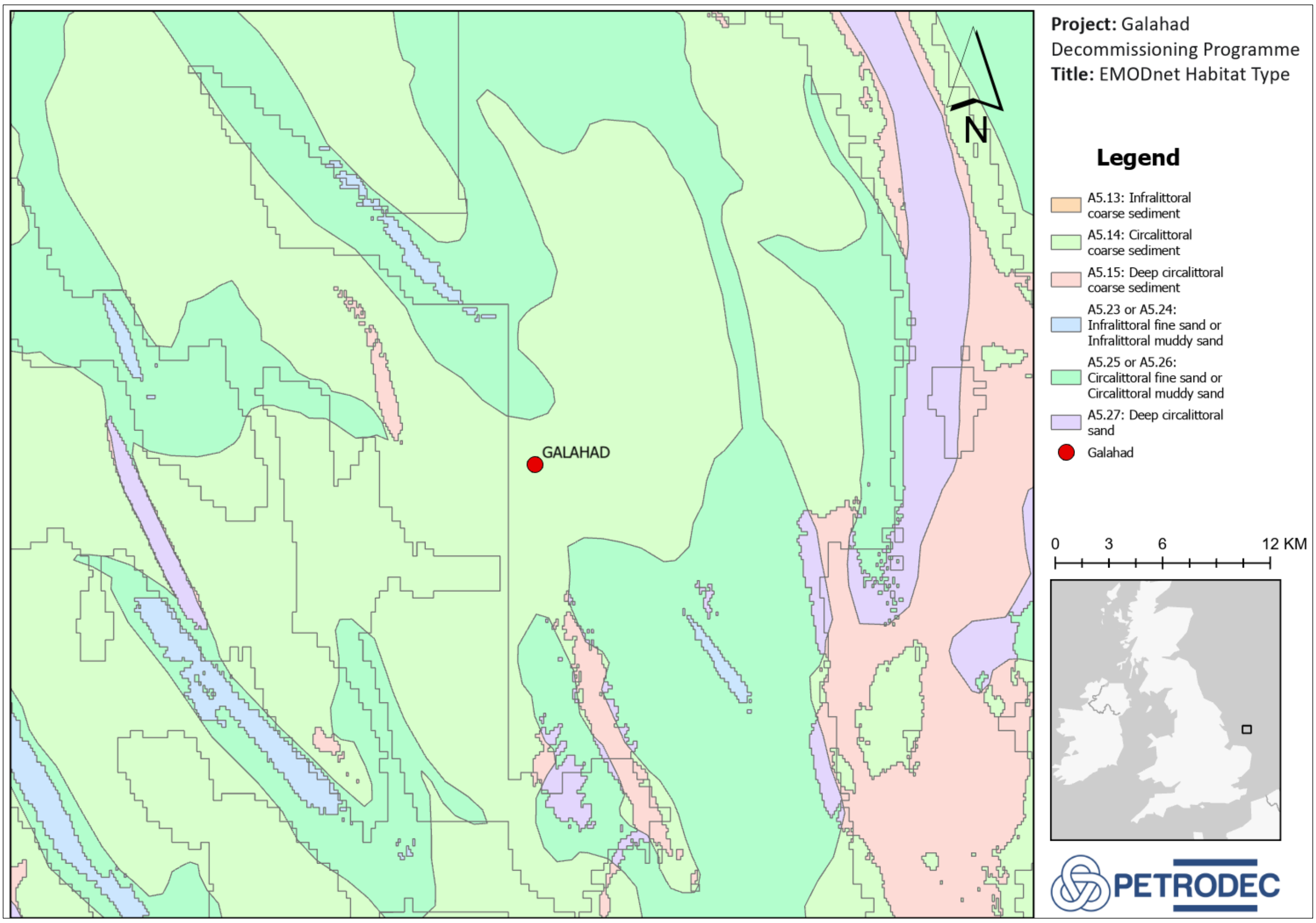


Figure 4.2. EMODnet habitat type for Galahad and surrounding area.

4.1.3.3 Benthic Habitat Survey Findings

The pre-decommissioning habitat and benthic survey at Galahad from November 2020 (Benthic Solutions, 2021) performed camera transects and utilised geophysical survey (N-Sea, 2020) data. Habitats dominated by coarse sand with underlying gravels were observed along all environmental camera transects within the Galahad survey area and at the Galahad reference station and corresponded to mapped areas of ‘gravelly SAND’ in the Galahad geophysical survey (N-Sea 2020). On most transects the sediment was characterised by coarse, irregularly rippled sand, where gravel/pebble material accumulated in patches in the troughs of such ripples, with occasional cobbles and boulders being observed, often partially buried by mobile sands.

Overall, the site conformed to the EUNIS classification of A5.14 ‘**Circalittoral coarse sediment’** (EUNIS, 2021) which corresponds to the JNCC habitat SS.SCS.CCS ‘Circalittoral coarse sediment’ (JNCC, 2015). This biotope is typically found in water depths of 1 to 50m and is often rich in infaunal polychaetes, crustaceans, and bivalves, and is the predicted habitat for this area of the southern North Sea mapped by EMODnet, Refer to Figure 4.3.

Figure 4.3. Example images of circalittoral coarse sediment (A5.14) habitat.

4.1.4 Seabed Chemistry

The pre-decommissioning survey Benthic Solutions (2021) collected eleven grab samples for analysis for Total Organic Carbon, sediment hydrocarbons, PAHs, and heavy metals. The findings are summarised below.

A review of the available drilling reports from when the wells were developed was conducted. There were no reports of Oil Based Mud (OBM) cuttings being discharged to sea.

4.1.4.1 Total Organic Carbon (TOC)

Total Organic Carbon (TOC) represents the proportion of biological material and organic detritus within the substrates. The sediments were analysed for TOC and moisture content; the results of which are presented in Table 4.1. The TOC results were low throughout the Galahad survey area (mean 0.10%), reflecting an organically deprived environment. This is unsurprising given that fines (mud particles) were consistently low across the survey area. TOC in surface sediments is an important source of food for benthic fauna, although an overabundance may lead to reductions in species richness and abundance due to oxygen depletion. Increases in TOC may also reflect increases in both physical factors (i.e., fines) and common co-varying environmental factors through greater sorption on increased sediment surface areas.

Terrestrially derived carbon from runoff and fluvial systems, combined with primary production from sources such as phytoplankton blooms, contribute to the TOC levels recorded in sediments. While both allochthonous and autochthonous sources will be present throughout the Galahad survey area, the general lack of fine sediment, and therefore reduced surface area for adsorption, meant that overall TOC levels were low. This may in turn affect the richness and abundance of deposit-feeding organisms within the sediment.

Table 4.1. Total Organic Matter/Carbon and Moisture Content.

Station	Depth (m)	Distance from Platform (m)	Total Organic Carbon (% M/M)	Moisture Content (% w/w)
Gd1000N	19	1000	0.12	9.6
Gd500N	19	500	0.10	15.0
Gd100N	19	100	0.10	17.9
Gd100E	19	100	0.10	14.7
Gd250E	19	250	0.10	18.0
Gd100S	19	100	0.08	17.9
Gd500S	19	500	0.08	19.8
Gd1000S	19	1000	0.11	13.2
Gd100W	20	100	0.09	21.9
Gd250W	19	250	0.10	16.4
GdREF1	19	2000	0.09	11.7
Mean			**0.10**	**16.0**
SD			**0.01**	**3.6**
CV (%)			**12.2**	**22.5**
Regional Comparison				
Pickerill A (BSL, 2020)	**Mean**		**0.14**	**20.2**
	SD		**0.05**	**3.3**
	CV (%)		**37.8**	**16.5**

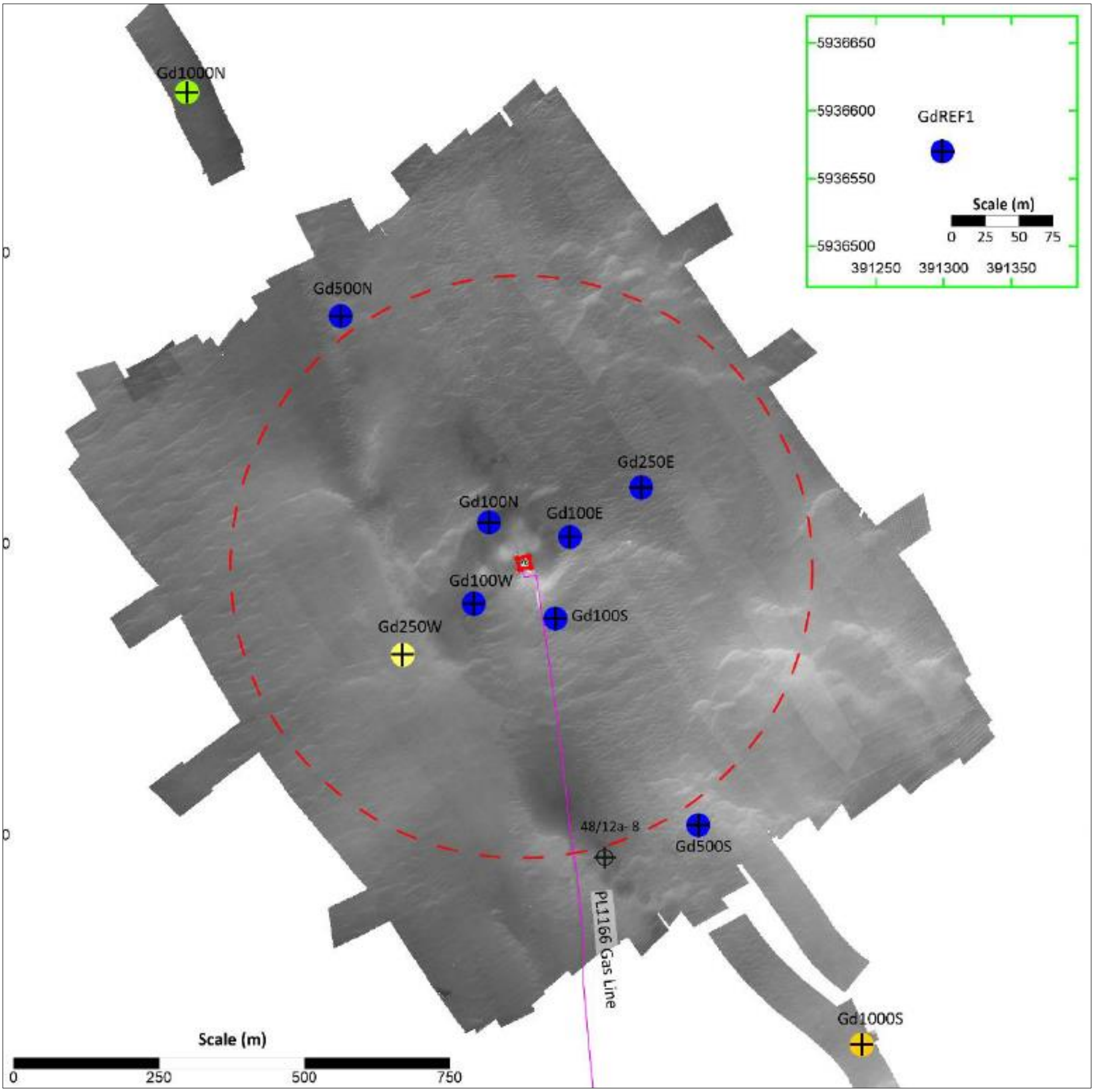


Figure 4.4. Benthic survey stations.

4.1.4.2 Sediment Hydrocarbons

The Total Hydrocarbon Content (THC) of the sediments was measured by integration of all non-polarised components within the GC trace. The measured concentrations ranged from 1.61mg.kg^{-1} to 20.2mg.kg^{-1}, as presented in Table 4.2.

The median background (50th percentile) THC for surface sediments located over 5 km from oil and gas platforms in the southern North Sea was estimated by UKOOA (2001) to be 3.20mg.kg^{-1}, with an upper 95th percentile background concentration of 11.40mg.kg^{-1}.

Four stations within the survey area exceeded the UKOOA 50th percentile for the SNS, with one station also above the UKOOA 95th percentile level. The station recording the highest THC (250m W), was located 250m from the Galahad platform, perpendicular to the prevailing current direction, suggesting the possibility of some low-level historic drilling impact. Overall, four station concentrations were elevated above typical background levels for the SNS (UKOOA, 2001), and the average recorded value for the Galahad site was slightly above the 50th percentile background level.

Higher concentrations of up to 450mg.kg^{-1} have been reported around oil and gas installations (Dann *et al.,* 1992) and no stations showed levels above the OSPAR (2006) 50mg.kg^{-1} threshold for THC, used to delineate the chemical boundaries of cuttings piles and above which impacts on the biota may occur.

Table 4.2. Hydrocarbon Concentrations

Station	Depth (m)	Distance from Platform (m)	THC (mg.kg^{-1})	Total n-alkanes (mg.kg^{-1})	Carbon Preference Index	Pristane / Phytane Ratio	Proportion of Alkanes (%)	Total PAHs (µg.kg^{-1})	NPD (mg.kg^{-1})
Gd1000N	19	1000	1.99	0.20	1.42	9.12	10.22	58.7	28.2
Gd500N	19	500	2.79	0.15	1.01	-	5.54	22.2	11.5
Gd100N	19	100	2.22	0.08	1.21	1.44	3.41	7.9	6.5
Gd100E	19	100	1.50	0.13	1.18	4.84	8.63	16.3	11.9
Gd250E	19	250	2.17	0.18	1.26	6.71	8.28	32.0	15.5
Gd100S	19	100	5.32	0.14	1.27	1.90	2.61	31.3	19.9
Gd500S	19	500	1.97	0.10	1.16	4.17	5.22	34.1	21.7
Gd1000S	19	1000	6.50	2.27	1.19	6.08	34.98	45.0	27.6
Gd100W	20	100	4.85	0.14	1.12	2.35	2.95	10.4	6.7
Gd250W	19	250	20.2	0.41	1.31	0.82	2.03	22.5	10.9
GdREF1	19	2000	1.61	0.08	1.24	2.74	4.79	23.8	12.6
Mean			**4.64**	**0.35**	**1.22**	**4.02**	**8.06**	**27.7**	**15.7**
SD			**5.41**	**0.64**	**0.11**	**2.67**	**9.32**	**14.9**	**7.6**
CV (%)			**116.6**	**182.0**	**8.70**	**66.40**	**115.60**	**53.90**	**48.50**
Regional Comparison									
SNS Survey (BSL, 2020)	**Mean**		**8.99**	**0.43**	**1.26**	**4.09**	**4.18**	**566.9**	**429.3**
	SD		**12.03**	**0.69**	**0.32**	**2.87**	**2.57**	**1487**	**1187**
	CV (%)		**133.8**	**161.4**	**25.2**	**70.2**	**61.5**	**262.5**	**276.6**
Reference Levels									
UKOOA (2001) SNS 50th %ile			**3.20**	**0.19**	**1.32**	**-**	**5.94**	**6**	**-**
UKOOA (2001) SNS 95th %ile			**11.40**	**0.78**	**2.12**	**-**	**6.85**	**366**	**-**
OSPAR (2006) THC Threshold			**50.00**	**-**	**-**	**-**	**-**	**-**	**-**

Yellow cell = above UKOOA SNS 50th %ile *Orange cell = above UKOOA SNS 95th %ile* *Red cell = above OSPAR THC Threshold*

4.1.4.3 Polycyclic Aromatic Hydrocarbons (PAH)

Polycyclic aromatic hydrocarbons were analysed at each station using gas chromatography-mass spectrometry (GC-MS). Results of the Single Ion Current (SIC) analyses are summarised in Table 4.2.

PAHs and their alkyl derivatives have been recorded in a wide range of marine sediments with most compounds produced from what is thought to be pyrolytic sources. These include the combustion of organic material such as forest fires, the burning of fossil fuels and, in the case of offshore oil fields, flare stacks. The resulting PAHs, rich in the heavier weight 4-6 ring aromatics, are normally transported to the sediments via atmospheric fallout or river runoff. Another PAH source is petroleum hydrocarbon, often associated with localised drilling activities.

Based on the analysis of sediment samples from Galahad, Total PAH concentrations (2-6 compounds) were low across the survey area with the highest value recorded at station Gd1000N and the lowest at station Gd100N (58.7µg.kg^{-1} and 7.9µg.kg^{-1}, respectively). No significant correlations (p>0.05) were observed between PAH and sediment characteristics. PAH concentrations at all stations exceeded the UKOOA 50th percentile for the SNS of 6.0µg.kg^{-1}, (UKOOA, 2001). Despite this, these levels were also found to sit at the low end of the Centre for Environment, Fisheries and Aquaculture Science (CEFAS) PAH concentrations for sediments surrounding North Sea oil and gas installations which range from 20µg.kg^{-1} to 74,700µg.kg^{-1} (Sheahan *et al.*, 2001).

4.1.4.4 Heavy and Trace Metals

4.1.4.4.1 Non-Normalised Heavy Metals

Metals are generally not harmful to organisms at concentrations normally found in marine sediments and some, like zinc, may be essential for normal metabolism although can become toxic above a critical threshold. To assign a level of context for toxicity, an approach used by Long *et al*. (1995) to characterise contamination in sediments was used. These researchers reviewed field and laboratory studies and identified nine metals that were observed to have ecological or biological effects on organisms. They defined Effect Range Low (ERL) as the lowest concentration of a metal that produced adverse effects in 10% of the data reviewed, whilst Effect Range Median (ERM) designate the level at which half of the studies reported harmful effects. Consequently, metal concentrations recorded below the ERL value are not expected to elicit adverse effects, while levels above the ERM value are likely to be toxic to some marine life.

Of relevance to the offshore oil and gas industry are metals associated with drilling-related discharges. These can contain substantial amounts of barium sulphate (barites) as a weighting agent and barium is frequently used to detect the deposition of drilling fluids around offshore installations. Solid barites are often discharged during the drilling process and contain measurable concentrations of heavy metals as impurities, including cadmium, chromium, copper, lead, mercury, and zinc.

Barium - At Galahad, natural barium levels ranged from 18.1mg.kg^{-1} at station Gd250E to 65.8mg.kg^{-1} at Gd1000N (mean 32.8mg.kg^{-1}). Natural Ba levels were more than the UKOOA (2001) 50th percentile (26mg.kg^{-1}) for the SNS at eight stations, however, no stations exceeded the 95th percentile (272.4mg.kg^{-1}). When Ba was measured by the fusion technique, which more effectively quantifies barium in the barite form used in drilling muds, higher concentrations were recorded but followed a similar pattern to that of natural barium. Barium by fusion results ranged between 136mg.kg^{-1} at station GdREF1 to 398mg.kg^{-1} at station Gd100S (mean 266mg.kg^{-1} ±73SD).

Barium concentrations recorded during the current survey are consistent with natural background levels, with contaminated stations within 500m of active UK platforms often showing concentrations in the thousands of mg.kg^{-1} (e.g., 33,562mg.kg^{-1}; Cefas, 2001; Table 4.3).

Levels of arsenic, vanadium, zinc, and iron were elevated above background levels (UKOOA 95th percentile as a minimum) for at least three stations. The aforementioned metals, in addition to cadmium and mercury, are often associated with drilling-related barite discharges but, in the absence of elevated barium concentrations, it is unlikely that the higher concentrations of these metals within the Galahad survey area are due to historic drilling operations.

Vanadium was recorded in concentrations above the UKOOA 95th percentile (35.8mg.kg^{-1}) at three of the eleven stations sampled, while zinc had concentrations above the UKOOA 95th percentile of 35.8mg.kg^{-1} at four of the stations. However, the presence of elevated vanadium and zinc concentrations at stations up to 2km from the platform, is more consistent with diffuse sources of these metals (e.g., shipping activities, Humber runoff etc) than point source drilling contamination (Table 4.3).

Mercury was below the UKOOA 50th percentile (0.02mg.kg-^{1}) at all but one station, GdREF1 where mercury was equal to this value. Mercury is often associated with barite discharges, however as the reference station situated 2km from the platform was the only station exhibiting mercury levels above the limit of detection, this source is unlikely. This suggests its concentrations at this station and within the Galahad survey area are largely natural (Table 4.3).

Arsenic was elevated above its associated OSPAR ERL and CCME TEL at all stations, ranging from 16.6mg.kg^{-1} at station Gd100W to 36.2mg.kg^{-1} at station Gd1000N (mean 24.5mg.kg^{-1}±6.7SD). High concentrations of arsenic in the western part of the SNS are a common feature for offshore environmental surveys and this phenomenon was discussed by Whalley *et al*. (1999) who suggested that arsenic and other metals were impacted by a combination of the Humber plume and the mobilisation of metal-rich shales by historic regional offshore drilling activities (Table 4.3).

No metals significantly correlated directly with barium (by fusion) concentrations in the survey area ($p<0.05$), however, almost all metals except for mercury, correlated significantly with each other and no metals correlated significantly ($p>0.05$) with distance from the Galahad platform. As such, the observed variations in barium levels are likely to reflect natural associations due to the speciation properties of the metals as opposed to a shared point source of discharge.

Furthermore, aluminium, which is a normaliser metal as it correlates with natural processes, had a significant positive correlation to all metals except mercury. Therefore, it can be assumed that significant positive correlations with other drilling-associated metals are likely to reflect natural associations due to the speciation properties of the metals, as opposed to a shared point source of discharge.

Iron (Fe) is an important metal as it is often associated with other elements, such as arsenic. Iron concentrations ranged from 10,700mg.kg^{-1} at station Gd500S to 24,700mg.kg^{-1} at station Gd1000N and were significantly correlated to all the metals except mercury. Iron concentrations exceeded the UKOOA 95th percentile for the SNS (18,555mg.kg^{-1}) at four stations within the Galahad survey area (Table 4.3).

Overall, while metals were elevated within much of the Galahad survey area, the concentrations are consistent with other studies in the region and are thought to reflect the input of contaminants from the Humber Estuary plume and/or the release of metals from the historic drilling of marine shales in this area of the SNS.

4.1.4.4.2 Normalised Heavy Metals

Normalised heavy and trace metal data were calculated to allow comparison to OSPAR Background Concentrations (BCs) and Background Assessment Concentrations (BACs) (OSPAR, 2014). BCs have been derived from analysis of sub-surface core samples to quantify pristine, pre-industrial metal concentrations, while BACs provide threshold concentrations below which contaminants can be considered at background levels (OSPAR, 2008). Normalisation for nine analysed metals (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn) was undertaken using the current Coordinated Environmental Monitoring Programme (CEMP) normalisation procedure, involving the use of pivot values (OSPAR, 2008). The remaining metals were normalised using a simple ratio approximation as pivot values were not available.

Metal concentrations normalised to 52ppm Lithium are displayed in Table 4.4, along with OSPAR BCs and BACs. As observed for non-normalised metals, no spatial pattern was evident after normalisation, however, where BC and BAC were available most metals exceeded these concentrations at all stations. Normalised metals were significantly elevated above their respective BACs with all values calculated for As and Cd at least double the reference levels for these metals.

Normalisation of lithium attempts to standardise metal data by filtering out the effect that variable clay content will have on metal concentrations and is considered a superior cofactor to aluminium for the normalisation of metal data from sediment derived mainly from the glacial erosion of crystalline rocks, such as those found in the southern North Sea.

Glacially derived sediments tend to be enriched with trioctahedral (T-O-T) phyllosilicates which can amplify results if an aluminium normalisation is undertaken (Loring 1990; Herut & Sandler, 2006). There was little variation in fine content within the survey area, and lithium showed variable positive and negative significant correlations with many of the sediment parameters rather than a distinctly negative or positive link. As such, the normalisation of heavy and trace metals to lithium may not be entirely beneficial within the Galahad survey area. This is further evidenced by most normalised metals exceeding their corresponding BACs, despite falling well below the ERL thresholds.

Table 4.3. Total Heavy and Trace Metal Concentrations (mg.kg^{-1} or ppm).

Station	Depth (m)	Distance from Platform (m)	Arsenic (AR-MS)	Cadmium (AR-MS)	Chromium (AR-MS)	Copper (AR-MS)	Lead (AR-MS)	Mercury (AR-MS)	Nickel (AR-MS)	Tin (AR-MS)	Vanadium (AR-MS)	Zinc (AR-MS)	Aluminium (AR-MS)	Iron (AR-MS)	Lithium (AR-MS)	Barium (AR-MS)	Barium by Fusion (ICPOES)
Gd1000N	19	1000	36.2	0.15	16.4	8.3	13.9	0.01	17.5	1.90	42.0	67.5	5,550	24,700	16.8	65.8	250
Gd500N	19	500	26.8	0.10	9.80	6.1	6.8	<0.01	11.0	<0.5	32.9	38.8	3,420	17,600	9.8	32.2	201
Gd100N	19	100	25.3	0.13	9.20	6.5	6.4	<0.01	10.7	<0.5	32.8	38.1	3,230	17,000	10.5	34.8	267
Gd100E	19	100	31.2	0.11	10.8	7.2	7.0	<0.01	12.0	<0.5	34.3	41.2	3,950	18,600	12.0	35.2	245
Gd250E	19	250	17.3	0.05	6.70	5.0	5.1	<0.01	6.5	<0.5	22.6	23.9	1,900	11,100	5.0	18.1	208
Gd100S	19	100	20.5	0.10	8.50	5.5	7.0	<0.01	8.9	<0.5	26.8	30.1	2,670	13,300	7.4	34.4	398
Gd500S	19	500	17.3	0.06	7.50	5.4	5.2	<0.01	8.1	<0.5	22.6	28.8	2,000	10,700	5.2	26.3	295
Gd1000S	19	1000	28.8	0.14	12.0	5.7	7.0	<0.01	12.1	<0.5	37.0	31.2	3,560	19,200	12.3	29.8	355
Gd100W	20	100	16.6	0.09	7.10	5.8	4.9	<0.01	7.2	<0.5	22.5	26.2	2,050	10,900	5.3	23.1	306
Gd250W	19	250	30.3	0.15	10.5	6.6	7.6	<0.01	12.2	<0.5	37.7	32.6	3,420	18,400	9.8	39.1	262
GdREF1	19	2000	19.7	0.05	7.20	3.3	5.0	0.02	6.6	<0.5	24.6	21.7	1,910	11,800	5.1	22.1	136
Mean			**24.6**	**0.10**	**9.6**	**5.9**	**6.9**	**NC***	**10.3**	**NC***	**30.5**	**34.6**	**3,060**	**15,754**	**9.0**	**32.8**	**266**
SD			**6.7**	**0.04**	**2.8**	**1.3**	**2.5**	**NC***	**3.3**	**NC***	**7.0**	**12.6**	**1,117**	**4,520**	**3.8**	**12.7**	**73**
CV (%)			**27.2**	**36.7**	**29.5**	**21.6**	**36.5**	**NC***	**31.9**	**NC***	**22.9**	**36.3**	**36.5**	**28.7**	**42.4**	**38.8**	**27**
Regional Comparison																	
SNS Survey (BSL, 2020)		**Mean**	**11.30**	**0.10**	**75.5**	**8.19**	**6.05**	**0.02**	**10.1**	**NC***	**29.7**	**26.9**	**3,119**	**13,497**	**-**	**41.3**	**466**
		SD	**3.16**	**0.08**	**8.62**	**3.64**	**1.46**	**0.00**	**5.19**	**NC***	**9.51**	**11.9**	**1,632**	**7,223**	**-**	**28.0**	**720**
		CV (%)	**27.95**	**77.1**	**11.4**	**44.5**	**24.2**	**20.6**	**51.4**	**NC***	**31.9**	**44.3**	**52.3**	**53.5**	**-**	**67.9**	**155.5**
Reference Levels																	
UKOOA 50th Percentile (UKOOA, 2001)			**-**	**0.03**	**6.51**	**2.04**	**6.00**	**0.02**	**3.97**	**-**	**14.7**	**12.2**	**-**	**5,183**		**26**	**-**
UKOOA 95th Percentile (UKOOA, 2001)			**-**	**0.72**	**44.8**	**13.9**	**21.0**	**0.05**	**21.5**	**-**	**35.8**	**35.8**	**-**	**18,555**		**272.4**	**-**
OSPAR ERL (OSPAR, 2009b)			**8.20**	**1.20**	**81**	**34**	**46.7**	**0.15**	**20.9**	**-**	**-**	**150**	**-**	**-**		**-**	**-**
OSPAR ERM (OSPAR, 2009b)			**70**	**9.60**	**370**	**270**	**218**	**0.71**	**51.6**	**-**	**-**	**410**	**-**	**-**		**-**	**-**

Light Yellow cell = above UKOOA 50th %ile *Orange cell = above UKOOA 95th %ile* *Pink cell = above ERL* *Red cell = above ER*

Table 4.4. Normalised Total Heavy and Trace Metal Concentrations (mg.kg^{-1} or ppm).

Station	Depth (m)	Distance from Platform (m)	Arsenic (AR-MS)	Cadmium (AR-MS)	Chromium (AR-MS)	Copper (AR-MS)	Lead (AR-MS)	Mercury (AR-MS)*	Nickel (AR-MS)	Tin (AR-MS	Vanadium (AR-MS)*	Zinc (AR-MS)	Aluminium (AR-MS)	Iron (AR-MS)*	Lithium (AR-MS)	Barium (AR-MS)*	Barium (By Fusion)*
Gd1000N	19	1000	128	0.48	25.75	28.4	46.6	0.04	58.8	7.13	158	231	9,813	92,625	52.0	247	938
Gd500N	19	500	200	0.61	-	43.2	41.8	NC	72.8	NC	272	263	-	145,655	52.0	266	1,663
Gd100N	19	100	168	0.77	-	41.6	34.5	NC	63.1	NC	242	230	-	125,538	52.0	257	1,972
Gd100E	19	100	172	0.51	-	38.2	32.0	NC	59.5	NC	206	207	3,700	111,600	52.0	211	1,470
Gd250E	19	250	689	0.99	-	193	151	NC	195	NC	1,085	771	-	532,800	52.0	869	9,984
Gd100S	19	100	250	1.02	-	64.5	72.6	NC	92.9	NC	378	320	-	187,765	52.0	486	5,619
Gd500S	19	500	575	1.23	-	177	130	NC	227	NC	904	840	-	428,000	52.0	1,052	11,800
Gd1000S	19	1000	152	0.67	7.22	28.2	30.9	NC	58.0	NC	214	142	1,455	111,036	52.0	172	2,053
Gd100W	20	100	505	2.25	-	178	109	NC	176	NC	831	680	-	402,462	52.0	853	11,298
Gd250W	19	250	229	1.02	-	47.3	48.3	NC	82.8	NC	312	212	-	152,276	52.0	324	2,168
GdREF1	19	2000	732	0.90	-	101	133	0.87	181	NC	1073	606	-	514,909	52.0	964	5,935
Mean			**345**	**0.95**	**16.5**	**85.5**	**75.4**	**0.46**	**115**	**7.13**	**516**	**409**	**4,989**	**254970**	**52.0**	**518**	**4,991**
SD			**232**	**0.49**	**13.1**	**65.7**	**46.2**	**0.59**	**65.1**	**-**	**373**	**259**	**4,325**	**175455**	**0.00**	**343**	**4,219**
CV (%)			**67.0**	**51.8**	**79.5**	**76.8**	**61.3**	**130**	**56.6**	**-**	**72.4**	**63.4**	**86.7**	**68.8**	**0.00**	**66.2**	**84.5**
Reference Levels																	
BC (OSPAR, 2014)			**15.0**	**0.20**	**60**	**20**	**25**	**0.05**	**30**		**-**	**90**	**-**			**-**	**-**
BAC (OSPAR, 2014)			**25.0**	**0.31**	**81**	**27**	**38**	**0.07**	**36**		**-**	**112**	**-**			**-**	**-**

Light Yellow cell = above BC *Orange cell = above BAC*

**- = Environmentally inadmissible results as per OSPAR CEMP (2008)*

4.1.5 Oceanography

The waves in the North Sea occur because of long-period swells from the Northern North Sea and North Atlantic, and also from locally generated storms. The wave cycle in the southern North Sea is seasonal with maximum wave heights occurring during the winter (January) (BEIS, 2022). The general circulation of near-surface water masses in the North Sea is cyclonic and is mostly driven by the ingression of Atlantic surface water from the west into the Northern North Sea (NSTF, 1993; BEIS, 2022). Refer to Figure 4.5. Salinities decrease both towards the south and towards the coastline, reflecting the influence of freshwater inputs from the adjacent landmasses.

It is important to note that significant variations in local currents occur in the vicinity of the Galahad and the LAPS Complex due to the presence of large bedforms (e.g., sandbanks and ridges) which can influence near bottom flow and current amplification around these features (Howarth & Huthnance, 1984; Collins *et al*., 1995). The shallow bathymetry and relatively fast water circulation in this area of the southern North Sea led to a relatively well-mixed water column throughout the year (BEIS, 2022). This leads to a consistent level of biological productivity throughout the year, with only minor peaks seen in spring and late summer, which are typical of deeper waters.

Sea surface temperatures in the vicinity of the Galahad are lowest from January to April (5.3 – 8.2°C) and warmer between May and December (9.6 – 16.1°C) with peak sea surface temperatures occurring in July, August, and September (Berx & Hughes 2009). Air temperatures offshore are generally at their lowest in January and February (mean 4°C - 6°C) and highest in July and August (ca. 16°C). Rainfall decreases in a south-north direction. Winds in the Southern North Sea are generally from between south and north-west; however, in spring the frequency of those from the north and east increases. Wind strengths are generally between Beaufort scale 1-6 (1-11m/s) in the summer months with a greater proportion of strong to gale force winds of force 7-12 (14-32m/s) in winter. In January, 20% of winds can be expected to exceed force 7 (14m/s), reducing to 2-4% in July. Easterly winds are not common and can bring exceptionally cold weather in winter (BEIS, 2022).

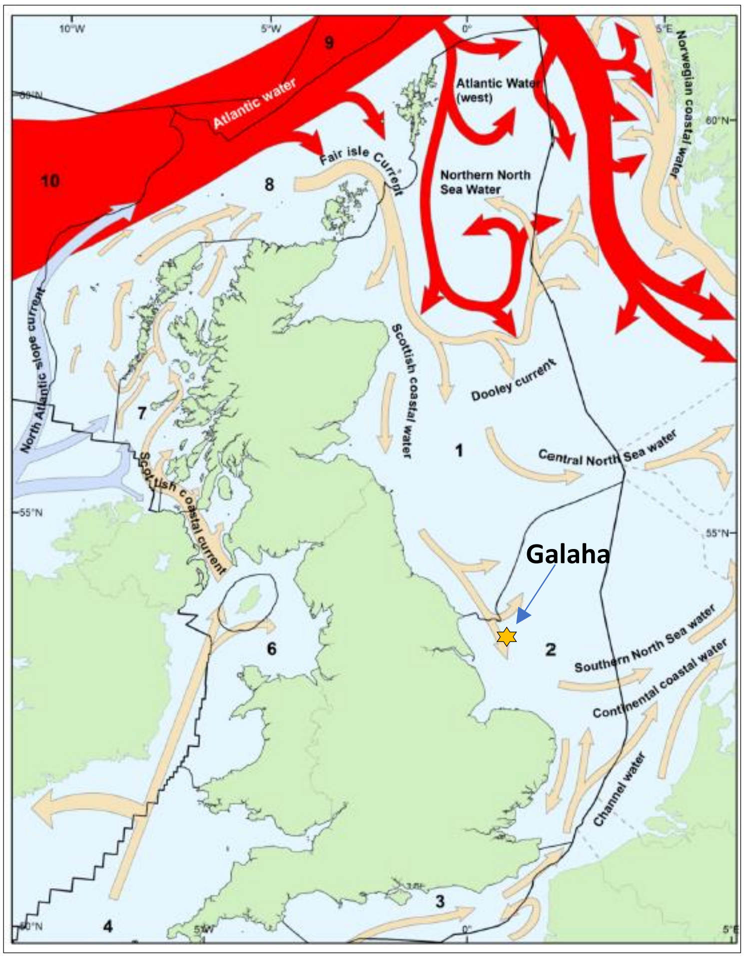


Figure 4.5. Major residual current flows.

4.2 Biological Environment

4.2.1 Plankton

The plankton community may be broadly divided into a plant component (phytoplankton) and an animal component (zooplankton). The ecology of the plankton community is strongly influenced by environmental and, potentially, anthropogenic factors. Consequently, the plankton acts as an important link between the biological and physical components of the ecosystem. Members of the plankton are key producers and primary consumers in marine ecosystems, so population changes will have impacts on organisms at higher trophic levels, with environmental and economic consequences (BEIS, 2022).

The Southern North Sea is characterised by shallow, well-mixed waters, which undergo large seasonal temperature variations. The region is largely enclosed by land and, as a result, the environment here is dynamic with considerable tidal mixing and nutrient-rich run-offs from the land (eutrophication). Under these conditions, there is relatively little stratification throughout the year and constant replenishment of nutrients, so opportunistic organisms such as diatoms are particularly successful. Diatoms comprise a greater proportion of the phytoplankton community than dinoflagellates from November to May, when mixing is at its greatest. The phytoplankton community is dominated by the dinoflagellate genus *Tripos*, along with higher numbers of the diatom, *Chaetoceros* (subgenera *Hyalochaete* and *Phaeoceros*) which are typically found in the Northern North Sea. Phytoplankton biomass is greater in the Northern North Sea and has been increasing since the 1988 ecological shift. Harmful Algal Blooms (HAB) caused by *Noctiluca* spp. are often observed in the region (BEIS, 2022).

The zooplankton community comprises C. *helgolandicus* and *C. finmarchicus* as well as *Paracalanus* spp., *Pseudocalanus* spp., *Acartia* spp., *Temora* spp. and cladocerans such as *Evadne* spp. Commonly seen jellyfish in the region include *A. aurita* and *Chrysaora hysoscella*. There has been a marked decrease in copepod abundance in the Southern North Sea in recent years, possibly linked to the North Atlantic Oscillation (NAO) index, which has a significant impact in the Southern North Sea, where the interface between the atmosphere and the sea is most pronounced (BEIS, 2022). The planktonic assemblage in the vicinity of the Galahad is not considered unusual.

4.2.2 Benthic Biodiversity

A pre-decommissioning habitat and benthic survey was conducted at Galahad in November 2020 (Benthic Solutions, 2021). Environmental sampling within the Galahad survey area involved the acquisition of physico-chemical and macrofauna samples using a Hamon grab sampler and underwater video footage using a BSL MOD4 camera system at a total of 11 stations (ten within the Galahad survey area and an additional reference station). Refer to Figure 4.1 for sampling location.

No invasive non-native species were noted at the site.

4.2.2.1 Macrofauna

Macrofaunal taxonomy of all recovered fauna identified a total of 570 individuals (infauna and solitary epifauna) in 50 taxa from the 22 samples analysed. Of the 50 taxa recorded, one belonged to the solitary epifauna, and 49 were infaunal, consisting of 29 annelid species accounting for 58.6% of the total individuals. The crustaceans were represented by seven species (3.2% of the total individuals), the molluscs by nine species (31.2% of the total individuals) and the echinoderms by a single species (3.3% of the total individuals). Solitary epifauna was represented by a single member of the Cnidaria (Edwardsiidae) accounting for 0.2% of total individuals. All other groups (Nemertea, Nematoda and Chordata) were represented by three species, accounting for 3.5% of the total individuals.

The richness of epifaunal taxa observed is as expected for areas of coarse sand habitat with occasional cobbles providing hard substrata for settlement, as seen around the Galahad platform.

Visible epifauna included mobile Crustacea such as hermit crabs (Paguridae) and the edible crab (*Cancer pagurus).* Echinoderms including the common starfish (*Asterias rubens*) were also observed. Sessile fauna included plumose anemones (*Metridium senile)*, barnacles (Cirripedia), hornwrack Bryozoa (*Flustra foliacea*), *Nemertesia* spp. and hydrozoan/bryozoan turf.

4.2.2.2 Potential Sensitive Habitats and Species

The habitat assessment identified the potential for several sensitive habitats and species. Several potential sensitive habitats and species can be ruled out, whereas other potential sensitive habitats and species are assessed in further detail and presented in Table 4.5.

Table 4.5. Habitat Assessment Summary.

Habitat type	Assessment	Potential presence of habitat
Biogenic reefs formed by *Sabellaria spinulosa*	No *Sabellaria spinulosa* individuals were recorded at any stations, either on video data or within the macrofaunal dataset. A detailed review of the geophysical data also did not reveal any distinctive mottled texture indicative of high-density aggregations of *S. spinulosa*.	None
Horse mussel (*Modiolus modiolus*) beds	No evidence of Horse mussel *Modiolus* beds was observed.	None
Fragile sponge and anthozoan communities on subtidal rocky habitats	The UKBAP, Annex I habitat fragile sponge and anthozoan communities on subtidal rocky habitats are known to occur within the nearby Holderness Inshore MCZ but were not thought to be present in the survey area. During video inspection little to no sponge communities were recorded, which are essential for the designation of this sensitive habitat.	None
Ocean quahog (*Arctica islandica*)	No evidence of *Arctica islandica* (ocean quahog) - no individuals were recorded in the macrofauna data at Galahad. No potential relict shells were observed along video transects, and no live individuals or their distinctive siphons were noted during the analysis of video footage and still photographs from the survey area.	None
Stony reefs formed from iceberg scour or moraine deposits	Low potential for Annex I Stony Reef. The presence of sporadic cobbles and boulders was recorded in video footage across the survey area, with increased densities noted at stations Gd100N and Gd_HAS01. Station Gd_HAS01, which was designated to investigate a bathymetric height of up to 30cm elevation was revealed to be mainly composed of gravel, stabilised by coarse sands with occasional boulders embedded within this matrix and constituted a coarse sediment habitat like that observed across the survey area. The densities and elevations of the recorded cobbles and boulders were insufficient to constitute a stony reef habitat at any station (i.e., <10% cover), and as such an assessment was not required.	Low
Herring spawning grounds	There is a low potential for Herring Spawning Grounds (HSG) in the area. The potential was as Galahad's proximity to CEFAS delineated herring spawning grounds. Of relevance to this area is the bank stock that inhabits this region of the North Sea. Spawning of this stock occurs during August to October and suitable HSGs include sediments that are well-oxygenated, allowing their sticky eggs to gestate for around three weeks before they hatch. From the data retrieved in this survey the sediment types identified appear unsuitable as an HSG due to the mixed nature of the coarser sediments retrieved and associated poor sorting. Most stations exhibited a bimodal distribution of sands and gravels, being classified as poorly or very poorly sorted. Those stations exhibiting a higher degree of sorting (Gd100W, Gd250E, GdREF1, and Gd500S) were represented by medium sands and as such likely have insufficient porosity to allow for the oxygenation of herring eggs. The slightly raised sediments found south-east of the Galahad platform and	Low

	investigated in camera transect Gd_HAS01 exhibited a higher observed gravel content in the video footage, however this gravel was embedded in a matrix of finer sand material and as such still represents a poorly sorted sediment, lacking the characteristic winnowing away of fine material found in many HSGs. As such, although no particle size data is available for this area it still exhibits a low potential for the presence of HSGs.	
Sandeel habitat	Sandbanks and other sandy substrates may be important habitats for sandeels, small, thin eel-like fish that form large shoals and live most of their life buried in the seabed (Ellis *et al.*, 2010). They are considered an important component of marine food webs providing food for marine predators such as seabirds, mammals, and other fish. Spawning generally takes place in December and January where females lay their demersal eggs on the seabed. The planktonic larvae hatch after several weeks, usually in February-March. The Galahad survey area falls within a low-intensity spawning ground for sandeels that encompasses the majority of the southern North Sea (Ellis *et al.*, 2010). Sandeels were observed on video footage at one station within the Galahad survey area and recorded in the macrofaunal dataset at four stations. Sandeels require specific sediment, favouring substratum with a high proportion of medium and coarse sand and low silt content. Particle size analyses for the current survey identified three Folk classifications ranging from "Slightly gravelly sand" to "Sandy gravel", and no stations exhibited fines content above 5%, meaning that the area cannot be ruled out as potential sandeel habitat. However, only one individual was noted in video data, and seven individuals were recorded in macrofaunal data across the four stations where sandeels were observed, and other factors such as salinity conditions, zooplankton densities, etc. have been reported to play an important role in sandeel abundance. Furthermore, even apparently optimal habitats may not be occupied by sandeels when populations are below the area's carrying capacity.	Low
Sandbanks which are slightly covered by seawater all the time	The Annex I habitat sandbanks which are slightly covered by seawater all the time are sandy sediments that are permanently covered by shallow sea water, typically occurring at depths of less than 20m below LAT. Whilst not within a designated SAC for sandbanks, the Galahad survey area lies approximately 4 km south-east of a known Annex I sandbank, known as "additional bank 92", with other sandbanks also present nearby. Water depths at these sandbanks range from approximately 10 to 15 meters below LAT, whereas water depths at Galahad were at a minimum of 18m below LAT. The predicted sediment type at the sandbanks is defined as circalittoral medium to fine sands and is used in the designation of sandbank habitats. In contrast to this, the sediment type found at the Galahad survey area was predominantly coarse gravelly sand, however, the JNCC definition for sandy sediments required to designate Annex I sandbanks encompasses coarse and gravelly sands, requiring only a gravel content of <30% and higher sand content than fines content (JNCC, 2017). Despite the deeper water depth in the Galahad survey area, the predominantly sandy sediment and shallow water depth mean there is a possibility of Annex I sandbank habitat being present at the site.	Low

4.2.3 Fish and Shellfish

The Southern North Sea is a dynamic ecosystem characterised by a sandy, flat, shallow seabed and considerable tidal mixing, and provides spawning and nursery grounds for several demersal and pelagic species. Species diversity within the fish community is greater in the Southern North Sea than in the Central or Northern North Sea and within the Southern North Sea, fish diversity is greatest in the west (BEIS, 2022). The North-East Atlantic and North Sea are divided into statistical grids called International Council for the Exploration of the Sea (ICES) Rectangles to facilitate the mapping of fisheries information. Galahad is located within ICES Rectangle 36F1.

Species that spawn within ICES Rectangle 36F1 include cod (*Gadus morhua*), lemon sole (*Microstomus kitt*), mackerel (*Scomber scombrus*), the crustacean *Nephrops norvegicus* (also known as the Dublin Bay prawn), plaice (*Pleuronectes platessa*), sole (*Solea solea*), sprat (*Sprattus sprattus*) and whiting (*Merlangius merlangus*) (Coull *et al*., 1998; Ellis *et al*., 2012). Refer to Table 4.6 and Figure 4.6.

ICES Rectangles 36F1 acts as also nursery grounds for Angler fish *Lophius piscatorius*), Cod, Herring, Horse Mackerel (*Trachurus trachurus*), Lemon Sole, Mackerel, Nephrops, sandeels (Ammodytes sp.), Sprat, Tope Shark and whiting.

Sandeels, like herring, exhibit a dependency on specific substratum for spawning. Sandeels lay their eggs in shallow sandy sediments in sticky clumps. Hatching success and recruitment can be affected by activities that disturb such sediments such as benthic fishing, seabed construction and dredging. Sandeels are also considered to be a key component of the North Sea fishery and are also a key food source for predatory fish and seabirds (BEIS, 2022).

In addition, on the IUCN Red List, global populations of Tope Sharks are listed as Critically Endangered, Cod and Horse Mackerel are listed as Vulnerable. Anglerfish, Herring, Lemon Sole, Mackerel, Nephrops, Plaice, Sandeel, Sprat, and Whiting are listed as Least Concern (IUCN, 2024).

Table 4.6. Species utilising ICES Rectangle 36F1 as spawning and nursery grounds (Coull *et al.,* 1998; Ellis *et al.,* 2012[1])

Species	Binomial name	J	F	M	A	M	J	J	A	S	O	N	D
Anglerfish	*Lophius piscatorius*	N	N	N	N	N	N	N	N	N	N	N	N
Cod	*Gadus morhua*	S N	S N	S N	S N	N	N	N	N	N	N	N	N
Herring	*Clupea harengus*	N	N	N	N	N	N	N	S N	S N	S N	N	N
Horse Mackerel[3]	*Trachurus trachurus*	N	N	N	N	N	N	N	N	N	N	N	N
Lemon Sole	*Microstomus kitt*	N	N	N	S N	S N	S N	S N	S N	S N	N	N	N
Mackerel[2]	*Scomber scombrus*	N	N	N	N	S N	S N	S N	S N	N	N	N	N
Nephrops[2]	*Nephrops norvegicus*	S N	S N	S N	S N	S N	S N	S N	S N	S N	S N	S N	S N
Plaice	*Pleuronectes platessa*	S	S	S	-	-	-	-	-	-	-	-	S
Sandeels	*Ammodytes spp.*	S N	S N	N	N	N	N	N	N	N	N	S N	S N
Sprat[2]	*Sprattus sprattus*	N	N	N	N	S N	S N	S N	S N	N	N	N	N
Tope Shark[4]	*Galeorhinus galeus*	S N	S N	S N	S N	S N	S N	S N	S N	S N	S N	S N	S N
Whiting	*Merlangius merlangus*	N	S N	S N	S N	S N	S N	N	N	N	N	N	N

Legend

S	Peak Spawning	S	Spawning	N	Nursery	No Activity Recorded	-

1. All data from Ellis et al 2012 unless otherwise stated (see note 2).
2. Mackerel spawning and Sprat spawning and nursery, and Nephrops breeding grounds based on Coull *et al. (1998)*.
3. Horse mackerel appear to be widespread and with no spatially discrete nursery grounds (Ellis et al., 2012).
4. Viviparous species such as Tope Shark that gives birth to live young *(Ellis et al., 2012).*

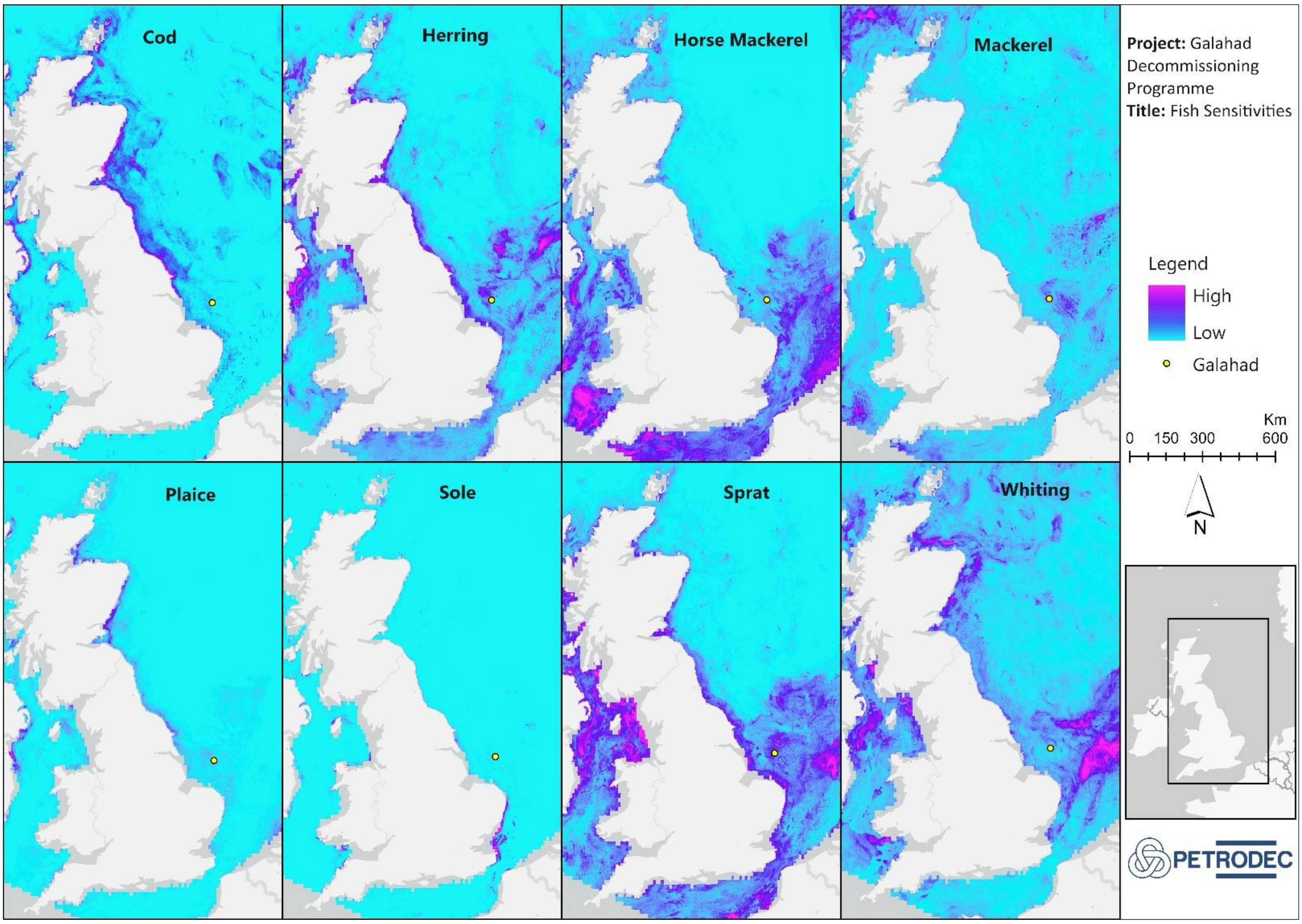


Figure 4.6. Fish sensitivities for Galahad and surrounding areas.

4.2.3.1 Elasmobranch Species

Elasmobranch species (sharks, skates, and rays) are also an important component of the North Sea ecosystem. Elasmobranchs have a low fecundity and slow growth rate, leaving them vulnerable to overfishing pressures and pollution events, and the subsequent recovery of populations in response to disturbance events is low. While species are typically not subjected to targeted fisheries, they are still under threat from commercial pelagic and demersal fishery by-catch.

Ellis *et al.* (2004) recorded 26 elasmobranch species throughout the North Sea and surrounding waters. Species which have been recorded in the Southern North Sea at various times throughout the year and may therefore be present in the vicinity of the survey area are listed in Table 4.7 (Ellis *et al*., 2004; IUCN, 2024). Of most concern out of the elasmobranch species found in Block 48/12, are Tope Shark which is listed as Critically Endangered on the IUCN Red List, and Common Smooth-Hound and Undulate Skate which are listed as Endangered. In addition, populations of Blonde Skate, Starry Smooth-Hound and Thornback Skate are listed as Near Threatened (IUCN, 2024).

Table 4.7. Elasmobranch Species Likely to be found in Block 48/12.

Common Name	Latin Name	Depth Range (m)	Global IUCN Status[1]	European IUCN Status[1]
Blonde skate	*Raja brachyura*	10 - 900	Near Threatened	Near Threatened
Common smooth hound	*Mustelus mustelus*	5 - 350	Endangered	Endangered
Thorny skate/ Starry ray	*Amblyraja radiata*	18 - 1400	Vulnerable	Vulnerable
Small spotted catshark	*Scyliorhinus canicula*	< 400	Least Concern	Least Concern
Spiny dogfish	*Squalus acanthias*	15 - 528	Vulnerable	Vulnerable
Spotted skate	*Raja montagui*	< 530	Least Concern	Least Concern
Starry smooth hound	*Mustelus asterias*	0 - 100	Near Threatened	Near Threatened
Thornback Skate	*Raja clavata*	10 - 300	Near Threatened	Near Threatened
Tope shark	*Galeorhinus galeus*	0 - 2000	Critically Endangered	Critically Endangered
Undulate skate	*Raja undulata*	50 - 200	Endangered	Endangered

[1]*Status as of June 2024 (IUCN, 2024)*

4.2.4 Seabirds

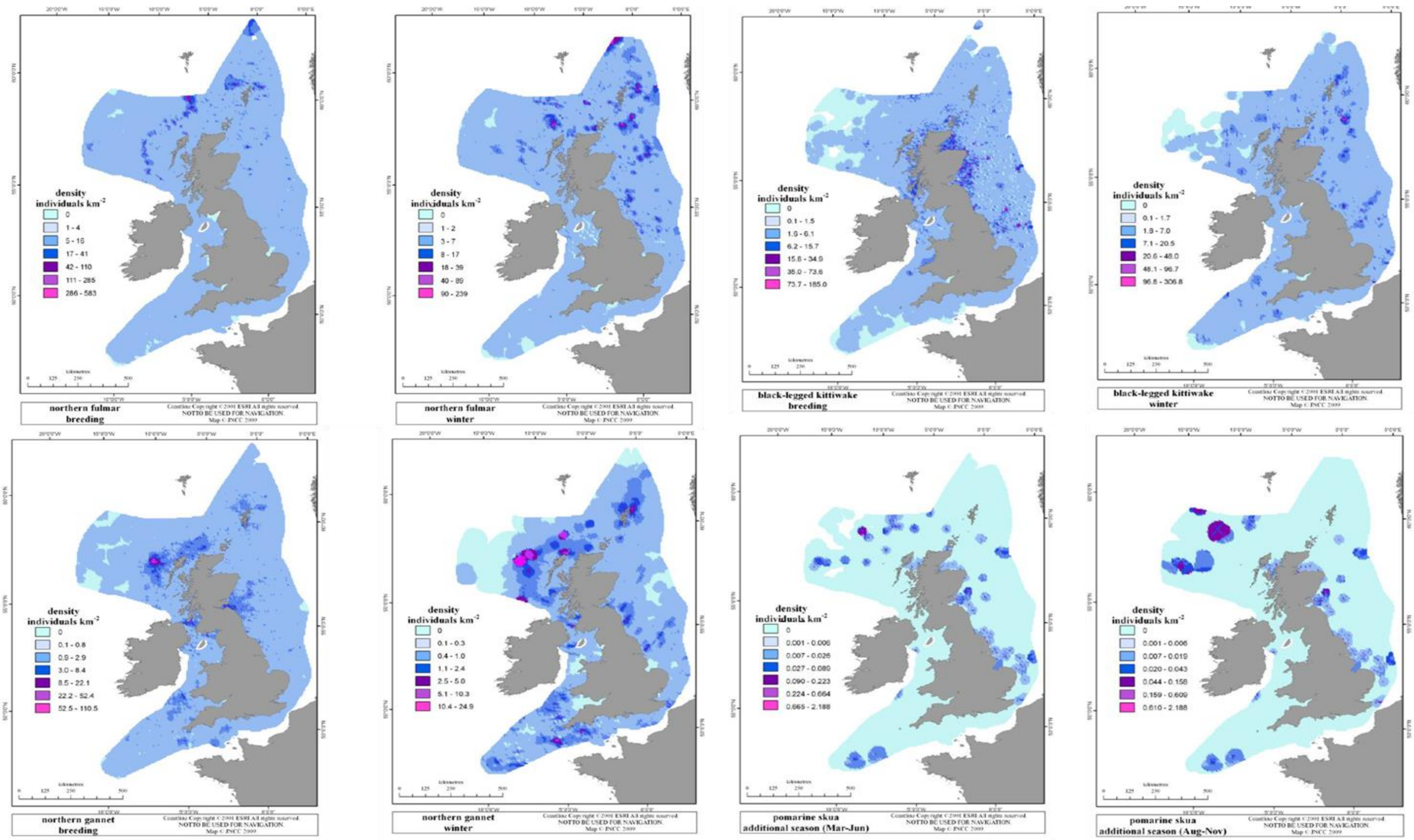
Seabird distribution and abundance in the Southern North Sea varies throughout the year, with offshore areas in general, containing peak numbers of birds following the breeding season and through winter. Zones where water masses meet, hydrographic fronts, can have enhanced primary productivity and aggregations of other marine organisms, including birds. A year-round frontal system off the coast of Flamborough Head – the Flamborough Front – is an important hydrographic feature close to the boundary between Regional Seas 1 and 2. The numbers of seabirds at sea are generally lower in Regional Sea 2 compared with waters further north. In October, there is a southward shift of common guillemot and razorbill populations with high concentrations of auks offshore, particularly in the southern gas fields off Norfolk and Lincolnshire (BEIS, 2022).

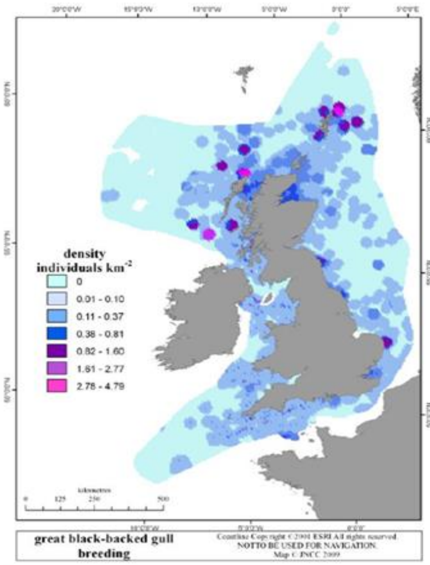
The counties along the east and south-east of England support an array of breeding seabirds, some of importance in a national and international context. The most important seabird breeding colonies in Regional Sea 2 (listed in geographical order, from north to south) are Flamborough and Filey Coast for Black-legged kittiwake, common guillemot, razorbill, northern gannet; Humber Estuary and Gibraltar Point for little terns, and The Wash for common tern and little tern (BEIS, 2022).

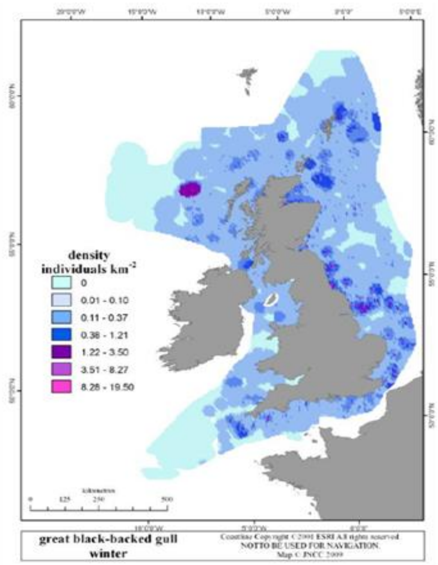
4.2.4.1 At-Sea Distribution of Seabirds

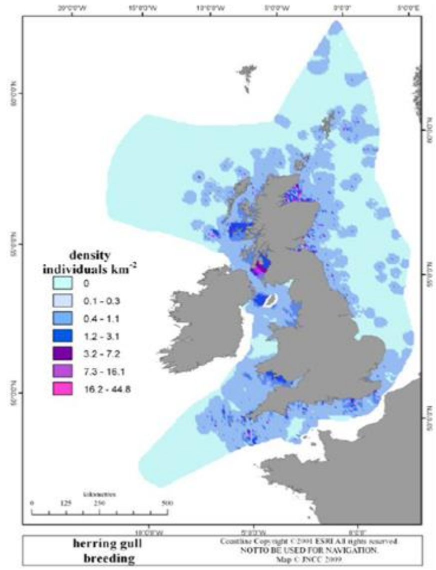
The European Seabirds at Sea (ESAS) database has been recording and monitoring the distribution of seabirds at sea, compiling a range of boat and transect data, since 1979 (ESAS, 2024). The data indicates that the proposed surveys do not lie within a hotspot area, defined as an important area of high seabird density at sea. Kober *et al* (2010) detail seabird density within the British Fishery Limit and document the birds of highest abundance within the vicinity of the proposed survey. Of the seabird species mentioned in Figure 4.7, the seabirds of most concern are the black-legged kittiwake (*Rissa tridactyla*) and the Atlantic puffin (*Fractercula arctica*) which are listed as Vulnerable on the IUCN red list (2024).

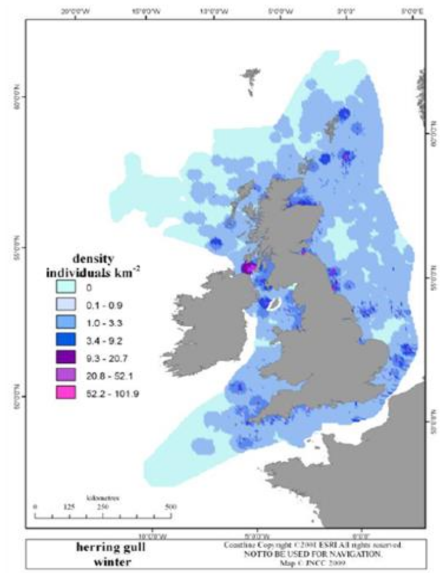
Figure 4.7. Seabird density surface maps for the species identified as frequently occurring in Block 48/12 (Kober et al, 2010).

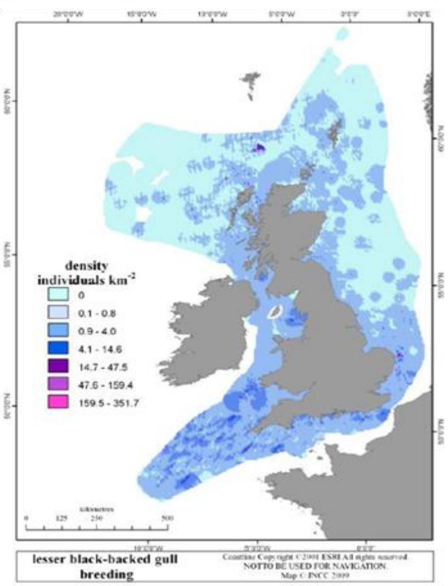


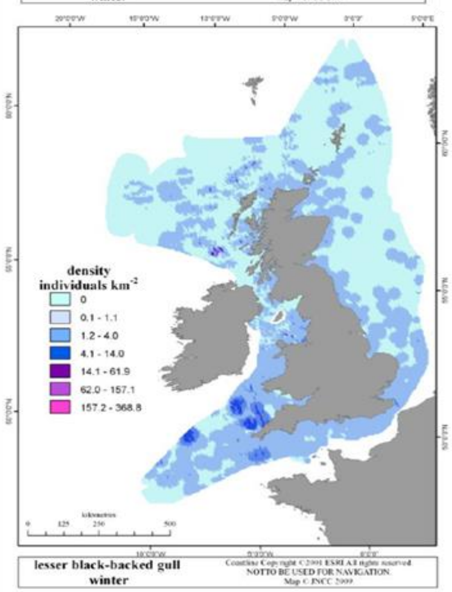

density individuals km^{-2}
0
0.01 - 0.10
0.11 - 0.37
0.38 - 0.81
0.82 - 1.60
1.61 - 2.77
2.78 - 4.79
great black-backed gull breeding
NOT TO BE USED FOR NAVIGATION

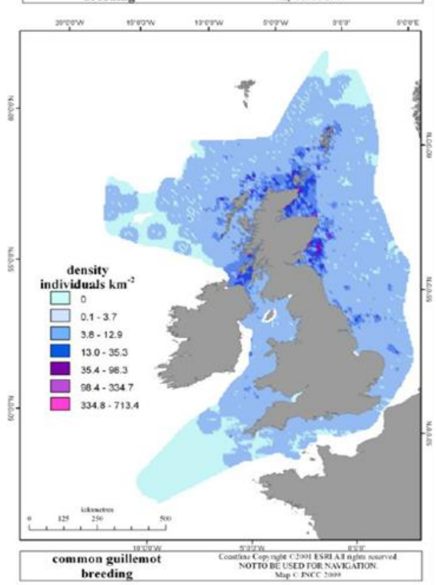

density individuals km^{-2}
0
0.01 - 0.10
0.11 - 0.37
0.38 - 1.21
1.22 - 3.50
3.51 - 8.27
8.28 - 19.50
great black-backed gull winter
NOT TO BE USED FOR NAVIGATION

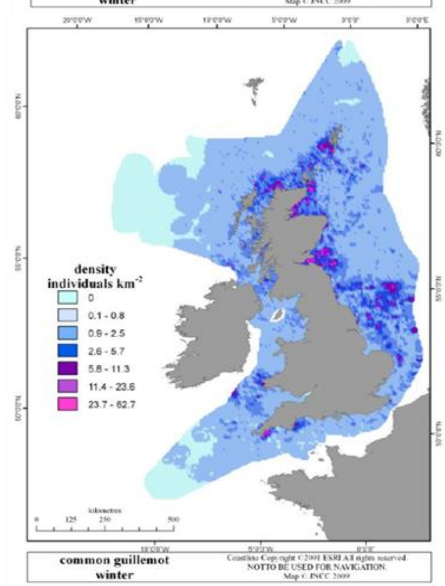

density individuals km^{-2}
0
0.1 - 0.3
0.4 - 1.1
1.2 - 3.1
3.2 - 7.2
7.3 - 16.1
16.2 - 44.8
herring gull breeding
NOT TO BE USED FOR NAVIGATION

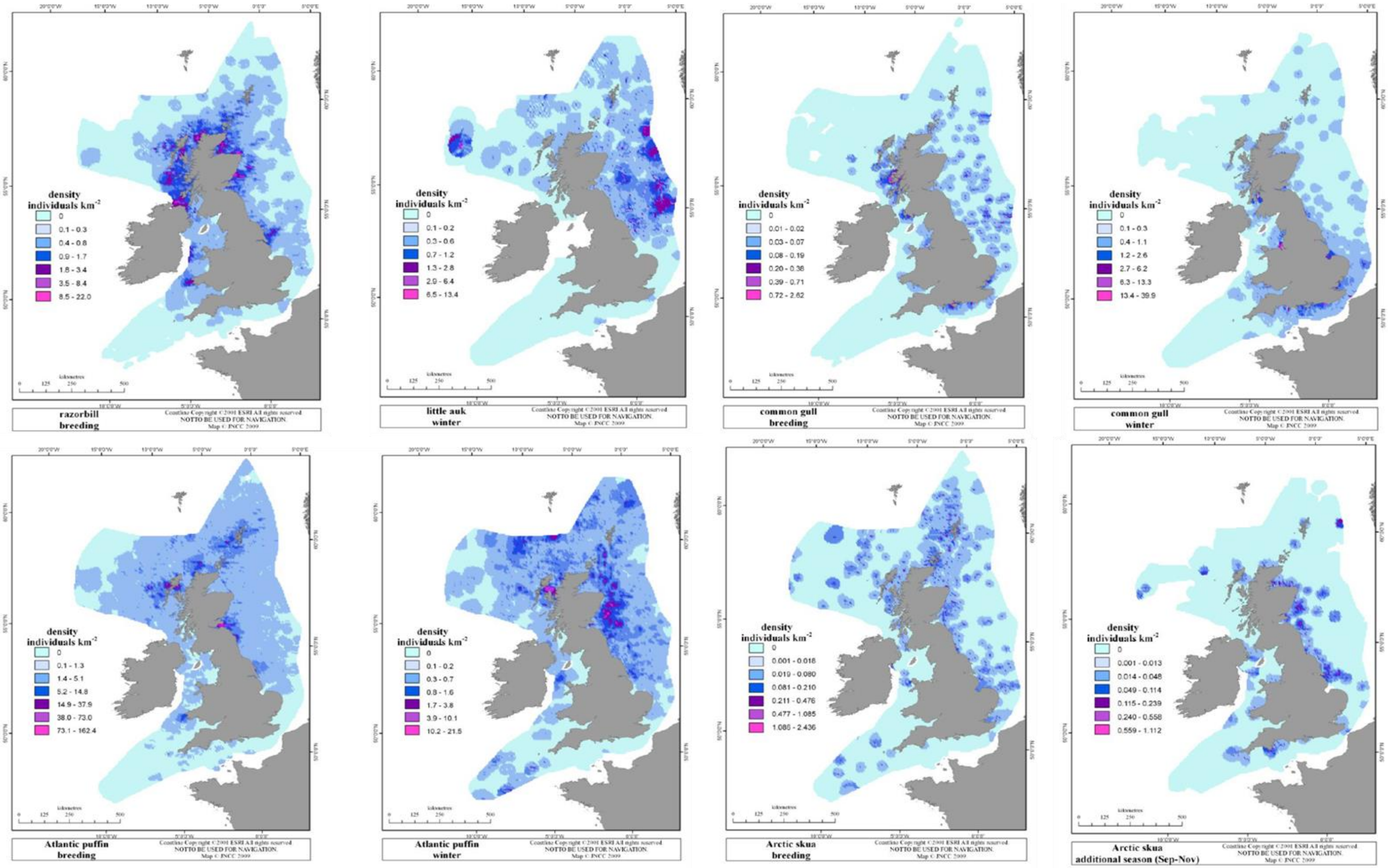

density individuals km^{-2}
0
0.1 - 0.9
1.0 - 3.3
3.4 - 9.2
9.3 - 20.7
20.8 - 52.1
52.2 - 101.9
herring gull winter
NOT TO BE USED FOR NAVIGATION


density individuals km^{-2}
0
0.1 - 0.8
0.9 - 4.0
4.1 - 14.6
14.7 - 47.5
47.6 - 159.4
159.5 - 351.7
lesser black-backed gull breeding
NOT TO BE USED FOR NAVIGATION


density individuals km^{-2}
0
0.1 - 1.1
1.2 - 4.0
4.1 - 14.0
14.1 - 61.9
62.0 - 157.1
157.2 - 368.8
lesser black-backed gull winter
NOT TO BE USED FOR NAVIGATION


density individuals km^{-2}
0
0.1 - 3.7
3.8 - 12.9
13.0 - 35.3
35.4 - 98.3
98.4 - 334.7
334.8 - 713.4
common guillemot breeding
NOT TO BE USED FOR NAVIGATION


density individuals km^{-2}
0
0.1 - 0.8
0.9 - 2.5
2.6 - 5.7
5.8 - 11.3
11.4 - 23.6
23.7 - 62.7
common guillemot winter
NOT TO BE USED FOR NAVIGATION



razorbill breeding
density individuals km^{-2}
0
0.1 - 0.3
0.4 - 0.8
0.9 - 1.7
1.8 - 3.4
3.5 - 8.4
8.5 - 22.0
little auk winter
density individuals km^{-2}
0
0.1 - 0.2
0.3 - 0.6
0.7 - 1.2
1.3 - 2.8
2.9 - 6.4
6.5 - 13.4
common gull breeding
density individuals km^{-2}
0
0.01 - 0.02
0.03 - 0.07
0.08 - 0.19
0.20 - 0.38
0.39 - 0.71
0.72 - 2.62
common gull winter
density individuals km^{-2}
0
0.1 - 0.3
0.4 - 1.1
1.2 - 2.6
2.7 - 6.2
6.3 - 13.3
13.4 - 39.9
Atlantic puffin breeding
density individuals km^{-2}
0
0.1 - 1.3
1.4 - 5.1
5.2 - 14.8
14.9 - 37.9
38.0 - 73.0
73.1 - 162.4
Atlantic puffin winter
density individuals km^{-2}
0
0.1 - 0.2
0.3 - 0.7
0.8 - 1.6
1.7 - 3.8
3.9 - 10.1
10.2 - 21.5
Arctic skua breeding
density individuals km^{-2}
0
0.001 - 0.018
0.019 - 0.080
0.081 - 0.210
0.211 - 0.476
0.477 - 1.085
1.086 - 2.436
Arctic skua additional season (Sep-Nov)
density individuals km^{-2}
0
0.001 - 0.013
0.014 - 0.048
0.049 - 0.114
0.115 - 0.239
0.240 - 0.558
0.559 - 1.112
NOTTO BE USED FOR NAVIGATION

4.2.4.2 Seabird Surveys of Galahad

Perenco UK commissioned seabird nesting surveys of its offshore assets in 2023 (Biocensus, 2023) and 2024 (Xodus, 2024). During both surveys, ornithologists onboard a chartered vessel conducted a seabird nesting of the Galahad. In 2023 and 2024 there were no nesting birds on Galahad. In 2023, two Kittiwakes were observed loafing on the topside during the survey. In the 2024 survey, four Kittiwakes were noted to be loafing on Galahad.

4.2.4.3 Seabird Vulnerability to Oil Pollution

Seabird populations are particularly vulnerable to surface pollution. The vulnerability of bird species to oil pollution varies considerably throughout the year and is dependent on a variety of factors, including time spent on the water, total biogeographical population, reliance on the marine environment and potential rate of population recovery. Species considered most vulnerable to sea surface pollution are those which spend a great deal of time on the sea surface, for example, puffin, guillemot, and razorbill. Species considered to be at lower risk due to spending less time on the sea surface include gannet, cormorant, and kittiwake.

The Seabird Oil Sensitivity Index (SOSI) has been developed to identify areas where seabirds are likely to be most sensitive to oil pollution (Webb *et al*., 2016), on a scale from 1, Extremely high, to 5, Low. The SOSI combines seabird data collected between 1995 and 2015 and individual seabird species sensitivity index values to create a single measure of seabird sensitivity to oil pollution. The SOSI score for UKCS Block 48/12, where Galahad is located, ranges from 5 (low sensitivity) in the summer months to 2 (very high) and 1 (extremely high sensitivity) between October and April. Refer to Table 4.8.

Table 4.8. Seabird Oil Sensitivity Index (SOSI) for Block 48/12.

Month	J	F	M	A	M	J	J	A	S	O	N	D
Seabird vulnerability	2	2	2	2	5	5	5	3	3	2	1	2

***Key**: 1= Extremely High; 2 = Very High; 3 = High; 4 = Medium; 5 = Low.*

4.2.5 Marine Mammals

4.2.5.1 Cetaceans

Compared to the Central and Northern North Sea, the Southern North Sea generally has a relatively low density of marine mammals, except for the Harbour Porpoise (*Phocoena phocoena*). While over ten species of cetaceans have been recorded in the Southern North Sea, only the Harbour Porpoise and White-Beaked Dolphin (*Lagenorhynchus albirostris*) can be considered as regularly occurring throughout most of the year, and the Minke Whale (*Balaenoptera acutorostrata*) as a frequent seasonal visitor. Bottlenose dolphins (*Tursiops truncates*) and the Atlantic White-Sided Dolphin (*Lagenorhynchus acutus*) can be considered uncommon visitors (BEIS, 2022).

All cetacean species are European Protected Species (EPS) (listed in Annex IV of the EC Habitats Directive) and are afforded protection under the Conservation of Offshore Marine Habitats and Species Regulations 2017.

SCANS

The Small Cetacean Abundance of the North Sea (SCANS) aerial and ship-based surveys identified the abundance and density of cetacean species within predefined sectors. The survey has been conducted at intervals of eight to eleven years since 1994. The years in which the SCANS surveys were conducted were 1994 (SCANS), 2005 (SCANS-II), 2016 (SCANS-III) and most recently 2022 (SCANS-IV). The surveys covered the North Sea, Celtic Sea, and continental European Atlantic waters (Gilles *et al., 2023*). The SCANS-IV survey area consists of 1,467,358 km^2 and is divided into sectors. Galahad is situated towards the southern end of the SCANS-IV block NS-C. (In the previous SCANS, the same area was classified as 'O' North Sea (Hammond *et al.,* 2021)). NS-C is 60,203 km^2, which is approximately 4.1% of the overall survey area.

In SCANS-IV, the estimates of abundance and density of a total of eleven species or groups were established. Of these, five species were recorded in the NS-C survey area, namely Harbour Porpoise, White-Beaked Dolphin (*Lagenorhynchus albirostris*), Bottlenose Dolphin, Minke Whale, and Common Dolphin (*Delphinus delphis*). A summary of the abundancy and density of these five species for the NS-C survey area, the North Sea (where available) and the total survey area is presented in Table 4.9.

The species with the highest abundance and density is the harbour porpoise. The density of the Harbour Porpoise (0.6027 individuals/km^2), is higher than for the North Sea (0.55 individuals/km^2) and the total surveyed area (0.2789 individuals/km^2), suggesting that Block NS-C is important for this species. This correlates with the designation of a portion of this area as the Southern North Sea SAC for the harbour porpoises. The harbour porpoise abundance in the North Sea has remained steady in the past thirty years (Gilles *et al.*, 2023). The white-beaked dolphin had a low abundance (894 individuals out of 67,138) but relatively high density (0.333 individuals/km^2). Bottlenose dolphin, minke whale and common dolphin (*Delphinus delphis*) were recorded at very low densities (0.0419, 0.0068 and 0.0032 individuals/km^2 respectively).

Table 4.9. SCANS IV Cetacean abundance and density NS-C and Total Survey Area.

Species	*SCANS-VI Block NS-C*		*North Sea Only*		*Total Survey Area*	
	Abundance	Average Density [1]	Abundance	Average Density [1]	Abundance	Average Density [1]
Harbour porpoise	36,286	0.6027	338,918	0.55	409,244	0.2789
White-beaked dolphin	894	0.333	46,300		67,138	0.091
Bottlenose dolphin	2,520	0.0419	2,730		80,809	0.0551
Minke whale	412	0.0068	7,853		12,417	0.0085
Common dolphin	192	0.0032	1,814		317,527	0.2164

[1] Density is the number of animals per km^2.

Inter-Agency Marine Mammal Working Group (IAMMWG)

The Inter-Agency Marine Mammal Working Group (IAMMWG) have identified Marine Mammal Management Units (MU) to provide information on the geographical range and abundance of marine mammals, and therefore to help understand the potential effects of anthropogenic activities on populations (IAMMWG, 2015). The North Sea MU includes the entire Greater North Sea, including the UK, Dutch and Norwegian water. The abundance of cetacean species within their respective MU, presented in Table 4.10, indicates that Harbour Porpoises are the most abundant species in the North Sea compared to the other dolphin species. The White-sided dolphins are the next most abundant within the UK sector of its MU, however, these were not recorded in significant numbers in the SCANS-IV Block NS-C, suggesting they are more prevalent in other parts of the North Sea.

Table 4.10. Estimates of Cetacean Abundance in the Relevant Marine Mammal MUs (IAMMWG, 2015[1], 2022[2]).

Species	Management Unit	Abundance in MU	Confidence Interval	Abundance in the UK part of MU	Confidence Interval
Harbour porpoise[2]	Greater North Sea	346,601	289,498 – 419,967	159,632	127,442 - 199,954
White-sided dolphin[1]	Celtic and Greater North Sea	69,293	34,339 – 139,828	46,249	26,993 – 79,243
Common dolphin[1]		56,556	33,014 – 96,920	13,607	8,720 – 21,234
White-beaked dolphin[1]		15,895	9,107 – 27,743	11,694	6,578 – 20,790

The Atlas of Cetacean Distribution in North-West European Water (Reid *et al*., 2003) provides a comprehensive review of cetacean sightings in northwest European waters for each ICES Rectangle. The seasonal sightings data for ICES Rectangle 36F1 is summarised in Table 4.11

Table 4.11. Cetaceans Sightings within ICES Rectangle 36F1.

Species	J	F	M	A	M	J	J	A	S	O	N	D
Harbour porpoise	-	3	-	-	-	3	3	3	3	3	-	-
White-beaked dolphin	3	-	-	-	-	-	-	-	-	3	-	-
White-sided dolphin	-	-	-	-	-	-	-	3	-	-	-	-

Key

1	High (>100)	2	Moderate (10-100)	3	Low (0.01-10)	-	No Sightings

It is important to note that the lack of recorded sightings does not necessarily preclude the presence of a species at a certain time of year. In addition, the highly mobile nature of cetaceans means that species that are found within the area in general, such as the harbour porpoise, white-beaked dolphin and white-sided dolphin may be present at other times of the year.

Harbour Porpoise

The harbour porpoise is listed under Annex II of the EC Habitats Directive, a status that obliges member states to afford protection to species and habitats through the designation of SAC. The Southern North Sea SAC has been identified as an area of importance for the harbour porpoise. This site includes key winter and summer habitats for this species and covers an area of 36,951 km^2, supporting an estimated 17.5 % of the UK North Sea Management Unit population. ICES Rectangles 36F1 is situated outside of the Southern North Sea SAC.

The conservation objectives of Southern North Sea SAC require that favourable conservation status be maintained for the designated feature (harbour porpoise) by assessing the impacts of human activities within the area that may affect the integrity of the site. This includes ensuring they remain a viable component of the site, that there is no significant disturbance to this species and that habitats and processes relevant to this species and their prey are maintained (JNCC, 2017).

Galahad is located 1.5km south of the Southern North Sea SAC.

4.2.5.2 Pinnipeds

Two species of Pinnipeds (seals), the grey seal (*Halichoerus grypus*) and the harbour (or common) seal (*Phoca vitulina*), are found in the North Sea around the east English coast. Both species are listed under Annex II of the EC Habitats Directive and are also protected under the Conservation of Seals Act 1970 (from 0 to 12 nautical miles from the coast).

Along the east coast of England, there are established colonies of seals present at recognised locations from Donna Nook to the North, at the mouth of the Humber, south to Scorby Sands near Great Yarmouth. Further south there are additional colonies along the coasts of Essex and Kent. The Natural Environment Research Council Special Committee on Seals (SCOS, 2022) annually monitor the seal populations. Populations along Southeast England in 2021 are presented in Table 4.12.

Table 4.12. Seal count in Southeast England 2021.

Seal species	Donna Nook	The Wash	Blakeney Point	Horsey	Scorby Sands	Essex/ Kent	Total
Grey seal (*Halichoerus grypus*)	3,897	799	493	380	1,377	749	7,695
Harbour seal (*Phoca vitulina*)	122	2,667	181	12	25	498	3,505

Grey Seals

Like all seals, grey seals spend a significant proportion of their time hauled out on land during the breeding, moulting and pupping seasons and between tides and foraging trips. Grey seals forage down to depths of 100 metres and at distances of up to 100 kilometres from their haul-out sites and therefore could be present in the vicinity of Galahad.

Models of marine usage by grey seals show that there are high levels of foraging activity along the east coast of England. However, their at-sea usage across the Galahad area is relatively low, with less than one individual per 25 km^2 in area (Russell *et al.*, 2017). Refer to Figure 4.8.

Harbour Seals

Harbour seals are the smaller of the two species and tend to be found closer to the coast. As with grey seals, the UK harbour seal population is predominantly found around the Scottish coast with smaller colonies around The Wash and along the east coast of England. Harbour seals are restricted to their haul-out sites and the surrounding waters during pupping (June and July) and during their annual moult (August) (SCOS, 2022). This species can be found offshore from late August through to the following June and tends to forage within 40 – 50 kilometres of its haul-out sites.

The stronghold of the Harbour Seal in the Southern North Sea is The Wash (refer to Table 4.12). Galahad is in a straight line from the wash, at a distance of approximately 90 km, at a location that appears to be towards the extent of the Harbour Seals feeding range in this part of the North Sea (Refer to Figure 4.9). The harbour seal usage of the sea in Block 48/12 is recorded as medium with up to 50 (mean at sea usage) individuals per 25 km^2 (Russell *et al.*, 2017).

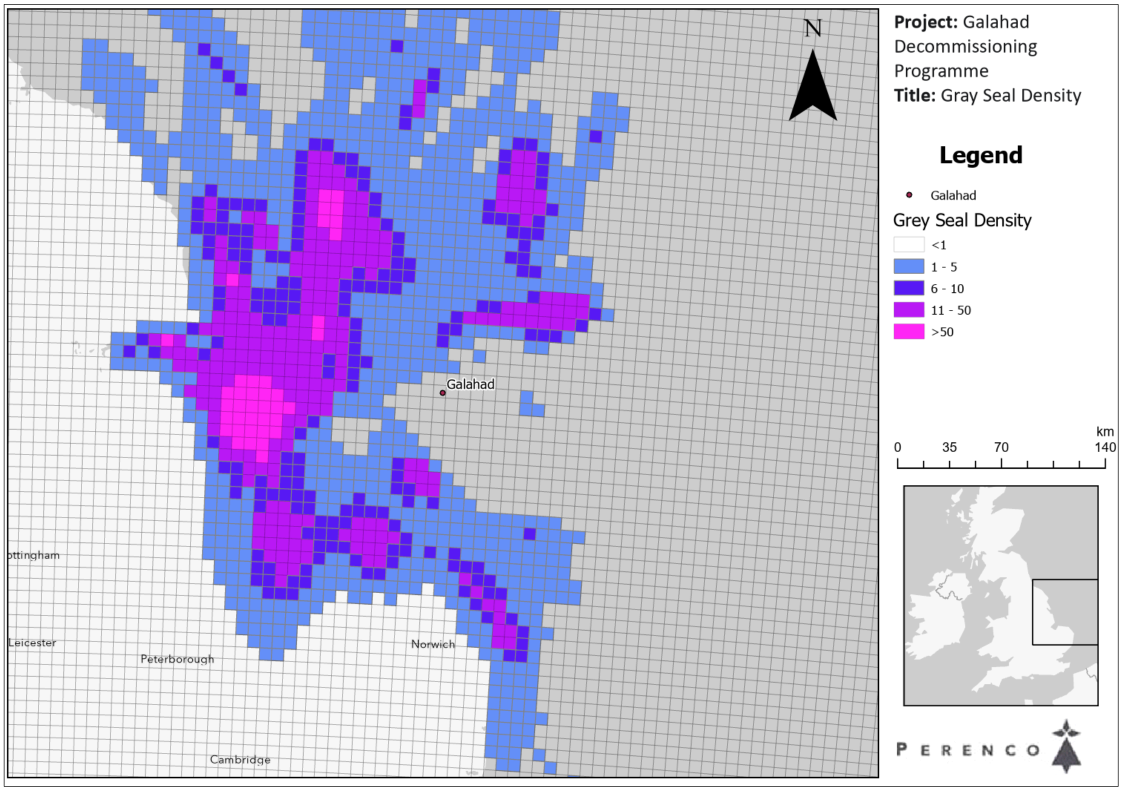


Figure 4.8. Density of grey seals in the vicinity of Galahad.

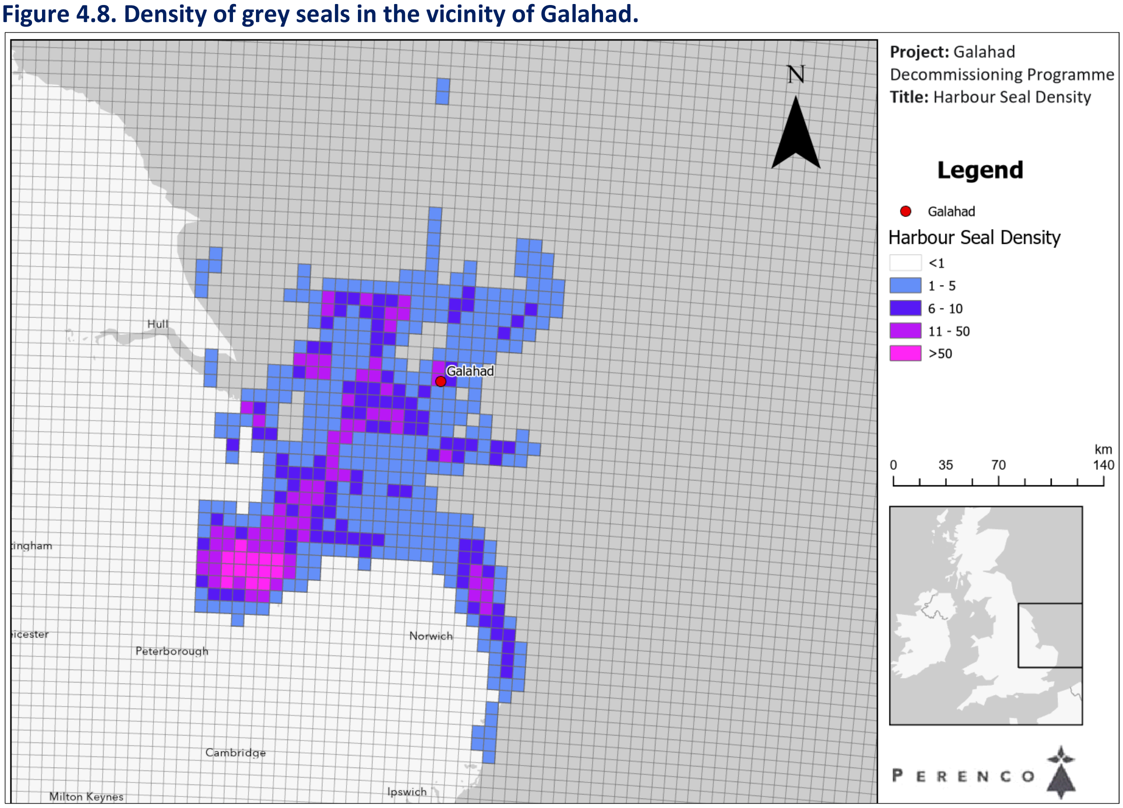


Figure 4.9. Harbour seal density in the vicinity of Galahad.

4.3 Offshore Conservation Management and Marine Planning

4.3.1 Conservation Areas

The UK is party to several international agreements to establish an ecological network of Marine Protected Areas (MPA's) in UK waters. The UK implemented directives relevant to MPAs, namely under the EC Birds and EC Habitats Directives and the requirements of the European Marine Strategy Framework Directive and Convention on Biological Diversity. As a signatory to the OSPAR Recommendation 2003/3 on a Network of Marine Protected Areas as amended by Recommendation 2010/2, the UK must establish an ecologically coherent and well-managed network of MPAs across the North-east Atlantic by 2016. These commitments are transposed through national legislation and regulations.

The main types of Marine Protected Areas in UK waters are:

- Special Areas of Conservation (SAC's) (also known as European Sites of Community Importance; SCI's) which are designated for habitats and species listed under the EU Habitats Directive. These qualifying features include three marine habitat types (sandbanks which are slightly covered by seawater all the time, reefs and submarine structures made by leaking gases) and four marine species (grey seal, harbour seal, bottlenose dolphin and harbour porpoise). There are 116 SACs with marine components within the UK (JNCC, 2023).
- Special Protection Areas (SPA's) which are designated to protect birds under the EU Wild Birds Directive. The Directive requires conservation efforts to be made across the sea and land area. In the UK 123 SPAs with marine components have been designated, including four wholly marine SPA's (JNCC, 2023).
- Marine Conservation Zones (MCZ's) which are designated under the Marine and Coastal Access Act (2009) to protect nationally important marine wildlife, habitats, geology, and geomorphology and can be designated anywhere in English, Welsh territorial, or UK offshore waters. To date, there are 91 designated MCZ's in UK waters (JNCC,2023).

SAC's and SPA's form part of the European Natura 2000 network. Other international designations such as Ramsar Wetlands of International Importance (hereafter referred to as Ramsar sites), and national designations such as Sites of Special Scientific Interest (SSSIs) also form part of the UK MPA network through their protection of marine, coastal terrestrial and geological features. OSPAR MPA's encompass existing MPA's designated under existing legislation and Conventions including SAC's, SPA's and MCZ's (JNCC, 2018). There are two MPA's within 40 kilometres of Galahad. Table 4.13 presents the qualifying features and a description for each of these sites and Figure 4.10 shows the MPA's in the vicinity of the of the Galahad platform.

Table 4.13. Marine Protected Areas within 40 kilometres of Galahad.

Site Name	Distance and Direction from Galahad	Qualifying Features and Site Description
Southern North Sea SAC	1.5 km NE	**Features:** Annex II species: Harbour porpoise (*Phocoena phocoena*) (1351). **Description:** Proposed for designation for the Annex II species harbour porpoise. The conservation objective for the Southern North Sea SAC is "to avoid deterioration of the habitats of the harbour porpoise or significant disturbance to the harbour porpoise, thus ensuring that the integrity of the site is maintained, and the site makes an appropriate contribution to maintaining Favourable Conservation Status for the UK harbour porpoise."
North Norfolk Sandbanks and Saturn Reef SAC	24 km E	**Features:** Annex I habitat: Sandbanks which are slightly covered by sea water all the time (1110) and Reefs (1170). **Description:** The North Norfolk Sandbanks are the most extensive example of the offshore linear ridge sandbank type in UK waters. The banks support communities of invertebrates which are typical of sandy sediments in the Southern North Sea such as polychaete worms, isopods, crabs, and starfish. Areas of *Sabellaria spinulosa* biogenic reef are present within the site, consisting of thousands of fragile sand-tubes made by ross worms (polychaetes) which have consolidated to create solid structures rising above the seabed.
Inner Dowsing, Race Bank and North Ridge SAC	33.6 km SW	**Features:** Annex I Habitat: Sandbanks which are slightly covered by sea water all the time (1110) and Reefs (1170). **Description:** The Inner Dowsing, Race Bank and North Ridge site is located off the south Lincolnshire coast in the vicinity of Skegness, extending eastwards and north from Burnham Flats on the North Norfolk coast, occupying The Wash Approaches. Abundant *Sabellaria spinulosa* agglomerations have consistently been recorded within the boundary of the SAC / SCI SAC. Survey data indicate that reef structures are concentrated in certain areas of the site, with a patchy distribution of crust-forming aggregations across the site.
Holderness Offshore MCZ	35.6 km NW	**Protected Feature:** Subtidal coarse sediment, Subtidal sand, Subtidal mixed sediments, Ocean quahog (Arctica islandica), North Sea glacial tunnel valleys **Description:** The Holderness Offshore MCZ lies partly in inshore and partly in offshore waters as it crosses the 12 nm territorial sea limit. The site is relatively shallow, ranging in depth from just over 5 m down to 50 m and covers an area of 1,176 km2. This site contains good examples of broad-scale habitats Subtidal mixed sediment, Subtidal sand, and Subtidal coarse sediment. The site also contains an area of geological interest (the northern point of the Inner Silver Pit glacial tunnel). This area has a high species biodiversity and is an ecologically important area providing habitats for many species. The threatened and/or declining Ocean quahog (Arctica islandica) is also found within this MCZ which highlights the importance of the Holderness Offshore designation.

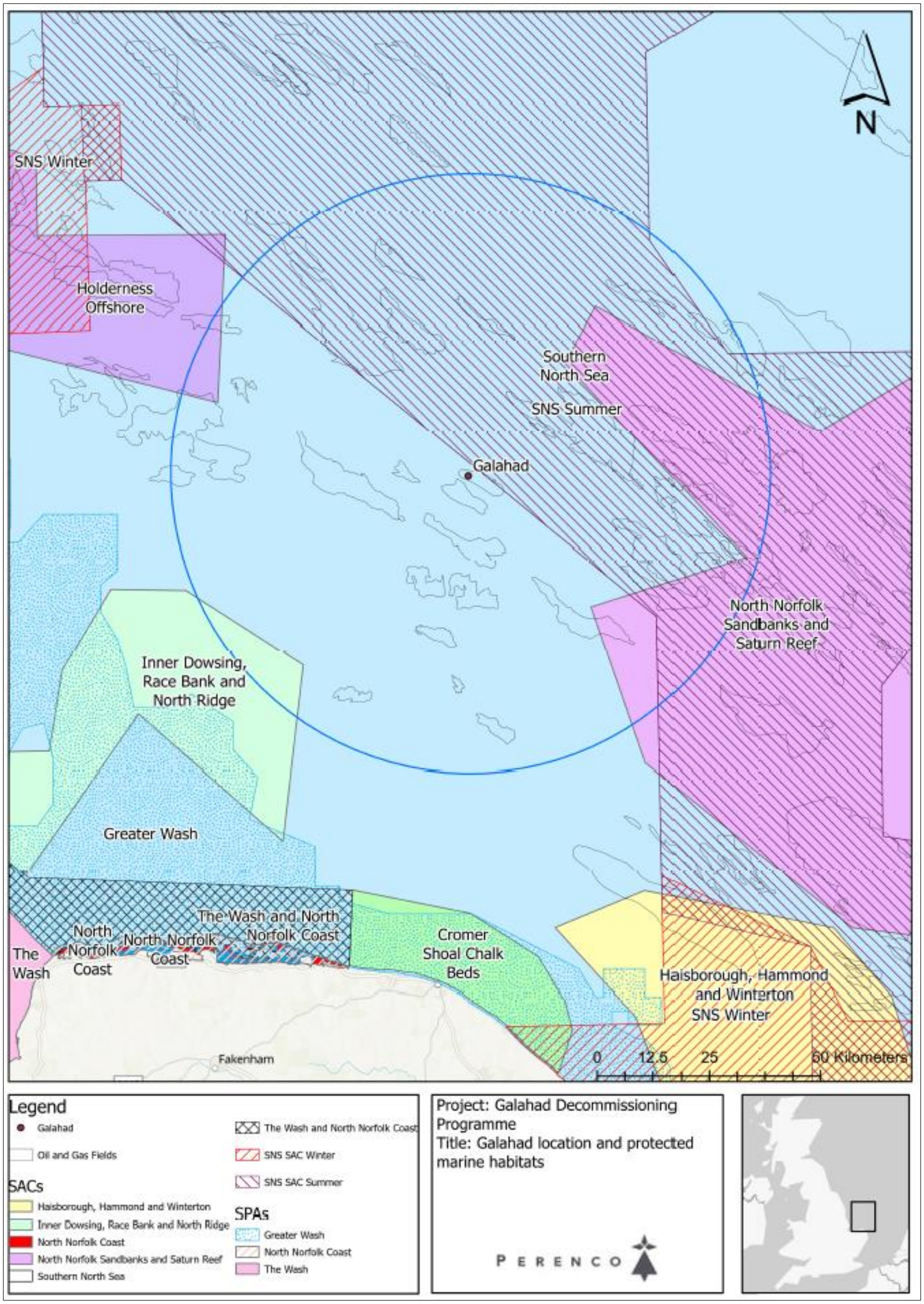


Figure 4.10. Marine protected areas within the vicinity of Galahad.

4.3.2 Marine Planning

Through the Marine and Coastal Access Act 2009, the UK Government introduced several measures to deliver its vision of 'clean, healthy, safe, productive, and biologically diverse oceans and seas'. This included the introduction of a new marine planning system with the Marine Management Organisation (MMO) being delegated several marine planning functions. Note that the OPRED manage several licencing functions about offshore energy activities rather than the MMO. In line with the Marine and Coastal Access Act 2009, several marine plans have been developed, or are being developed for inshore and offshore waters around the UK. Marine plans, together with the overarching Marine Policy Statement underpin the new planning system for inshore and offshore activities.

Galahad is located within the East Offshore marine plan area. The marine plans associated with these areas aim to provide a clear spatial approach to the East Inshore and East Offshore areas, their resources, and the activities and interactions that take place within them. It is intended that these marine plans will help ensure the sustainable development of the marine area (DEFRA, 2014). The Marine Plan has considered throughout the Environmental Appraisal process, the objectives and policies in the East Offshore Marine Plan that may be relevant to the proposed activities to allow for sustainable use of the marine environment. Further details are in Table 4.14.

Table 4.14. Marine Planning Objectives and Policies Relevant to the Proposed Galahad Decommissioning

Relevant Objectives	Associated Policies	Addressed by Project
Economic Productivity - To promote the sustainable development of economically productive activities, taking account of spatial requirements of other activities of importance to the East marine plan areas.	**EC1** - Proposals that provide economic productivity benefits which are additional to the Gross Value Added currently generated by existing activities should be supported.	The proposed decommissioning strategy is in line with minimising taxpayer costs for decommissioning oil & gas infrastructure in the SNS.
Employment and Skill Levels - To support activities that create employment at all skill levels, taking account of the spatial and other requirements of activities in the East Marine Plan areas.	**EC2** - Proposals that provide additional employment benefits should be supported, particularly where these benefits have the potential to meet employment needs in localities close to the marine plan areas.	The proposed operations will utilise local contractors in the area and a support base close to the proposed operations.
Heritage Assets - To conserve heritage assets, and nationally protected landscapes and ensure that decisions consider the seascape of the local area.	**SOC2** - Proposals that may affect heritage assets should demonstrate, in order of preference: a) that they will not compromise or harm elements which contribute to the significance of the heritage asset; b) how, if there is compromise or harm to a heritage asset, this will be minimised; c) how, where compromise or harm to a heritage asset cannot be minimised, it will be mitigated against, or; d) the public benefits for proceeding with the proposal if it is not possible to minimise or	The proposed decommissioning strategy is not anticipated to have an impact on any heritage assets or the character of the marine area.

	mitigate compromise or harm to the heritage asset. **SOC3** - Proposals that may affect the terrestrial and marine character of an area should demonstrate, in order of preference: a) that they will not adversely impact the terrestrial and marine character of an area; b) how, if there are adverse impacts on the terrestrial and marine character of an area, they will minimise them; c) how, where these adverse impacts on the terrestrial and marine character of an area cannot be minimised, they will be mitigated against; the case for proceeding with the proposal if it is not possible to minimise or mitigate the adverse impacts.	
Healthy Ecosystem - To have a healthy, resilient, and adaptable marine ecosystem in the East marine plan areas.	**ECO1** - Cumulative impacts affecting the ecosystem of the East marine plans and adjacent areas (marine, terrestrial) should be addressed in decision-making and plan implementation.	Refer to Section 6. Environmental & Social impact assessment.
	ECO2 - The risk of the release of hazardous substances as a secondary effect due to any increased collision risk should be considered in proposals that require authorisation.	The proposed decommissioning strategy minimises the risk of release of hazardous substances which would be limited to vessel fuel inventory during short surveys.
Biodiversity - To protect, conserve and, where appropriate, recover biodiversity that is in or dependent upon the East marine plan areas.	**BIO1** - Appropriate weight should be attached to biodiversity, reflecting the need to protect biodiversity as a whole, taking account of the best available evidence including habitats and species that are protected or of conservation concern in the East marine plans and adjacent areas (marine, terrestrial).	The proposed decommissioning strategy reduces any potential impact on biodiversity in the East marine plan and terrestrial areas.
MPAs - To support the objectives of MPAs (and other designated sites around the coast that overlap or are adjacent to the East marine plan areas), individually and as part of an ecologically coherent network.	**MPA1** - Any impacts on the overall MPA network must be considered in strategic level measures and assessments, with due regard given to any current agreed advice on an ecologically coherent network	Refer to Section 4.3.1. The decommissioning strategy will not significantly impact the objectives of MPAs.
Governance - To ensure integration with other plans, and in the regulation and management of key activities	**GOV2** - Opportunities for co-existence should be maximised wherever possible.	Refer To Section 4.4
	GOV3 - Proposals should demonstrate in order of preference:	Refer To Section 4.4

and issues, in the East marine plans, and adjacent areas.	a) that they will avoid displacement of other existing or authorised (but yet to be implemented) activities; b) how, if there are adverse impacts resulting in displacement by the proposal, they will minimise them; c) how, if the adverse impacts resulting in displacement by the proposal, cannot be minimised, they will be mitigated against, or; the case for proceeding with the proposal if it is not possible to minimise or mitigate the adverse impacts of displacement.	

4.4 Socio-Economical Environment

4.4.1 Commercial Fisheries

Fish communities within the Southern North Sea are dominated by small benthic groups such as flatfish. Comparisons of catch rates have shown that in general, the catchability of these smaller demersal species is greater using beam trawls than otter trawls. Consequently, beam trawling effort is greatest in the Southern North Sea, while otter trawling is less frequent in the region. Beam trawl activity is concentrated in the Southern Bight and the fleet mainly targets plaice and sole. Cod catches are typically highest in the Southern North Sea in the 1st and 2nd quarters of the year. Haddock is only rarely caught in the Southern North Sea, during years of very strong recruitment. There are also significant seine and gillnet fisheries for plaice towards the north of the region. Industrial fisheries target the sandeel populations of the Southern and Central North Sea. The fishery is focused on the Dogger Bank and takes place mainly during the summer months (BEIS, 2022).

Pelagic fisheries in the Southern North Sea mainly target herring, sprat, and horse mackerel. Purse seiners and pelagic trawls are usually used in the herring fishery, with the greatest landings in the 3rd quarter. Targeted mackerel fishing is prohibited in the Southern North Sea throughout the year (BEIS, 2022).

Shellfish fisheries are important in the region, particularly in inshore waters where a number of species are harvested from estuaries and bays. In addition to these fisheries, Nephrops may be landed from the Dogger Bank, particularly during autumn and winter. Edible crabs and lobsters are also valuable species, typically caught with static gear such as pots or creels, while fisheries for pink and brown shrimps are also prosecuted. The Humber Estuary is an important site for shrimp trawling and crab and lobster potting, while the Wash is a prime habitat for mussels, cockles, and brown shrimp (BEIS, 2022).

Specific fishing efforts and landings data for ICES Rectangle 36F1 for the years between 2018 and 2022 indicate commercial fishing around the Galahad field. The fishing effort is 36F1, with a monthly average over the five years from 2018 to 2022 including 56. The average and median for the North Sea is 81- and 54-days effort (range 3 to 910 effort days).

In 36F1, the fishing effort is generally higher between July and November. There was a significant increase in fishing efforts in July and August 2020 (Marine Directive, 2023). Refer to Figure 4.11.

The fisheries landings data indicates that area 36F1 is important for crustaceans (crabs and lobsters) and shellfish (Scallops and Whelks) between 2018 and 2022 (Marine Directive, 2023).

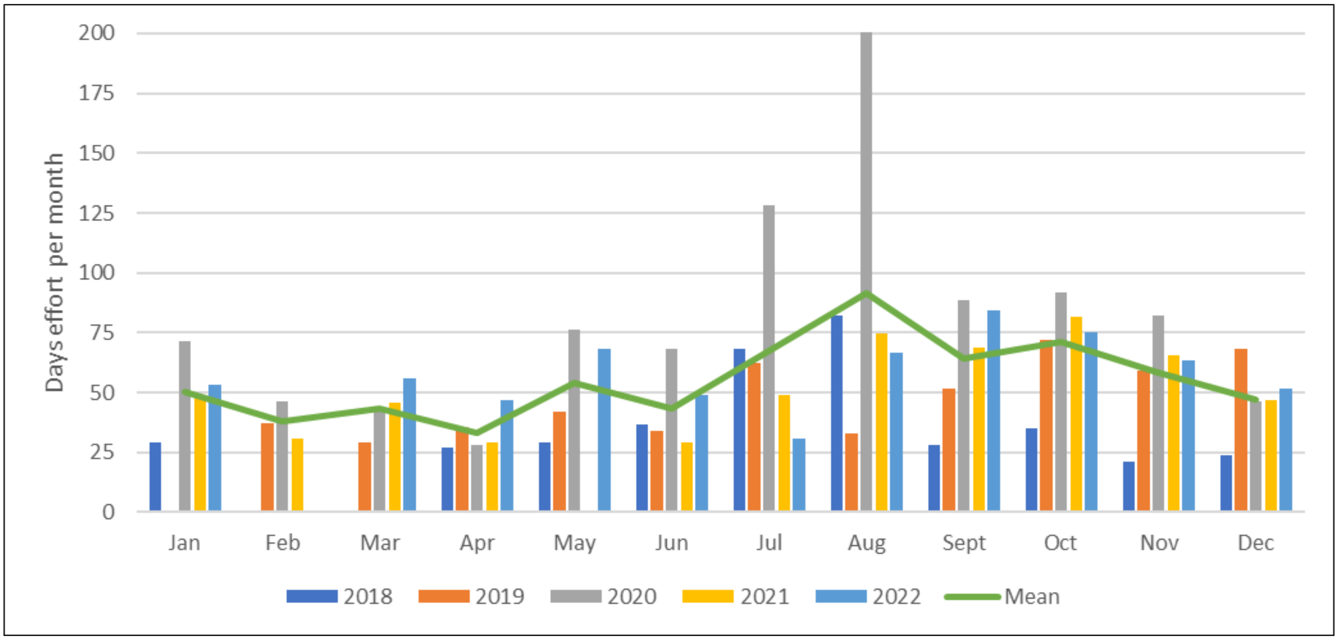


Figure 4.11. Total fishing effort for ICES Rectangle 36F1.

4.4.2 Oil and Gas Activities

Oil and gas activity within the Southern North Sea is generally high and targets several existing gas fields. There is significant surface and subsurface infrastructure in UKCS Blocks 48/12, 48/17, 48/21 and 48/22 which is predominantly associated with the LAPS Complex. Refer to Figure 3.2 and Figure 3.3.

The surrounding area has also been heavily licensed for oil and gas development, although many have now ceased production, including the Pickerill and Amethyst fields, owned by PUK, to the west and the Anglia field to the east has ceased production. Further afield, to the north, the West Sole field (PUK ownership) and the Clipper field to the east are producing (NSTA, 2024).

4.4.3 Shipping and Ports

The North Sea (Regional Seas 1 & 2) contains some of the world's busiest shipping routes, with significant traffic generated by vessels trading between ports on either side of the North Sea and the Baltic. North Sea oil and gas fields generate moderate vessel traffic in the form of support vessels (BEIS, 2022). Grimsby & Immingham is the UK's busiest port, handling 11.4% of the UK's traffic (equal to 54.1Mt) in 2019. Another major port in the area is Felixstowe (BEIS, 2022). Great Yarmouth is an important port along the Norfolk Coast, servicing the offshore sector. The density of shipping traffic in the Southern North Sea is relatively high due to the presence of fishing vessels, some ferries between the UK and the rest of Europe and cargo and offshore support vessels (BEIS, 2022). The density of traffic is regarded as 'high' in UKCS Block 48/12. This is due to the relative proximity to important ports around the East Riding of Yorkshire, Lincolnshire, and Norfolk coasts and offshore energy activity.

4.4.4 Telecommunication and Power Cables

No subsea telecommunication cables cross Block 48/12. The nearest cable is Tampnet, located approximately 49 km to the east. The closest active wind cable is to the Hornsea 1 Offshore Electricity Transmission (OFTO) located approximately 19 km north of the Galahad installation (Figure 4.12).

4.4.5 Marine Aggregates

There are no marine aggregate areas within Block 48/12. The closest marine aggregate area to Block 48/12 is Outer Drowsing which at its closest is approximately 15 km south-west of the Galahad platform. Refer to Figure 4.12.

4.4.6 Offshore Wind Farms

A number of active and proposed windfarms are located in the vicinity of Galahad. The windfarms currently in operation that are closest to Galahad are Triton Knoll, Dudgeon and Hornsea Projects 1 and 2 (Crown Estates, 2024). Proposed windfarms in the vicinity of Galahad are R4 Project 3 (Outer Dowsing Offshore), Hornsea Project 4 and Dudgeon Extension. (Crown Estates, 2024). Refer to Figure 4.12.

The Outer Dowsing Offshore is a proposed windfarm. Currently, it is in the pre-planning application phase, which incorporates an area of approximately 500 km^2 and includes the Galahad platform. The Outer Dowsing Wind Development Consent Order application was accepted in April 2024, and the development is still pending consent. Based on the project timeline, and assuming the consent is issued within the normal timeframe, the construction will commence in 2026/2027, with commercial operations commencing in 2030 (outerdowsing.com, 2024).

4.4.7 Military Activity

The Galahad platform lies approximately 3.3 km south of a Royal Airforce Manageable Danger Area, the EGD323E Southern Complex (NATS, 2024).

4.4.8 Archaeology

There are no designated wrecks protected under The Protection of Wrecks Act 1973, The Protection of Military Remains Act 1986, or Designated Maritime Scheduled Ancient Monuments (Historic England, 2024; MCA, 2020) within Block 48/12. Furthermore, there are no wrecks recorded on the Admiralty Chart within 5km of Galahad (Admiralty, 2017).

4.4.9 Tourism and Leisure

The tourism industry is socially and economically important to the UK and the coast in particular is a popular destination for British holidaymakers of all age groups. From large traditional seaside resorts to small-scale coastal attractions, this sector makes an important contribution to the local, regional, and national character of the coast (BEIS, 2022). Leisure-based and tourist activities are fairly widespread along the east coast of England and tend to be highest during the summer months. A number of beaches are located along the Yorkshire and Lincolnshire coast including Hornsea, Mablethorpe, Skegness, Sutton-on-Sea, Scarborough, Whitby and Withernsea were awarded Blue Flag in 2024 (Blue Flag, 2024).

Mablethorpe and Skegness are important coastal towns in Lincolnshire. The coastline is well served by footpaths and heritage trails that attract walkers, particularly during the spring and summer months. The region’s rich wildlife attracts recreational anglers, birdwatchers and wildfowlers and the coastal waters around Bridlington, the Humber estuary and the North Norfolk coast are popular for dinghy sailing and windsurfing (BEIS, 2022).

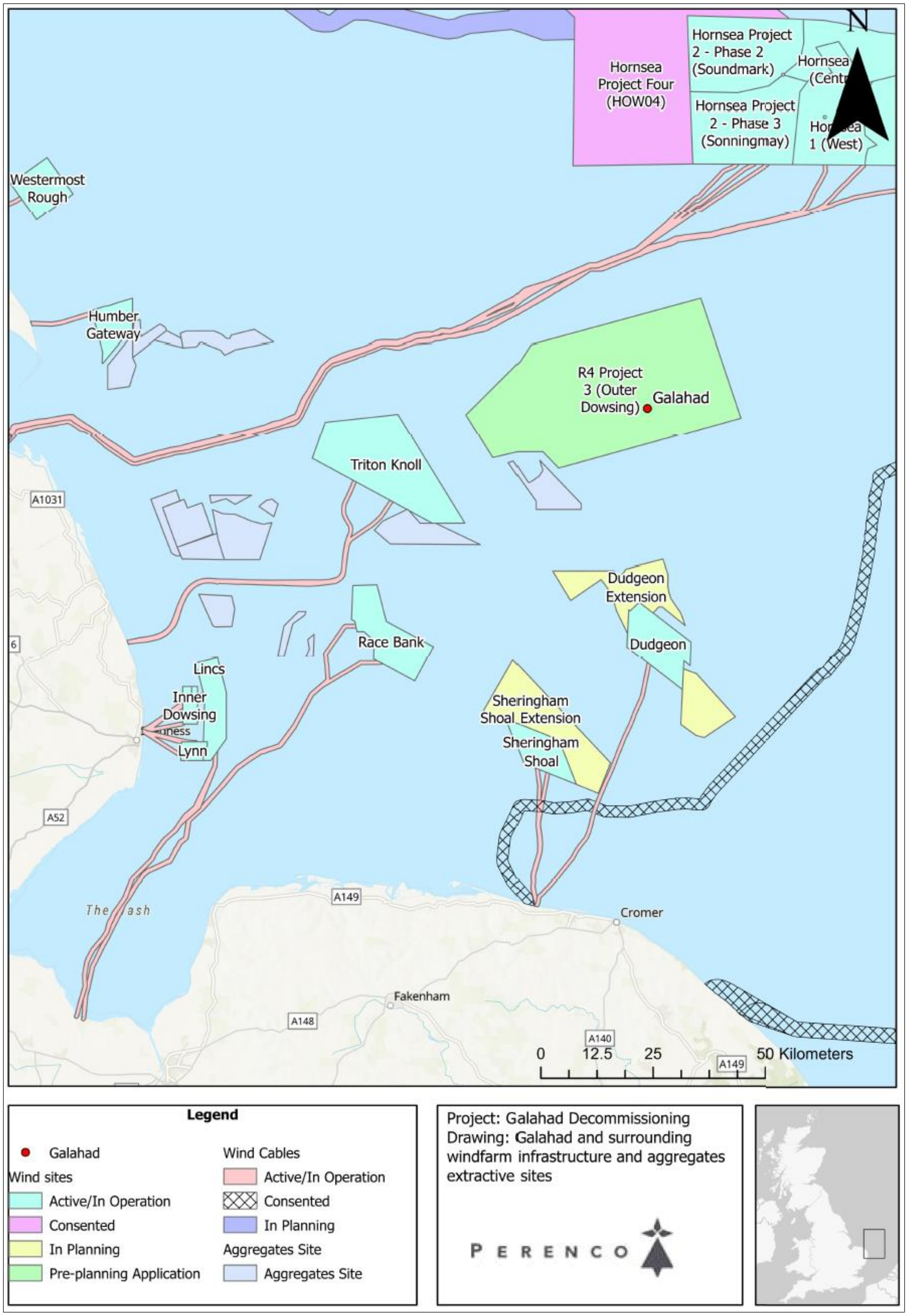


Figure 4.12. Subsea cables, aggregates, and wind farms within the vicinity of Galahad.

5 Environmental Issues Identification

An Environmental Impacts Identification (ENVID) was undertaken to identify project activities and associated potential impacts and is summary of the ENVID presented in Table 5.1.

Table 5.1. Environmental Hazard Identification (ENVID)

Assessment Topic	Project Activity / Event	Physical Receptors				Biological Receptors						Human Receptors										
		Seabed Sediments & Features	Water Quality	Air Quality	Climate	Plankton	Benthic Communities	Fish & Shellfish	Seabirds	Marine Mammals	Marine Protected Areas	Shipping	Commercial Fisheries	Oil & Gas & CCS Activity	Subsea Cables	Renewable Energy Activity	Cultural Heritage	Military Activity	Disposal, Dredging & Aggregate Activity	Seascape	Tourism & Leisure	Population & Human Health
Physical Presence	Presence of Heavy Lift Vessel (HLV) and other support vessels						A					A	A	A				A				
	Removal of topside and monopod (considering nesting birds)								A													
	Removal of 500m zone											P	P	P				P				
Seabed disturbance	Positioning of HLV (spud cans)/use of anchors	A	A			A	A	A														
	Removal of Monopod and piles removal	A	A			A	A	A														
Noise Emissions	Operational activity of HLV, support vessels and helicopters							A	A	A												
	Cutting piles and removing monopod							A		A												
Marine Discharges	Discharge (operational and domestic) to sea from HLV and support vessels		A			A	A	A		A												
Atmospheric Emissions	Engine emissions from operational activity of HLV and support vessels			A	A																	A
Solid Waste Generated	Operational waste (hazardous and Non-hazardous)																					A
	Recovery/disposal of topside, monopods & piles																					A
Accidental Events	Vessel collision – loss of containment	A	A	A	A																	

Key

(yellow)	Potential for likely significant effects (scoped in)	(green)	No potential for significant effects (scoped out)	**A**	Adverse effect	**P**	Beneficial effect	(blank)	No interaction

6 Environmental and Social Assessment

6.1 Assessment Methodology

6.1.1 Introduction

The method used to determine if Galahad decommissioning is likely to have any significant effects on the environment is described in this section and follows EIA best practice guidance (e.g., EC, 2017; CIEEM, 2018; SNH and HES, 2018; IEMA, 2016). The process commences with the identification of Project Activities (or aspects) that could impact environmental and socio-economic receptors (i.e., components of the receiving environment), with consideration given to both planned (routine) activities and unplanned (accidental) events. In the context of this Environmental Appraisal, impacts are defined as changes to the environment as a direct result of Galahad installation decommissioning and can be either beneficial or adverse. Effects are defined as the consequences of those impacts upon receptors.

All activities are assessed to determine if they could potentially result in significant effects by conducting an assessment based on available baseline environmental conditions (Section 4) and professional judgment. Section 6.2 presents the impacts that have been assessed as being insignificant and Section 6.3 presents significant impacts.

6.1.2 Identification of Impacts

Those aspects of the environment that may be impacted by the Galahad decommissioning project have been identified in the ENVID in Table 6.1. The ENVID has been populated by PUK, concerning the requirements of Article 3(1) of the EIA Directive, the BEIS OPRED EIA Guidance (2021) and the Offshore SEA (BEIS, 2022).

The type of impacts which could occur from the Project can be categorised as follows:

- **Direct:** resulting from a direct interaction between a planned or unplanned project activity and a receptor;
- **Indirect:** occurring as a consequence of a direct impact and may arise as a result of a complex pathway and be experienced at a later time or spatially removed from the direct impact;
- **In-combination (or Intra-Project):** arising from different activities within the project resulting in several impacts on the same receptor or where different receptors are adversely affected to the detriment of the entire ecosystem;
- **Cumulative (or Inter-Project):** resulting from incremental changes caused by other past, present, or reasonably foreseeable projects/proposals together with the project itself.

The nature, duration, scale, and frequency of the effects resulting from these impacts will vary and are described using the terminology in Table 6.1.

Table 6.1. Impact Category Definitions

Category	Descriptor	Definition
Nature	Adverse	Unfavourable consequences on receptors.
	Beneficial	Favourable consequences on receptors.
Duration	Short-term	Effects are predicted to last for a few days or weeks.
	Medium-term	Effects are predicted to last for a prolonged period of time, between one and five years.
	Long-term	Effects are predicted to last for a prolonged period of time, greater than 5 years.
	Temporary	Effects are reversible.
	Permanent	Effects are irreversible.
Scale	Local	Effects are limited to the area surrounding the project site or are restricted to a single habitat/biotope or community.
	Regional	Effects occur beyond the local area to the wider region.
	National	Effects occur at a national level (UKCS).
	Transboundary	Effects occur at an international level (outside of the UKCS).
Frequency	One-off	Effects which occur only once.
	Intermittent	Effects that occur on an occasional basis.
	Continuous	Effects that occur continuously.

6.1.3 Evaluation of Impact Significance

This section describes the criteria used for determining the significance of effects on the environment.

6.1.3.1 Planned Activities

For planned activities, the significance of effects has been evaluated by considering the **sensitivity** of the receptor affected in combination with the **magnitude** of impact that is likely to arise, having regard to the criteria detailed in Annex III of the EIA Directive (EC, 2011), including:

- The magnitude and spatial extent of the impact (geographical area and size of the population likely to be affected);
- The nature of the impact;
- The transboundary nature of the impact;
- The intensity and complexity of the impact;
- The probability of the impact;
- The expected onset, duration, frequency, and reversibility of the impact;
- The accumulation of the impact with the impact of other existing and/or approved projects and/or projects not yet approved, but that PUK is aware of;
- The possibility of effectively reducing the impact.

Sensitivity Criteria

Sensitivity is a function of the value of the receptor (a measure of its importance, rarity and worth), its capacity to accommodate change when pressure is applied (resistance or tolerance), and its subsequent recoverability (resilience). The criteria presented in Table 6.2 has been used to guide this assessment to determine the sensitivity of receptors.

Table 6.2. Determining Sensitivity Matrix.

		Resistance and Resilience			
		Very High	*High*	*Medium*	*Low*
Value	*Low*	Low	Low	Medium	Medium
	Medium	Low	Medium	Medium	High
	High	Low	Medium	High	Very High
	Very High	Medium	High	Very High	Very High

Resistance and Resilience Definitions	
Very High:	Highly adaptive and resilient to pressure. High recoverability in the short-term.
High:	Some tolerance/capacity to accommodate pressure. High recoverability in the medium-term.
Medium:	Limited tolerance/capacity to accommodate pressure. Recoverability is slow and/or costly.
Low:	Very limited or no tolerance/capacity to accommodate pressure. Recovery is unlikely or not possible.
Value	
Very High:	Very high value and/or of international importance.
High:	High value and/or of national importance.
Medium:	Moderate value and/or of regional importance.
Low:	Low value and/or of local importance.

Magnitude of Impact Criteria

The magnitude of impact considers the characteristics of the change that is likely to arise (e.g., a function of the spatial extent, duration, reversibility, and likelihood of occurrence of the impact) and can be adverse or beneficial. Where it is not possible to quantify impacts, a qualitative assessment has been carried out, based on the best available scientific evidence and professional judgement. The criteria presented in Table 6.3 has been used as a guide in this assessment to define the magnitude of impact.

Table 6.3. Determining Magnitude of Impact.

Magnitude	Definition
Substantial	Permanent or long-term (>5 years) change in baseline environmental conditions, which is certain to occur. The impact may be one-off, intermittent, or continuous and/or experienced over a very wide area (i.e., transboundary in scale). The impact is likely to result in environmental quality standards or threshold criteria being routinely exceeded.
Major	Medium to long-term (1 – 5 years), reversible change in baseline environmental conditions, which is likely to occur. The impact may be one-off, intermittent, or continuous and/or experienced over a wide area (i.e., national in scale). Impact could result in a one-off exceedance of environmental quality standards or threshold criteria.
Moderate	Short to medium-term (< 1 year), temporary change in baseline environmental conditions, which is likely to occur. The impact may be one-off, intermittent, or continuous and/or regional in scale (i.e., beyond the area surrounding the Project site to the wider region). The impact is unlikely to result in an exceedance of environmental quality standards or threshold criteria.
Minor	Short-term (a few days to weeks), temporary change in baseline environmental conditions, which could possibly occur. The impact may be one-off, intermittent and/or localised in scale, limited to the area surrounding the proposed Project site. The impact would not result in an exceedance of environmental quality standards or threshold criteria.
Negligible	Immeasurable or undetectable changes (i.e., within the range of normal natural variation).

Significance of Effect

For planned activities, the overall significance of an effect has been determined by cross-referencing the sensitivity of the receptor with the magnitude of impact, using the matrix shown in Table 6.4.

In the context of this assessment, effects classified as **Major** or **Moderate** are considered to be "significant" in EIA terms and therefore mitigation measures are required to prevent, reduce or offset adverse significant effects or enhance beneficial effects. The overall significance of the effect is then re-evaluated, considering the mitigation measures, to determine the residual effect utilising the methodology outlined above. Effects classed as **Minor** are not considered to be significant and are usually controlled through good industry practice. Effects classed as **Negligible** are also not considered to be significant.

Table 6.4. Significance Evaluation Matrix (Planned Activities).

		Magnitude of Impact				
		Negligible	**Minor**	**Moderate**	**Major**	**Substantial**
Receptor Sensitivity	**Low**	Negligible	Minor	Minor	Minor	Minor / Moderate
	Medium	Negligible	Minor	Minor	Moderate	Moderate / Major
	High	Negligible	Minor	Moderate	Major	Major
	Very High	Negligible	Minor / Moderate	Moderate / Major	Major	Major

6.1.3.2 Unplanned Events

For unplanned events, such as accidental hydrocarbon releases or a ship collision, significance has been determined using a risk assessment approach, where the likelihood (probability) of the unplanned event occurring is considered against the severity (significance of effect) if the event was to occur. The approach taken is in line with the Petrodec Risk Control Procedure (PED-IMS-06-DOC-008).

The likelihood of an unplanned event occurring, and the effect is determined using the criteria presented in Table 6.5.

A risk category (low, medium, or high) has then been assigned to the unplanned event using the matrix shown in Table 6.4.

In the context of this assessment:

- **High-risk** events are considered to be "significant" in EIA terms and are unacceptable.
- **Medium** risk events are also considered to be "significant" in EIA terms unless it can be demonstrated that the risk has been reduced to as low as reasonably practicable (ALARP) through mitigation, control measures and good industry practice.
- **Low-risk** events are not considered to be "significant" in EIA terms but should still be controlled through good industry practice.

Table 6.5. Petrodec Risk Assessment Matrix.

1-6	Minor risk						Likelihood				
8-12	Acceptable if ALARP										
15-30	Unacceptable risk						1	2	3	4	5
Risk = Likelihood x Severity							Never heard of in industry	Heard of industry	Has happened in our organisation or more than once per year in the industry	Has happened at the location or more than once per year in the organisation	Has happened more than once per year at the location
Severity		Persons	Environment	Damage	Effect		Very unlikely	Unlikely	Possible	Likely	Very likely
	1	No harm or no First Aid required	No effect	Negligible Damage, Damage < €1,000	Insignificant		1	2	3	4	5
	2	One or more First Aid Cases	Minor effect, contained within the location	Minor Damage to equipment/ assets/ tools, €1,000 ≤ Damage < €50,000	Minor		2	4	6	8	10
	3	One or more Medical Treatment Cases	Minor Damage to or disturbance of flora/ fauna, no lasting effects	Significant Damage to equipment/ assets/ tools, €50,000 ≤ Damage < €100,000	Significant		3	6	9	12	15
	4	One or more Lost Workday Cases	Single loss of, or local Damage to, flora/ fauna with persisting effect that requires clean-up outside the premises	Loss of, or serious Damage to, equipment/ assets/ tools, €100,000 ≤ Damage < €700,000	Serious		4	8	12	16	20
	5	One Fatality or one or more Permanent Total Disabilities	Severe environmental Damage requiring extensive measures to restore the environment	Total loss of asset, €700,000 ≤ Damage < €7,000,000	Major		5	10	15	20	25
	6	Multiple Fatalities	Persistent severe environmental Damage leading to loss of commercial use or loss of natural resources over a wide area	Massive Damage, Damage ≥ €7,000,000	Catastrophic		6	12	18	24	30

6.2 Insignificant Impacts

Each activity presented in the Environmental Impact Identification (ENVID) that was considered insignificant is presented in this section.

6.2.1 Physical Presence

6.2.1.1 Presence of HLV and Support Vessels

A Heavy Lift Vessel (HLV) will undertake the Galahad topside and monopod removal, with the support of other vessels such as tugboats (for the rig move), supply vessels and an ERRV. Following the rig move, the HLV will remain in position adjacent to the Galahad platform, and therefore within the 500m safety zone, for the project duration. An ERRV typically is assigned to the installation for the project duration and remains in a holding position in or around the safety zone. Typically, there are supply vessels every couple of days, and they remain alongside the HLV during cargo handling activities.

The receptors that could be affected by the HLV and support vessels would be other sea users such as fishing vessels, cargo vessels and ferries.

The Outer Dowsing Offshore Wind Development construction will commence in 2026/2027 at the earliest. There is potential for an overlap in the timing of the Galahad decommissioning activity and the Outer Dowsing construction phase, during which time there could be an elevated number of vessels above the typical marine traffic levels for the area.

Mitigation for the safety of other sea users will be in place for the project duration. This includes a 500m zone that is marked on the navigation charts so that other sea users know to avoid the area, including any windfarm construction vessels. Consent to Locate will be obtained before the deployment of the HLV. Aids to navigation will be active on the HLV, and the ERRV will monitor vessel movements. The potential impact of the Outer Dowsing Wind Development construction will be further considered in the Consent to Locate application when both project times are better established.

Sensitivity: Medium

Magnitude: Negligible

Significance: Negligible

The mitigation measure will ensure that sea users will be aware of the operations and safely avoid the Galahad, HLV and other vessels during the decommissioning activities. As a result, no further assessment is required.

6.2.1.2 Removal of Topside/Monopod – Seabird Nesting

There have been documented cases of seabirds, in particular the Black-legged Kittiwake *(Rissa tridactyla)*, building nests on offshore platforms (Christensen-Dalsgaard *et al.,* 2019). All birds, including the Kittiwake, are protected under the EU Birds Directive (Directive 2009/147/EC) as naturally occurring wild bird species. The EU Birds Directive is transposed for the UK offshore area by The Conservation of Offshore Marine Habitats and Species Regulations 2017. Under regulation Part 3 (40) of The Conservation of Offshore Marine Habitats and Species Regulations 2017 it is an offence to deliberately capture, injure, or kill any wild bird; take, damage, or destroy the nest of any wild bird while that nest is in use or being built; or take or destroy an egg of any wild bird.

In recent years, there has been a growing awareness of the presence of nesting birds on platforms and the delays it can cause in decommissioning activities. Therefore, it is recommended by OPRED to have a Seabird Management Plan in place to monitor and manage nesting birds to ensure their protection and to remove the risk of project delays.

The physical presence of the Galahad installation in the North Sea offers potentially suitable nesting spaces for seabirds.

PUK appointed an ornithologist to undertake a seabird survey of Galahad in 2023 and 2024. No nesting birds were encountered on the installation on both occasions. In 2023, two Kittiwakes were observed loafing on the topside during the survey. In the 2024 survey, four Kittiwakes were noted to be loafing on Galahad.

Sensitivity: High

Magnitude: Negligible

Significance: Negligible

Kittiwakes typically have an affinity to a nesting site and establishing a new roosting site is a slow process. As there have been no birds recorded nesting on Galahad, there is a very low chance of a roost forming in the coming years. As a result, no further assessment is required.

Recommendation – continue to undertake an annual nesting survey of Galahad and maintain a Seabird Management Plan for the installation.

6.2.1.3 Removal of 500m Safety Zone

Under the Petroleum Act 1987, all oil and gas installations which project above the sea surface at any state of the tide are automatically protected by a 500m safety zone. Under normal circumstances, no vessel may enter the 500m zone without permission of the asset owner/operator. Therefore, vessels must navigate around the safety zone.

A new 500m safety zone order (ON54) application will be made to keep the 500m exclusion zone in place around Galahad until the decommissioning of the pipeline, which will be included with the wider Lancelot Area Production System pipeline (LAPS) network following the COP of the LAPS field.

6.2.2 Noise Emissions

6.2.2.1 Operational Activity of HLV, Support Vessels and Helicopters

A source of noise emissions associated with the Galahad decommissioning project is those from the operation of the HLV, support vessels and helicopters. The HLV noise sources are on the deck. The HLV's air gap would be approximately 20m above sea level (LAT). Helicopter flights are infrequent. This distance from the sea would abate the noise impact on the marine environment. The support vessels are of modest size (70m length) and engine noises are not expected to have an impact on the marine environment.

The Outer Dowsing Wind Development construction, which will commence in 2026/2027 at the earliest, could result in an increase in noise activity in the area. There is potential for an overlap in the timing of the Galahad decommissioning activity and the Outer Dowsing construction phase. As the Galahad decommissioning activity will not produce significant noise, it is considered that the decommissioning will not result in accumulative noise impact on the area.

Sensitivity: High

Magnitude: Negligible

Significance: Negligible

The noise impact from all these sources is considered to be minor and no further assessment is required.

6.2.2.2 Cutting and Removing Piles and Monopod

The intended method for severing the monopod's piles is the use of internal high-pressure abrasive water jet cutting (AWJC). An AWJC tool will be deployed into the pile to approximately 3m below the seabed. The tool's cutting nozzle is hydraulically actuated under high pressure to travel around the internal wall of the inner pile, performing the cut as it travels.

The Harbour Porpoise is the species most sensitive to marine noise that is known to be present in this part of the southern North Sea. Galahad is positioned 1.5km outside of the Southern North Sea SAC, which has been designated to conserve Harbour Porpoises.

The current guidance for assessing the significance of noise disturbance against harbour porpoises (JNCC, 2020) does not classify abrasive water jet cutting as a significant source of noise. Therefore, it is deemed that abrasive water jet cutting does not have an auditory impact on Harbour Porpoise or other marine species.

Sensitivity: High

Magnitude: Negligible

Significance: Negligible

The noise impact of abrasive jet cutting is not considered a risk to marine animals. No further assessment is required.

6.2.3 Marine Discharges

The topside is hydrocarbon safe (HCS), and all wells have been plugged and abandoned, following the topside decommissioning activities conducted in 2021. Therefore, there are minimal operational chemicals (rig wash and jacking grease) required for the topside and monopod removal project.

All other discharges during the operations will be controlled under either MARPOL or OPRED permits. Deck water discharged will have an Oil Discharge Permit. Bilge oily water and sewage discharges are controlled under MARPOL rules.

Sensitivity: Medium

Magnitude: Negligible

Significance: Negligible

There are minimal marine discharges, and all are subject to regulatory controls. As a result, no further assessment is required.

6.2.4 Atmospheric Emissions

The offshore decommissioning activities will produce atmospheric emissions, primarily through fuel combustion. These GHG-emitting activities are required to meet decommissioning obligations for the infrastructure. As presented in Appendix 2, the emissions will be minimal in terms of the overall carbon footprint of the UKCS oil and gas activity and the UK national carbon budget.

Sensitivity: High

Magnitude: Negligible

Significance: Negligible

Best practices will be employed to minimise this carbon footprint. This includes optimising the logistical planning of vessels and operating effective environmental management systems minimising their emissions. As a result, no further assessment is required.

6.2.5 Solid Waste Generation

All waste generated during decommissioning activities will be handled, and recovered or disposed of, following the principles of the waste hierarchy and in line with existing waste management legislation. Only licensed contractors will be used for waste handling and treatment/disposal. The HLV and support vessels will have an approved MARPOL Garbage Management Plan.

The topside and monopod waste treatment will be conducted onshore. Over 95% of the topside and monopod's waste is steel, which can be fully recovered and reused. Overall, the aim is to recover over 98% of the waste generated during the project.

Sensitivity: Medium

Magnitude: Negligible

Significance: Negligible

As there is strict alignment with waste management legislation and the very high waste recovery target, no further assessment is required.

6.2.6 Seabed Disturbance

The disturbance of the seabed will primarily come from two activities:

- The HLV rig moves into the working position alongside the Galahad installation. This includes the placement of the HLV's spudcans (bottom of the legs) and deployment of anchors and anchor lines on the seabed,
- Removal of monopod

Seabed disturbance will result in the suspension of sediment in the water column. The resettling of suspended sediment can result in smothering of species and habitats. Furthermore, the disturbance of sediment can result in the spreading of contaminants in the sediment.

The sediment chemical analysis noted elevated hydrocarbons and metals in certain sampling stations, as presented in Section 4.1.4. For example, four station concentrations were elevated above typical background levels for the SNS (UKOOA, 2001), and the average recorded value for the Galahad site was slightly above the 50th percentile background level. However, no stations showed levels above the OSPAR (2006) 50mg.kg^{-1} threshold for THC is used to delineate the chemical boundaries above which impacts on the biota may occur.

Certain metals, such as vanadium, zinc, and iron were recorded at levels above the UKOOA 95th percentile at three or four stations. Arsenic levels at all stations exceeded the OSPAR ERL value. While metals were elevated within much of the Galahad survey area, the concentrations are consistent with other studies in the region and are thought to reflect the input of contaminants from the Humber Estuary plume and/or the release of metals from the historic drilling of marine shales in this area of the SNS.

Sensitivity: Medium

Magnitude: Minor

Significance: Minor

The re-suspension of sediments will be minor in the context of the background turbidity. Sediment plumes will be extremely short-lived, given the strong tidal currents in the area. There were no sensitive benthic habitats recorded in the vicinity of the installation (refer to Section 4.2.2.2). Therefore, no further assessment is required.

6.2.7 Accidental Events – Loss of Containment

As the Galahad wells have been plugged and abandoned, and the topside is hydrocarbon safe, there is no risk of hydrocarbon release from the installation. However, the use of an HLV and support vessels afford the risk of a spill from these vessels. For example, a burst fuel hose during bunkering.

Based on OPEP Guidelines (BEIS, 2022a), an installation within a block greater than 40km from a coastline does not require an Oil Spill Model. Block 48/12 is 68km from the Lincolnshire coastline.

Likelihood: Possible

Severity: Minor

Risk: **Low**

Galahad installation will have an OPEP, and a CIP will be prepared and approved before the commencement of the decommissioning activity. A bunkering procedure will be in place to control the bunkering process to limit the potential for the release of diesel during bunkering.

6.2.7.1 Potential for a Major Environmental Incident

A Major Environmental Incident (MEI) is defined as an incident that results, or is likely to result, in significant adverse effects on the environment in accordance with Directive 2004/35/EC of the European Parliament and the Council on Environmental Liability concerning the prevention and remedying of environmental damage ('the Environmental Liability Directive'). For an event to be considered an MEI, a Major Accident must be a precursor, as per the Offshore Safety Directive Regulations (OSDR) 2015.

The potential quantities of hydrocarbons lost from a bunkering incident (typically less than 100 litres) do not qualify as an MEI. In addition, to qualify as an MEI, the liquid hydrocarbon release would have to impact a protected coastal or offshore habitat (e.g., a Special Area of Conservation). While Galahad is located with close to the Southern North Sea SAC, the worst-case scenario spill volumes are below the threshold that would result in an MEI. The beach of oils would be very unlikely due to the distance from the coast and the breakdown of hydrocarbons from wave action.

6.3 Potential Significant Impacts Assessment

The ENVID assessment did not identify any planned activity that was considered to have a significant environmental impact.

6.4 Cumulative and Transboundary Impacts

Galahad is located within the footprint of the planned Outer Dowsing Windfarm Development. Based on the current planning application time frame, the windfarm will not commence construction until 2026/2027. Galahad will likely be decommissioned before the commencement of the windfarm construction phase. If there is an overlap in timing, the impact on either project will be minimal. Galahad's 500m zone will be in place to ensure the safety of the decommissioning project. The decommissioning activity does not generate significant marine noise that would cause an accumulative effect on the windfarm construction activity.

Galahad is located approximately 108 km from the UK/Netherlands median line. Due to the distance, a spill of diesel (during bunkering) is very unlikely to cross the median line.

Galahad is located within a busy part of the Southern North Sea with much oil and gas activity as well as windfarm developments. During the permit preparation stage for the decommissioning project, a review of planned activities would be required to determine the cumulative impacts during the project execution. Since the project will not have significant environmental impacts, it is unlikely to contribute to a cumulative impact on the wider area.

7 EA Conclusions

Following a detailed review of the proposed decommissioning options, the environmental sensitivities present in the area, and potential impacts on other sea users and the environment, it has been determined that the decommissioning of the Galahad topside and monopod will not present any significant impacts.

All identified impacts associated with the decommissioning project are well understood and managed through the implementation of established mitigation measures. All activities are considered to have an insignificant impact on the environment.

The EA is considered by PUK to be in alignment with the objectives and marine planning policies of the East marine plan area.

Based on the assessment findings of this EA, including the identification and subsequent application of appropriate mitigation measures it is considered that the proposed Galahad decommissioning activities do not pose any significant impact to environmental or societal receptors within the UKCS or internationally.

References

Admiralty (2017). *Admiralty Chart 2182A. North Sea Southern Sheet*. Admiralty Paper Chart Services.

BEIS (2018). *Guidance notes Decommissioning of Offshore Oil and Gas Installations and Pipelines*. Department of Business, Energy, and Industrial Strategy.

BEIS (2022). *UK Offshore Energy Strategic Environmental Assessment 4 (OESEA4)*. Department of Business, Energy, and Industrial Strategy.

BEIS (2022a). *Guidance Notes for Preparing Oil Pollution Emergency Plans for Offshore Oil and Gas Installations and Relevant Oil Handling Facilities*. Department of Business, Energy, and Industrial Strategy.

Berx, B. and Hughes, S. (2009). *Climatology of Surface and Near-bed Temperature and Salinity on the North-West European Continental Shelf for 1971–2000 dataset*. DOI: 10.7489/1900-1.

BGS (2024). Offshore GeoIndex [Online]. Available from: http://mapapps2.bgs.ac.uk/geoindex_offshore/home.html. (British Geological Society), [Accessed June 2024].

Biocensus (2023). *Perenco Assets Ornithological Assessment 2023*. RSK Biocensus, UK.

Blue Flag (2024). *Worldwide Blue Flag sites 2022.* Available from: https://www.blueflag.global/ [Accessed June 2024].

Bordin, G., McCourt, J. and Rodriguez, A. (1992). Trace metals in the marine bivalve *Macoma balthica* in the Westerschelde Estuary, the Netherland. Part 1: analysis of total copper, cadmium, zinc, and iron-locational and seasonal variations. *Sci. Tot. Environ*, 127: 225-280.

BSL (2019). Pickerill A - Pre-decommissioning Survey - Environmental Baseline Survey Report. Benthic Solutions Limited.

Benthic Solutions (2021). Galahad – Pre-decommissioning Environmental Baseline Survey Field Report – on behalf of Perenco UK. Benthic Solutions.

CEFAS (2001) North Sea Fish and Fisheries. Technical report produced for Strategic Environmental Assessment – SEA2. [Online] Available from:https://www.gov.uk/government/consultations/strategicenvironmental-assessment-2-sea-2 [Accessed June 2024].

Chester, R. and Voutsinou, F.G. (1981). The initial assessment of trace metal pollution in coastal sediments. *Marine Pollution Bulletin.* 12: 84-91.

Christensen-Dalsgaard, S., Langset, M., Anker-Nilssen, T., 2019. *Offshore oil rigs–a breeding refuge for Norwegian Black-legged Kittiwakes Rissa tridactyla?* Seabird 32, 30–32.

CIEEM (2018). *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine.* Chartered Institute of Ecology and Environmental Management, Winchester.

Collins, M.B., Shimwell, S.J., Gao, S., Powell, H., Hewitson, C. & Taylor, J.A. (1995) Water and sediment movement in the vicinity of linear sandbanks: the Norfolk Banks, southern North Sea. *Marine Geology,* 123: 125-142.

Coull, K. A., Johnstone, R., and Rogers, S. I. (1998). *Fisheries Sensitivity Maps in British Waters*. Published and distributed by UKOOA Ltd.

Crown Estates (2024). *The Crown Estates Offshore Activity*. Available from: https://opendata-thecrownestate.opendata.arcgis.com [Accessed June 2024].

Dann, R., van het Groenewoud, H., de Jong, S.A. and Mulder, M. (1992). Physico-chemical and biological features of a drilling site in the North Sea, 1 year after discharges of oil contaminated drill cuttings. *Mar. Ecol Prog. Ser.*, 91: 37-45.

DEFRA (2014). *East Inshore and East Offshore Marine Plans*. Marine Management Organisation, Department for Environment, Food and Rural Affairs (DEFRA).

Ellis, J. R., Milligan, S. P., Readdy, L., Taylor, N. & Brown, M.J. (2012). *Spawning and nursery grounds of selected fish species in UK waters, CEFAS, Science Series, Technical Report no. 147.*

Ellis, J.R., Cruz-Martínez, A., Rackham, B.D. and Roger, S.I. (2004) *The Distribution of Chondrichthyan Fishes around the British Isles and Implications for Conservation*. Journal of Northwest Atlantic Fishery Science, 25: 195-213.

Ellis, J.R., Milligan, S., Readdy, L., South, A., Taylor, N., and Brown, N. (2010). MB5301 Mapping spawning and nursery areas of species to be considered in Marine Protected Areas (Marine Conservation Zones). Report No 1: Final Report on development of derived data layers for 40 mobile species considered to be of conservation importance 96pp.

EMODnet (European Marine Observation and Data Network) (2024). *EUSeaMap - Broad-scale Seabed Habitat Map for Europe,* Available from: https://emodnet.ec.europa.eu/en/seabed-habitats [Accessed June 2024].

ESAS (2024). *European Seabirds at Sea*. ICES, Copenhagen, Denmark. https://esas.ices.dk [Accessed June 2024].

EUNIS (2021). EUNIS terrestrial habitat classification review 2021_1. Available from https://www.eea.europa.eu/data-and-maps/data/eunis-habitat-classification-1/eunis-terrestrial-habitat-classification-review-2021 [Accessed June 2024].

EC (2011)*. Directive on the Assessment of the Effects of Certain Public and Private Projects on The Environment (Codification).* Directive 2011/92/EU. European Commission, European Union.

EC (2017). *Environmental Impact Assessment of Projects Guidance on the Preparation of the Environmental Impact Assessment Report (Directive 2011/92/EU as amended by 2014/52/EU).* European Commission, European Union.

Gilles, A., Authier, M., Ramirez-Martinez, N.C., Araújo, H., Blanchard, A., Carlstrom, J., Eira, C., Dorémus, G., Fernandez-Maldonad, C., Geelhoed, S.C.V. and Kyhn, L. (2023). Estimates of cetacean abundance in European Atlantic waters in summer 2022 from the SCANS-IV aerial and shipboard surveys. University of Veterinary Medicine Hannover.

Hammond, P.S., Lacey, C., Gilles, A., Viquerat, S., Börjesson, P., Herr, H., Macleod, K., Ridoux, V., Santos, M.B., Scheidat, M., Teilmann, J., Vingada, J., Ǿien, N. (2021). *Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys*, June 2021.

Herut, B. and Sandler, A. (2006). Normalization methods for pollutants in marine sediments: review and recommendations for the Mediterranean. IOLR Report H, 18(23), 1-23.

Historic England (2024). *Protected Wrecks. Online Mapping.* https://historicengland.org.uk/advice/heritage-at-risk/protected-wreck-sites-at-risk/ [Accessed June 2024].

Howarth, M.J. and Huthnance, J.M. (1984). Tidal and residual currents around a Norfolk sandbank. *Estuarine and Coastal Shelf Science*, 19: 105-117.

IAMMWG (2015) *Management Units for Cetaceans in UK Waters (January 2015).* Joint Nature Conservation Committee (JNCC), Report No. 547.

IAMMWG (2022). *Updated abundance estimates for cetacean Management Units in UK waters*. JNCC Report No. 680, JNCC Peterborough

IEMA (2016). *Environmental Impact Assessment Guide to: Delivering Quality Development, July 2016*. Institute of Environmental Management and Assessment.

IUCN (2024). *The IUCN Red List of Threatened Species*. International Union for Conservation of Nature [Online] Available from: http://www.iucnredlist.org [Accessed June 2024].

JNCC (2015). The Marine Habitat Classification for Britain and Ireland Version 15.03. Available from: https://mhc.jncc.gov.uk [Accessed June 2024].

JNCC (2017). *Southern North Sea MPA*. Southern North Sea MPA | JNCC - Adviser to Government on Nature Conservation [Accessed June 2024]. Joint Nature Conservation Committee.

JNCC (2018). Annex I Reefs in UK offshore waters. Available from: http://jncc.defra.gov.uk/page-5201 [Accessed June 2024].

JNCC (2023). *About Marine Protection Areas* [website]. Joint Nature Conservation Committee. Available at https://jncc.gov.uk/our-work/about-marine-protected-areas/ [Accessed June 2024].

Kober, K., Webb, A., Win, I., Lewis, M., O'Brien, S., Wilson, L.J. & Reid, J.B. (2010). *An analysis of the numbers and distribution of seabirds within the British Fishery Limit aimed at identifying areas that qualify as possible marine SPAs*, JNCC Report No. 431. JNCC, Peterborough, ISSN 0963-8091.

Long, E. R., MacDonald, D. D., Smith, S. L. and Calder, F. D. (1995). Incidence of adverse biological effects within ranges of chemical concentrations in marine and estuary sediments. Environmental Management 19: 81-97.

Loring, D.H. (1990). Lithium—a new approach for the granulometric normalization of trace metal data. *Marine Chemistry*, 29: 155-168.

Marine Directive (2023). *2022 Scottish Sea Fisheries Statistics - Fishing Effort and Quantity and Value of Landings by ICES Rectangles.* [Online] Available at. https://doi.org/10.7489/12474-1 [Accessed June 2024].

MCA (2020). *Receiver of wreck: protected wrecks*. Maritime and Coastguard Agency. Available from: https://www.gov.uk/government/publications/receiver-of-wreck-protected-wrecks [Accessed June 2024].

NATS (2024). *UAS Restriction Zones Map* (website). https://nats-uk.ead-it.com/cms-nats/opencms/en/uas-restriction-zones/ [Accessed June 2024].

Neff, J.M. (2005). *Composition, Environmental Fates, and biological effects of Water Based Drilling Muds and Cuttings Discharged to the Marine Environment: A Synthesis and Annotated Bibliography*.

NSTA (2024). *Oil and Gas mapping data*. North Sea Transition Authority. https://www.nstauthority.co.uk/data-and-insights/. [Accessed June 2024].

N-Sea (2020). *Decommissioning seabed surveys results report volume 1A - Galahad Platform, on behalf of Perenco UK Ltd*. N-Sea Offshore B.V., Dordrecht, The Netherlands

NSTF (1993). North Sea quality status report 1993 – London (Oslo and Paris commissions) & Fredensborg, North Sea task force, Denmark.

OGUK (2019). *Oil Spill Response Effectiveness in UK Waters Guidelines, Issue 2*. Aberdeen: UK Oil and Gas Industry Associated Limited.

ONS (2024). UK Environmental Accounts: 2024. Measuring the contribution of the environment to the economy, impact of economic activity on the environment, and response to environmental issues. Office of National Statistics, UK. https://www.ons.gov.uk/economy/environmentalaccounts/bulletins/ukenvironmentalaccounts/2024. [Accessed June 2024]

OSPAR (2008). CEMP Assessment Manual Coordinated Environmental Monitoring Programme Assessment Manual for contaminants in sediment and biota. 379/2008. pp 39.

OSPAR (2009a). Agreement on CEMP Assessment Criteria for the QSR 2010. OSPAR agreement number: 2009-2.

OSPAR (2009b). *Background document on CEMP assessment criteria for QSR 2010*. Publication Number: 461/2009. pp. 23

OSPAR (2014). *Levels and Trends in Marine Contaminants and. their Biological Effects*. CEMP Assessment Report 2013. Publication number: 631/2014, OSPAR Commission 2014

Reid, J. B., Evans, P. G. H. and Northridge, S. P. (2003) *Atlas of Cetacean distribution in north-west European waters*. Peterborough: Joint Nature Conservation Committee (JNCC).

Russell, D.J.F., Jones, E.L. and Morris, C.D. (2017). *Updated Seal Usage Maps: The Estimated at-sea Distribution of Grey and Harbour Seals*. Scottish Marine and Freshwater Science, 8 (25).

SCOS (2022). *Scientific Advice on Matters Related to the Management of Seal Populations: 2022*. St Andrews: Special Committee on Seals (SCOS). Special Committee on Seals on behalf of Natural Environment Research Council (NERC).

Sheahan, D., Rycroft, R., Allen, Y., Kenny, A., Mason, C. and Irish, R. (2001). Contaminant status of the North Sea. Technical Report TR_004. Report produced for Strategic Environmental Assessment – SEA2.

SNH and HES (2018). Environmental Impact Assessment Handbook - Guidance for competent authorities, consultation bodies, and others involved in the Environmental Impact Assessment process in Scotland. Version 5, April 2018. Scottish Natural Heritage and Historic Environment Scotland.

Tessier, A., Campbell, P. G. C., and Bisson, M. (1979). Sequel Extraction Procedure for the Speciation of Particulate Trace Metals. *Analytical Chemistry*, 51: 844 - 851.

UKOOA (2001). An analysis of U.K Offshore Oil & gas Environmental Surveys 1975-95, pp. 141.

Webb, A., Elgie, M., Irwin, C., Pollock, C. and Barton, C. (2016) Sensitivity of offshore seabird concentrations to oil pollution around the United Kingdom: Report to Oil & Gas UK.

Whalley, C., Rowlatt, S., Bennett, M. and Lovell, D. (1999). Total Arsenic in Sediments from the Western North Sea and the Humber Estuary, *Marine Pollution Bulletin*, 38: 394-400.

Xodus (2024). Perenco: Ornithological Support Perenco Asset Survey 2024. Xodus, Aberdeen, UK.

Youngblood, W.W. and Blumer, M. (1975). Polycyclic aromatic hydrocarbons in the environment: homologues series in soils and recent marine sediments. *Geochim Cosmochim Acta*, 39:1303-1314.

Appendix 1 - Environmental Management

This section describes the arrangements that will be put into place by PUK to ensure that the mitigation and other measures of control, including the reduction or elimination of potential impacts, are implemented, and conducted effectively. This section also serves to outline the key elements of relevant corporate policies and how PUK will manage the environmental aspects of the Galahad decommissioning operations.

Introduction

PUK hold ISO 14001 standard certification. Additionally, PUK operates under a Safety and SEMS, which forms part of the PUK Operating Management System (POMS). The POMS provide the framework for PUK to achieve safe and reliable operations day-in and day-out and ensures compliance with PUK's HSSE Policy.

In addition to enabling the implementation of identified mitigation and control measures, the SEMS provides the means to monitor the effectiveness of these measures through check and environmental performance. The SEMS, by design, will enable PUK to control activities and operations with a potential environmental impact and provide the assurance on the effectiveness of the environmental management.

Scope of the SEMS

The SEMS provides the framework for the management of Health and Safety Executive (HSE) issues within the business. This EMS is intended for application to all PUK's activities as directed under the OSPAR recommendation 2003/5, promoting the design, use and implementation of Environmental Management Systems by the Offshore Industry. PUK, as a business, is centred on oil and gas exploration activities both onshore and offshore, with the offshore components of their business including seismic and drilling operations. As a relatively small operator, PUK intends to source such projects through the utilisation of contractors, should these not be available within the business itself.

The SEMS focuses on:

- Clear assignment of responsibilities;
- Excellence in HSE performance;
- Sound risk management and decision making;
- Efficient and cost-effective planning and operations;
- Legal compliance throughout all operations;
- A systematic approach to HSE critical business activities; and
- Continual improvement.

Principle of the SEMS

The following sub-sections describe the principles followed though the utilisation of the SEMS.

Improvement Programmes and the Management of Change

The purpose of employing an improvement programme is to:

- Ensure the continuous development of the PUK policy commitment.
- Introduce changes and innovations that ensure the achievement of performance standards where current performance is below expectations.

The SEMS also makes provisions for the management of change. Changes may occur for several reasons, and at a number of levels. A 'management of change' procedure specifies the circumstances under which formal control of change is required to ensure that significant impacts remain under control and/or new impacts are identified, evaluated, and controlled.

Roles and Responsibilities

PUK will review existing environmental roles and responsibilities for staff participating in the Galahad Installation DP. These will be amended and recorded in individual job descriptions to ensure that they consider any changes required for the management of the impacts identified in this EA.

Training and Competence

The competence of staff with environmental responsibilities is a critical means of control. The SEMS, in conjunction with the Human Resources department of PUK allows for the appointment of suitably competent staff. The development and implementation of training programmes facilitates understanding and efficient application.

Communication

Internal environmental communication generally employs existing channels such as management meetings, minutes, poster displays, etc. External communication with stakeholders and interested parties is controlled through a communication programme. This establishes links between each stakeholder, the issues that are of concern to them, and the information they require to assure them that their concerns and expectations are being addressed. This EA and the consultation process that informed its production will be used to design the ongoing communication programme. Communication and reporting will employ information derived from the monitoring programme.

Document Control

The control of the SEMS documents is managed in the PUK Document Control System.

Records

Records provide the evidence of conformance with the requirements of the SEMS and of the achievement of the objectives and targets in improvement programmes. The PUK SEMS specifies those records that are to be generated for these purposes, and controls their creation, storage, access, and retention.

Monitoring and Audit

Checking techniques employed within PUK's SEMS are a combination of monitoring, inspection activities and periodic audits.

The requirement for monitoring and inspection stems from the need to provide information to a number of different stakeholders, but primarily regulators, and PUK management. As such, there is a requirement for the results of monitoring and inspection to be integrated with the PUK internal and external communication programme.

Monitoring and inspection activities focus on:

- Checks that process parameters remain within design boundaries (process monitoring);
- Checks that emissions and discharges remain within specified performance standards – (emissions monitoring); and
- Checks that the impacts of emissions and discharges are within acceptable limits (ambient monitoring).

Incident Reporting and Investigation

The PUK SEMS stipulates documented procedures to control the reporting and investigation of incidents.

Non-Confidence and Corrective Action

The checking techniques outlined above are the means of detecting error or non-conformances. PUK's SEMS includes procedures for the formal recording and reporting of detected non-conformance, the definition of appropriate corrective action, the allocation of responsibilities and monitoring of close out.

Review

PUK's SEMS includes arrangements for a management review. This provides the means to ensure that the EMS remains an effective tool to control the environmental impacts of operations, and to re-configure the EMS in the light of internal or external change affecting the scope or significance of the impacts. Of particular importance is the role management review plays in the definition and implementation of the improvement programme, and the management of change.

Appendix 2 - Quantifying GHG Emissions

Planned Activity and Potential Sources of GHG Emissions

The Galahad topside and monopod removal project is planned to be completed in 30 days. The GHG emissions calculations are based on the estimated fuel usage of the HLV, support vessels and helicopters. These are classified as Petrodec Scope 1 "Direct GHG Emissions" from the HLV, as well as the Scope 3 emissions "purchased goods and services" (ERRV, support vessels and helicopter trips). Refer to Table A2.7. 1 for estimated emissions concentrations. All other emissions (e.g., Scope 2 and other Scope 3) are outside of the scope of these calculations.

Table A2.7. 1. Fuel consumption and GHG emissions from the HVL deployment at Galahad.

Parameter	Total Fuel Use (tonnes)	Emissions (tonnes)[1]			
		CO2e [2]	CO_2	CH_4	NO_x
HLV [3]	150	484	479	0.6	4.9
ERRV [4]	60	194	191	0.2	2.0
Supply Vessel [4]	34	111	109	0.1	1.1
Helicopters [5]	84	268	265	0.2	2.2
Total	**330**	**1,084**	**1,045**	**30**	**10.3**

Note 1: Emission factors from DEFRA Greenhouse gas reporting: conversion factors 2023 (DESNZ, 2023)
Note 2: CO2e = CO2 equivalent with a Global Warming Potential (GWP) for a 100-year time horizon (GWP factor: CO2 = 1; CH4 = 32; N2O = 298).
Note 3: Assumes HLV on location for 30 days with a diesel consumption of 5 MT/day.
Note 4: Assumes ERRV and supply vessel consumes 2 tonnes/day. Four supply vessels per week.
Note 5: Assumes 3 return helicopter trips per week (4 weeks) with a diesel consumption of 0.655 tonnes/hr.

UK National Carbon Budget

The Climate Change Act 2008 (as amended) requires the UK government to set legally-binding 'carbon budgets' to act as stepping-stones towards the 2050 Net Zero target. These carbon budgets restrict the total amount of Greenhouse Gas (GHG) that the UK can emit over five-year periods, ensuring continued progress towards the UK's long-term climate target. Table A2.7. 2 presents information on the current 4th Carbon Budget.

Table A2.7. 2. UK Carbon Budgets (HM Government, 2021).

Carbon Budget	Carbon Budget Level	Reduction Below 1990 Levels	Due to Meet Target
4th carbon budget (2023 to 2027)	1,950 million tonnes CO_2e	51% by 2025	Off track

Quantitative Comparison of GHG Emissions

A quantitative comparison between the predicted CO_2e emissions generated during the Galahad operations, compared to all UKCS offshore operations, UK total GHG emissions and the UK Carbon Budget, are presented Table A2.7. 3.

Table A2.7. 3. Comparison of Galahad GHG Emissions and Decommissioning project to Industry and UK Total Emissions.

Metric	Estimated Annual GHG Emissions (tonnes CO_{2eq})	Project's % UKCS Offshore Emissions	Project's % of Total UK Emissions	Project's % UK 4th Carbon Budget
Galahad decommissioning	1,084	-	-	-
UKCS Offshore GHG Emissions for 2022[1]	14,300,000	0.008	-	-
UK Total GHG Emissions[2]	506,000,000	-	0.0002	-
UK Fourth Carbon Budget[3]	1,950,000,000	-	-	0.0001

Note 1: Emissions Report 2023 (*OEUK, 2023*).
Note 2: Total UK Emissions from 2022 data (ONS, *2024*).
Note 3: HM Government, 2021.