RWE Renewables UK Dogger Bank South (West) Limited

RWE Renewables UK Dogger Bank South (East) Limited

Dogger Bank South Offshore Wind Farms

Appendix 10-3 Back-calculation of the Peak Atlantic Herring Spawning Period (Revision 2) (Clean)

Document Date:	October 2025
Document Reference:	7.10.10.3
Revision Number:	02
Classification:	Unrestricted

Company:	**RWE Renewables UK Dogger Bank South (West) Limited and RWE Renewables UK Dogger Bank South (East) Limited**	Asset:	**Development**
Project:	**Dogger Bank South Offshore Wind Farms**	Sub Project/Package	**Consents**
Document Title or Description:	Appendix 10-3 Back-calculation of the Peak Atlantic Herring Spawning Period (Revision 2) (Clean)		
Document Number:	005954513-02	Contractor Reference Number:	PC2340-ERM-OF-ZZ-AX-Z-0124

Rev No.	Date	Status/Reason for Issue	Author	Checked by	Approved by
01	June 2025	Submission for Deadline 6	ERM	RWE	RWE
02	October 2025	Post-Examination Update	ERM	RWE	RWE

Revision Change Log			
Rev No.	**Page**	**Section**	**Description**
01	N/A	N/A	Submitted for Deadline 6
02	9 to 55	1 and 3 to 5	Update to prioritise the use of the Heath (1993) 0.25mm/day larval growth rate to inform the back-calculation in preference to Kotthaus (1939), following advice provided by Cefas. Acceptance of the MMO's precautionary back-calculation.

Contents

Tables

Figures

Glossary

Term	Definition
Array Areas	The DBS East and DBS West offshore Array Areas, where the wind turbines, offshore platforms and array cables would be located. The Array Areas do not include the Offshore Export Cable Corridor or that part of the Inter-Platform Cable Corridor within which no wind turbines are proposed. Each area is referred to separately as an Array Area.
Dogger Bank South (DBS) Offshore Wind Farms	The collective name for the two Projects, DBS East and DBS West.
Impact	Used to describe a change resulting from an activity via the Projects, i.e. increased suspended sediments / increased noise.
Offshore Development Area	The Offshore Development Area for ES encompasses both the DBS East and West Array Areas, the Inter-Platform Cable Corridor, the Offshore Export Cable Corridor, plus the associated Construction Buffer Zones.
Offshore Export Cable Corridor	This is the area which will contain the offshore export cables between the Offshore Converter Platforms and Transition Joint Bays at the landfall.
Sediment	Particulate matter derived from rock, minerals or bioclastic matter.
The Projects	DBS East and DBS West (collectively referred to as the Dogger Bank South Offshore Wind Farms).
The Applicants	The Applicants for the Projects are RWE Renewables UK Dogger Bank South (East) Limited and RWE Renewables UK Dogger Bank South (West) Limited. The Applicants are themselves jointly owned by the RWE Group of companies (51% stake) and Masdar (49% stake).

Acronyms

Term	Definition
AbSmall	An abundance metric defined in the International Herring Larval Survey as the number of 0-ringer larvae per m^2
Cefas	Centre for Environment, Fisheries and Aquaculture Science
DBS	Dogger Bank South
EGL2	Eastern Green Link 2
IHLS	International Herring Larval Survey
KP	Kilometre Points
MMO	Marine Management Organisation
PSD	Particle Size Distribution
ST	Station numbers

1 Preface

1. This document is an appendix to **Chapter 10 Fish and Shellfish Ecology (Revision 2)** [REP7-042] and is intended for use in determining the period of peak egg-laying and larval development from peak spawning information via a back-calculation method.

2. The back-calculation method has been refined during a comprehensive consultation process with the Marine Management Organisation (MMO) and the Centre for Environment, Fisheries, and Aquaculture Science (Cefas). Discussions regarding the back-calculation have been presented during the Dogger Bank South (DBS) Examination period, in which the Applicants and / or the MMO and Cefas have not aligned on the suggested input parameters and underlying data.

3. The need for a back-calculation approach to determine the period of peak egg-laying and larval development stems from the proposed licence condition 28 within Deemed Marine Licences 3 and 4 presented within the **Draft DCO (Revision 12)** [REP9-003]. for a temporal restriction on cable laying activities between the 1st August and the 31st October. This restriction was proposed as a mitigation measure to protect the Banks population of Atlantic herring from the potential effects of cable laying activities during the spawning season. The Applicants acknowledge the need to alleviate pressure on the Banks spawning population from offshore activities. However, it is the Applicants' position that a 3 month temporal restriction on works is over-precautionary based on the predicted impacts from cable laying activities, and subsequently places unnecessary operational and programme and financial burdens on the DBS Offshore Export Cable installation campaign.

4. The Applicants recommended the implementation of a back-calculation approach to identify the peak risk to Atlantic herring, similar to that undertaken for the Eastern Green Link 2 (EGL2) project. EGL2 is a transmission cable installation project with the potential to interact with the Banks herring spawning population. It therefore has a high degree of similarity to the Projects in terms of cable laying activities and geography.

5. Based on the advice provided by Cefas the MMO disagreed with the input parameters initially presented by the Applicants, which reflected that of the EGL2 back-calculation. Following discussions on the approach, the MMO suggested a refined back-calculation approach which resulted in a proposed temporal restriction from the 21st August to the 30th September (representative of the MMO's current precautionary position as of September 2025).

6. This revised document represents the current positions (following recent discussions held on 15th September 2025) of the Applicants, the MMO and Cefas on the input parameters of the back-calculation. It is intended that this document would be revised during the post-consent phase of the project using contemporaneous data to present the final restricted period to be applied to construction, as dictated by the details of proposed licence condition 28 within Deemed Marine Licences 3 and 4 presented within the **Draft DCO (Revision 12)** [REP9-003].

2 Background Information

7. This document provides information regarding the period within which Atlantic herring (*Clupea harengus*) eggs and larvae are most at risk from cable laying activities. There is no direct measurement data for eggs on the seabed within the Offshore Development Area, therefore the peak period of egg development and larval hatching must be back-calculated from larval data sampled during the International Herring Larval Survey (IHLS) within known spawning grounds in the central North Sea.

8. The Kyle-Henney *et al*. (2024) approach is utilised within **Chapter 10 Fish and Shellfish Ecology (Revision 2)** [REP7-042] to identify potential spawning habitat for Atlantic herring within the Offshore Development Area, including DBS East and DBS West Array Areas and the Offshore Export Cable Corridor.

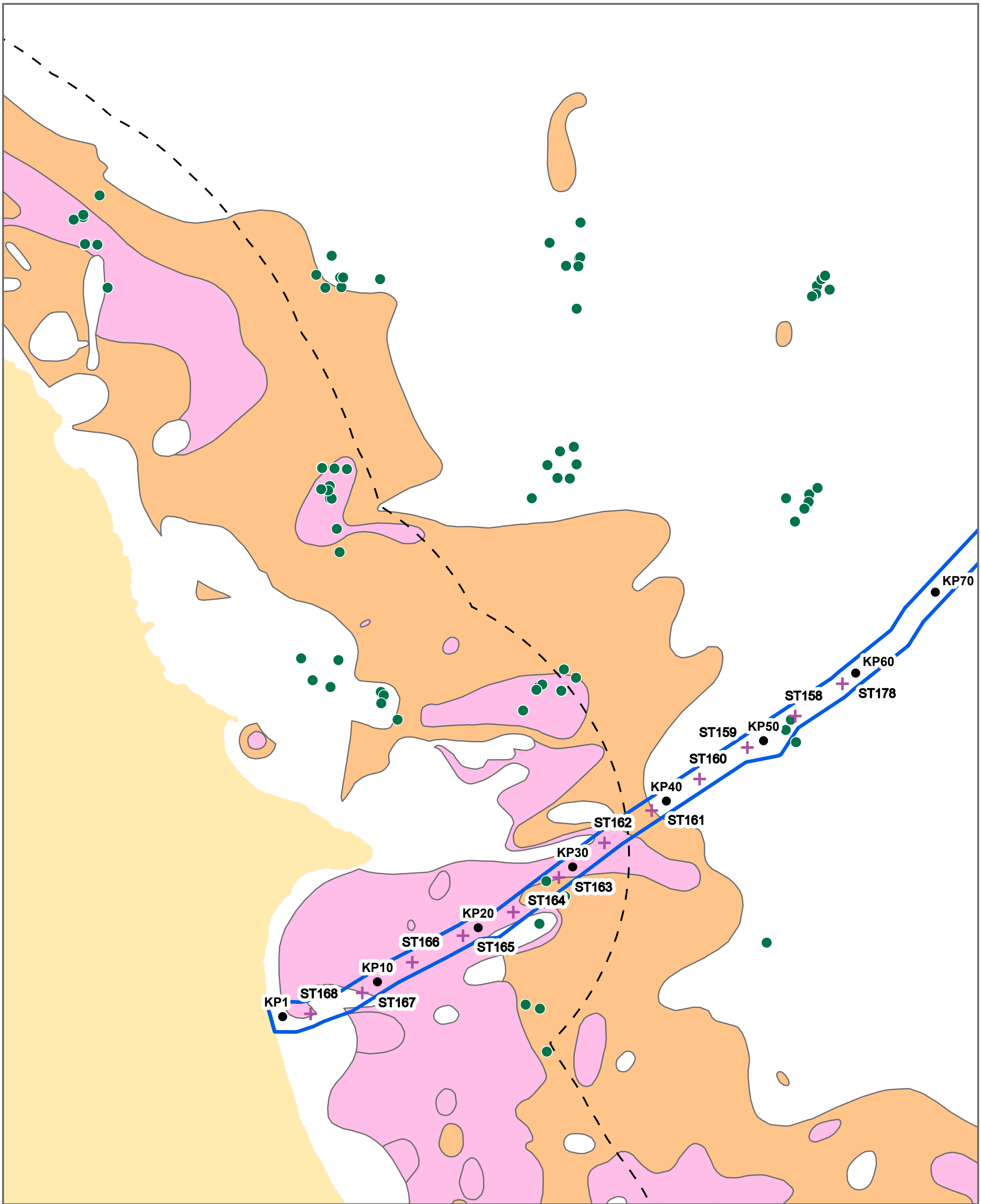
9. As stated in Kyle-Henney *et al*. (2024), the identification of potential spawning habitat may over-represent localised preferred or marginal seabed sediment types. This section uses Particle Size Distribution (PSD) data, collected by Fugro (2023) on behalf of the Projects, to ground-truth the heat map in accordance with the approach recommended by Kyle-Henney *et al*. (2024).

2.1 Particle Size Distribution Analysis

10. The locations of sediment sampling stations (ST159-ST168) along the Offshore Export Cable Corridor, identified as potential spawning habitat, are shown in **Figure 2-1**[1] and **Figure 2-2**.

11. **Table 2-1** and **Figure 2-2** show the seabed sediment types between ST159-ST168 to be primarily unsuitable for spawning, with the exception of ST161-ST162 and ST167-ST168 where suitable spawning habitat has been identified. Whilst Atlantic herring have a tolerance for variation in gravel-dominated sediment types and sandy gravel, the species will not spawn in sand dominated sediment types or those containing fines (Kyle-Henney *et al*., 2024). For reference, ST167-ST168 are located between KP1-KP10; whilst ST161-ST162 are located between KP30-KP40.

[1] Station numbers (ST) and Kilometre Points (KP) are presented for reference.



UK Territorial Sea Limit (12 nm)

Offshore Development Area

KP Points

IHLS Temperature Data Locations (2007-2022)

DBS Sampling Stations

Marginal substrates

Preferred substrates

0 4 8 12

Kilometers

N

Title:
IHLS Sampling Stations and Underlying EMODnet 1:250k Seabed Sediment Type

SCALE: See Scale Bar	VERSION: A01
SIZE: A4	DRAWN: ER
PROJECT: 0754512	CHECKED: MH
DATE: 09/06/2025	APPROVED: MH

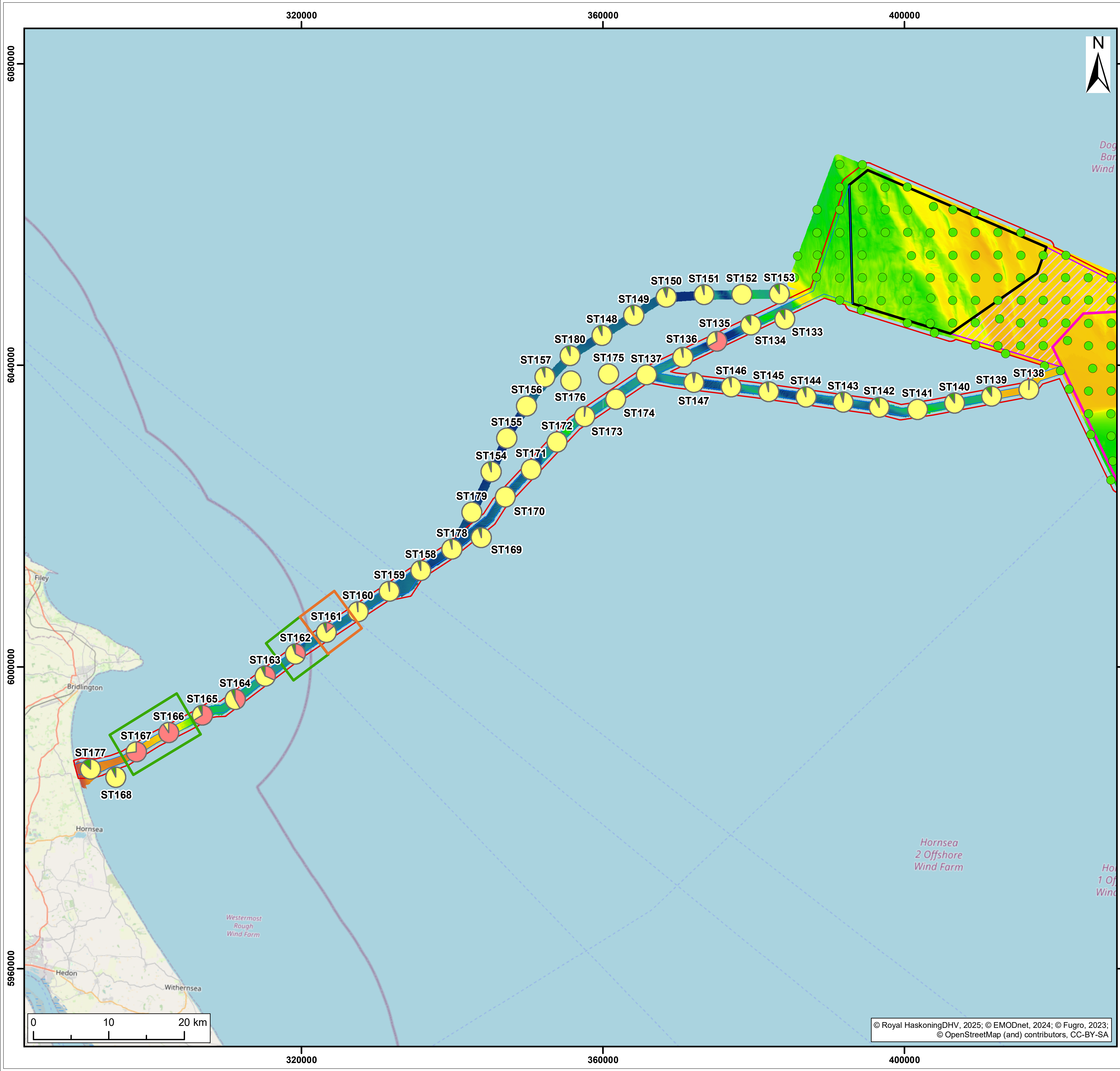
ERM

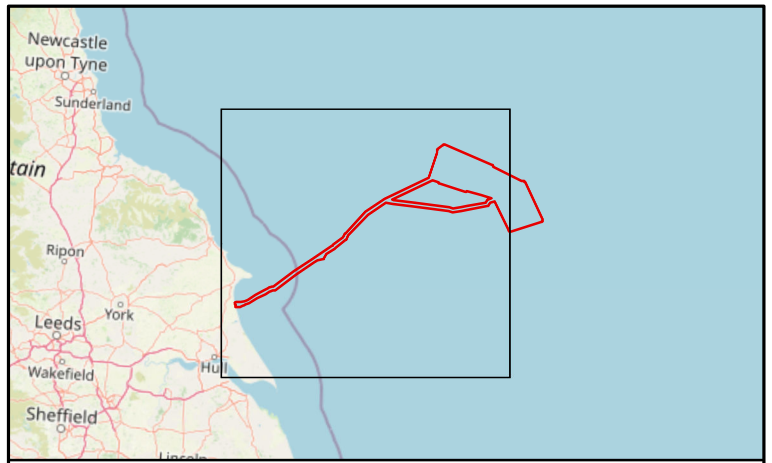
DBS Offshore Wind

PROJECTION: WGS 1984 UTM Zone 31N

SOURCE: World Topographic Map (ESRI). ICES Eggs and Larvae dataset (2007 - 2023). ICES, Copenhagen

Path: Z:\Projects\J0754512 - Dogger Bank\04_Drawing\Pro\J0754512 - Dogger Bank.aprx / J0754512-MAP-13-IHLSStations&Sediment-01 v2





Legend:

- Offshore Development Area
- Offshore Export Cable Corridor
- DBS East Array Area
- DBS West Array Area
- Inter-Platform Cable Corridor

Fractional Sediment Composition

- Gravel
- Sand
- Fines
- Array Station

Sediment type

- Marginal sediment type at ST161
- Preferred sediment type at ST162, ST166 & ST167

Remaining stations are unsuitable for Atlantic herring spawning activity

Bathymetry (LAT)

High : 1.90336

Low : -69.8343

S2	P01	10/06/2025	Suitable for information	SM	RF	CC
SUI	REV	DATE	DESCRIPTION	DRW	CHK	APR

Title:

Spatial variations of percentages of sand, gravel and fines, Offshore Export Cable Corridor for DBS East and DBS West (from Fugro, 2023). Green boxes indicate preferred sediment type at ST162, ST166, and ST167; and the orange box indicates the marginal sediment type at ST161. The remaining stations are unsuitable for Atlantic herring spawning activity.

Figure: 2-2 Drawing No: PC2340-RHD-OF-ZZ-DR-Z-1088

Co-ordinate system: WGS 1984 UTM Zone 31N | Page Size: A3 | Scale: 1:500,000

Project: Dogger Bank South Offshore Wind Farms

Report: Appendix 10-3 Back-calculation of the Peak Atlantic Herring Spawning Period

Royal HaskoningDHV
Enhancing Society Together

DBS Offshore Wind

Table 2-1: Particle Size Distribution (PSD) data collected within the Offshore Export Cable Corridor on behalf of the Projects (Fugro, 2023). Survey stations ST159-ST168 overlap with high potential spawning habitat for Atlantic herring in Figure 2-1. Green outline rows indicate preferred sediment type at ST162, ST166, and ST167; and the orange outline row indicates the marginal sediment type at ST161.

Station	% Gravel	% Sand	% Fines	Folk Description
ST159	0.74	97.05	2.22	Sand
ST160	0.79	97.02	2.19	Sand
ST161	**13.84**	**81.02**	**5.13**	**Gravelly Sand**
ST162	**32.58**	**61.64**	**5.78**	**Sandy Gravel**
ST163	31.70	61.08	7.23	Muddy Sandy Gravel
ST164	42.29	51.48	6.23	Muddy Sandy Gravel
ST165	66.12	27.00	6.88	Muddy Sandy Gravel
ST166	**89.87**	**9.43**	**0.69**	**Gravel**
ST167	**72.78**	**26.58**	**0.63**	**Sandy Gravel**
ST168	0.07	92.78	7.15	Sand

Unsuitable Potential Spawning Habitat	Marginal Potential Spawning Habitat	Preferred Potential Spawning Habitat

12. The objective of the back-calculation approach is to identify the peak in spawning activity within the Offshore Export Cable Corridor, and then use egg and larval development rates to predict the period in which eggs are present on suitable habitat for spawning.

13. The back-calculation is underpinned by IHLS larval data, which is collected at approximately 5m above the seabed rather than on the seabed itself (where hatching occurs). The location of IHLS sampling stations are ground-truthed as unsuitable spawning habitat (**Figure 2-1**), therefore it is likely that the larvae sampled within the IHLS originated from areas outside of the Offshore Export Cable Corridor, being transported by near-bed currents. The direction of currents off Flamborough Head and within the Offshore Export Cable Corridor are predominantly south-east and north-west, parallel with the shoreline (**Chapter 8 Marine Physical Environment (Revision 2)** [REP7-036]). Therefore, it is unlikely that significant quantities of larvae were transported in a westerly direction from the suitable habitat at ST161-ST162 to the IHLS sampling station at ST163-ST164.

3 Back-Calculation Input Parameters

14. The back-calculation utilises the following key metrics to determine the peak risk to Atlantic herring from cable laying activities:

- Minimum larval length at hatching;
- Maximum 0-ringer larval length;
- Growth rate;
- Egg development period.

15. Since 2003, the IHLS has been undertaken within the Banks spawning grounds between the 16-30th September (inclusive), sampling Atlantic herring larvae at approximately 5m above the seabed. Historical IHLSs (1972-2003) have been undertaken in between 1st -15th September and / or 1st -15th October, however the peak of spawning in terms of caught larval abundance generally remained within the 16-30th September sampling period.

16. Therefore, the back-calculation approach must consider variation in larval length per day within the 16-30th September 'peak' period. For example, smaller larvae will have hatched later than larger larvae collected by the IHLS on the same day; reflecting the period in which the associated eggs were laid on the seabed.

17. The Marine Management Organisation (MMO) and its scientific advisors have provided a list of input parameters to conduct the back-calculation. These parameters are presented as follows:

- Minimum larval length at hatching = 5mm (MMO pers. comms.);
- Maximum 0-ringer larval length = 9mm (Dickey-Collas, 2005; MMO pers. comms.);
- Growth rate = 0.25mm/day (Heath, 1993);
- Egg development period = 9 days (Kotthaus, 1939 in Russell, 1976).

18. The following sections describe the appropriate input parameters based on literature and IHLS data from within and immediately outside of the Offshore Export Cable Corridor.

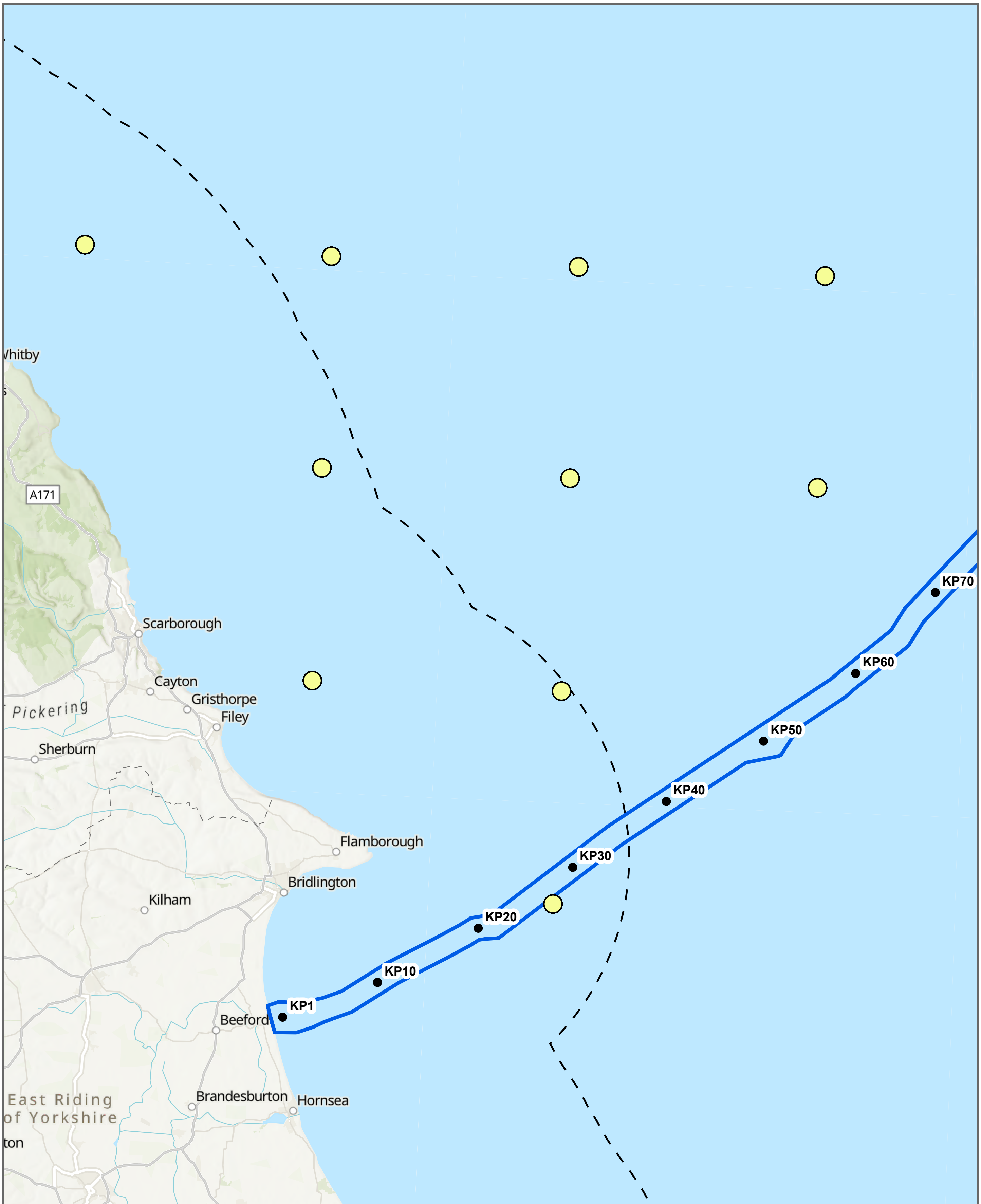
3.1 International Herring Larval Survey: Temperature

19. The IHLS survey collects and records temperature data as 'TempMaxSam' in pre-2017 surveys and 'BotTemp' in 2018-present surveys. The Projects have interrogated the 2007-present IHLS dataset (ICES, 2025), with annual temperature data presented in **Figure 3-1** to **Figure 3-14**. There are no temperature data available for 2017 or 2018.

20. Whilst there are limitations with respect to the sample temperature being recorded at approximately 5m above the seabed rather than on the seabed, it is understood that the MMO recommends the IHLS temperature data as the best available evidence.

21. The figures show that the temperatures recorded within and around the Offshore Export Cable Corridor are consistently >13°C, with the exception of samples recorded between 12.8-13°C in 2008 and 2023, and samples recorded between 12-12.3°C in 2012, 2021 and 2023 (ICES, 2025).

22. For the purposes of the back-calculation, the Offshore Export Cable Corridor is characterised by average temperatures >12.8°C.



KP Points

Offshore Development Area

UK Territorial Sea Limit (12 nm)

Temperature (ºC)

- <12ºC
- 12.01 - 12.30ºC
- 12.31 - 12.80ºC
- 12.81 - 13.00ºC
- >13ºC

0 4 8 12
Kilometers

N

Title:

IHLS Temperature Data (2007)

SCALE: See Scale Bar	VERSION: A01
SIZE: A4	DRAWN: ER
PROJECT: 0754512	CHECKED: MH
DATE: 09/06/2025	APPROVED: MH

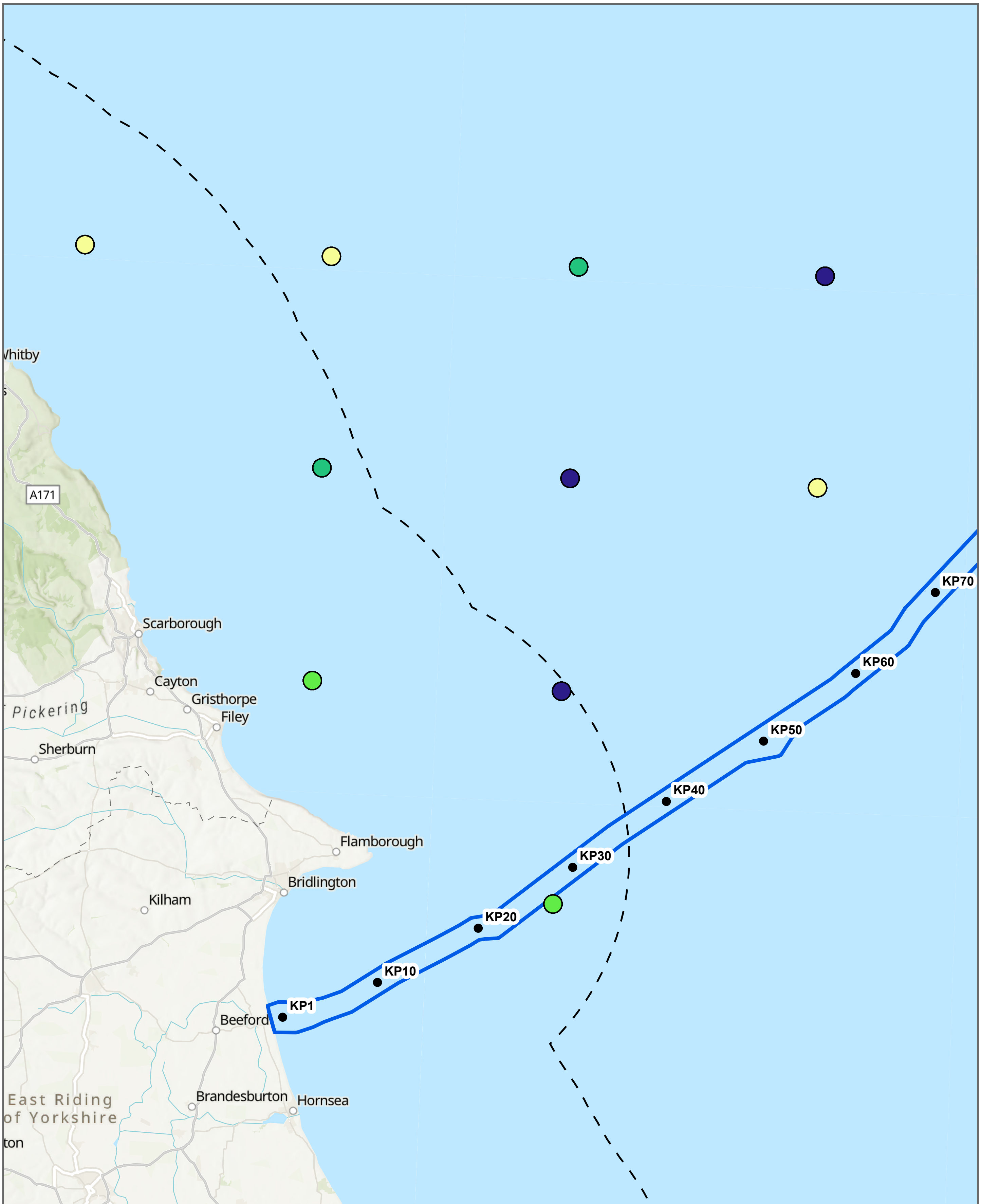
ERM

DBS Offshore Wind

PROJECTION: WGS 1984 UTM Zone 31N

SOURCE: World Topographic Map (ESRI). ICES Eggs and Larvae dataset (2007 - 2023). ICES, Copenhagen

Path: Z:\Projects\J0754512 - Dogger Bank\04_Drawing\Pro\J0754512 - Dogger Bank.aprx / J0754512-MAP-12.1-2007Temperature-01



KP Points

Offshore Development Area

UK Territorial Sea Limit (12 nm)

Temperature (ºC)

- <12ºC
- 12.01 - 12.30ºC
- 12.31 - 12.80ºC
- 12.81 - 13.00ºC
- >13ºC

0 4 8 12
Kilometers

N

Title:

IHLS Temperature Data (2008)

SCALE: See Scale Bar	VERSION: A01
SIZE: A4	DRAWN: ER
PROJECT: 0754512	CHECKED: MH
DATE: 09/06/2025	APPROVED: MH

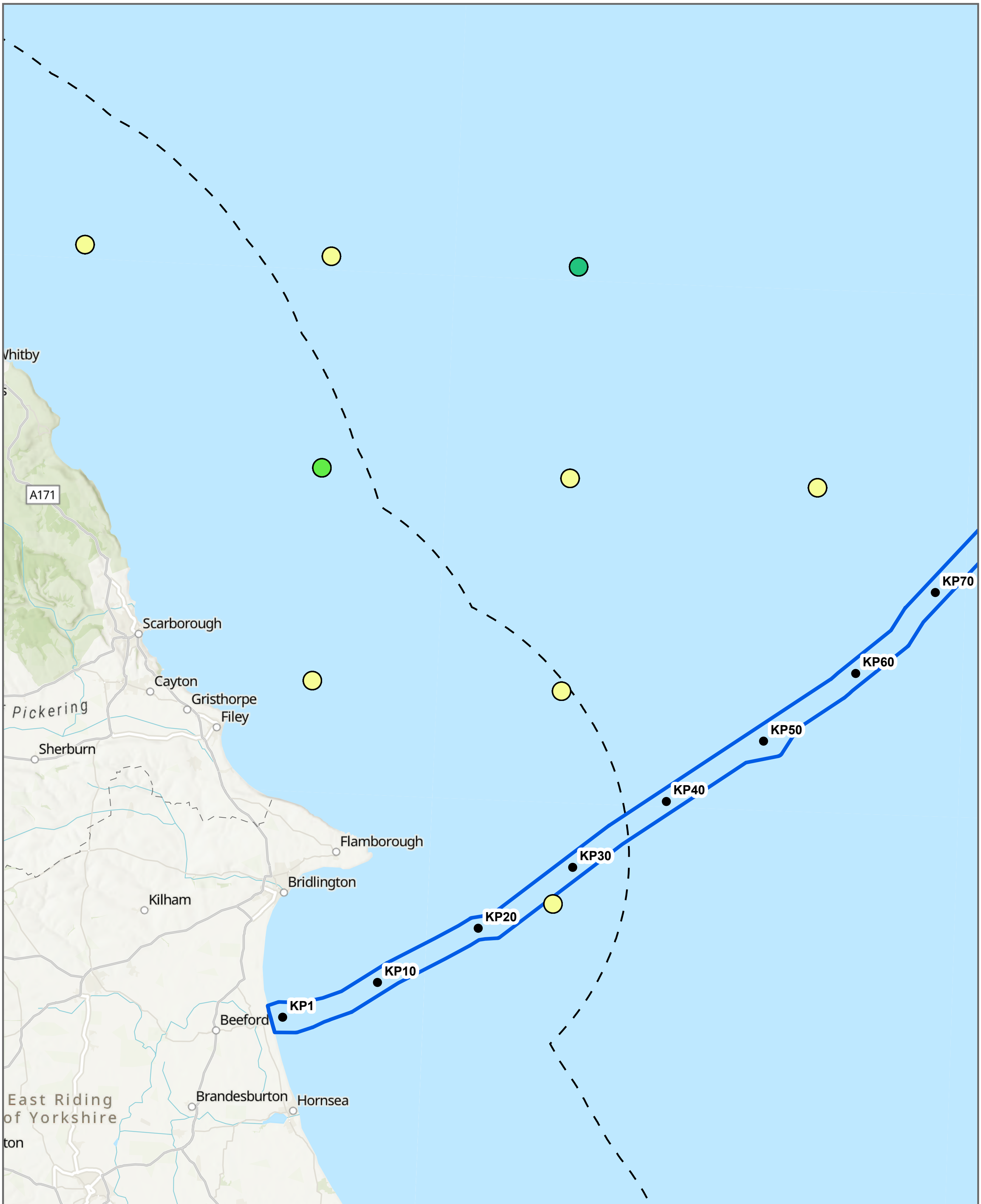
ERM

DBS Offshore Wind

PROJECTION: WGS 1984 UTM Zone 31N

SOURCE: World Topographic Map (ESRI). ICES Eggs and Larvae dataset (2007 - 2023). ICES, Copenhagen

Path: Z:\Projects\J0754512 - Dogger Bank\04_Drawing\Pro\J0754512 - Dogger Bank.aprx / J0754512-MAP-12.2-2008Temperature-01



KP Points

Offshore Development Area

UK Territorial Sea Limit (12 nm)

Temperate (ºC)

- <12ºC
- 12.01 - 12.30ºC
- 12.31 - 12.80ºC
- 12.81 - 13.00ºC
- >13ºC

0 4 8 12
Kilometers

N

Title:

IHLS Temperature Data (2009)

SCALE: See Scale Bar	VERSION: A01
SIZE: A4	DRAWN: ER
PROJECT: 0754512	CHECKED: MH
DATE: 09/06/2025	APPROVED: MH

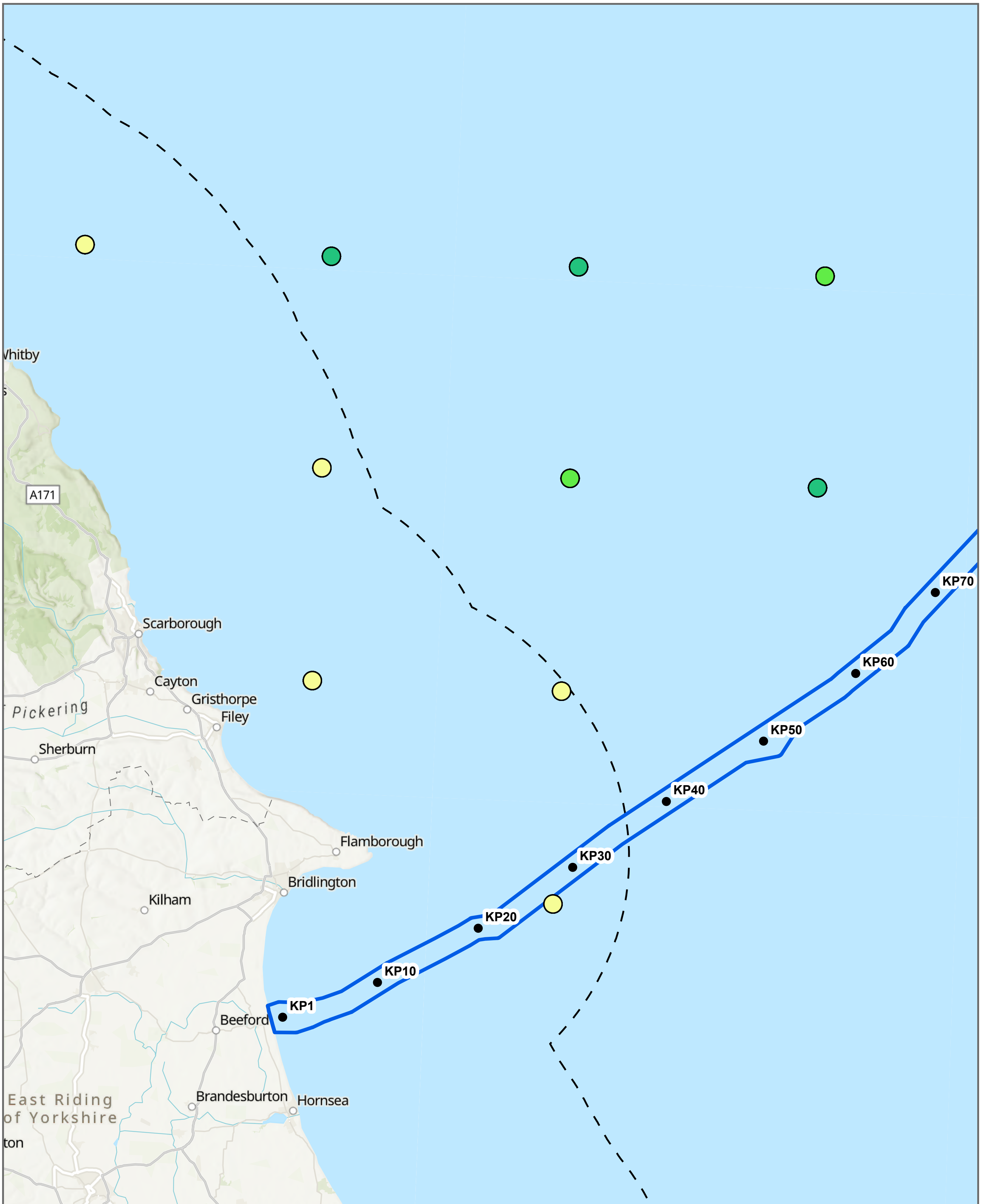
ERM

DBS Offshore Wind

PROJECTION: WGS 1984 UTM Zone 31N

SOURCE: World Topographic Map (ESRI). ICES Eggs and Larvae dataset (2007 - 2023). ICES, Copenhagen

Path: Z:\Projects\J0754512 - Dogger Bank\04_Drawing\Pro\J0754512 - Dogger Bank.aprx / J0754512-MAP-12.3-2009Temperature-01



KP Points
Offshore Development Area
UK Territorial Sea Limit (12 nm)

Temperature (ºC)
<12ºC
12.01 - 12.30ºC
12.31 - 12.80ºC
12.81 - 13.00ºC
>13ºC

0 4 8 12
Kilometers

N

Title:

IHLS Temperature Data (2010)

SCALE: See Scale Bar	VERSION: A01
SIZE: A4	DRAWN: ER
PROJECT: 0754512	CHECKED: MH
DATE: 09/06/2025	APPROVED: MH

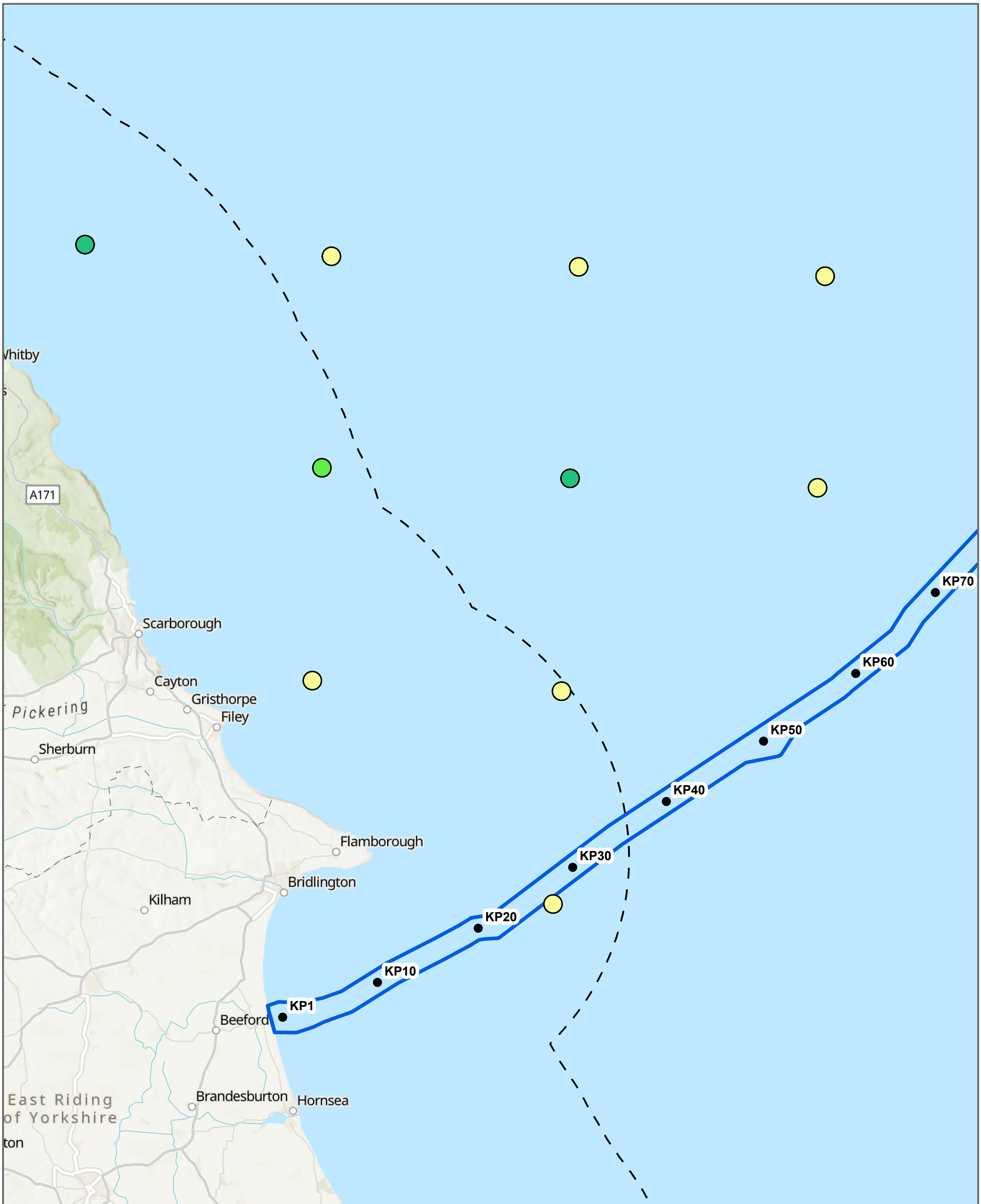
ERM

DBS Offshore Wind

PROJECTION: WGS 1984 UTM Zone 31N

SOURCE: World Topographic Map (ESRI). ICES Eggs and Larvae dataset (2007 - 2023). ICES, Copenhagen

Path: Z:\Projects\J0754512 - Dogger Bank\04_Drawing\Pro\J0754512 - Dogger Bank.aprx / J0754512-MAP-12.4-2010Temperature-01



● KP Points

Offshore Development Area

UK Territorial Sea Limit (12 nm)

Temperature (ºC)

- <12ºC
- 12.01 - 12.30ºC
- 12.31 - 12.80ºC
- 12.81 - 13.00ºC
- >13ºC

0 4 8 12

Kilometers

N

Title:

IHLS Temperature Data (2011)

SCALE: See Scale Bar	VERSION: A01
SIZE: A4	DRAWN: ER
PROJECT: 0754512	CHECKED: MH
DATE: 09/06/2025	APPROVED: MH

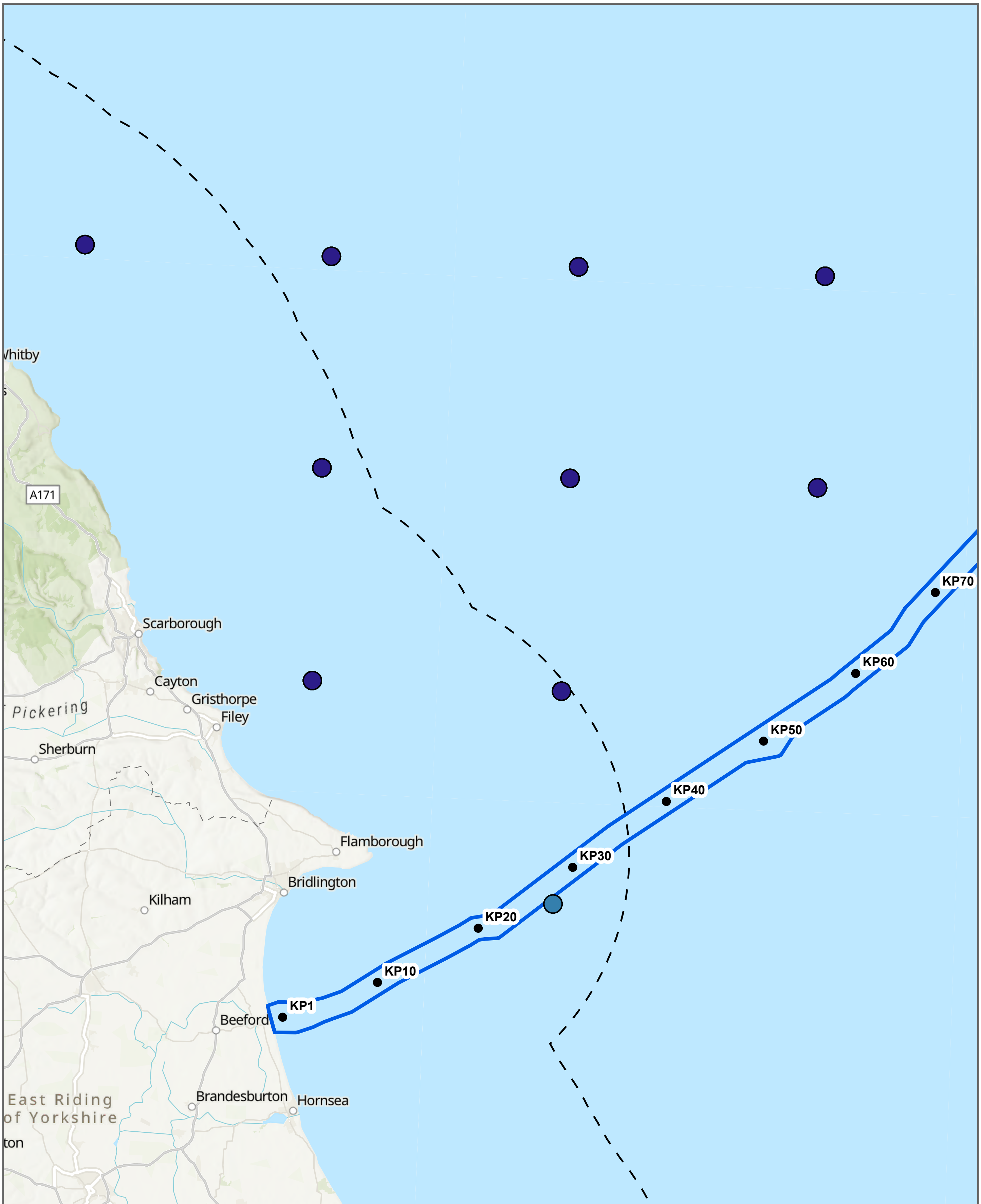
ERM

DBS Offshore Wind

PROJECTION: WGS 1984 UTM Zone 31N

SOURCE: World Topographic Map (ESRI). ICES Eggs and Larvae dataset (2007 - 2023). ICES, Copenhagen

Path: Z:\Projects\J0754512 - Dogger Bank\04_Drawing\Pro\J0754512 - Dogger Bank.aprx / J0754512-MAP-12.5-2011Temperature-01



KP Points
Offshore Development Area
UK Territorial Sea Limit (12 nm)

Temperature (ºC)
- <12ºC
- 12.01 - 12.30ºC
- 12.31 - 12.80ºC
- 12.81 - 13.00ºC
- >13ºC

0 4 8 12
Kilometers

N

Title:

IHLS Temperature Data (2012)

SCALE: See Scale Bar	VERSION: A01
SIZE: A4	DRAWN: ER
PROJECT: 0754512	CHECKED: MH
DATE: 09/06/2025	APPROVED: MH

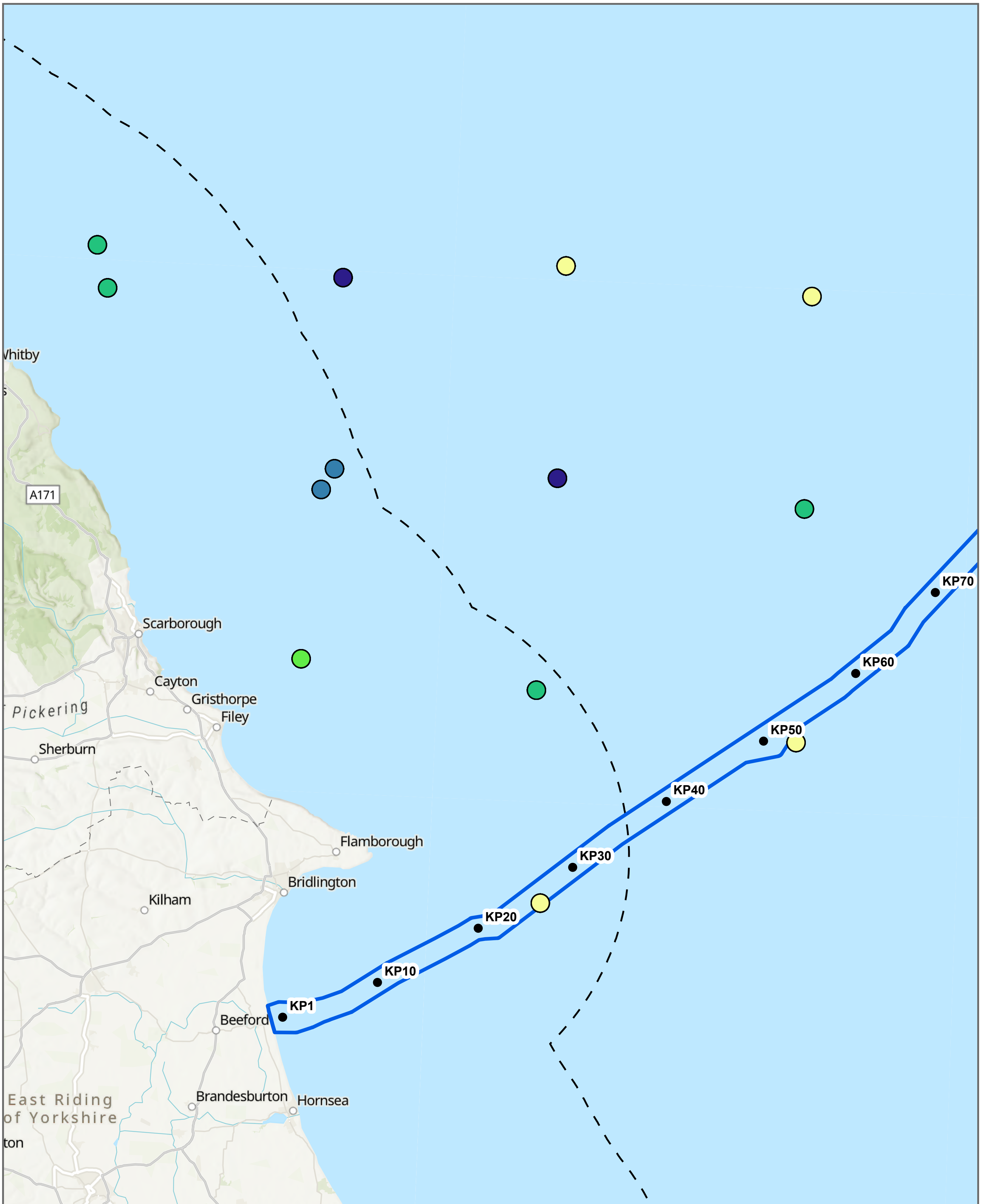
ERM

DBS Offshore Wind

PROJECTION: WGS 1984 UTM Zone 31N

SOURCE: World Topographic Map (ESRI). ICES Eggs and Larvae dataset (2007 - 2023). ICES, Copenhagen

Path: Z:\Projects\J0754512 - Dogger Bank\04_Drawing\Pro\J0754512 - Dogger Bank.aprx / J0754512-MAP-12.6-2012Temperature-01



KP Points

Offshore Development Area

UK Territorial Sea Limit (12 nm)

Temperature (ºC)

- <12ºC
- 12.01 - 12.30ºC
- 12.31 - 12.80ºC
- 12.81 - 13.00ºC
- >13ºC

0 4 8 12

Kilometers

N

Title:

IHLS Temperature Data (2013)

SCALE: See Scale Bar	VERSION: A01
SIZE: A4	DRAWN: ER
PROJECT: 0754512	CHECKED: MH
DATE: 09/06/2025	APPROVED: MH

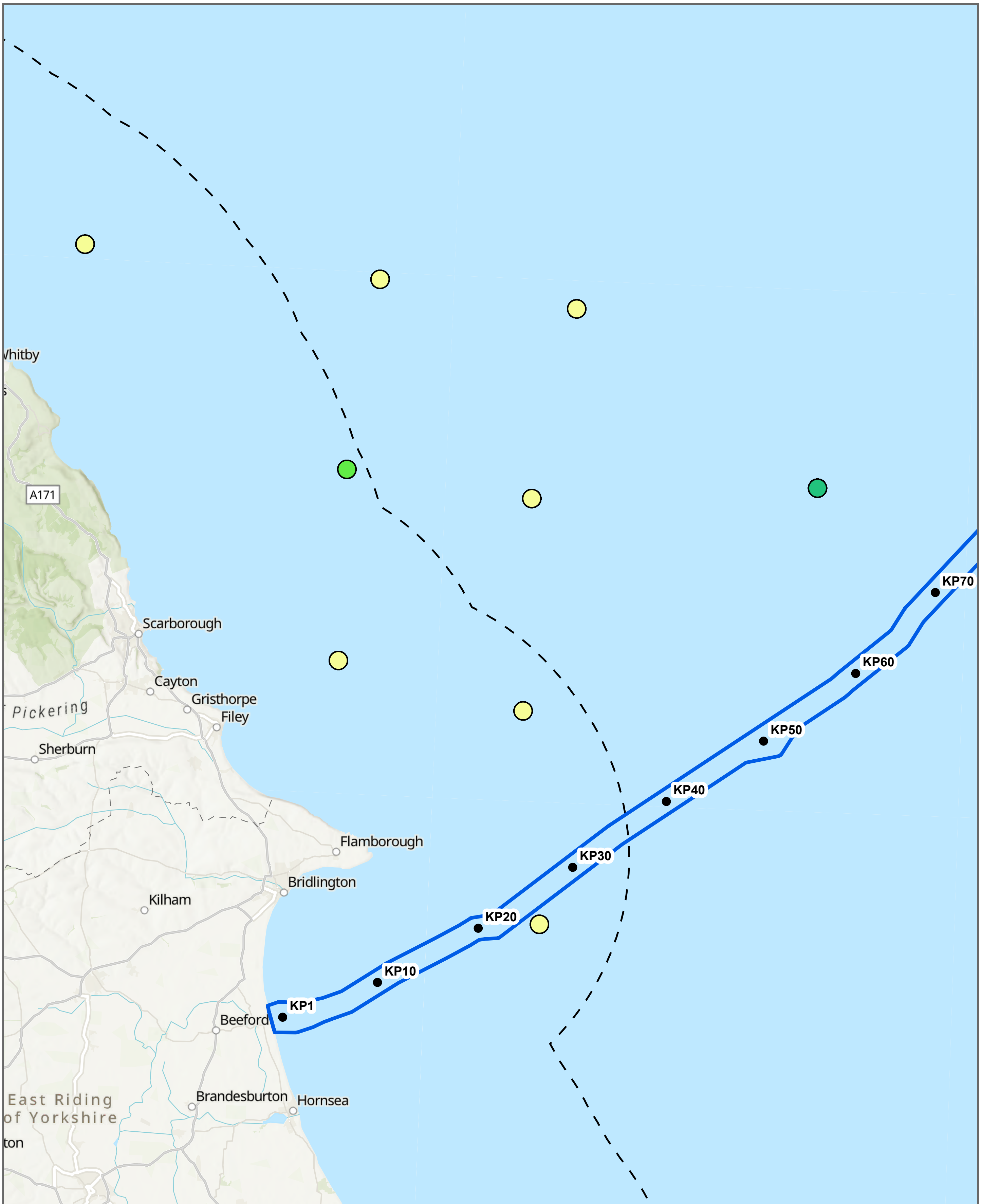
ERM

DBS Offshore Wind

PROJECTION: WGS 1984 UTM Zone 31N

SOURCE: World Topographic Map (ESRI). ICES Eggs and Larvae dataset (2007 - 2023). ICES, Copenhagen

Path: Z:\Projects\J0754512 - Dogger Bank\04_Drawing\Pro\J0754512 - Dogger Bank.aprx / J0754512-MAP-12.7-2013Temperature-01



KP Points
Offshore Development Area
UK Territorial Sea Limit (12 nm)

Temperature (ºC)
<12ºC
12.01 - 12.30ºC
12.31 - 12.80ºC
12.81 - 13.00ºC
>13ºC

0 4 8 12
Kilometers

N

Title:

IHLS Temperature Data (2014)

SCALE: See Scale Bar	VERSION: A01
SIZE: A4	DRAWN: ER
PROJECT: 0754512	CHECKED: MH
DATE: 09/06/2025	APPROVED: MH

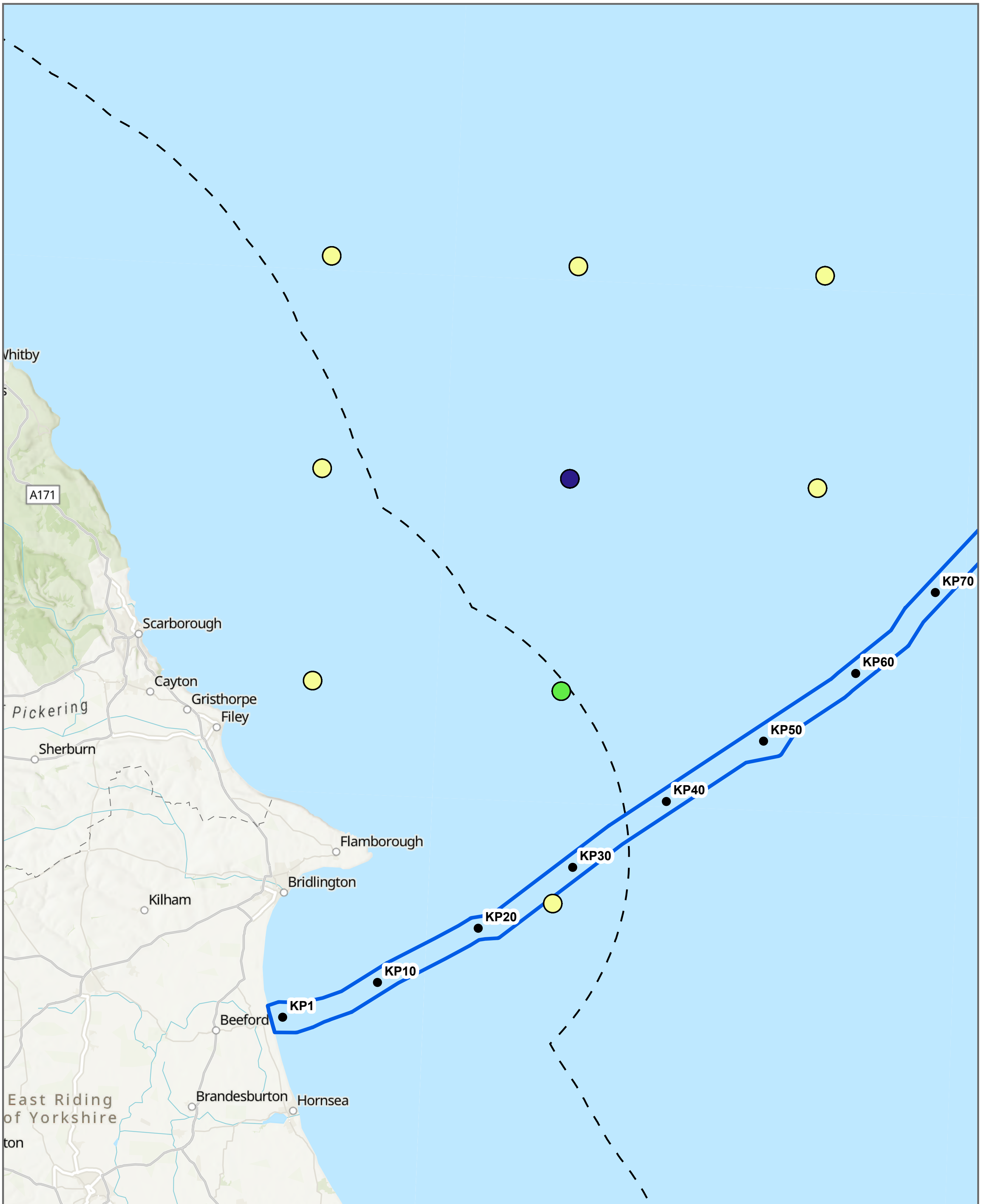
ERM

DBS Offshore Wind

PROJECTION: WGS 1984 UTM Zone 31N

SOURCE: World Topographic Map (ESRI). ICES Eggs and Larvae dataset (2007 - 2023). ICES, Copenhagen

Path: Z:\Projects\J0754512 - Dogger Bank\04_Drawing\Pro\J0754512 - Dogger Bank.aprx / J0754512-MAP-12.8-2014Temperature-01



PROJECTION: WGS 1984 UTM Zone 31N

KP Points

Offshore Development Area

UK Territorial Sea Limit (12 nm)

Temperature (ºC)

- <12ºC
- 12.01 - 12.30ºC
- 12.31 - 12.80ºC
- 12.81 - 13.00ºC
- >13ºC

0 4 8 12
Kilometers

N

Title:

IHLS Temperature Data (2015)

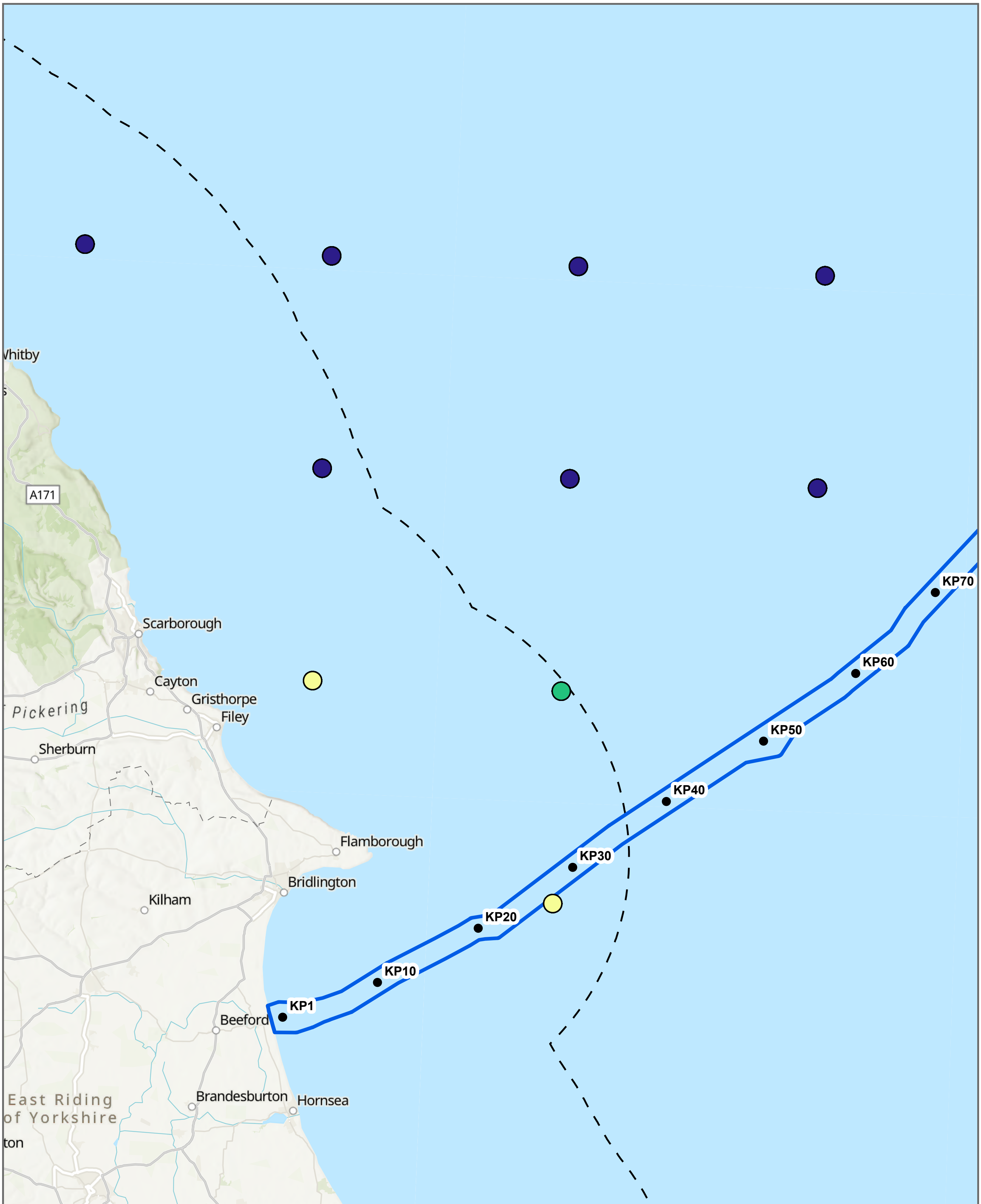
SCALE: See Scale Bar	VERSION: A01
SIZE: A4	DRAWN: ER
PROJECT: 0754512	CHECKED: MH
DATE: 09/06/2025	APPROVED: MH

ERM

DBS Offshore Wind

SOURCE: World Topographic Map (ESRI). ICES Eggs and Larvae dataset (2007 - 2023). ICES, Copenhagen

Path: Z:\Projects\J0754512 - Dogger Bank\04_Drawing\Pro\J0754512 - Dogger Bank.aprx / J0754512-MAP-12.9-2015Temperature-01



KP Points

Offshore Development Area

UK Territorial Sea Limit (12 nm)

Temperature (ºC)
- <12ºC
- 12.01 - 12.30ºC
- 12.31 - 12.80ºC
- 12.81 - 13.00ºC
- >13ºC

0 4 8 12
Kilometers

N

Title:

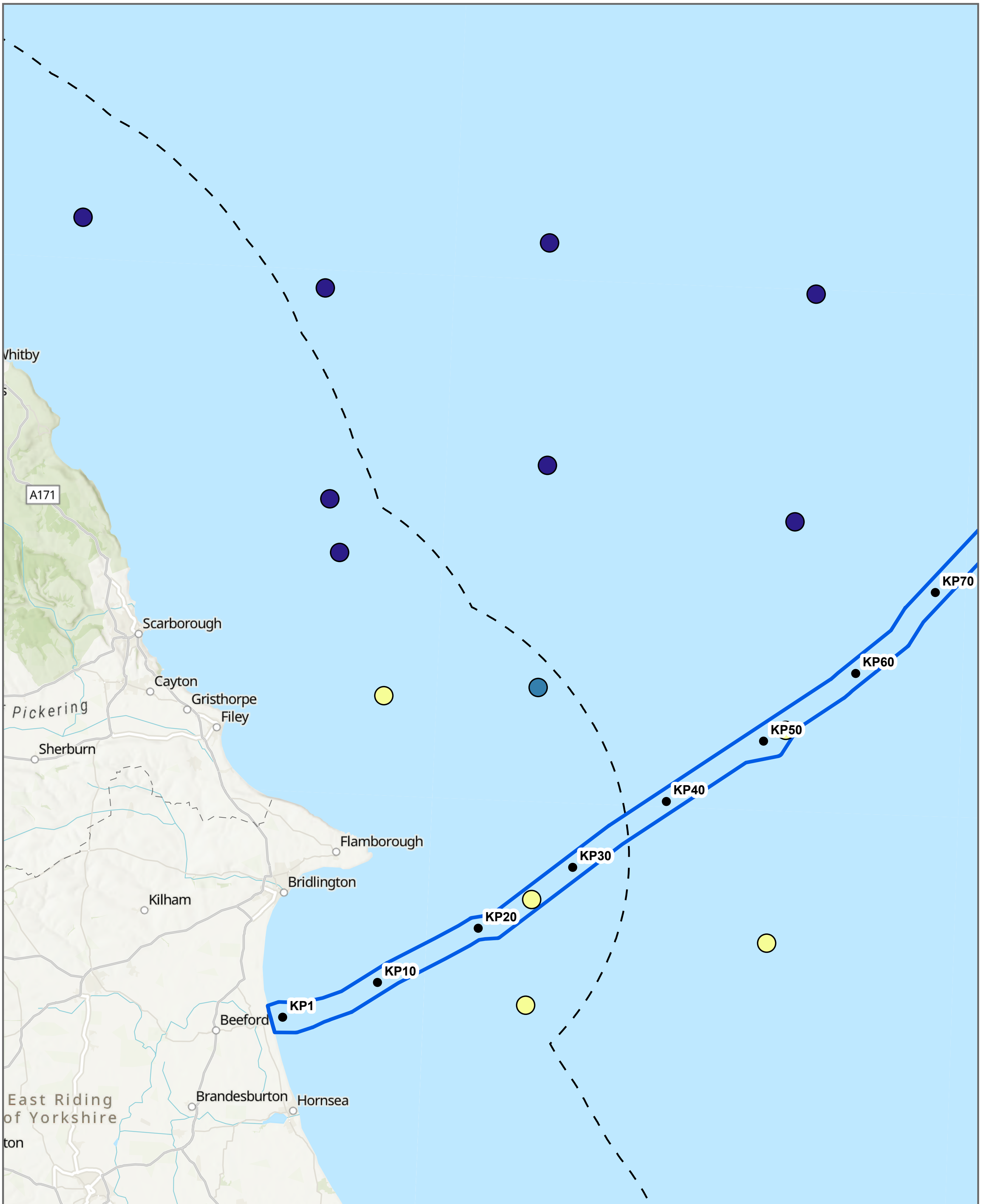
IHLS Temperature Data (2016)

SCALE: See Scale Bar	VERSION: A01
SIZE: A4	DRAWN: ER
PROJECT: 0754512	CHECKED: MH
DATE: 09/06/2025	APPROVED: MH

PROJECTION: WGS 1984 UTM Zone 31N

SOURCE: World Topographic Map (ESRI). ICES Eggs and Larvae dataset (2007 - 2023). ICES, Copenhagen

Path: Z:\Projects\J0754512 - Dogger Bank\04_Drawing\Pro\J0754512 - Dogger Bank.aprx / J0754512-MAP-12.10-2016Temperature-01



- KP Points
- Offshore Development Area
- UK Territorial Sea Limit (12 nm)

Temperature (ºC)
- <12ºC
- 12.01 - 12.30ºC
- 12.31 - 12.80ºC
- 12.81 - 13.00ºC
- >13ºC

0 4 8 12
Kilometers

N

Title:

IHLS Temperature Data (2019)

SCALE: See Scale Bar	VERSION: A01
SIZE: A4	DRAWN: ER
PROJECT: 0754512	CHECKED: MH
DATE: 09/06/2025	APPROVED: MH

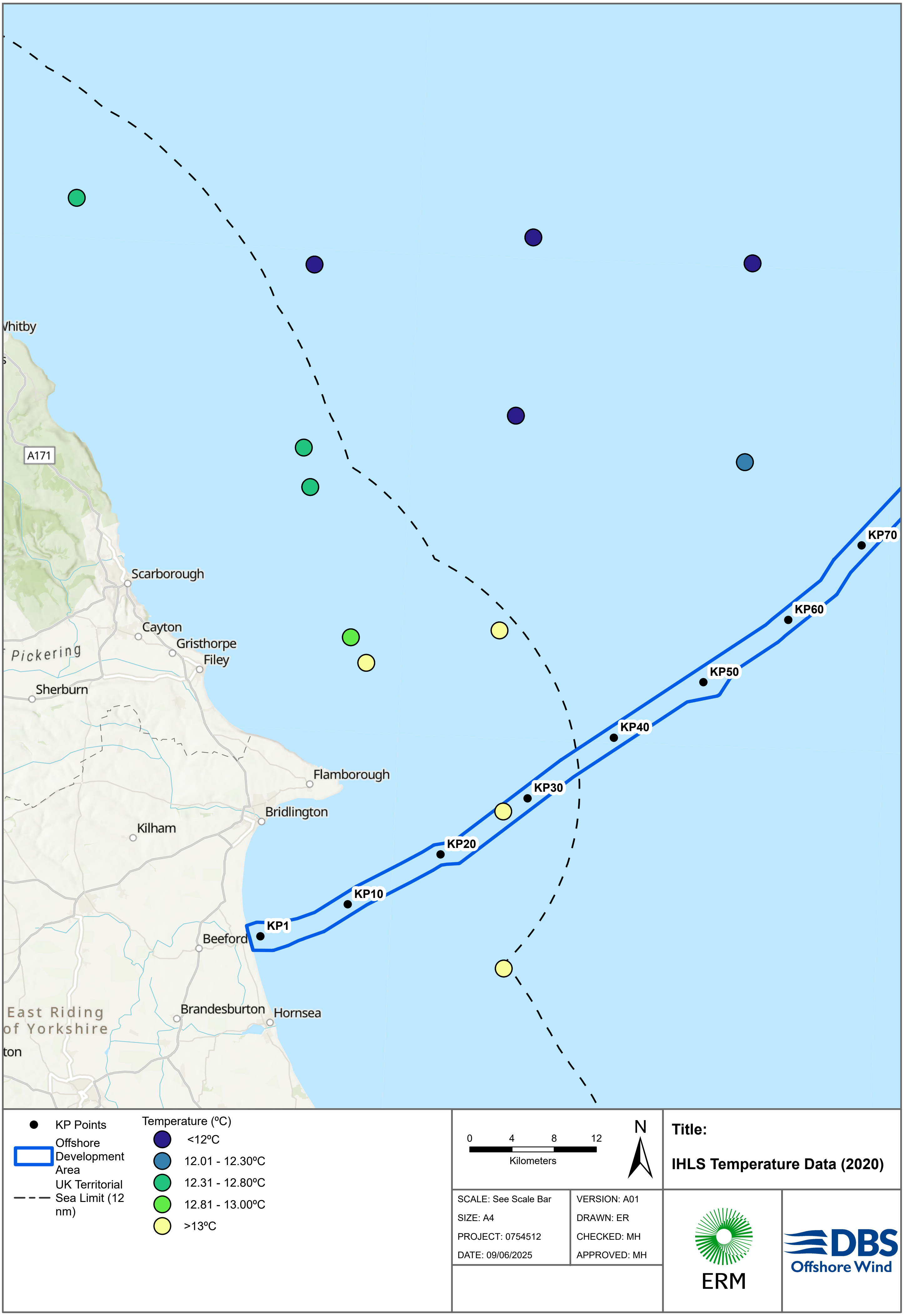
ERM

DBS Offshore Wind

PROJECTION: WGS 1984 UTM Zone 31N

SOURCE: World Topographic Map (ESRI). ICES Eggs and Larvae dataset (2007 - 2023). ICES, Copenhagen

Path: Z:\Projects\J0754512 - Dogger Bank\04_Drawing\Pro\J0754512 - Dogger Bank.aprx / J0754512-MAP-12.11-2019Temperature-01



PROJECTION: WGS 1984 UTM Zone 31N

Title:

IHLS Temperature Data (2020)

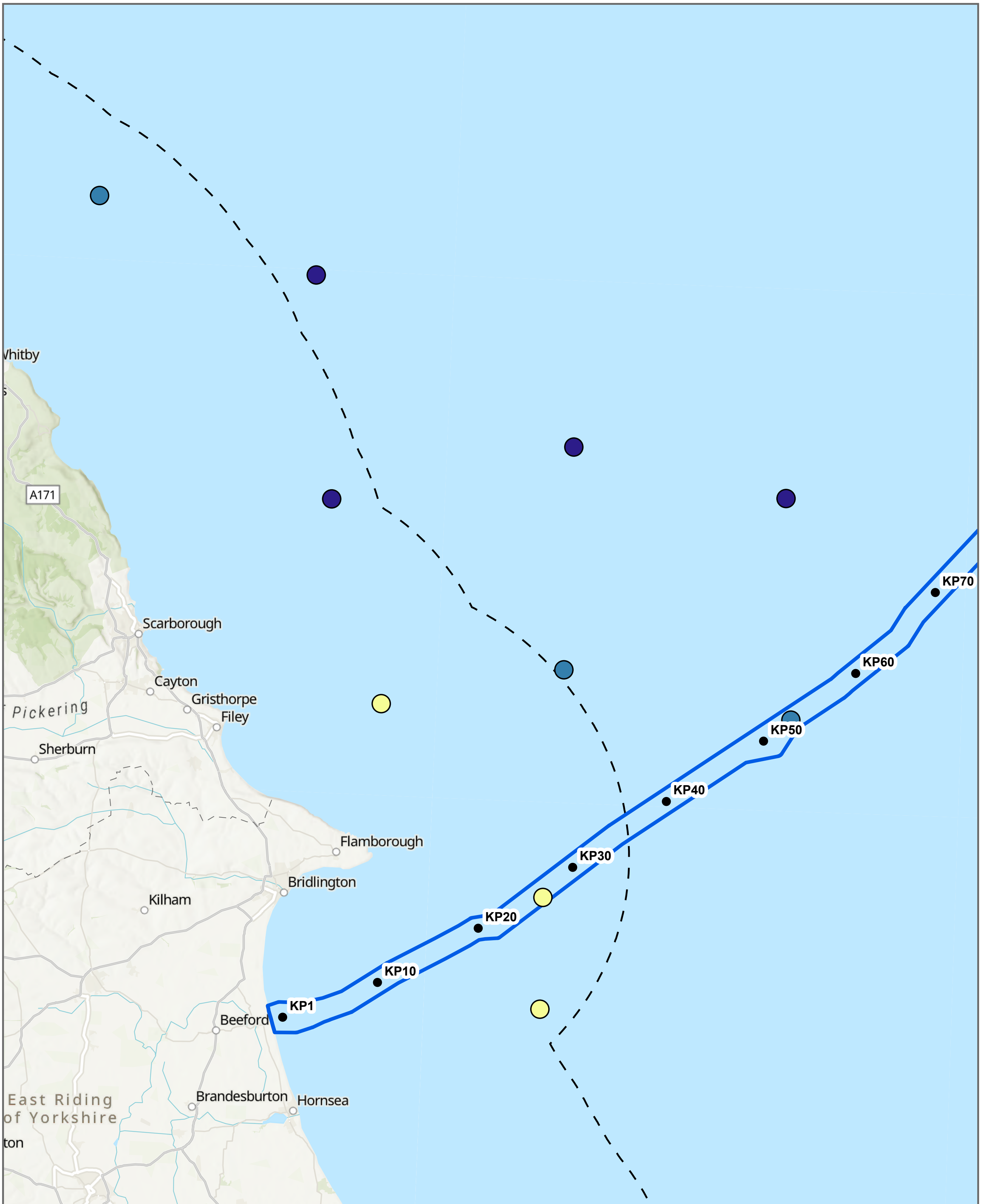
SCALE: See Scale Bar	VERSION: A01
SIZE: A4	DRAWN: ER
PROJECT: 0754512	CHECKED: MH
DATE: 09/06/2025	APPROVED: MH

ERM

DBS Offshore Wind

SOURCE: World Topographic Map (ESRI). ICES Eggs and Larvae dataset (2007 - 2023). ICES, Copenhagen

Path: Z:\Projects\J0754512 - Dogger Bank\04_Drawing\Pro\J0754512 - Dogger Bank.aprx / J0754512-MAP-12.12-2020Temperature-01



PROJECTION: WGS 1984 UTM Zone 31N

- KP Points
- Offshore Development Area
- UK Territorial Sea Limit (12 nm)

Temperature (ºC)

- <12ºC
- 12.01 - 12.30ºC
- 12.31 - 12.80ºC
- 12.81 - 13.00ºC
- >13ºC

0 4 8 12
Kilometers

N

Title:

IHLS Temperature Data (2021)

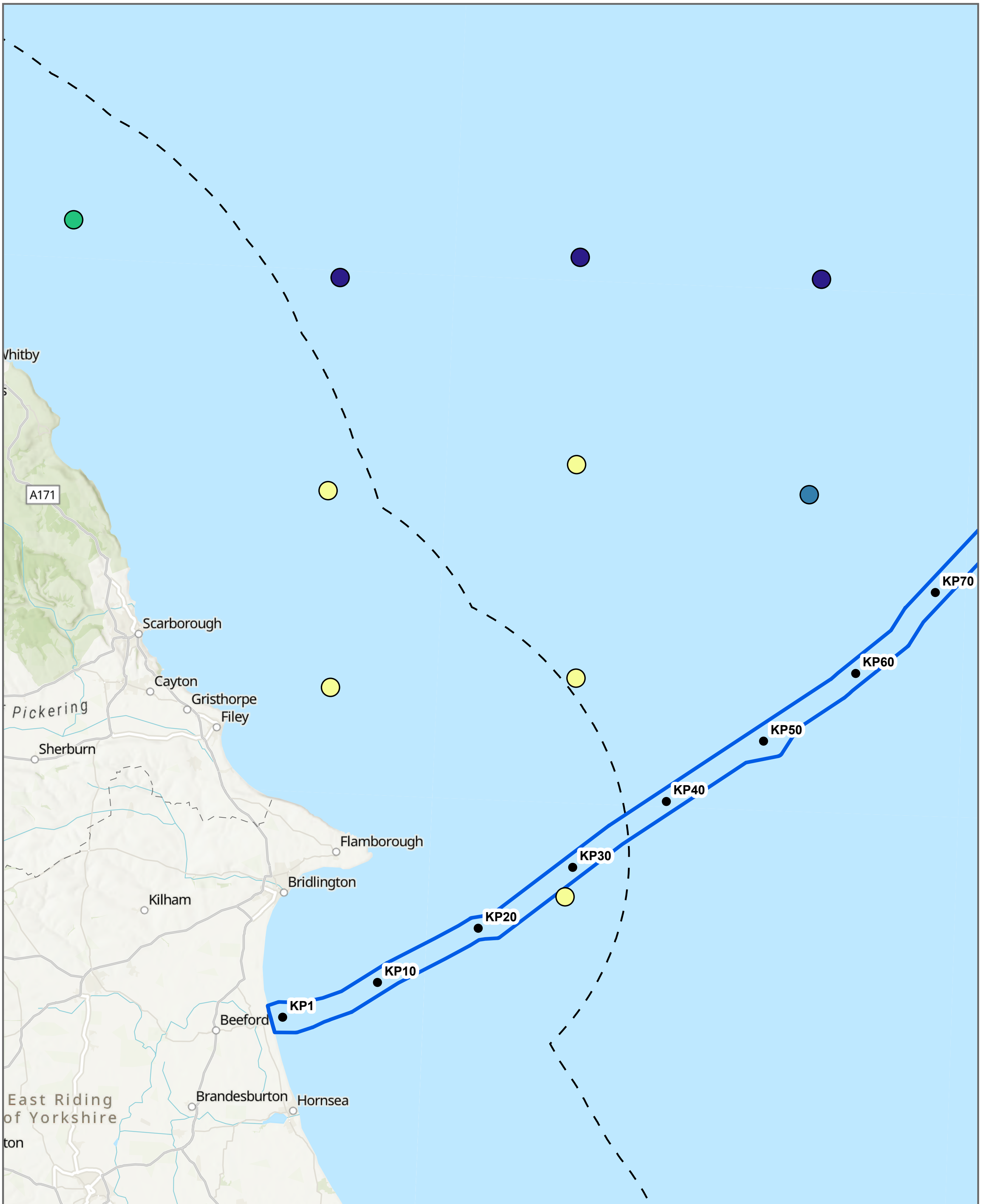
SCALE: See Scale Bar	VERSION: A01
SIZE: A4	DRAWN: ER
PROJECT: 0754512	CHECKED: MH
DATE: 09/06/2025	APPROVED: MH

ERM

DBS Offshore Wind

SOURCE: World Topographic Map (ESRI). ICES Eggs and Larvae dataset (2007 - 2023). ICES, Copenhagen

Path: Z:\Projects\J0754512 - Dogger Bank\04_Drawing\Pro\J0754512 - Dogger Bank.aprx / J0754512-MAP-12.13-2021Temperature-01



KP Points
Offshore Development Area
UK Territorial Sea Limit (12 nm)

Temperature (ºC)
<12ºC
12.01 - 12.30ºC
12.31 - 12.80ºC
12.81 - 13.00ºC
>13ºC

0 4 8 12
Kilometers
N

Title:

IHLS Temperature Data (2022)

SCALE: See Scale Bar
SIZE: A4
PROJECT: 0754512
DATE: 09/06/2025

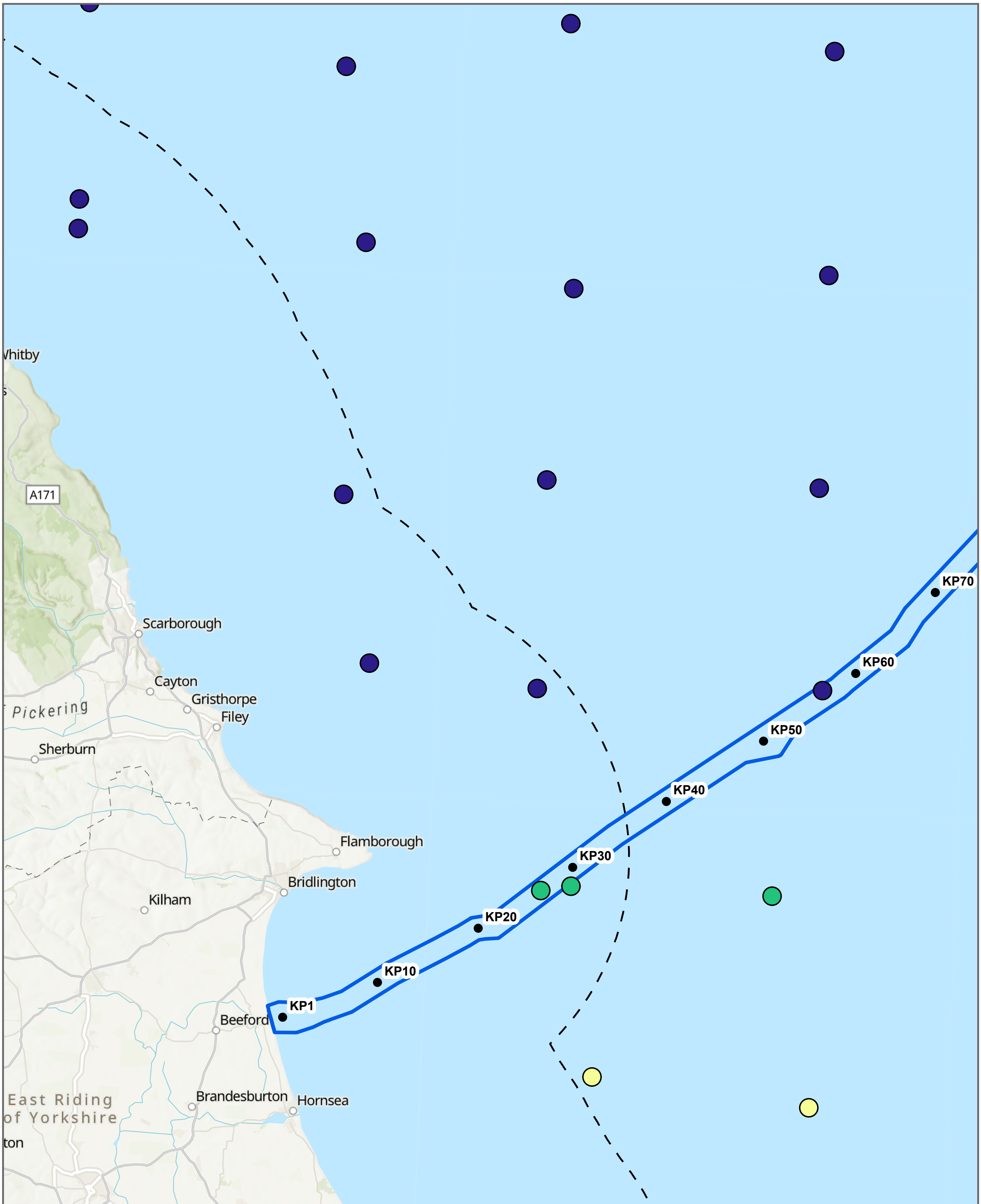
VERSION: A01
DRAWN: ER
CHECKED: MH
APPROVED: MH

ERM
DBS Offshore Wind

PROJECTION: WGS 1984 UTM Zone 31N

SOURCE: World Topographic Map (ESRI). ICES Eggs and Larvae dataset (2007 - 2023). ICES, Copenhagen

Path: Z:\Projects\J0754512 - Dogger Bank\04_Drawing\Pro\J0754512 - Dogger Bank.aprx / J0754512-MAP-12.14-2022Temperature-01



- KP Points
- Offshore Development Area
- UK Territorial Sea Limit (12 nm)

Temperature (ºC)

- <12ºC
- 12.01 - 12.3ºC
- 12.3 - 12.8ºC
- 12.81 - 13.00ºC
- >13ºC

0 4 8 12
Kilometers

N

Title:

IHLS Temperature Data (2023)

SCALE: See Scale Bar	VERSION: A01
SIZE: A4	DRAWN: ER
PROJECT: 0754512	CHECKED: MH
DATE: 09/06/2025	APPROVED: MH

ERM

DBS Offshore Wind

PROJECTION: WGS 1984 UTM Zone 31N

SOURCE: World Topographic Map (ESRI). ICES Eggs and Larvae dataset (2007 - 2023). ICES, Copenhagen

Path: Z:\Projects\J0754512 - Dogger Bank\04_Drawing\Pro\J0754512 - Dogger Bank.aprx / J0754512-MAP-12.15-2023Temperature-01

3.2 International Herring Larval Survey: Abundance

23. The primary objective of the IHLS is to collect abundance and biometric data for Atlantic herring larvae to inform ICES stock assessments. As for the temperature data, annual larval abundance (measured as number per m^2) is presented in **Figure 3-16** to **Figure 3-28**. Due to a change in survey method and other limiting factors (e.g. weather and COVID-19), the abundance data for post-2017 monitoring is limited and does not reflect the magnitude of previous spawning activity. Therefore, ten years of abundance data from 2007-2017 have been used to identify the timing of peak spawning activity for the purposes of back-calculation.

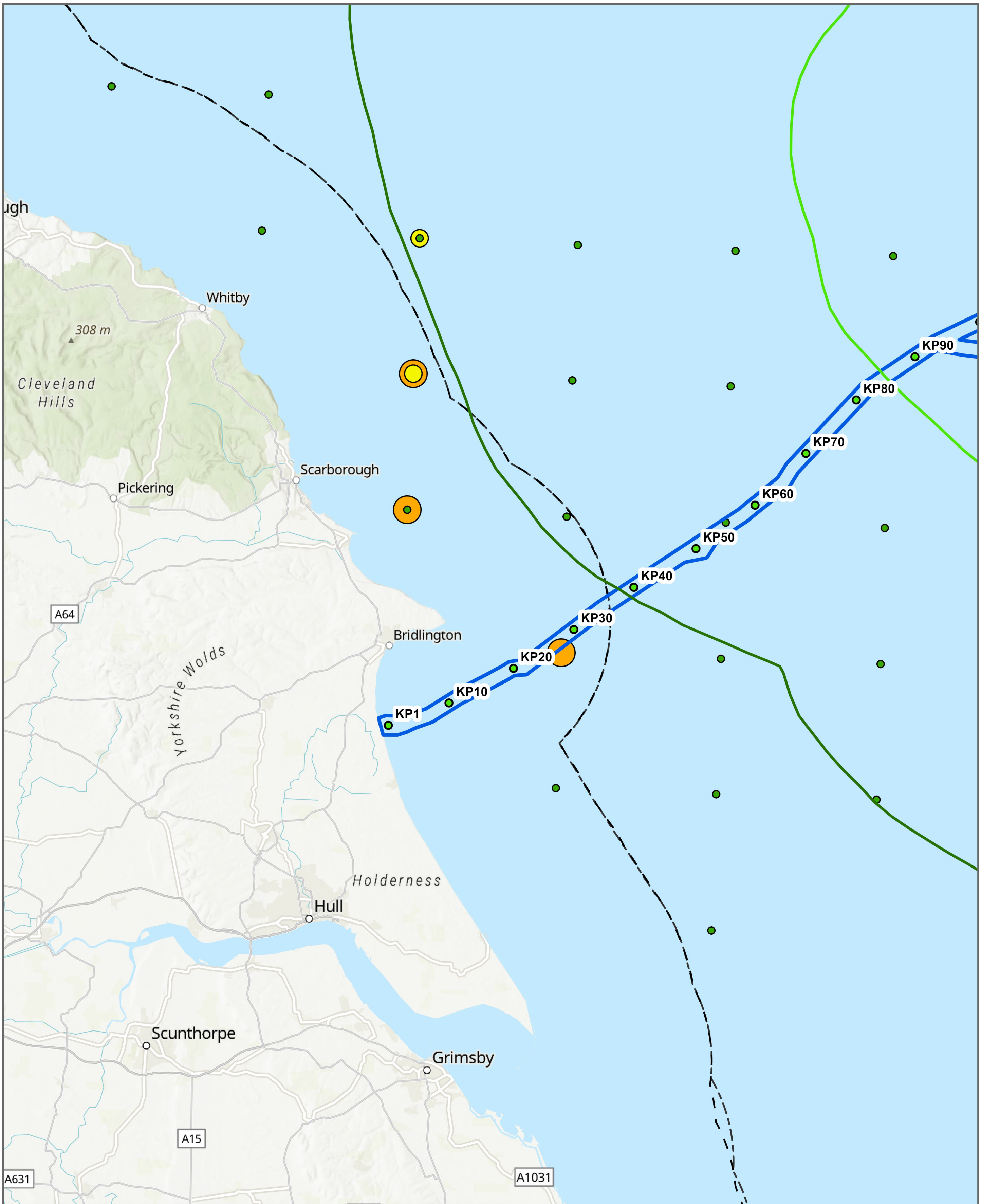
24. The biometric data within the IHLS abundance dataset allows a prediction of the larval length classes present at the sampling station during collection, which in turn allows for an approximation of the stage of development on the day of capture. Variation in length can therefore be identified to ensure that precaution is applied within the back-calculation.

25. The two IHLS stations within the immediate vicinity of the Offshore Export Cable Corridor (**Figure 2-1**). are located within areas ground-truthed as unsuitable spawning habitat for Atlantic herring, with the station at ~KP25 being represented as muddy sandy Gravel (located between ST163-St164) and the station at ~KP55 being represented as Sand (located at ST158). Please refer to **Figure 2-2** showing these locations.

26. The IHLS station of interest, located within the Offshore Export Cable Corridor and overlaps with potential spawning habitat, did not record any 0-ringer larvae for the period 16th -21st September in any year between 2007-2017 (ICES, 2025). The majority of larvae were caught from 24-29 September, with length classes between 7-9mm (**Figure 3-29**). Similar abundance data are shown in **Figure 3-30** for the IHLS station located in unsuitable spawning habitat. It is noted that both IHLS stations within the Offshore Export Cable Corridor recorded a peak in 8mm larvae on 24th September 2015 (**Figure 3-29** and **Figure 3-30**). The total cumulative abundance caught at both stations during the 2007-2017 period is shown in **Figure 3-31**.

27. Whilst the actual number of 9mm larvae caught on this date is comparatively low, the back-calculation will include a scenario for 9mm larvae caught on 22nd September.

28. It is noted that Atlantic herring larvae increase in buoyancy as the yolk is absorbed / depleted, and rise into the water column away from the seabed (Dickey-Collas *et al.*, 2009). When in the water column, larvae are no longer considered at risk from cable laying activities.



KP Points
Offshore Development Area
UK Territorial Sea Limit (12 nm)
Disturbance Threshold (based on Hawkins et al., 2014)
135dB
Key UWN Thresholds (Popper et al., 2014)
186dB

2007 Larval Abundance per m^2
0 - 50
51 - 200
201 - 600
601 - 1,200
1,201 - 10,000
10,001 - 56,258

0 4 8 12 16 20
Kilometers

N

Title:
IHLS survey data Caught values (2007)

SCALE: See Scale Bar	VERSION: A01
SIZE: A4	DRAWN: MW
PROJECT: 0754512	CHECKED: MH
DATE: 4/16/2025	APPROVED: MH

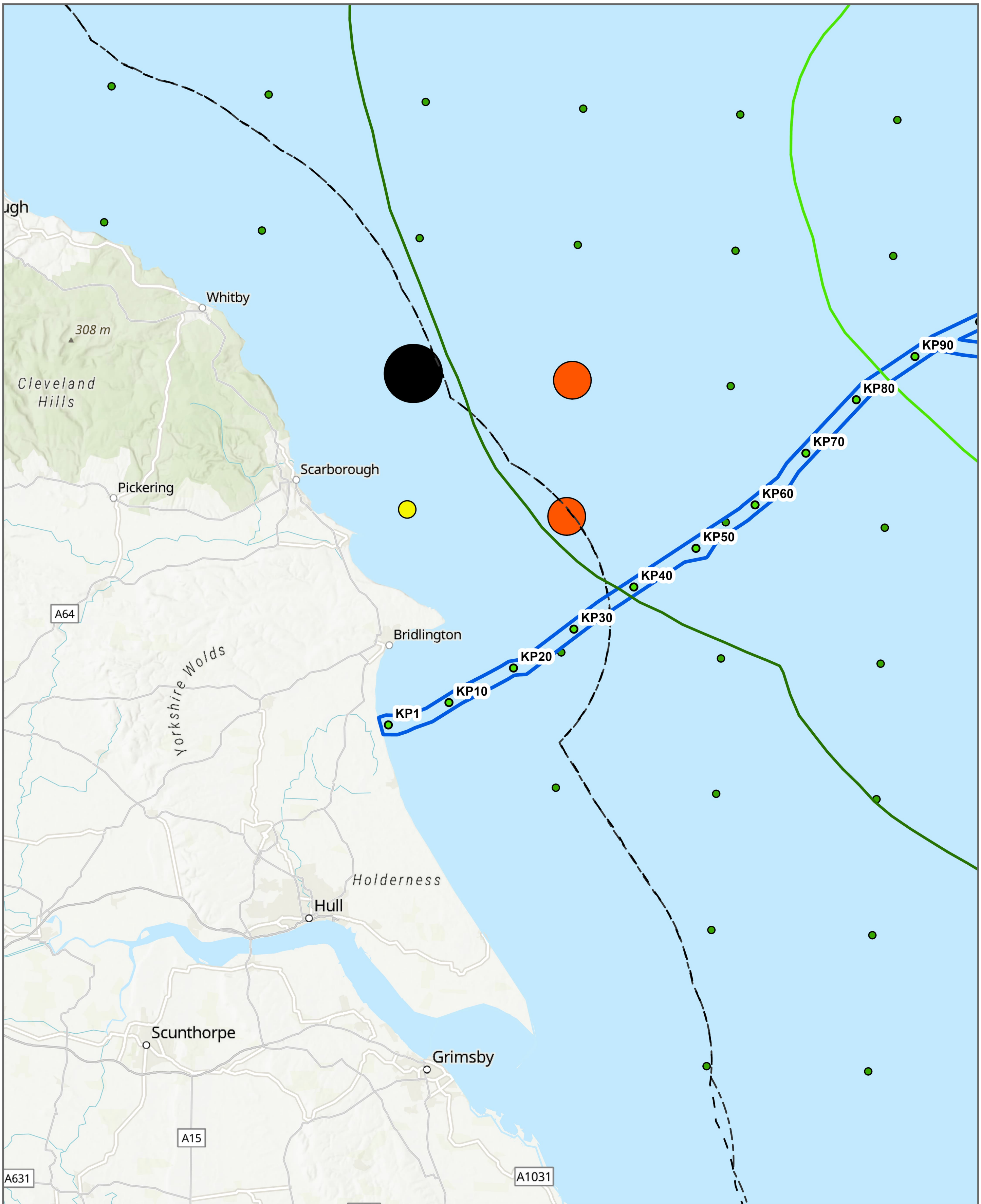
ERM

Figure 3-16

PROJECTION: WGS 1984 UTM Zone 31N

SOURCE: World Topographic Map (ESRI). ICES Eggs and Larvae dataset (2007 - 2023). ICES, Copenhagen

Path: Y:\Projects\J0754512 - Dogger Bank\04_Drawing\Pro\J0754512 - Dogger Bank.aprx / J0754512-MAP-110.1-2017CaughtValues-01



KP Points
Offshore Development Area
UK Territorial Sea Limit (12 nm)
Disturbance Threshold (based on Hawkins et al., 2014)
135dB
Key UWN Thresholds (Popper et al., 2014)
186dB

2008 Larval Abundance per m^2
0 - 50
51 - 200
201 - 600
601 - 1,200
1,201 - 10,000
10,001 - 56,258

0 4 8 12 16 20
Kilometers
N

Title:
IHLS survey data
Caught values (2008)

SCALE: See Scale Bar	VERSION: A01
SIZE: A4	DRAWN: MW
PROJECT: 0754512	CHECKED: MH
DATE: 4/16/2025	APPROVED: MH

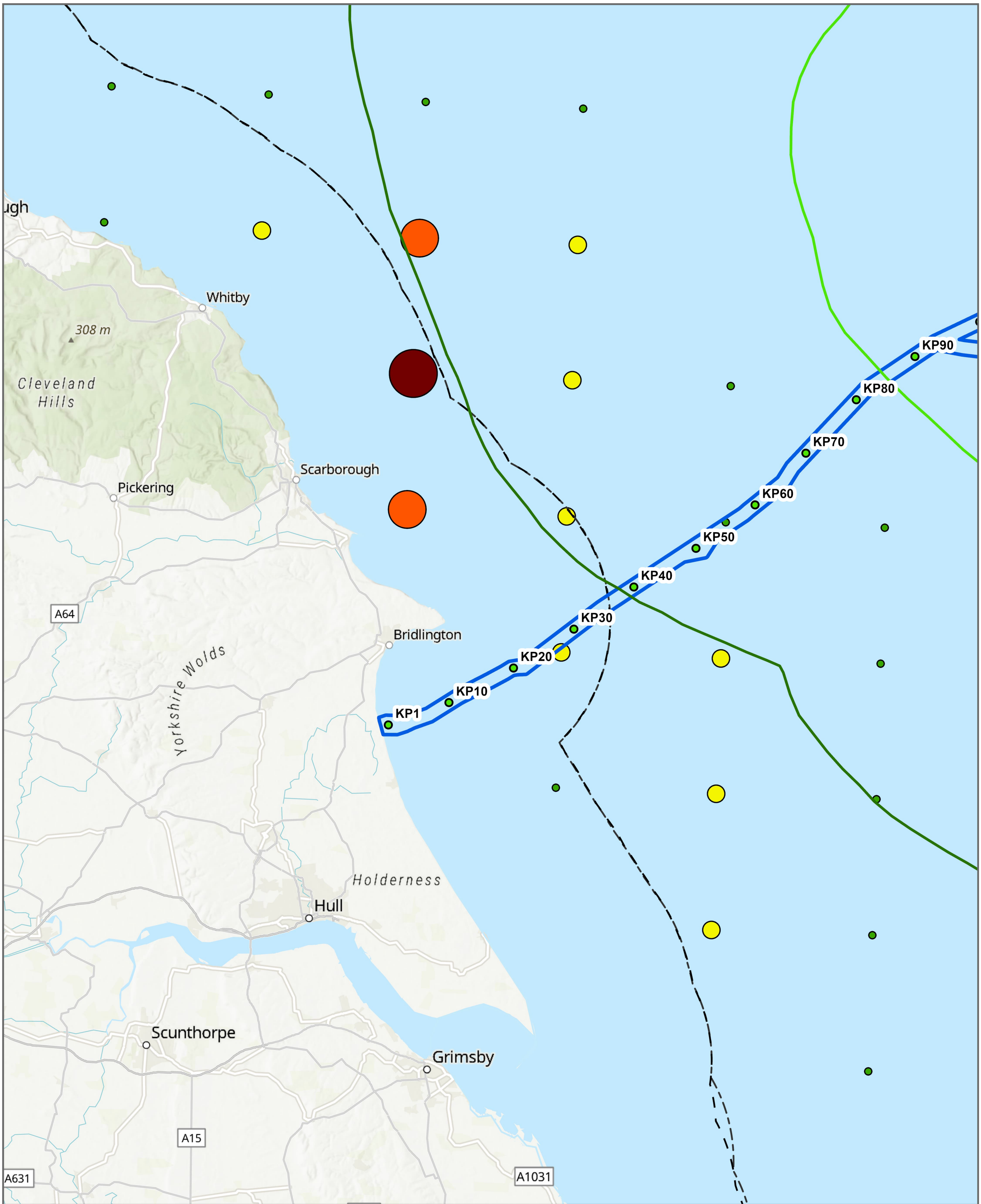
ERM

Figure 3-17

PROJECTION: WGS 1984 UTM Zone 31N

SOURCE: World Topographic Map (ESRI). ICES Eggs and Larvae dataset (2007 - 2023). ICES, Copenhagen

Path: Y:\Projects\J0754512 - Dogger Bank\04_Drawing\Pro\J0754512 - Dogger Bank.aprx / J0754512-MAP-110.2-2008CaughtValues-01



KP Points
Offshore Development Area
UK Territorial Sea Limit (12 nm)
Disturbance Threshold (based on Hawkins et al., 2014)
135dB
Key UWN Thresholds (Popper et al., 2014)
186dB

2009 Larval Abundance per m^2
0 - 50
51 - 200
201 - 600
601 - 1,200
1,201 - 10,000
10,001 - 56,258

0 4 8 12 16 20
Kilometers

N

Title:
IHLS survey data Caught values (2009)

SCALE: See Scale Bar
SIZE: A4
PROJECT: 0754512
DATE: 4/16/2025

VERSION: A01
DRAWN: MW
CHECKED: MH
APPROVED: MH

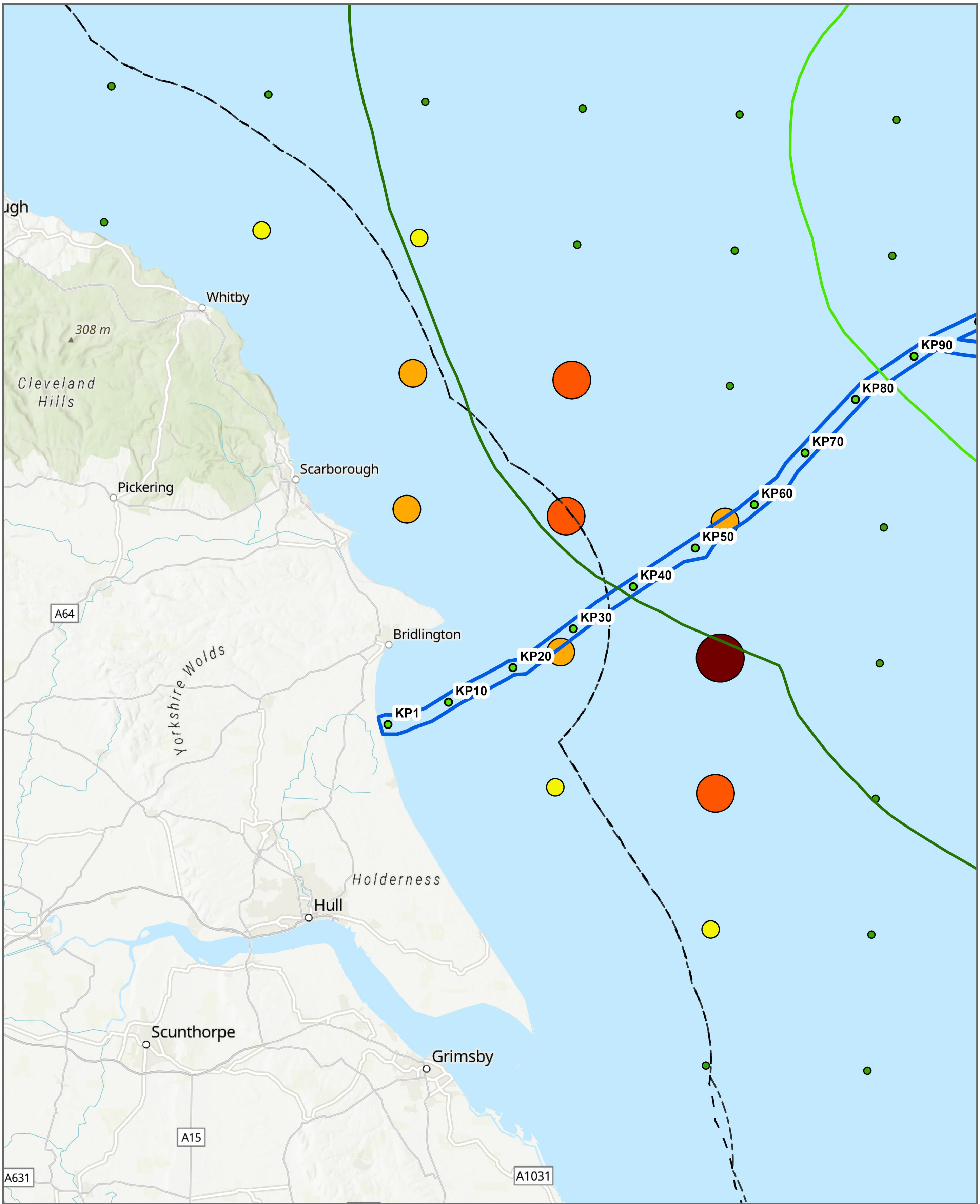
ERM

Figure 3-18

PROJECTION: WGS 1984 UTM Zone 31N

SOURCE: World Topographic Map (ESRI). ICES Eggs and Larvae dataset (2007 - 2023). ICES, Copenhagen

Path: Y:\Projects\J0754512 - Dogger Bank\04_Drawing\Pro\J0754512 - Dogger Bank.aprx / J0754512-MAP-110.3-2009CaughtValues-01



KP Points
Offshore Development Area
UK Territorial Sea Limit (12 nm)
Disturbance Threshold (based on Hawkins et al., 2014)
135dB
Key UWN Thresholds (Popper et al., 2014)
186dB

2010 Larval Abundance per m²
0 - 50
51 - 200
201 - 600
601 - 1,200
1,201 - 10,000
10,001 - 56,258

0 4 8 12 16 20
Kilometers
N

Title:
IHLS survey data
Caught values (2010)

SCALE: See Scale Bar	VERSION: A01
SIZE: A4	DRAWN: MW
PROJECT: 0754512	CHECKED: MH
DATE: 4/16/2025	APPROVED: MH

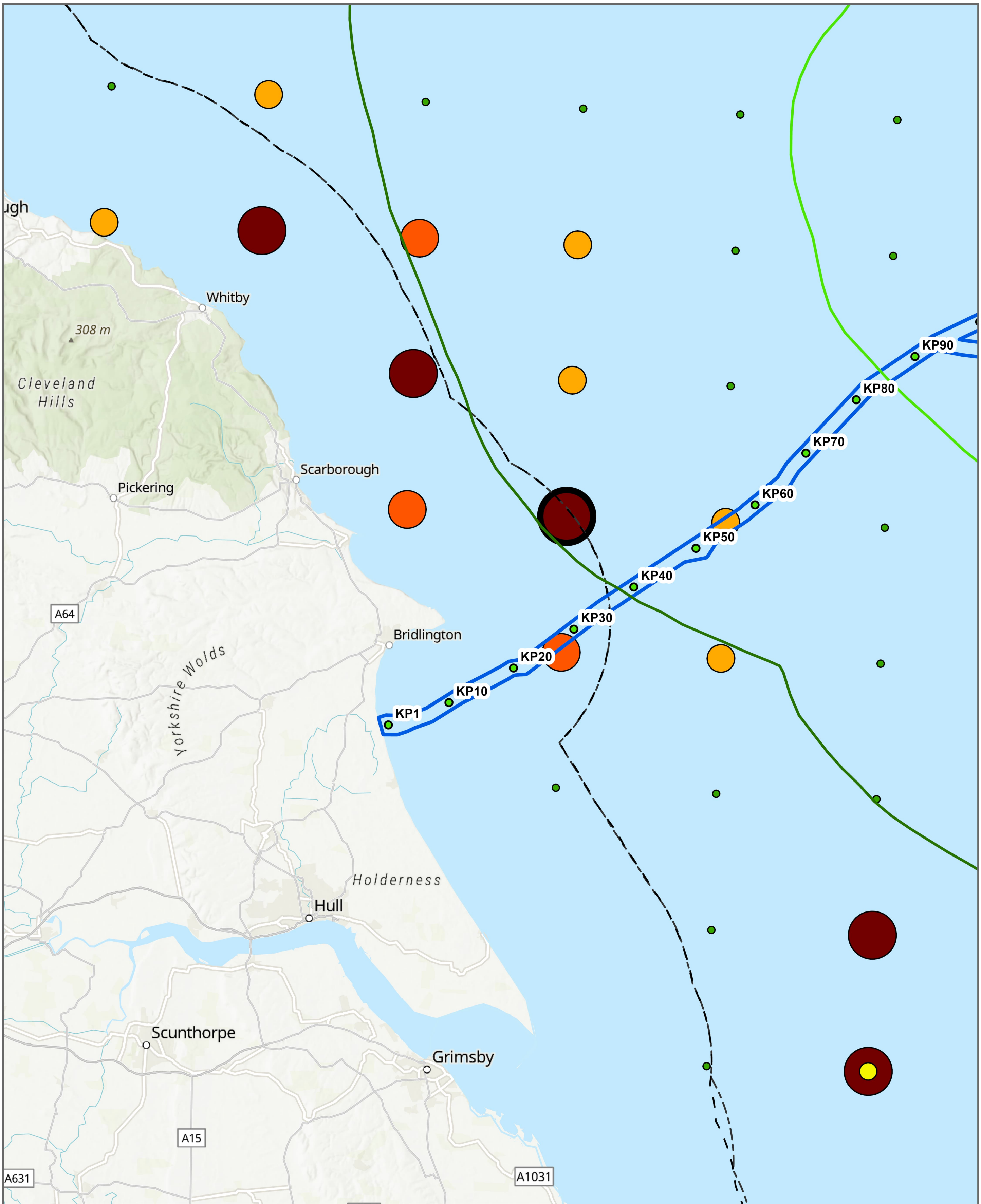
ERM

Figure 3-19

PROJECTION: WGS 1984 UTM Zone 31N

SOURCE: World Topographic Map (ESRI). ICES Eggs and Larvae dataset (2007 - 2023). ICES, Copenhagen

Path: Y:\Projects\J0754512 - Dogger Bank\04_Drawing\Pro\J0754512 - Dogger Bank.aprx / J0754512-MAP-110.4-2010CaughtValues-01



KP Points
Offshore Development Area
UK Territorial Sea Limit (12 nm)
Disturbance Threshold (based on Hawkins et al., 2014)
135dB
Key UWN Thresholds (Popper et al., 2014)
186dB

2011 Larval Abundance per m^2
0 - 50
51 - 200
201 - 600
601 - 1,200
1,201 - 10,000
10,001 - 56,258

0 4 8 12 16 20
Kilometers
N

Title:
IHLS survey data
Caught values (2011)

SCALE: See Scale Bar	VERSION: A01
SIZE: A4	DRAWN: MW
PROJECT: 0754512	CHECKED: MH
DATE: 4/16/2025	APPROVED: MH

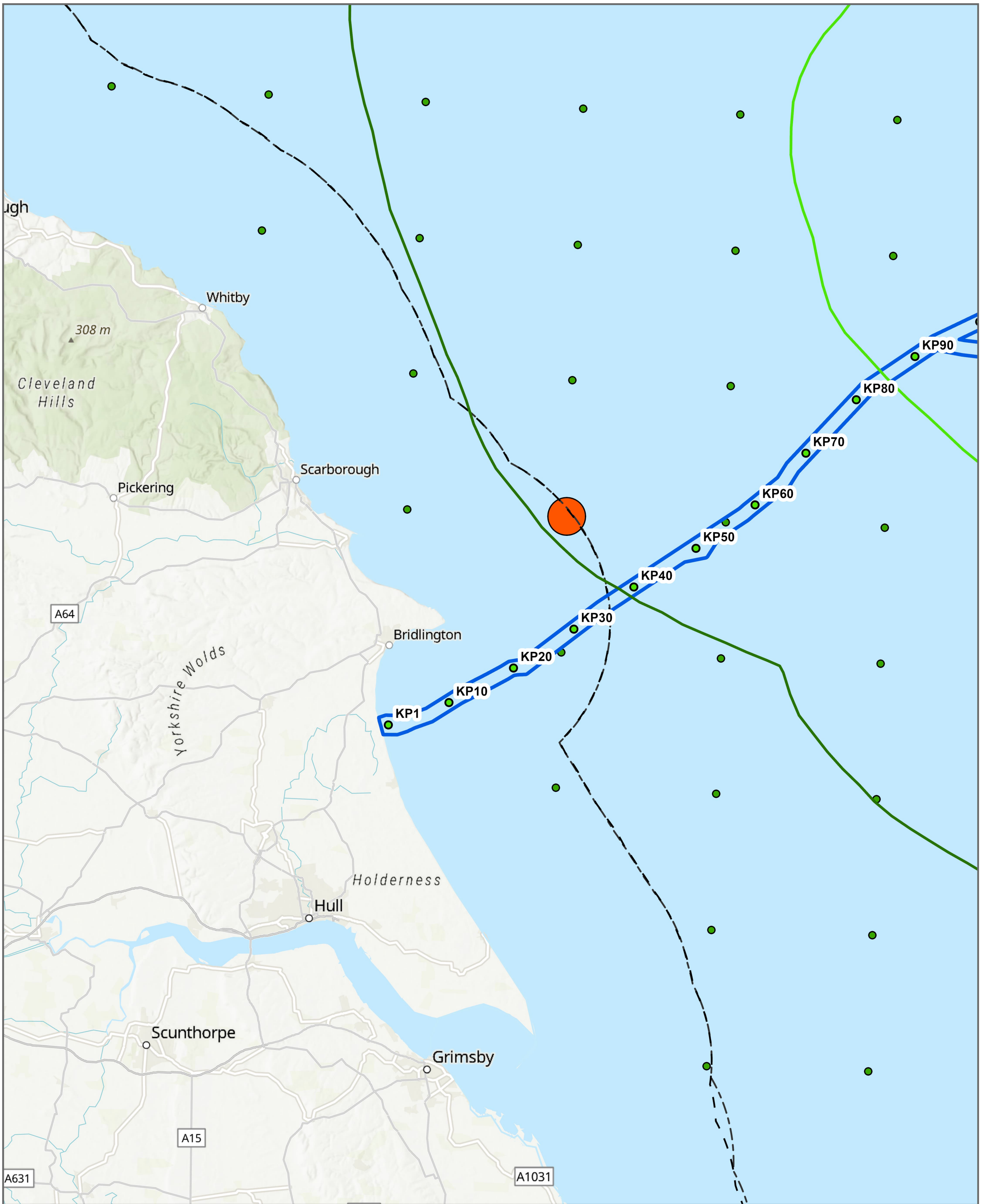
ERM

Figure 3-20

PROJECTION: WGS 1984 UTM Zone 31N

SOURCE: World Topographic Map (ESRI). ICES Eggs and Larvae dataset (2007 - 2023). ICES, Copenhagen

Path: Y:\Projects\J0754512 - Dogger Bank\04_Drawing\Pro\J0754512 - Dogger Bank.aprx / J0754512-MAP-110.5-2011CaughtValues-01



KP Points
Offshore Development Area
UK Territorial Sea Limit (12 nm)
Disturbance Threshold (based on Hawkins et al., 2014)
135dB
Key UWN Thresholds (Popper et al., 2014)
186dB

2012 Larval Abundance per m^2
0 - 50
51 - 200
201 - 600
601 - 1,200
1,201 - 10,000
10,001 - 56,258

0 4 8 12 16 20
Kilometers
N

Title:
IHLS survey data Caught values (2012)

SCALE: See Scale Bar	VERSION: A01
SIZE: A4	DRAWN: MW
PROJECT: 0754512	CHECKED: MH
DATE: 4/16/2025	APPROVED: MH

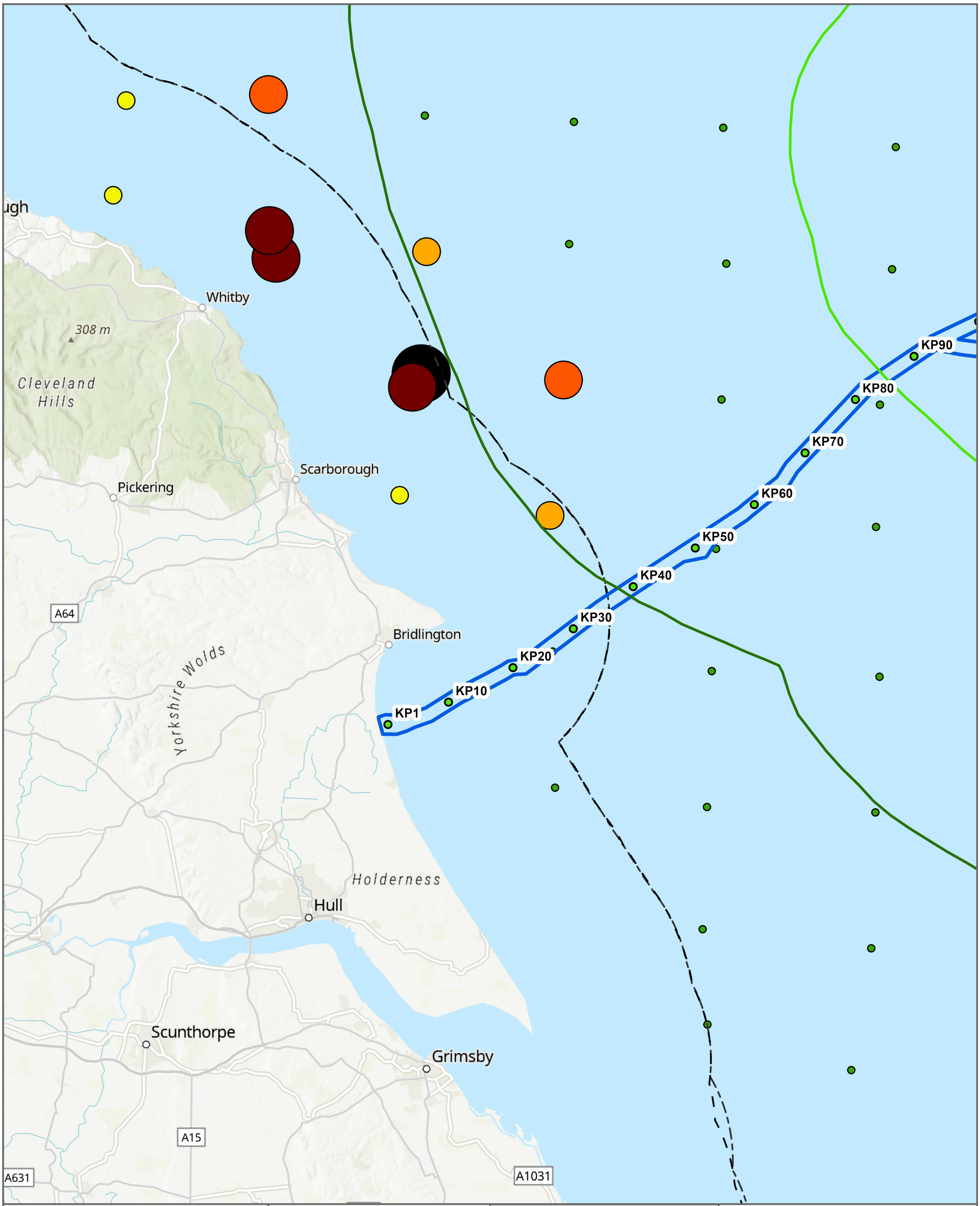
ERM

Figure 3-21

PROJECTION: WGS 1984 UTM Zone 31N

SOURCE: World Topographic Map (ESRI). ICES Eggs and Larvae dataset (2007 - 2023). ICES, Copenhagen

Path: Y:\Projects\J0754512 - Dogger Bank\04_Drawing\Pro\J0754512 - Dogger Bank.aprx / J0754512-MAP-110.6-2012CaughtValues-01



KP Points
Offshore Development Area
UK Territorial Sea Limit (12 nm)
Disturbance Threshold (based on Hawkins et al., 2014)
135dB
Key UWN Thresholds (Popper et al., 2014)
186dB

2013 Larval Abundance per m²
0 - 50
51 - 200
201 - 600
601 - 1,200
1,201 - 10,000
10,001 - 56,258

0 4 8 12 16 20
Kilometers

N

Title:
IHLS survey data
Caught values (2013)

SCALE: See Scale Bar	VERSION: A01
SIZE: A4	DRAWN: MW
PROJECT: 0754512	CHECKED: MH
DATE: 4/16/2025	APPROVED: MH

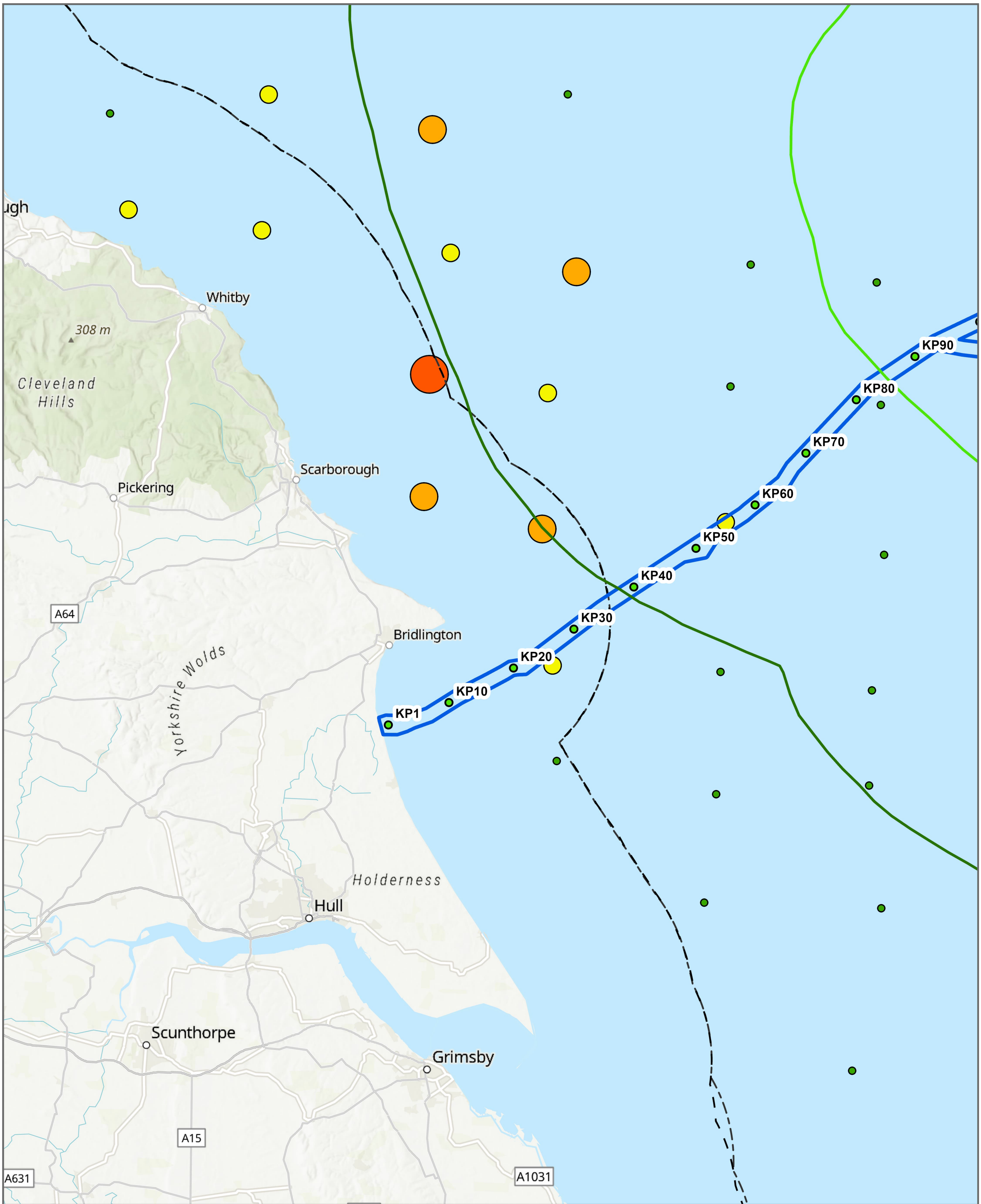
ERM

Figure 3-22

PROJECTION: WGS 1984 UTM Zone 31N

SOURCE: World Topographic Map (ESRI). ICES Eggs and Larvae dataset (2007 - 2023). ICES, Copenhagen

Path: Y:\Projects\J0754512 - Dogger Bank\04_Drawing\Pro\J0754512 - Dogger Bank.aprx / J0754512-MAP-110.7-2013CaughtValues-01



KP Points
Offshore Development Area
UK Territorial Sea Limit (12 nm)
Disturbance Threshold (based on Hawkins et al., 2014)
135dB
Key UWN Thresholds (Popper et al., 2014)
186dB

2014 Larval Abundance per m^2

- 0 - 50
- 51 - 200
- 201 - 600
- 601 - 1,200
- 1,201 - 10,000
- 10,001 - 56,258

PROJECTION: WGS 1984 UTM Zone 31N

0 4 8 12 16 20
Kilometers

N

Title:
IHLS survey data
Caught values (2014)

SCALE: See Scale Bar
SIZE: A4
PROJECT: 0754512
DATE: 4/16/2025

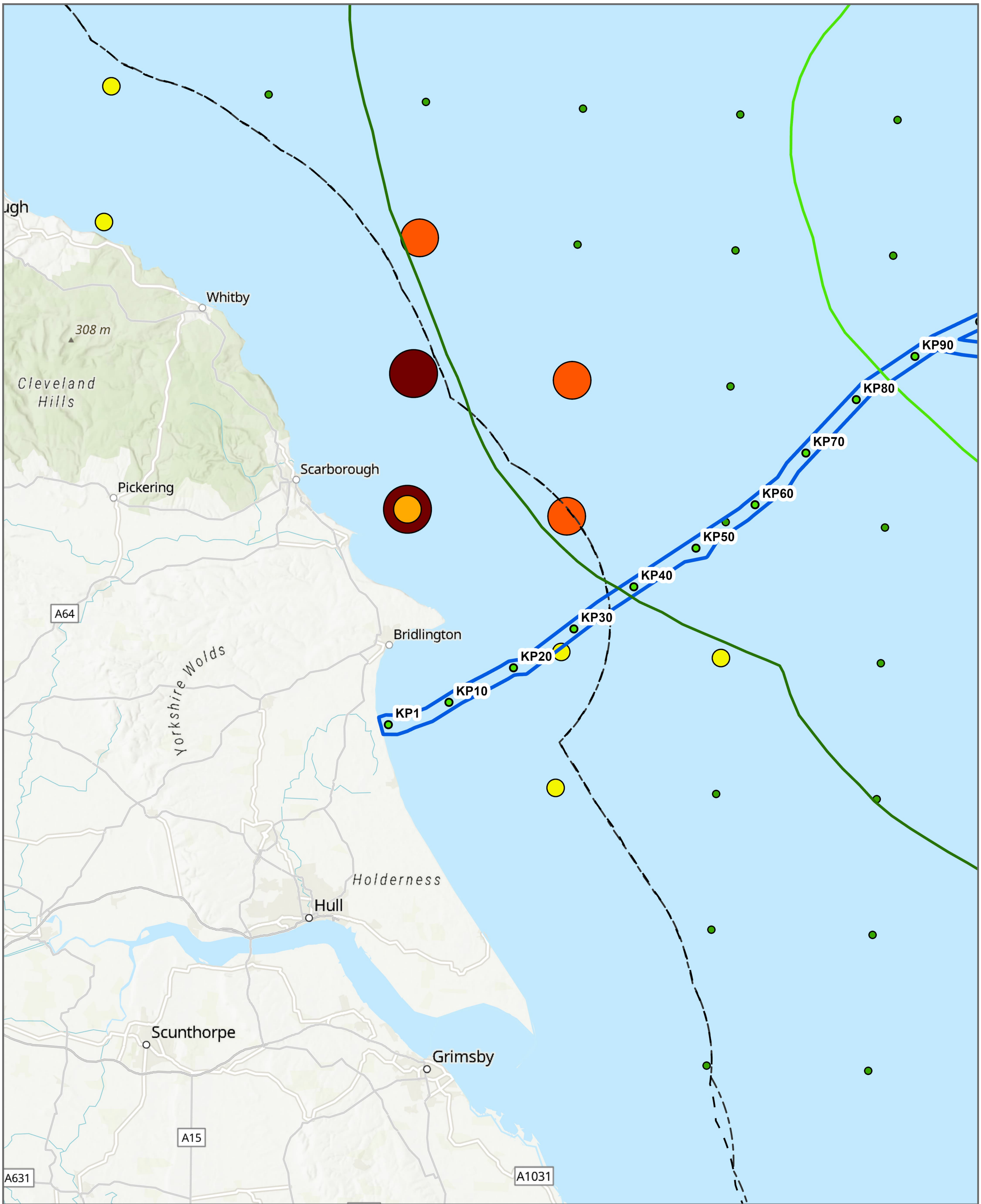
VERSION: A01
DRAWN: MW
CHECKED: MH
APPROVED: MH

ERM

Figure 3-23

SOURCE: World Topographic Map (ESRI). ICES Eggs and Larvae dataset (2007 - 2023). ICES, Copenhagen

Path: Y:\Projects\J0754512 - Dogger Bank\04_Drawing\Pro\J0754512 - Dogger Bank.aprx / J0754512-MAP-110.8-2014CaughtValues-01



KP Points

Offshore Development Area

UK Territorial Sea Limit (12 nm)

Disturbance Threshold (based on Hawkins et al., 2014)

135dB

Key UWN Thresholds (Popper et al., 2014)

186dB

2015 Larval Abundance per m²

- 0 - 50
- 51 - 200
- 201 - 600
- 601 - 1,200
- 1,201 - 10,000
- 10,001 - 56,258

0 4 8 12 16 20

Kilometers

N

Title:
IHLS survey data Caught values (2015)

SCALE: See Scale Bar	VERSION: A01
SIZE: A4	DRAWN: MW
PROJECT: 0754512	CHECKED: MH
DATE: 4/16/2025	APPROVED: MH

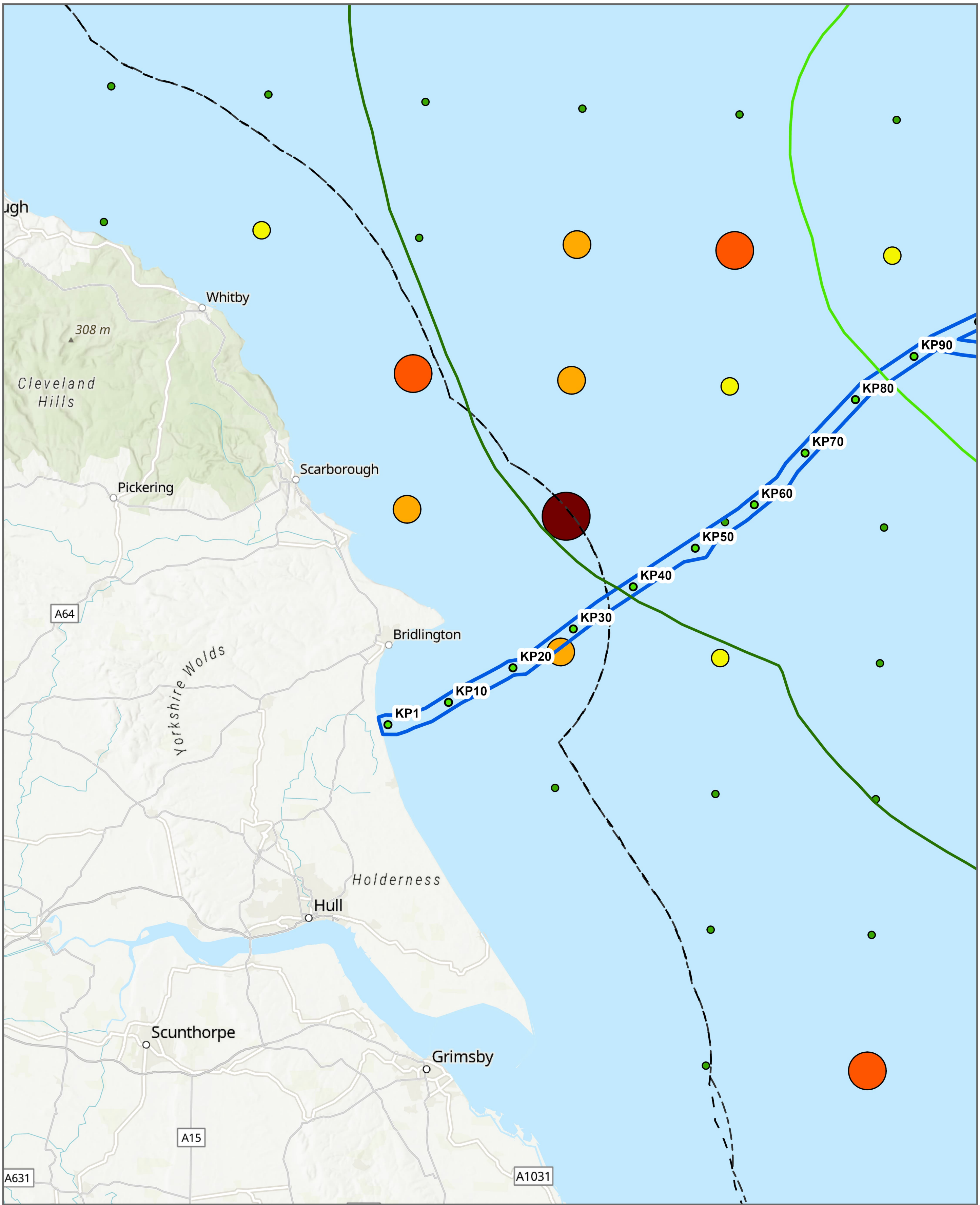
ERM

Figure 3-24

PROJECTION: WGS 1984 UTM Zone 31N

SOURCE: World Topographic Map (ESRI). ICES Eggs and Larvae dataset (2007 - 2023). ICES, Copenhagen

Path: Y:\Projects\J0754512 - Dogger Bank\04_Drawing\Pro\J0754512 - Dogger Bank.aprx / J0754512-MAP-110.9-2015CaughtValues-01



KP Points
Offshore Development Area
UK Territorial Sea Limit (12 nm)
Disturbance Threshold (based on Hawkins et al., 2014)
135dB
Key UWN Thresholds (Popper et al., 2014)
186dB

2016 Larval Abundance per m^2
- 0 - 50
- 51 - 200
- 201 - 600
- 601 - 1,200
- 1,201 - 10,000
- 10,001 - 56,258

0 4 8 12 16 20
Kilometers

N

Title:
IHLS survey data
Caught values (2016)

SCALE: See Scale Bar	VERSION: A01
SIZE: A4	DRAWN: MW
PROJECT: 0754512	CHECKED: MH
DATE: 4/16/2025	APPROVED: MH

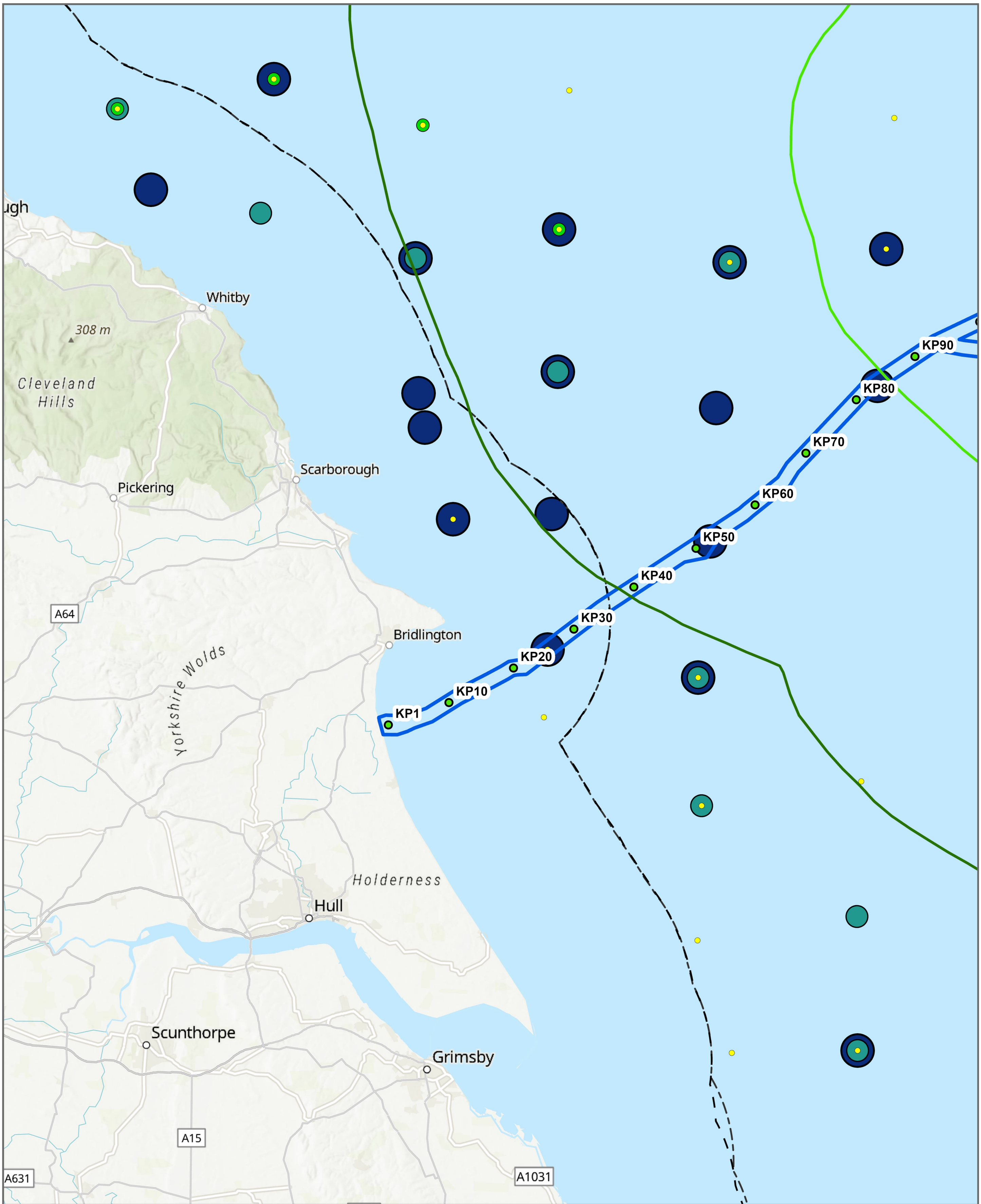
ERM

Figure 3-25

PROJECTION: WGS 1984 UTM Zone 31N

SOURCE: World Topographic Map (ESRI). ICES Eggs and Larvae dataset (2007 - 2023). ICES, Copenhagen

Path: Y:\Projects\J0754512 - Dogger Bank\04_Drawing\Pro\J0754512 - Dogger Bank.aprx / J0754512-MAP-110.10-2016CaughtValues-01



KP Points

UK Territorial Sea Limit (12 nm)

Disturbance Threshold (based on Hawkins et al., 2014)

135dB

Key UWN Thresholds (Popper et al., 2014)

186dB

2019 Larval Abundance per m^2

1 - 6

7 - 13

14 - 25

26 - 57

0 4 8 12 16 20

Kilometers

N

Title:
IHLS survey data
Caught values (2019)

SCALE: See Scale Bar	VERSION: A01
SIZE: A4	DRAWN: MW
PROJECT: 0754512	CHECKED: MH
DATE: 4/16/2025	APPROVED: MH

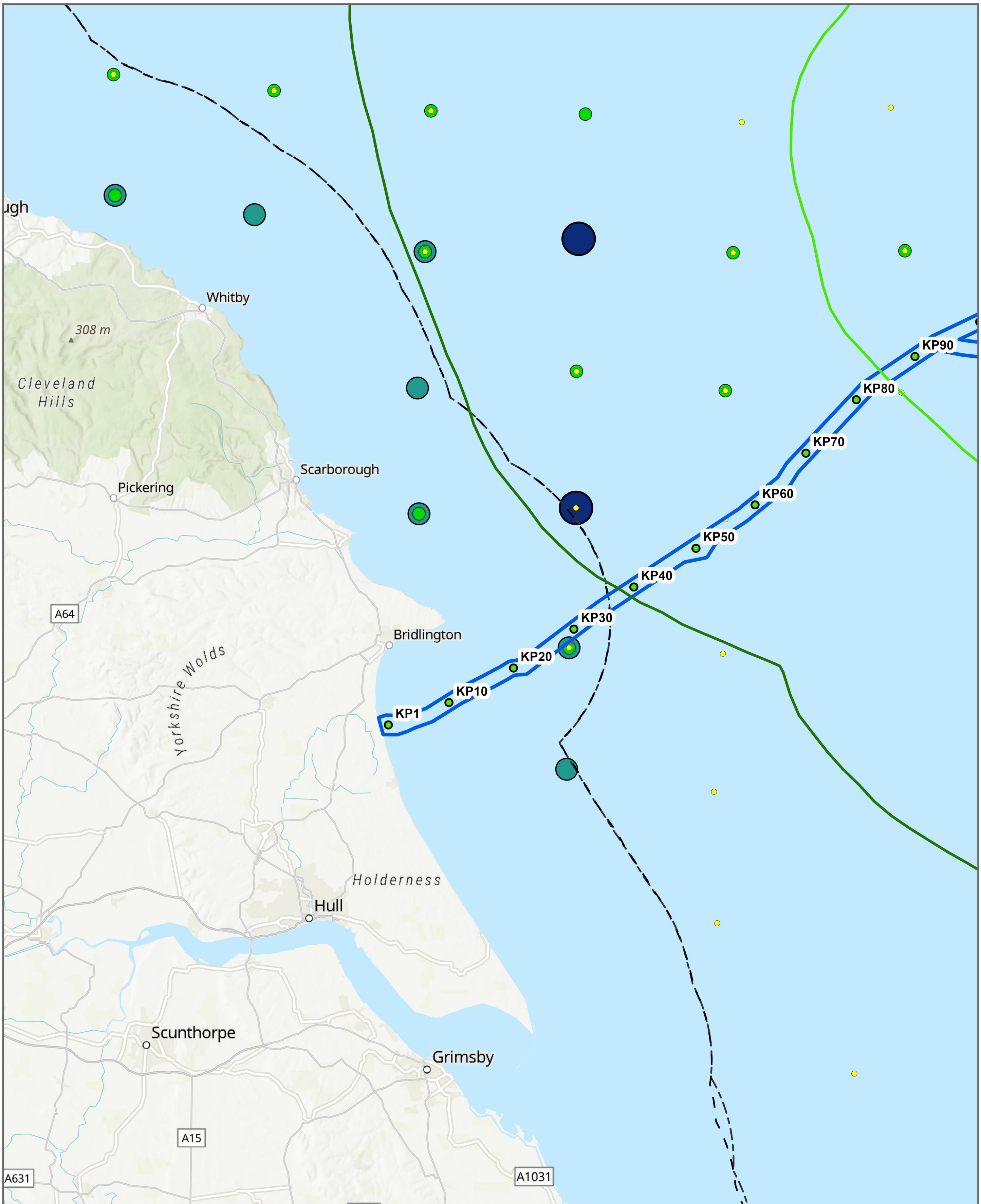
ERM

Figure 3-26

PROJECTION: WGS 1984 UTM Zone 31N

SOURCE: World Topographic Map (ESRI). ICES Eggs and Larvae dataset (2007 - 2023). ICES, Copenhagen

Path: Y:\Projects\J0754512 - Dogger Bank\04_Drawing\Pro\J0754512 - Dogger Bank.aprx / J0754512-MAP-110.11-2019CaughtValues-01



KP Points

UK Territorial Sea Limit (12 nm)

Disturbance Threshold (based on Hawkins et al., 2014)

135dB

Key UWN Thresholds (Popper et al., 2014)

186dB

2022 Larval Abundance per m²

1 - 6

7 - 13

14 - 25

26 - 57

0 4 8 12 16 20

Kilometers

N

Title:
IHLS survey data
Caught values (2022)

SCALE: See Scale Bar	VERSION: A01
SIZE: A4	DRAWN: MW
PROJECT: 0754512	CHECKED: MH
DATE: 4/16/2025	APPROVED: MH

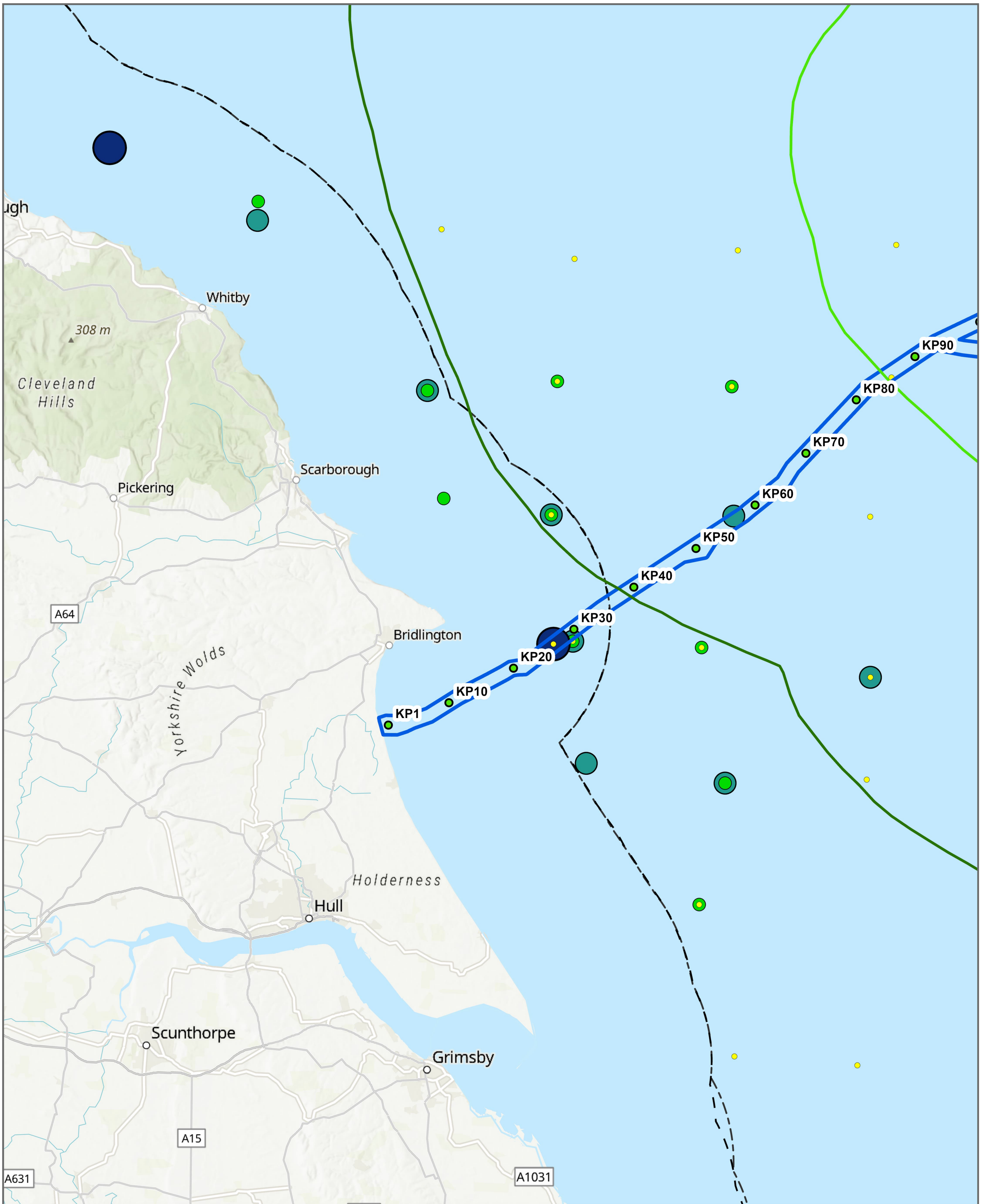
ERM

Figure 3-27

PROJECTION: WGS 1984 UTM Zone 31N

SOURCE: World Topographic Map (ESRI). ICES Eggs and Larvae dataset (2007 - 2023). ICES, Copenhagen

Path: Y:\Projects\J0754512 - Dogger Bank\04_Drawing\Pro\J0754512 - Dogger Bank.aprx / J0754512-MAP-110.12-2022CaughtValues-01



PROJECTION: WGS 1984 UTM Zone 31N

KP Points

UK Territorial Sea Limit (12 nm)

Disturbance Threshold (based on Hawkins et al., 2014)

135dB

Key UWN Thresholds (Popper et al., 2014)

186dB

2023 Larval Abundance per m^2

1 - 6

7 - 13

14 - 25

26 - 57

0 4 8 12 16 20

Kilometers

N

Title:
IHLS survey data
Caught values (2023)

SCALE: See Scale Bar	VERSION: A01
SIZE: A4	DRAWN: MW
PROJECT: 0754512	CHECKED: MH
DATE: 4/16/2025	APPROVED: MH

ERM

Figure 3-28

SOURCE: World Topographic Map (ESRI). ICES Eggs and Larvae dataset (2007 - 2023). ICES, Copenhagen

Path: Y:\Projects\J0754512 - Dogger Bank\04_Drawing\Pro\J0754512 - Dogger Bank.aprx / J0754512-MAP-110.13-2023CaughtValues-01

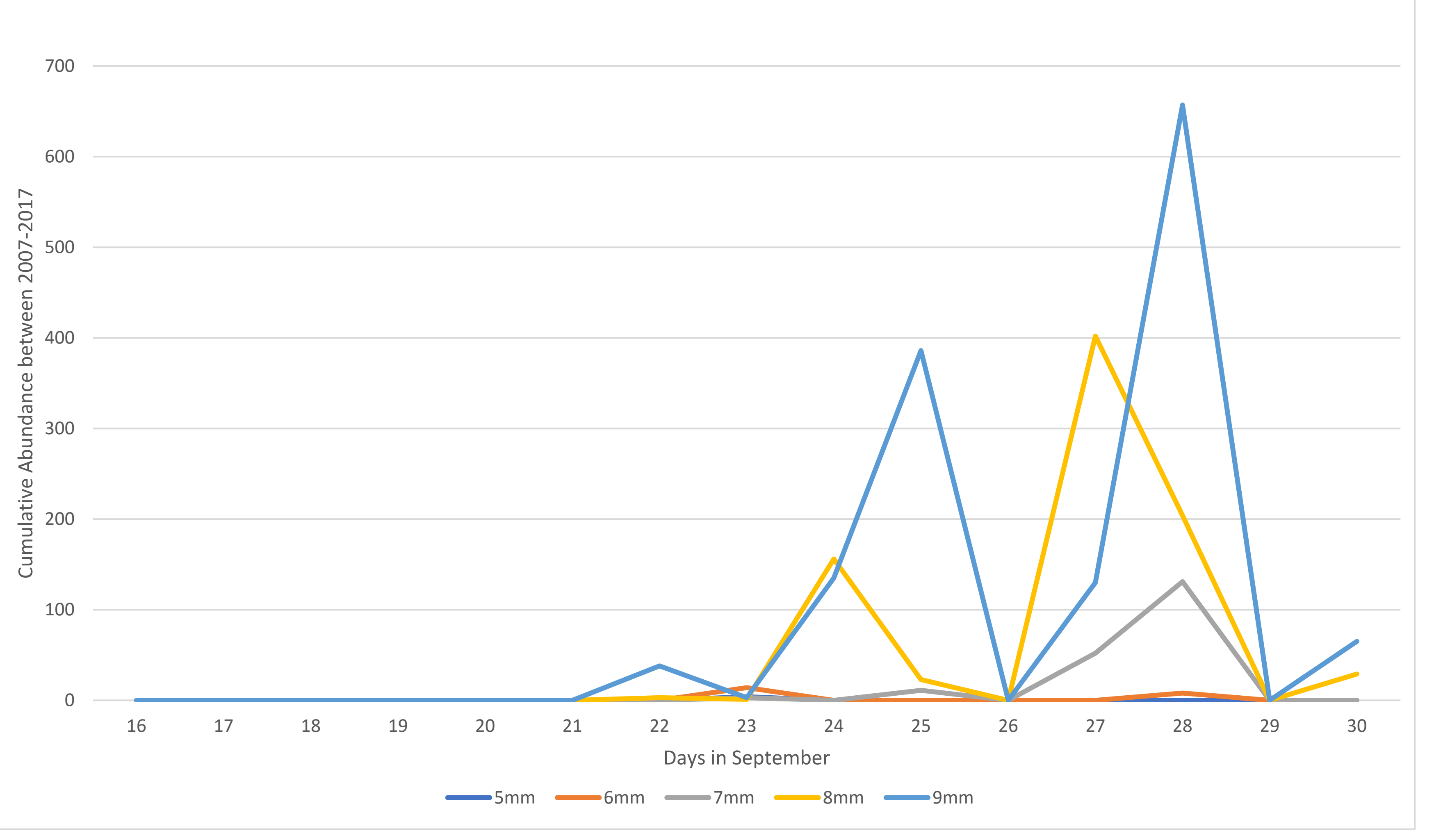


Figure 3-29: International Herring Larval Survey cumulative abundance per length class in areas defined as suitable spawning habitat within the Offshore Export Cable Corridor

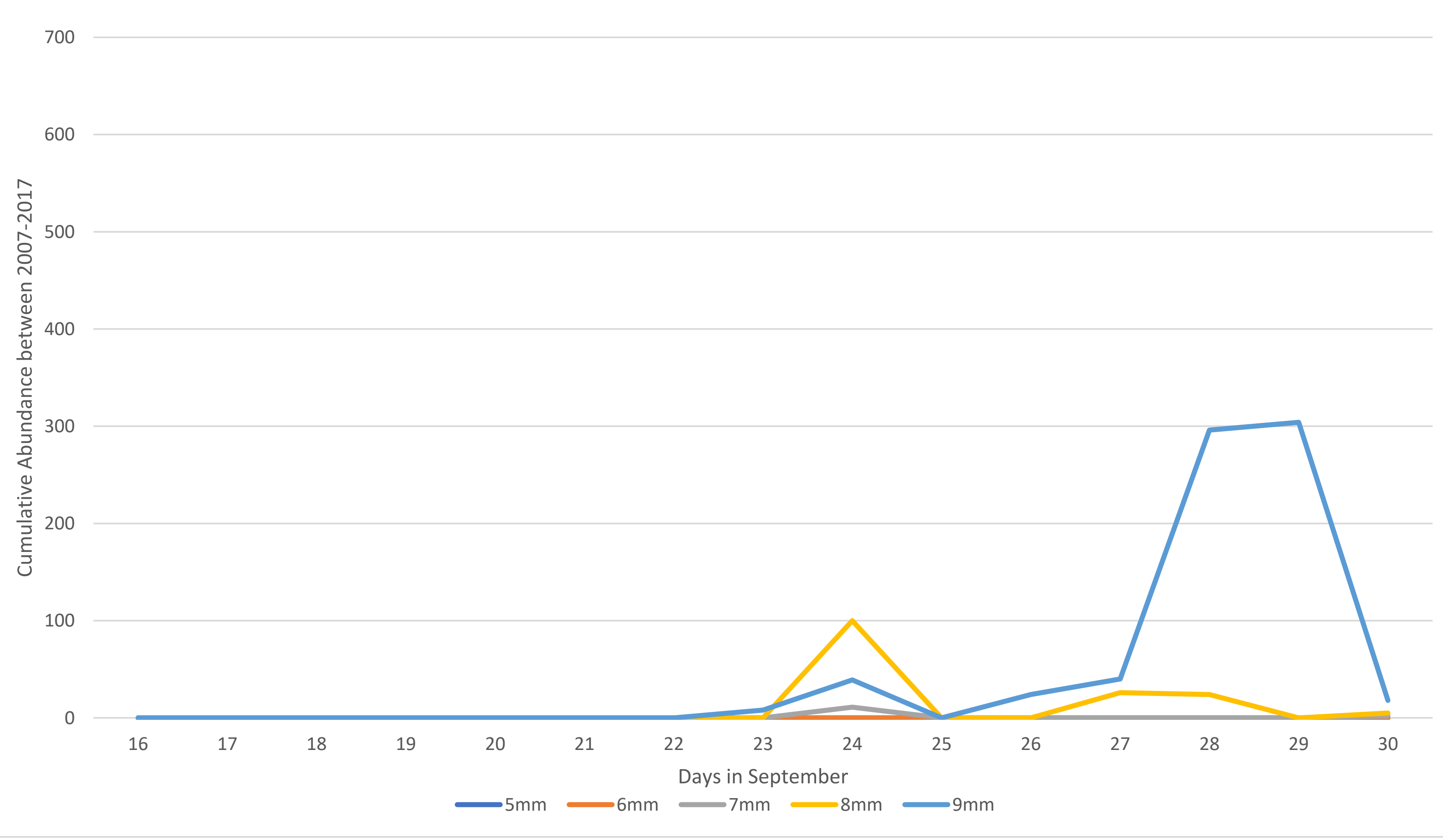


Figure 3-30: International Herring Larval Survey cumulative abundance per length class in areas defined as unsuitable spawning habitat within the Offshore Export Cable Corridor

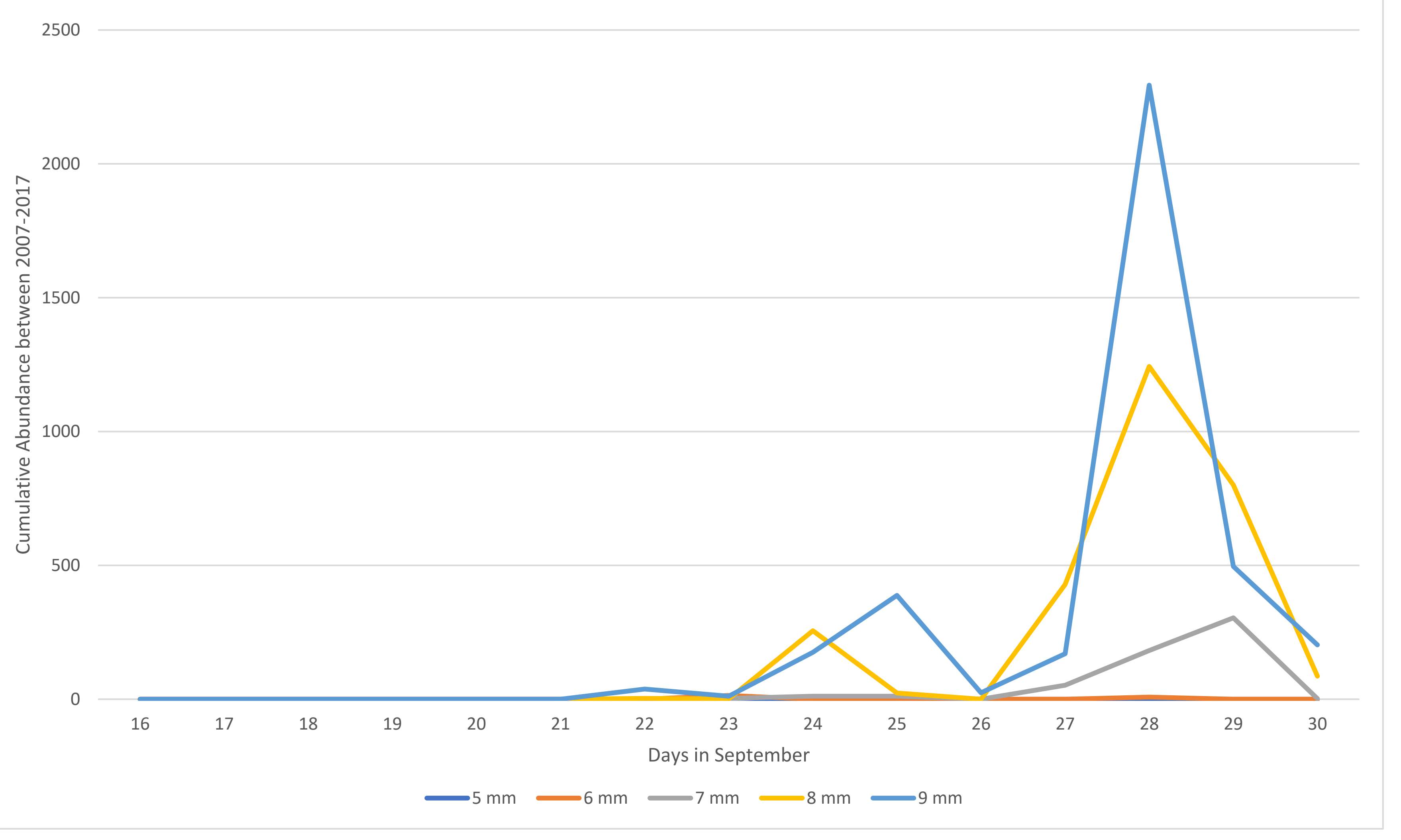


Figure 3-31: International Herring Larval Survey total cumulative abundance per length class within the Offshore Export Cable Corridor

3.3 Egg Development Period and Larval Growth Rates

29. Several of the back-calculation's input parameters are temperature-dependent and based on a number of sources. The temperature-dependent egg development periods defined by Kotthaus (1939) in Russell (1976) are shown in **Table 3-1**.

Table 3-1: The temperature dependent egg development periods defined by Kotthaus (1939) in Russell (1976)

Average Temperature (°C)	Egg Development Period (Days)
12.3	7-9
10.7	10-12
8.7	14-18
8.3	17-20

30. When considering the average temperatures within the Offshore Export Cable Corridor of >12.8°C, the egg development period is determined as <7 days on a precautionary basis.

31. Following advice provided by Cefas, the Kotthaus (1939) larval development (yolk absorption/external disappearance of the yolk sac and yolk sac absorption) periods have been superseded by the 0.25mm/day growth rate (Heath, 1993) for 0-ringer larvae between 5mm and 9mm. This growth rate remains inclusive of the larval development periods defined by Kotthaus (1939).

32. Assuming a 0.25mm/day growth rate, the number of days taken for hatched larvae at 5mm to reach 9mm in length is 16 days. **Table 3-2** shows the number of days taken to achieve each integer length as recorded within the IHLS abundance data.

Table 3-2: The number of days taken to achieve a 9mm maximum 0-ringer length assuming a 0.25mm/day growth rate (Heath, 1993)

Larval Length (mm)	Number of Days Taken to Achieve Larval Length
5	0 (larvae are 5mm in length at hatching)
6	4
7	8
8	12
9	16

4 Back-Calculation Method

33. The Applicants consider that the following metrics are fit for purpose along with respective justifications, to define the periods at which there is potential risk to Atlantic herring eggs and larvae:

- 24h grace period (to account for the settling of any suspended sediments elevated during cable installation works)[2];
- Minimum larval length at hatching = 5mm (MMO pers. comms.);
- Maximum 0-ringer larval length = 9mm (Dickey-Collas, 2005; MMO pers. comms.);
- Growth rate = 0.25mm per day (Heath, 1993);
- Egg development period = 7 days (Kotthaus, 1939 in Russell, 1976):
    - The Applicants do not consider the temperature of 12.3°C used to define the MMO's position of a 9 day period to be reflective of the average temperatures within the Offshore Development Area. The IHLS data shows that the Offshore Development Area is consistently >13°C, with an average temperature of >12.8°C, resulting in an egg development period of <7 days as a precaution.

[2] The 24 h grace period has been added to the back-calculation at the request of Cefas.

34. The Projects' back-calculation has been performed over the following scenarios[3] to adequately capture the variability in timing of spawning within the immediate vicinity of the Offshore Export Cable Corridor:

- Scenario 1 – egg development for 5mm larvae caught on 16th September.
- Scenario 2 - egg development and growth period for 6mm larvae caught on 16th September.
- Scenario 3 - egg development and growth period for 8mm larvae caught on 23rd September.
- Scenario 4 - egg development and growth period for 9mm larvae caught on 22nd September.

35. The back-calculation has an inherent variability dependent on whether it is conducted on 16th September (inclusive) or up to the 16th September (exclusive).

36. The back-calculation and resulting timelines for all scenarios for inclusive days and exclusive days are presented in sections 4.1 and 4.2. The MMO's back-calculation is presented alongside these scenarios for comparison, including a 24 precautionary grace period to enable works to cease prior to the egg development period.

[3] These scenarios are evidence-based and represent the maximum-case scenarios within the IHLS dataset.

4.1 Inclusive Back-Calculation

<table>
<tr><th rowspan="2">Scenario</th><th colspan="25">August</th></tr>
<tr><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th><th>13</th><th>14</th><th>15</th><th>16</th><th>17</th><th>18</th><th>19</th><th>20</th><th>21</th><th>22</th><th>23</th><th>24</th><th>26</th><th>26</th><th>27</th><th>28</th><th>29</th><th>30</th><th>31</th></tr>
<tr><td>1 (5mm on 16th September)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2 (6mm on 16th September)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>3 (8mm on 24th September)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4 (9mm on 22nd September)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>24h</td><td></td></tr>
<tr><td>MMO Example</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>24h</td><td colspan="9">Egg Development (9 days, >12.3°C)</td></tr>
</table>

<table>
<tr><th rowspan="2">Scenario</th><th colspan="30">September</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th><th>13</th><th>14</th><th>15</th><th>16</th><th>17</th><th>18</th><th>19</th><th>20</th><th>21</th><th>22</th><th>23</th><th>24</th><th>25</th><th>26</th><th>27</th><th>28</th><th>29</th><th>30</th></tr>
<tr><td>1 (5mm on 16th September)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>24h</td><td colspan="7">Egg Development (7 days, >12.8°C)</td><td colspan="14">Hatched Larvae in IHLS Samples</td></tr>
<tr><td>2 (6mm on 16th September)</td><td></td><td></td><td></td><td></td><td>24h</td><td colspan="7">Egg Development (7 days, >12.8°C)</td><td>5mm to 6mm Growth Period (4 days)</td><td colspan="17">Hatched Larvae in IHLS Samples</td></tr>
<tr><td>3 (8mm on 24th September)</td><td></td><td></td><td></td><td></td><td>24h</td><td colspan="7">Egg Development (7 days, >12.8°C)</td><td colspan="9">5mm to 8mm Growth Period (12 days)</td><td colspan="9">Hatched Larvae in IHLS Samples</td></tr>
<tr><td>4 (9mm on 22nd September)</td><td colspan="6">Egg Development (7 days, >12.8°C)</td><td colspan="13">5mm to 9mm Growth Period (16 days)</td><td colspan="11">Hatched Larvae in IHLS Samples</td></tr>
<tr><td>MMO Example</td><td colspan="16">5mm to 9mm Growth Period (16 days)</td><td colspan="14">Hatched Larvae in IHLS Samples</td></tr>
</table>

4.2 Exclusive Back-Calculation

<table>
<tr><th rowspan="2">Scenario</th><th colspan="25">August</th></tr>
<tr><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th><th>13</th><th>14</th><th>15</th><th>16</th><th>17</th><th>18</th><th>19</th><th>20</th><th>21</th><th>22</th><th>23</th><th>24</th><th>25</th><th>26</th><th>27</th><th>28</th><th>29</th><th>30</th><th>31</th></tr>
<tr><td>1 (5mm on 16th September)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2 (6mm on 16th September)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>3 (8mm on 24th September)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4 (9mm on 22nd September)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>24h</td><td colspan="2"></td></tr>
<tr><td>MMO Example</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>24h</td><td colspan="9">Egg Development (9 days, >12.3°C)</td><td></td></tr>
</table>

<table>
<tr><th rowspan="2">Scenario</th><th colspan="30">September</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th><th>13</th><th>14</th><th>15</th><th>16</th><th>17</th><th>18</th><th>19</th><th>20</th><th>21</th><th>22</th><th>23</th><th>24</th><th>25</th><th>26</th><th>27</th><th>28</th><th>29</th><th>30</th></tr>
<tr><td>1 (5mm on 16th September)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>24h</td><td colspan="7">Egg Development (7 days, >13°C)</td><td colspan="15">Hatched Larvae in IHLS Samples</td></tr>
<tr><td>2 (6mm on 16th September)</td><td></td><td></td><td></td><td>24h</td><td colspan="7">Egg Development (7 days, >13°C)</td><td colspan="4">5mm to 6mm Growth Period (4 days)</td><td colspan="15">Hatched Larvae in IHLS Samples</td></tr>
<tr><td>3 (8mm on 24th September)</td><td></td><td></td><td></td><td>24h</td><td colspan="7">Egg Development (7 days, >13°C)</td><td colspan="12">5mm to 8mm Growth Period (12 days)</td><td colspan="7">Hatched Larvae in IHLS Samples</td></tr>
<tr><td>4 (9mm on 22nd September)</td><td colspan="5">Egg Development (7 days, >13°C)</td><td colspan="16">5mm to 9mm Growth Period (16 days)</td><td colspan="9">Hatched Larvae in IHLS Samples</td></tr>
<tr><td>MMO Example</td><td colspan="15">5mm to 9mm Growth Period (16 days)</td><td colspan="15">Hatched Larvae in IHLS Samples</td></tr>
</table>

5 Back-Calculation Results

37. The back-calculations presented in sections 4.1 and 4.2 show that the peak period in which eggs and recently hatched larvae are associated with the seabed occurs in early September.

38. Based upon the limited number of 9mm larvae caught on 22nd September 2015 (38 larvae), the precautionary back-calculated risk to Atlantic herring eggs and larvae in the vicinity of the Offshore Export Cable Corridor from cable laying activities is expected to begin on **29th August** including the 24h grace period (Scenario 4).

39. However, when determining the peak in spawning activity, the first significant quantities of larvae are 8mm in length and caught within the Offshore Export Cable Corridor on 24th September. The 'peak' back-calculated risk to Atlantic herring eggs and larvae in the vicinity of the Offshore Export Cable Corridor from cable laying activities is expected to begin on **4th September** including the 24h grace period (Scenario 3).

40. The MMO's example back-calculation starting on 21st August assumes that larvae will be 9mm on the 16th of September, and that the average temperature within the Offshore Export Cable Corridor is 12.3°C. Both assumptions are not supported by evidence within the IHLS dataset, but are instead precautionary in nature.

41. Based on the precautionary back-calculation and the peak back-calculation, the peak spawning period for Atlantic herring in the area surrounding the Offshore Export Cable Corridor is considered to occur throughout September.

42. Given the limited extent of potential spawning habitat along the Offshore Export Cable Corridor, it is unlikely that cable laying activities will result in a significant effect on Atlantic herring spawning within the region.

6 Conclusion

43. The MMO's example back-calculation represents a refinement from 91 days (1st August to 31st October, inclusive) to 41 days (21st August to 30th September, inclusive), and includes precaution justified by the potential for lower than average temperatures and early spawning events (compared to the IHLS data presented in section 3).

44. As such, the Applicants are willing to accept the MMO's precautionary back-calculation for the purposes of refining the temporal restriction on cable laying activities to the period 21st August to 30th September (inclusive), subject to a review of most recent IHLS information post-consent.

References

Dickey-Collas, M. (2005). Desk Study on the transport of larval herring in the southern North Sea (Downs herring) (No. C031/05). RIVO.

Dickey-Collas, M., Bolle, L.J., van Beek, J.K. and Erftemeijer, P.L. (2009). Variability in transport of fish eggs and larvae. II. Effects of hydrodynamics on the transport of Downs herring larvae. *Marine Ecology Progress Series*, 390, pp. 183-194.

Fischbach, V., Finke, A., Moritz, T., Polte, P. and Thieme, P. (2023). A staging system for Atlantic herring (*Clupea harengus*) larvae based on external morphology and skeletal development. *Limnology and Oceanography: Methods*, 21(7): pp. 357-376.

Fugro (2023). *DBS WMP1 WMP2 WMP3 - Benthic Ecology Monitoring Report*.

Griffin, F.J., Smith, E.H., Vines, C.A. and Cherr, G.N. (2009). Impacts of suspended sediments on fertilization, embryonic development, and early larval life stages of the Pacific herring, *Clupea pallasi*. *The Biological Bulletin*, 216(2): pp. 175-187.

Heath, M. (1993). An evaluation and review of the ICES herring larval surveys in the North Sea and adjacent waters. *Bulletin of Marine Science*, 52: 795-817.

ICES (2025). Data Portals. Eggs and Larvae. Available online at: https://www.ices.dk/data/data-portals/Pages/Eggs-and-larvae.aspx.

Kiørboe, T., Frantsen, E., Jensen, C. and Sørensen, G. (1981). Effects of suspended sediment on development and hatching of herring (*Clupea harengus*) eggs. *Estuarine, Coastal and Shelf Science*, 13(1): pp. 107-111.

Kyle-Henney, M., Reach, I., Barr, N., Warner, I., Lowe, S., and Lloyd Jones, D. (2024). *Identifying and Mapping Atlantic Herring Potential Spawning Habitat: An Updated Method Statement*. Available at: https://www.erm.com/globalassets/insights/documents/Identifying_and_Mapping_Atlantic_Herring_Potential_Spawning_Habitat_An_Updated_Method_2024_w_Appendices.pdf [Accessed June 2025].

RWE Renewables UK Dogger Bank
South (West) Limited

RWE Renewables UK Dogger Bank
South (East) Limited

Windmill Business Park
Whitehill Way
Swindon
Wiltshire, SN5 6PB