East Anglia TWO Offshore Windfarm

Appendix 14.2

East Anglia TWO Navigational Risk Assessment

Environmental Statement
Volume 3

Applicant: East Anglia TWO Limited
Document Reference: 6.3.14.2
SPR Reference: EA2-DWF-ENV-REP-IBR-000906_002 Rev 01
Pursuant to APFP Regulation: 5(2)(a)

Author: Royal HaskoningDHV
Date: October 2019
Revision: Version 1

East Anglia TWO Offshore Windfarm
Navigational Risk Assessment
(Appendix 14.2)

Prepared by	Anatec Limited
Presented to	ScottishPower Renewables
Date	4th June 2019
Revision Number	02
Document Reference	A4393-SPR-NRA-2 App 14.2

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Revision Number	Date	Summary of Change
00	10th August 2018	Initial Draft
01	14th January 2019	Updates following changes to layout
02	4th June 2019	Updates following layout and site boundary changes, Section 42 responses and 2018 summer survey

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Abbreviations Table

Abbreviation	Definition
AfL	Agreement for Lease
AIS	Automatic Identification System
ALARP	As Low as Reasonably Practicable
ALB	All-Weather Lifeboat
AtoN	Aids to Navigation
BEIS	Department for Business, Energy and Industrial Strategy
BMAPA	British Marine Aggregate Producers Association
CA	Cruising Association
CGOC	Coastguard Operations Centre
CIA	Cumulative Impact Assessment
COLREGs	International Regulations for Preventing Collisions at Sea
CoS	Chamber of Shipping
CRO	Coastguard Rescue Officer
CRT	Coastguard Rescue Team
DCO	Development Consent Order
DfT	Department for Transport
DML	Deemed Marine Licence
DWR	Deep Water Route
E	East
EIA	Environmental Impact Assessment
ERCoP	Emergency Response Co-operation Plan
ES	Environmental Statement
EU	European Union
FSA	Formal Safety Assessment
GT	Gross Tonnage
HAML	Hanson Aggregate Marine Ltd
HSE	Health and Safety Executive
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities

Abbreviation	Definition
IHO	International Hydrographic Organisation
ILB	Inshore Lifeboat
IMO	International Maritime Organization
km	kilometre
LAT	Lowest Astronomical Tide
LOA	Length Overall
LPG	Liquid Petroleum Gas
m	metre
MAIB	Marine Accident Investigation Branch
MCA	Maritime and Coastguard Agency
MEHRA	Marine Environmental High Risk Area
Met Mast	Meteorological Mast
MGN	Marine Guidance Note
MHWS	Mean High Water Springs
MMO	Marine Management Organisation
MoD	Ministry of Defence
MSC	Maritime Safety Council
MW	Megawatt
N	North
nm	Nautical Mile
NMOC	National Maritime Operations Centre
NOREL	Nautical Offshore Renewable Energy Liaison
NRA	Navigation Risk Assessment
NUC	Not Under Command
OfTO	Offshore Transmission
OREI	Offshore Renewable Energy Installations
PEIR	Preliminary Environmental Information Report
PEXA	Practice and Exercise Area
PLL	Potential Loss of Life
REZ	Renewable Energy Zone

Abbreviation	Definition
RIV	Rapid Intervention Vessel
RNLI	Royal National Lifeboat Institution
Ro Ro	Roll on Roll off
RYA	Royal Yachting Association
SAR	Search and Rescue
SMS	Safety Management System
SNSOWF	Southern North Sea Offshore Wind Forum
SOLAS	International Convention for the Safety of Life at Sea
SPR	ScottishPower Renewables
STS	Ship-to-Ship
TSS	Traffic Separation Scheme
UK	United Kingdom
UKHO	United Kingdom Hydrographic Office
VHF	Very High Frequency

Glossary

Term	Definition
As Low As Reasonably Practicable (ALARP)	The principle that the residual risk shall be reduced as far as reasonably practicable.
Allision	Contact between a moving and stationary object.
Automatic Identification System (AIS)	Automatic Identification System. A system by which vessels automatically broadcast their identity, key statistics e.g. length, brief navigation details e.g. location, destination, speed and current status e.g. survey. Most commercial vessels and European Union (EU) fishing vessels over 15 m are required to have AIS.
Baseline	The assessment of risk based on current shipping densities and traffic types as well as the marine environment.
Collision	The act or process of colliding (crashing) between two moving objects.
Environmental Statement (ES)	A document reporting the findings of the Environmental Impact Assessment (EIA) and produced in accordance with the EIA

Term	Definition
	Directive as transposed into United Kingdom (UK) law by the EIA Regulations.
Formal Safety Assessment (FSA)	A structured and systematic process for assessing the risks and costs (if applicable) associated with shipping activity.
Future Case	The assessment of risk based on the predicted growth in future shipping densities and traffic types as well as foreseeable changes in the marine environment.
Marine Environmental High Risk Area (MEHRA)	Areas in UK coastal waters where ships' masters are advised of the need to exercise more caution than usual i.e. crossing areas of high environmental sensitivity where there is a risk of pollution from commercial shipping.
Marine Guidance Note (MGN)	A system of guidance notes issued by the Maritime and Coastguard Agency (MCA) which provide significant advice relating to the improvement of the safety of shipping and of life at sea, and to prevent or minimise pollution from shipping.
Navigational Risk Assessment (NRA)	A document which assesses the overall impact to shipping and navigation of a proposed Offshore Renewable Energy Installation (OREI) based upon formal risk assessment.
Not Under Command (NUC)	Under Part A of the International Regulations for Preventing Collisions at Sea (COLREGs), the term "vessel not under command" means a vessel which through some exceptional circumstance is unable to manoeuvre as required by these Rules and is therefore unable to keep out of the way of another vessel.
Offshore Renewable Energy Installation (OREI)	OREIs as defined by Guidance on UK Navigational Practice, Safety and Emergency Response Issues, MGN 543. For the purpose of this report and in keeping with the consistency of the EIA, OREI can mean offshore turbines and the associated electrical infrastructures such as offshore High Voltage Alternating Current (HVAC) transformer substations, offshore High Voltage Direct Current (HVDC) converter substations, construction, operation and maintenance (accommodation) platforms and offshore HVAC booster stations.
Radar	Radio Detection And Ranging – an object-detection system which uses radio waves to determine the range, altitude, direction, or speed of objects.
Regular Operator	A commercial vessel operator whose vessel(s) are observed to transit through a particular region on a regular basis.

Term	Definition
Safety Zone	A marine zone demarcated for the purposes of safety around a possibly hazardous installation or works / construction area under the Energy Act 2004.

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1 Introduction

1.1 Background

1. Anatec were commissioned by ScottishPower Renewables (SPR) to undertake a Navigational Risk Assessment (NRA) for the proposed East Anglia TWO project. The report presents information on the offshore development area relative to the existing and future case navigational activity.

1.2 Environmental Impact Assessment (EIA)

2. Assessments of impacts on shipping and navigation during the construction, operation and decommissioning phase are informed by an NRA. Following the Maritime and Coastguard Agency (MCA) methodology for assessing marine navigational risk of offshore windfarms (MCA 2015) and Marine Guidance Note (MGN) 543 (MCA 2016), the NRA includes:

   - Overview of base case environment;
   - Marine traffic survey data and analysis;
   - Assessment of navigational risk pre and post development of the offshore development area;
   - Emergency response;
   - Technical assessment for the Formal Safety Assessment (FSA) being undertaken as part of the EIA;
   - Identification of mitigation measures; and
   - Through life safety management.

3. Results from the NRA are then used to inform the EIA, a process which identifies the environmental effects of the offshore development area, both negative and positive, in accordance with European Union (EU) Directives.

2 Regulations and Guidance

2.1 Primary Guidance

4. The primary guidance documents used to inform this NRA are as follows:

- MCA MGN 543 (Merchant and Fishing) Safety of Navigation Offshore Renewable Energy Installations (OREIs) – Guidance on United Kingdom (UK) Navigational Practice, Safety and Emergency Response (MCA 2016);
- MCA Methodology for Assessing Marine Navigational Safety Risks of Offshore Wind Farms (2015); and
- Guidelines for FSA – Maritime Safety Council (MSC)/Circular 1023/MEPC/Circular 392 (International Maritime Organization (IMO) 2002).

5. MGN 543 highlights issues that shall be taken into consideration when assessing the effect on navigational safety from offshore renewable energy developments, proposed in UK internal waters, territorial sea or Renewable Energy Zone (REZ).

6. The MCA require that their methodology is used as a template for preparing NRAs, including the completion of an FSA. The methodology is centred on risk management and requires a submission that shows that sufficient controls are, or will be, in place for the assessed risk (base case and future case) to be judged as broadly acceptable or tolerable with mitigation. An MGN 543 checklist referencing the sections in this report which address all MCA requirements is presented in *Appendix 14.5 MGN 543 Checklist.*

2.2 East Marine Plan

7. During consultation, the Chamber of Shipping (CoS) requested that the East Inshore and East Offshore Marine Plans (HM Government, 2014) be taken into consideration, therefore the ports and shipping policies have been presented in *Table 2.1* and where they have been addressed.

Table 2.1 East Marine Plan Ports and Shipping Policies

Policy Number	Description	East Anglia TWO Approach
PS1	Proposals that require static sea surface infrastructure or that significantly reduce under-keel clearance should not be authorised in IMO designated routes.	The offshore development area is not situated within IMO designated routes as presented in section 8.3.
PS2	Proposals that require static sea surface infrastructure that encroaches upon important navigation routes should not be authorised unless there are external circumstances. Proposals should:	Baseline and future vessel routeing around the offshore development area has been assessed in section 14 and section 16, respectively.

Policy Number	Description	East Anglia TWO Approach
	▪ Be compatible with the need to maintain space for safe navigation, avoiding economic impact; ▪ Anticipate and provide for future safe navigational requirements where evidence and / or stakeholder input allows; and ▪ Account for impacts upon navigation in-combination with other existing and proposed activities.	
PS3	Proposals should demonstrate, in order of preference: ▪ That they will not interfere with current activity and future opportunity for expansion of ports and harbours; ▪ How, if the proposal may interfere with current activity and future opportunities for expansion, they will minimise this; ▪ How, if the interference cannot be minimised, it will be mitigated; and ▪ The case for proceeding if it is not possible to minimise or mitigate the interference.	Given that the East Anglia TWO windfarm site is out with the operational area or harbour limits of any ports, harbours or marinas there are not considered to be any cumulative impacts associated with the construction, operation and maintenance or decommissioning phases. Routeing to and from ports is considered in section 14 and 16 (offshore development area in isolation) and section 20.4 (cumulatively).

2.3 Other Guidance

8. Other (secondary) guidance documents used during the NRA are listed below:

- MCA MGN 372 (Merchant and Fishing) OREIs Guidance to Mariners Operating in the Vicinity of UK OREIs (MCA 2008);
- International Association of Marine Aids to Navigation (AtoN) and Lighthouse Authorities (IALA) Recommendation O-139 on The Marking of Man-Made Offshore Structures, Edition Two (IALA 2013);
- Royal Yachting Association (RYA) – the RYA's Position on Offshore Renewable Energy Developments Paper One – Wind Energy (RYA 2015); and
- Department for Business, Energy and Industrial Strategy (BEIS) Standard Marking Schedule for Offshore Installations (BEIS 2011).

3 NRA Methodology

3.1 Methodology for Assessing the East Anglia TWO Windfarm Site in Isolation

9. As per the primary guidance described in section 2.1, shipping and navigation impacts are assessed within the EIA based on an FSA approach. The NRA forms the technical workings of, and primary input to, the FSA.

10. The NRA has evaluated all required effects as detailed within MGN 543 (listed in *Appendix 14.5)* and as required by the MCA. Those effects associated with shipping and navigation receptors have then been carried forward to *Chapter 14 Shipping and Navigation* as impacts requiring assessment.

11. Where an impact has been identified the overall severity of consequence to the receptor and likely frequency of occurrence of the impact have been determined. As this process incorporates a degree of subjectivity both screening of significant impacts from the NRA process and the consequent assessment within the EIA have used the following sources:

- Scoping responses;
- Baseline data and assessment (including marine traffic survey data);
- Expert opinion;
- Outputs of the Hazard Workshop (*Appendix 14.2*);
- Level of stakeholder concern;
- Significance of any deviation;
- Number of transits of specific vessel and / or vessel type;
- Outputs of modelling where undertaken; and
- Lessons learnt from existing offshore projects.

12. The definitions used within the FSA for severity of consequence and frequency of occurrence are presented in *Table 3.1* and *Table 3.2*, respectively. These rankings assume the embedded mitigation measures listed in section 22 will be in place. It should be noted that the primary concern of the NRA and subsequent FSA is navigational safety (risk to the safety of vessels and / or crew) however financial and reputation consequences have also been considered from a cost benefit approach as per the methodology (MCA 2015).

Table 3.1 Severity of Consequence Definitions

Rank	Severity	Definition
1	Negligible	No injury to persons. No significant damage to infrastructure or vessel. No significant environmental impacts. No significant business (safety), operation or reputation impacts.

Rank	Severity	Definition
2	Minor	Slight injury(s) to person. Minor damage to infrastructure or vessel. Tier 1 pollution assistance (marine pollution). Minor business (safety), operation or reputation impacts.
3	Moderate	Multiple moderate or single serious injury to persons. Moderate damage to infrastructure or vessel. Tier 2 pollution assistance (marine pollution). Considerable business (safety), operation or reputation impacts.
4	Serious	Serious injury or single fatality. Major damage to infrastructure or vessel. Tier 2 pollution assistance (marine pollution). Major national business (safety), operation or reputation impacts.
5	Major	More than one fatality. Extensive damage to infrastructure or vessel (> £10M). Tier 3 pollution assistance (marine pollution). Major international business (safety), operation or reputation impacts (> £10M).

Table 3.2 Frequency of Occurrence Definitions

Rank	Description	Definition
1	Negligible	< 1 occurrence per 10,000 years
2	Extremely Unlikely	1 per 100 to 10,000 years
3	Remote	1 per 10 to 100 years
4	Reasonably Probable	1 per 1 to 10 years
5	Frequent	Yearly

13. The significance of each impact is then assessed as either "**Broadly Acceptable**", "**Tolerable**", or "**Unacceptable**" based on the tolerability risk matrix presented in *Table 3.3*. Definitions of these significance rankings are presented in *Table 3.4*. Where an impact is assessed as being of **Unacceptable** significance, additional mitigation is required to reduce the significance of the impact to within the "**Broadly Acceptable**" or "**Tolerable**" ranges. The impact is then considered to be As Low as is Reasonably Practicable (ALARP).

Table 3.3 Tolerability Risk Matrix

Frequency						
	Frequent	Tolerable	Tolerable	Unacceptable	Unacceptable	Unacceptable
	Reasonably Probable	Broadly Acceptable	Tolerable	Tolerable	Unacceptable	Unacceptable
	Remote	Broadly Acceptable	Broadly Acceptable	Tolerable	Tolerable	Unacceptable
	Extremely Unlikely	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Tolerable	Tolerable
	Negligible	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Tolerable
		Negligible	**Minor**	**Moderate**	**Serious**	**Major**
		Severity				

Table 3.4 Significance Ranking Definitions

Ranking	Definition
No Impact	No impact on shipping and navigation receptors.
Broadly Acceptable	Risk ALARP with no additional mitigations or monitoring required above embedded mitigations. Includes impacts that have no perceptible effect (effect would not be noticeable to receptors).
Tolerable	Risk acceptable but may require additional mitigation measures and monitoring in place to control and reduce to ALARP.
Unacceptable	Significant risk mitigation or design modification required to reduce to ALARP.

3.2 Scope

14. Following the Scoping Report (SPR 2017), the following receptors were identified for impact assessment during the construction, operation and decommissioning phases of the East Anglia TWO windfarm site and offshore cable corridor:

- Commercial vessels;
- Commercial fishing vessels;
- Marine aggregate dredgers;
- Recreational craft; and
- Emergency response.

15. Impacts on these receptors have been assessed in *Chapter 14 Shipping and Navigation*.

16. It should be noted that impacts on communications, navigation and marine radar interference have been scoped out of the assessment following consultation with the MCA (see *Table 5.1*).

3.3 Methodology for Assessing Cumulative Impacts

17. Cumulative effects have been considered for shipping and navigation within this NRA; this includes impacts of other offshore developments, as well as activities associated with other marine operations. Fishing, recreation and marine aggregate dredging transits have been considered as part of the baseline assessment. Other developments and relevant marine activities have been identified within section 8 and section 12, and summarised in the baseline assessment in *Chapter 14 Shipping and Navigation*.

18. A list of screened in cumulative developments and activities is presented in section 20. Associated cumulative effects are then assessed within the Cumulative Impact Assessment (CIA) within *Chapter 14 Shipping and Navigation*.

3.4 Methodology of Assessing Transboundary Impacts

19. *Chapter 5 EIA Methodology* presents the methodology associated with transboundary impact assessment. Similar to the cumulative impacts this section will consider transboundary offshore wind projects with regards to vessel routeing and international ports. It should be noted that fishing, recreation and marine aggregate dredging impacts, although they have the potential to be internationally owned or located, have been considered as part of the baseline assessment.

3.5 Assumptions

20. The shipping and navigation baseline and impact assessment has been carried out based on the information available, and consultation responses received (including the Scoping Report (SPR 2017)) at the time of preparation. This includes design parameters of the offshore development area (as set out in the Design Envelope), and the anticipated schedule.

21. Assessment has considered a worst case scenario (from a shipping and navigation perspective) from the proposed design envelope noting the final locations of structures will not be finalised until post consent.

3.6 Study Areas

3.6.1 Shipping and Navigation Study Area

22. The analysis within this NRA has largely been undertaken within a ten nautical mile (nm) buffer of the East Anglia TWO windfarm site (hereafter referred to as the shipping and navigation study area). This buffer has been used as it is considered best practice for NRA and it presents a sufficient area to capture the relevant marine traffic for the project in terms of baseline data, while still remaining site specific to the East Anglia TWO windfarm site. The shipping and navigation study area was initially defined to include the most up to date boundary of the East Anglia TWO windfarm site available at the time (10th August 2018). However, since the analysis was first undertaken at the PEIR stage, the northern extent of the East Anglia TWO windfarm site has been reduced in order to reduce seascape impacts. Despite this change, the shipping and navigation study area has remained the same in order to allow the analysis undertaken at the ES stage to remain comparable to that undertaken at the PEIR stage. It is noted that there has been no reduction in the shipping and navigation study area and that analysis has been carried out within a minimum of 10nm around the East Anglia TWO windfarm site.

23. The shipping and navigation study area is presented in *Figure 3.1.*

3.6.2 Offshore Cable Corridor Study Area

24. In addition, analysis of marine traffic data and relevant navigational features has been undertaken within a 2nm buffer of the offshore cable corridor (hereafter referred to as the offshore cable corridor study area). The offshore cable corridor study area was initially defined to include the most up to date boundary of the offshore cable corridor available at the time. However, since the analysis was first undertaken at the PEIR stage, the offshore cable corridor has been altered due to the reduction in the East Anglia TWO windfarm site boundary. This new section is therefore not included within the offshore cable corridor study area; however the limited spatial extent of the change means there is negligible impact on the assessment undertaken at the PEIR stage. Regardless, the shipping and navigation study area (see section 3.6.1) does capture the affected area.

25. The offshore cable corridor study area is presented in *Figure 3.1.*

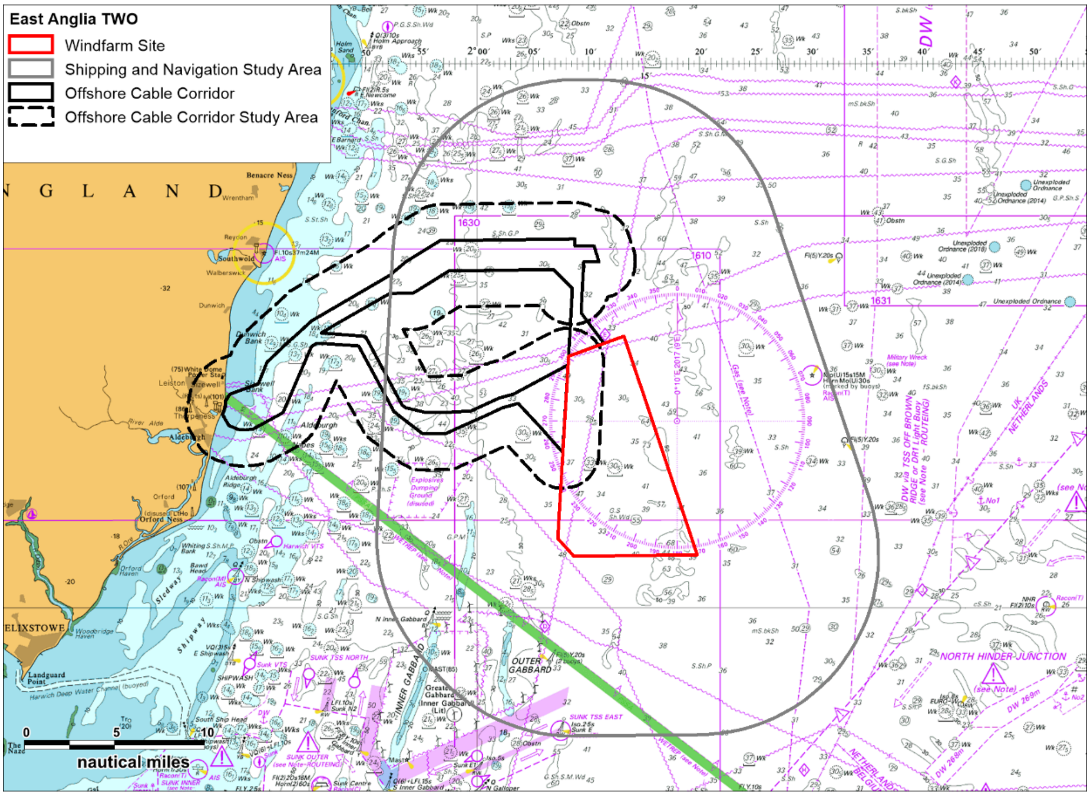


Figure 3.1 Shipping and Navigation Study Area and Offshore Cable Corridor Study Area

26. Cumulative impacts have been considered within a 10nm buffer around the East Anglia TWO windfarm site (as per the shipping and navigation study area) but where applicable vessel routes which transit through this area have been considered outside of this study area where they intersect another cumulative site.

4 Offshore Development Area Description

4.1 Boundaries and Layouts

27. The East Anglia TWO windfarm site is approximately 218.4 kilometres squared (km^2) in area. At its nearest point, the East Anglia TWO windfarm site is 37km from Lowestoft and 33km from Southwold. The key corner coordinates of the East Anglia TWO windfarm site are presented in *Table 4.1* below, with the corresponding corner points then plotted in *Figure 4.1.*

Table 4.1 East Anglia TWO Windfarm Site Coordinates

Corner	Latitude (WGS 84)	Longitude (WGS 84)
C1	52° 13’ 57.49” North (N)	002° 08’ 10.87” East (E)
C2	52° 15’ 04.02” N	002° 13’ 12.15” E
C3	52° 02’ 57.28” N	002° 19’ 46.70” E
C4	52° 02’ 52.97” N	002° 08’ 40.30” E
C5	52° 03’ 53.13” N	002° 07 14.88” E

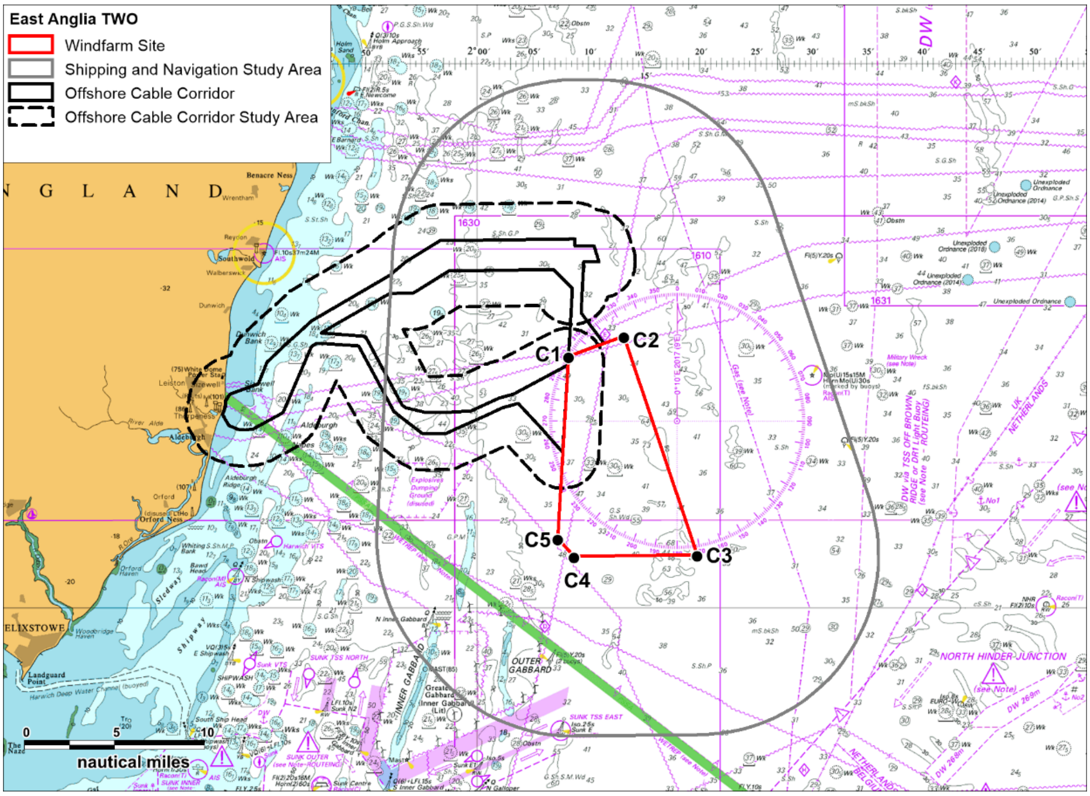


Figure 4.1 East Anglia TWO Windfarm Site Coordinates

4.2 Offshore Development Area Details

28. Within the East Anglia TWO windfarm site it is proposed that up to 75 wind turbines would be constructed.

29. Offshore export cables would connect the offshore electrical platforms within the East Anglia TWO windfarm site to shore, making landfall between Sizewell and Thorpeness in Suffolk.

30. The key characteristics of the offshore development area under consideration are summarised in *Table 4.2.*

Table 4.2 Indicative Offshore Development Area Characteristics

Offshore Infrastructure Characteristics	
Maximum Wind Turbine Blade Tip Height (above Lowest Astronomical Tide (LAT))	300 metres (m)
Wind Turbine Rotor Diameter	Up to 250m
Minimum Clearance above Sea Level	A minimum of 22m (Mean High Water Springs (MHWS))
Minimum Turbine Spacing	800m
Number of Offshore Electrical Platforms	Up to four
Number of Construction, Operation and Maintenance Platforms	One
Number of Operational Meteorological Masts (Met Masts)	One
Number of Export Cables	Up to Two
Inter-array Cables	Up to 200km
Platform Link Cables	Up to seven, 15km in length per cable (max 75km length)

31. Several foundations types are currently under consideration for use, these are:

- Monopiles;
- Suction caissons;
- Gravity base structures;
- 4-leg jackets on piles; and
- 4-leg jackets on suction caissons.

32. As site conditions, in particular water depths, vary across the East Anglia TWO windfarm site, it is possible that more than one foundation type may be used for wind turbines, offshore platforms and the Met Mast.

33. The wind turbines will maintain at least one line of orientation.

4.3 Worst Case Layout

34. For the purpose of this NRA, the worst case layout (from a shipping and navigation perspective) has been chosen from layouts currently under consideration for use as input to the modelling process (as described in section 17). The worst case layout from a shipping and navigation perspective is represented by the maximum number of structures covering the maximum area. Following a review of the potential layouts, the worst case is presented in *Figure 4.2* (up to 75 wind turbines).

35. The worst case parameters considered for the assessment are detailed in *Table 4.3*. It should be noted that the minimum inter-row and in-row spacing have only been qualitatively assessed rather than modelled, given that the worst case from a shipping and navigation perspective is maximum number of structures over the greatest area. Therefore, 1060m inter-row spacing and 2400m in-row spacing within the 75 wind turbine indicative layout has been modelled, rather than the actual minimum spacing being considered.

Table 4.3 Worst Case Structure Dimensions

Parameter	Dimensions
Number of turbines	75
Wind Turbine Surface Dimensions	55.5 x 55.5m
Offshore Substation Surface Dimensions	50 x 70m
Wind Turbine Rotor Diameter	250m
Minimum Spacing (Modelled)	1060m (inter-row) and 2400m (in row)
Minimum Spacing (Qualitatively Assessed)	1200m (inter-row) and 800m (in row)

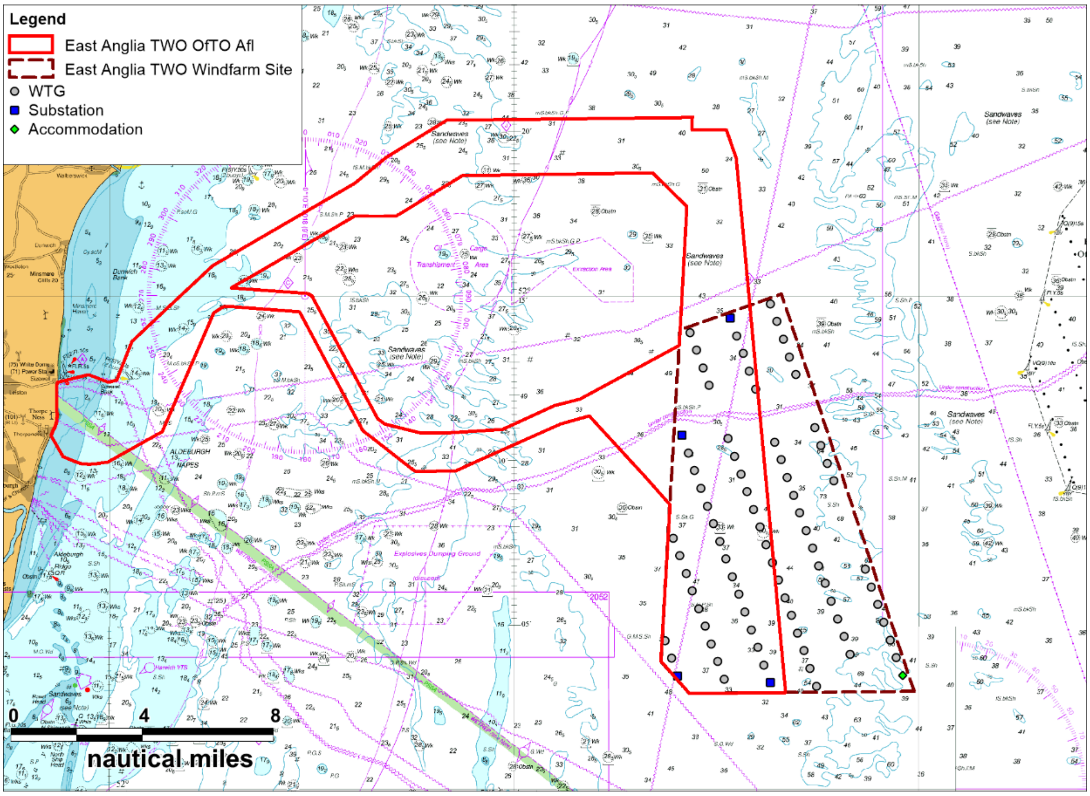


Figure 4.2 East Anglia TWO 250m Wind Turbine Layout (Up to 75 Wind Turbines)

5 Consultation

5.1 Introduction

36. A key input to the NRA and subsequent FSA were responses received from key statutory and non-statutory stakeholders relevant to shipping and navigation. This included consideration of responses received within the Scoping Opinion in response to the Scoping Report issued for the windfarm (SPR 2017), regular operator responses, consultation undertaken via a Hazard Workshop and responses received under Section 42 of the Planning Act 2008 to the Preliminary Environmental Information Report (PEIR).

37. It is noted that since the consultation was undertaken, the East Anglia TWO windfarm site and offshore cable corridor boundaries have changed (as described in section 3.6) however these changes do not affect any of the consultation responses.

38. The marine traffic survey data presented in section 12 was used to identify any regular operators utilising the area. Regular operator responses received are included in *Table 5.3* and key consultation outputs from the Hazard Workshop (see section 20.2) are summarised in *Table 5.4*.

5.2 Scoping and Statutory Stakeholder Responses

39. Key consultation responses arising from the scoping process and from subsequent meetings held with statutory stakeholders are provided in *Table 5.1* and *Table 5.3*, with an explanation of how the points raised have been addressed, or a reference to where they have been addressed, included.

Table 5.1 Consultation Responses

Consultee	Comment	East Anglia TWO Approach
The Planning Inspectorate	In the absence of justification for the proposed approach the Inspectorate does not agree that the matter of impacts to communications, navigations and radar of commercial vessels can be scoped out.	Justification on this was provided to the MCA on the 25th April 2017. Agreement from the MCA was received on the 11th May 2017.
	The marine traffic baseline was established by utilising 14 days of data between May and June 2017 during a yacht race. The Applicant should discuss and agree with relevant consultees whether this is an appropriate level of data to inform the baseline. If necessary, a larger data set which takes into account seasonal effects in order to achieve a more accurate baseline for marine traffic should be used.	No issues relating to summer baseline assessment during consultation. The Cruising Association (CA) highlighted during consultation on 12th April 2018 that yacht races and regattas in the area are common therefore this should not be seen as out of the ordinary.
	The Applicant should include a clear and concise justification for the chosen study area.	Section 3.6 details the study area chosen and *Figure 3.1* presents the study area.
	Highlights to the Applicant the risk of invalidating the NRA if the hydrographic surveys do not fulfil the requirements according to Marine Guidance Note 543 and advises that this guidance should be taken into account. The Applicant is referred to the comments of the MCA in this regard.	Noted. Any hydrographic surveys will be undertaken in compliance with MGN 543 Annex 2 and IHO Order 1a and details will be provided to the MCA Hydrographic Manager.

Consultee	Comment	East Anglia TWO Approach
	Recommends that the Applicant seeks agreement with the MCA on the approach of the assessment, particularly in respect to commercial traffic.	The approach to cumulative assessment has been considered as part of the NRA and PEI consultation process; as well as within the Scoping Opinion.
Maritime and Coastguard Agency	MCA relatively comfortable with summer only vessel survey.	Noted. Summer survey carried out by a dedicated vessel during May and June 2017 and during August and September 2018 therefore 28 days of survey vessel data collected.
	MCA currently looking at best orientations for windfarms. It may be preferable for helicopters to have turbines facing downwind rather than with prevailing winds.	Noted; will be considered post consent during layout discussions which will be secured under the Deemed Marine Licence (DML)
	The PEI should supply detail on the possible impact on navigational issue for both commercial and recreational craft.	Section 14.6 of *Chapter 14 Shipping and Navigation* assesses the impacts on both commercial vessels and recreational craft.
	A NRA will need to be submitted in accordance with MGN 543 (and MGN 372) and the MCA Methodology for Assessing the Marine Navigation Safety & Emergency Response Risks of OREIs. The NRA should be accompanied by an MGN 543 Checklist.	This NRA includes the completed MGN 543 Checklist as *Appendix 14.5*
	Attention needs to be paid to routeing; particularly in heavy weather ensuring shipping can continue safe passage without significant large scale deviations. The possible cumulative effects on shipping routes should also be considered.	Analysis of post windfarm routeing is provided within section 16 of this NRA. The cumulative routeing assessment is provided in section 20. Adverse weather routeing for DFDS Seaways is discussed in section 12.2.8.
	The turbine layout design will require MCA approval prior to construction. As such, MCA would seek to ensure all structures are	The final layout will be agreed with the MCA post consent; this process will be secured through the DML.

Consultee	Comment	East Anglia TWO Approach
	aligned in straight rows and columns. Any additional navigation safety and / or Search and Rescue (SAR) requirements will be agreed at the approval stage.	
	Particular attention should be paid to cabling routes. A Burial Protection Index study and an anchor penetration study should be undertaken if necessary. The MCA would accept a 5% reduction in depth referenced to Chart Datum.	A Cable Burial Risk Assessment will be undertaken post consent as per embedded mitigations (section 22). This will include an assessment of expected cable burial depths and a plan for other forms of protection where necessary.
	Information on potential mooring arrangements of floating wind turbines should be included in the ES.	Floating wind turbines are not being considered for the offshore development area.
	Any application for safety zones would need to be carefully assessed and additionally supported by experience from the development and construction stages.	As discussed in section 22, an application for safety zones will be submitted post consent.
	Consideration should be given to the implications of the site size and location of SAR resources and Emergency Response Co-operation Plans (ERCoP).	The East Anglia TWO windfarm site will comply with MGN 543 as per embedded mitigations (section 22).
	MGN 543 Annex 2 details the requirements of hydrographic surveys. Failure to report the survey or conduct it may invalidate the NRA.	Noted. Any hydrographic surveys will be undertaken in compliance with MGN 543 Annex 2 and IHO Order 1a and details will be provided to the MCA Hydrographic Manager.
	The radar effects of a windfarm on ships' radars are an important issue and the effects, particularly with respect to adjacent windfarms on either side of a route, will need to be assessed on a site specific basis taking into consideration previous reports on the subject	A request to scope out the consideration of impacts of turbines on Very High Frequency, Automatic Identification System (AIS) and Radar equipment was submitted at a meeting with MCA in April 2017. A subsequent letter was submitted to MCA on the 25th April,

Consultee	Comment	East Anglia TWO Approach
	available on the MCA website.	2017. A formal agreement to this request was received on the 11th May, 2017 which approved the scoping out of impacts of Very High Frequency (VHF), AIS and Radar equipment.
	Suggested consultation with MCA once bathymetry data is available for the offshore cable corridor. The MCA request that SPR provide water depths at all cable crossing locations to enable consultation on appropriate conditions to be input to Development Consent Order (DCO). Assessment of under keel clearance and vessel activity may be required.	Noted. Hydrographic data and water depths will be provided to the MCA.
	An NRA without a current Radar traffic survey cannot be relied upon as AIS has obvious limitations. Although the Radar data may only be just outside the 24 month window, the MCA cannot be sure this will not slip further therefore we would appreciate reconsideration of the traffic surveys in line with MGN 543.	A marine traffic survey (AIS and Radar) has been undertaken in August / September 2018. The impact assessment and this NRA have been updated with these data which will be submitted as part of the ES.
Trinity House	Expect the NRA to include: ▪ vessel traffic analysis in accordance with MGN 543; ▪ cumulative and in-combination effects on shipping routes and patterns; ▪ layouts that conform with MGN 543; and ▪ additional risk assessment of offshore platforms or Met Masts that lie out with the wind turbine layout.	An MGN 543 checklist has been completed as part of this NRA (*Appendix 14.5*). Up to date marine traffic survey data has been used to assess current shipping levels and patterns within the vicinity of the East Anglia TWO windfarm site. The results of the analysis are available in section 12. Vessel routeing has been considered on a cumulative basis in section 20. Associated impacts have been assessed in *Chapter 14*

Consultee	Comment	East Anglia TWO Approach
		Shipping and Navigation. The final layout will be agreed with the MCA post consent; this process will be secured through the DML. This process will include consideration of any offshore platforms and Met Masts.
	The development will require marking in accordance with IALA 0-139 Recommendations (IALA 2013). Additional aids to navigation may also be required. All marine navigational marking will need to be agreed with TH.	The East Anglia TWO windfarm will comply with the requirements of IALA O-139 as per embedded mitigations (section 22). All lighting and marking will be agreed with TH prior to implementation.
	Monitoring equipment must also be marked as required by TH.	Monitoring equipment will be marked as agreed with TH prior to implementation.
	A decommissioning plan which includes a scenario where an obstruction is left on site therefore a danger to navigation should be considered.	A decommissioning plan will be created post consent. Impacts associated with the decommissioning of the East Anglia TWO windfarm site are considered in *Chapter 14 Shipping and Navigation*.
	The impact on navigation and requirements for appropriate mitigation should be assessed for the possible requirement of marking export cables and vessels laying them.	The impacts associated with the offshore cable corridor are presented in section 14.6 of *Chapter 14 Shipping and Navigation*.
	Highlighted that ferries sometimes transit closer to shore during adverse weather therefore having inshore access reduced during adverse weather may be a concern to operators.	Noted. Adverse weather routeing for DFDS Seaways is discussed in section 12.2.8.
Norfolk Country	The PEI should indicate that suitable navigation and shipping	As described in section 22, embedded mitigation measures will be in

Consultee	Comment	East Anglia TWO Approach
Council	mitigation measures can be agreed with the appropriate regulatory bodies to ensure that Norfolk's Ports (King's Lynn and Wells) are not adversely affected by this proposal. The PEI will need to consider the wider cumulative impacts taking into account existing operational windfarm; those under constructions; those consented and those in planning.	place. Vessel routeing has been considered on a cumulative basis in section 20 of the NRA. Associated impacts have been assessed in section 14.6 of *Chapter 14 Shipping and Navigation.*
Royal Yachting Association	Any reduction in water depth is required to be marked and notified where necessary, particularly within the landfall.	Noted.
	Content with application for statutory safety zones during construction and major operation and maintenance activities.	Noted. No action required.
Chamber of Shipping	Primary concern to avoid choke points in traffic particularly entering and leaving Harwich and Felixstowe. The southern area of East Anglia TWO may be a concern due to potential impact on Eastbound and Westbound traffic.	Vessel routeing has been considered on a cumulative basis in section 20 of this NRA.
	Agree with safety zone approach for construction and operation and maintenance however disagree with permanent safety zones around fixed assets.	As noted in section 22, an application for safety zones will be submitted post consent.
	There should be consideration of shipping policies within the East Marine Plan.	Ports and shipping policies from the East Marine Plan are considered in section 2.2.
	It would be useful to have a breakdown of cargo vessel types recorded.	Breakdown of cargo vessels by type is provided in section 12.2.4 of this NRA.
	Queried methodology for CIA.	The CIA methodology is detailed in section 14.4 of *Chapter 14*

Consultee	Comment	East Anglia TWO Approach
		Shipping and Navigation. Cumulative impacts are then assessed in section 14.4.7.
CA	Concern over AIS only winter survey as it is possible that not all yachts and recreational craft have AIS systems or will turn their AIS on.	Section 12.1 highlights that only 4% of tracks recorded during summer were via Radar. Baseline data also considers the RYA United Kingdom (UK) Coastal Atlas of Recreational Boating. Additional AIS and Radar marine traffic survey data is also being collated in 2018.

5.3 Section 42 Responses

40. Responses received under Section 42 of the Planning Act 2008 in response to the PEIR are detailed in *Table 5.2*.

Table 5.2 Section 42 Responses

Consultee	Comment	Response / Where Addressed
CA	Almost all yachts in the area will be on long-distance passages with very little local or day-sailing. A high proportion will be strangers to the area, many foreign-flagged and unlikely to have local charts on board with full details of windfarm turbine positions. While the distance between the site and the shore is generally adequate for traffic north-south it should be noted that tidal streams in the area can be strong and yachts will cross the cable corridor either close to the shore or close to the windfarms. The coast is not hospitable and in inclement weather yachts will transit closer to the wind farms, possibly increasing encounter risk with commercial vessels	Noted. The impact on recreational vessels has been assessed in section 14.6.5 of *Chapter 14 Shipping and Navigation*. Assessment of encounter risk is presented in section 18.1 and includes recreational vessels.

	also sailing north-south and forced to do so by the project.	
	Yachts on passage east-west may choose to pass between the turbines. Cumulative effects are becoming an issue. Many yacht harbours are tidal so additional time or distance can have important impacts on safety in poor weather	Minimum spacing and turbine alignments mean that small craft, such as recreational vessels, will be able to navigate through the array during the operational phase.
	The minimum air-draught clearance adopted of 22m above MHWS meets our present standard. This was determined many years ago to enable 97% of all sailing craft in Europe to clear safely and is now under review with indications that it should be increased to perhaps 24m.	East Anglia TWO complies with the existing guidance on minimum blade tip clearance.
	We advocate minimum spacing of turbine towers to be 900m x 1000m and the pattern to be square or rectangular in regular straight lines. While the proposal of 800m x 1200m is acceptable we would confirm the need for a straight-line layout to have platforms and met-masts in line with the turbines. The windfarm field should have straight edges avoiding outlying structures. Fewer, larger, turbine towers with increased spacing are of course safer for passage between than more, smaller ones, closer together but it is important visually that designs are not mixed.	East Anglia TWO will comply with requirements on layout design contained within MGN 543 as per section 22 (embedded mitigation).
	Concern with export cable landfalls is any impact to anchoring of recreational craft. Ask that recognised yacht anchorages are avoided and have no concerns about cables in water depths of > 10m. In lesser depths ask that cables are buried 1.5m including any cable protection and leave a smooth seabed with no humps over. This depth is currently under review but unlikely to be altered. The Thorpeness area is not a recognised anchorage but emergency anchoring in strong weather could take place. The charted anchorage off Southwold is rarely used if at all by yachts and not a problem to recreational craft.	East Anglia TWO will undertake an assessment of export cable routes, cable burial and protection post consent as per section 22 (embedded mitigation).
	No concerns regarding tower or foundation type but request that there is a 3m clear	East Anglia TWO will comply with existing guidance on

	depth of water around visible parts of the structure and suggest identical structures are used throughout each field.	under keel clearance including that contained within MGN 543 as per section 22 (embedded mitigation).
	Appreciate the embedded mitigations but add the following comments: ▪ Marking of the gaps by buoyage at corners between neighbouring windfarms could be very helpful. ▪ It has been requested by some of our members to suggest that in addition a horizontal black band round corner towers at HAT level would be useful. ▪ Agree with the use of 500m safety zones around active Restricted in Ability to Manoeuvre construction vessels and with 50m zones around each completed tower including whether pre-commissioned or operational. ▪ Note that up to 74 or so construction and other vessels may be on site. We ask that the Coastguard be warned and a regular 'all ships' warning is promulgated by marine VHF. ▪ Request that construction and other vessels regularly visiting the site follow regular publicised routes between base and site.	▪ Buoyage will be deployed at the request of TH as per section 22 (embedded mitigation). ▪ Lighting and marking with be as per the requirements of TH and MCA as per section 22 (embedded mitigation). ▪ As per embedded mitigations in section 22 an application for safety zones post consent around structures where construction or major maintenance is being undertaken. ▪ As per embedded mitigations in section 22 a dedicated Marine Coordination Centre will be established to manage on-site vessels.
	The baseline estimates for recreational traffic may be somewhat low, but do not have alternative data to offer. Confirm that recreational traffic is gradually increasing but have no figures to offer and accept your estimate of 10%.	Noted, baseline estimates are based on AIS, radar and visual surveys as per the requirements of MGN 543. A total of 42 days data has now been collected including two summer periods (Radar and AIS).

Hanson Aggregate Marine Ltd. (HAML)	Concerned that there is potential for some existing activities, e.g. navigation and fishing, being displaced to areas where marine aggregate operations have traditionally taken place, increasing the operational risks to ourselves and other aggregates operators / licensees (including H&S issues arising from navigational risk). Associated with displacement are the increased issues that will arise from the 'squeeze' and condensing of activities. The nature of these impacts are likely to be disproportionately harder to overcome for dredging operators concerned, including ourselves, because of the differences in comparative size/value of the projects.	Marine aggregate dredgers are considered within the baseline assessment and assessment of impact on commercial vessels contained within section 14.6.1 of *Chapter 14 Shipping and Navigation*. Impacts are assessed to be within acceptable parameters.
	Traditional routes that HAML/others use to transit from licensed areas to discharge ports could be impacted. Normally, these are very different to established navigation routes, (short term AIS analysis will not necessarily recognise these) and HAML consider that it may be helpful to examine this issue so the information is available to feed into Crown Estate Conflict checks (through their MARS system / GIS).	BMAPA transit routes are considered within section 8 (existing environment).
TH	Sent through draft DCO / DML conditions.	Noted. Consultation on the DCO / DML will be undertaken as part of the Statement of Common Ground

		post consent.
MCA	Note the levels of vessel activity observed within and in close proximity of the site, including high levels of recreational activity during the summer survey, and active fishing recorded within the shipping and navigation study area. As the development areas carries a significant amount of through traffic, and attention needs to be paid to routeing, particularly in heavy weather ensuring shipping can continue to make safe passage without significant large-scale deviations. We see this has been considered in section 15 of the NRA.	Noted.
	Appreciate the early opportunity to comment on the draft MGN 543 checklist, and we can discuss the elements further as the project progresses.	Noted.
	We are content at this stage with regards to the process you have undertaken in order to comply with MGN 543, and its annexes, and we welcome the work undertaken in order to achieve our requirements.	Noted.
	Note section 4.3 of the NRA "….the worst case layout (from a shipping and navigation perspective) has been chosen from layouts currently under consideration for use as input to the modelling process (as described in section 16). The worst case layout from a shipping and navigation perspective is represented by the maximum number of structures covering the maximum area." The MCA welcomes the indicative worse case layout in a grid formation with a minimum of two lines of orientation, and other structures all in alignment, as seen in *Figure 4.2.*	Noted.
	The NRA has assessed worst case which includes just one line of orientation. At this stage, MCA can only agree to a single line of orientation where a detailed safety justification is provided (as per MGN 543) for both surface navigation and SAR	Noted. The final layout and any required justifications will be discussed post consent as per the DCO / DML conditions.

	capability. The NRA itself would not provide that justification but would be used to inform the safety case as well as any results from surveys and other constraints leading to just one line of orientation in the layout design, and the consideration of the impact on SAR with just one line of orientation.	
	The turbine layout design will require MCA approval prior to construction to minimise the risks to surface vessels, including rescue boats, and SAR aircraft operating within the site. MCA will seek to ensure all structures are aligned in straight rows and columns, including any platforms. Any additional navigation safety and/or SAR requirements, as per MGN 543 Annex 5, will be agreed at the approval stage.	The layout and any additional navigational safety and / or SAR requirements will be agreed with the MCA post consent as per the DCO / DML conditions.
	Note our previous comment that "an NRA without a current Radar traffic survey cannot be relied upon as AIS has obvious limitations. Although the Radar data may only be outside the 24 month window, the MCA cannot be sure this will not slip further therefore we would appreciate reconsideration of the traffic surveys in line with MGN 543" And the following response for East Anglia TWO: "A Marine traffic survey (AIS and Radar) would be undertaken in August/September 2018. The impact Assessment and NRA will then be submitted as part of the ES" Please confirm whether the application will contain current data collected within two years of application submission.	An updated AIS and Radar summer survey was undertaken during August and September 2018. The analysis of this data is presented in section 12.3.
	The NRA addresses those gaps between projects, and the MCA's requirement for sufficient room within the corridor between windfarms for a vessel to deviate up to 20°. The East Anglia TWO, East Anglia ONE North and East Anglia ONE development areas create a gap, and the MCA welcomes the assessment of the gap against the guidance to ensure compliance.	Noted.

	This will also influence the lighting and marking requirements going forward to be discussed further as the project progresses.	
	MGN 543 requires that hydrographic surveys should fulfil the requirements of the IHO Order 1a standard, with the final data supplied as a digital full density data set, and survey report to the MCA Hydrography Manager. This information will need to be submitted, ideally at the ES stage.	Hydrographic surveys are compliant with IHO Order 1a and MCA requirements as per MGN 543.
	Export cable routes, cable burial protection index and cable protections are issues that are yet to be fully developed. However due cognisance needs to address cable burial and protection, particularly close to shore where impacts on navigable water depth may become significant. Any consented cable protection works must ensure existing and future safe navigation is not compromised. The MCA would accept a maximum of 5% reduction in surrounding depth referenced to Chart Datum. Where burial depths are not achieved consultation will need to take place with MCA regarding the locations, impact and potential risk mitigation measures.	An assessment of export cable routes, cable burial and protection will be carried out post consent as per section 22 (embedded mitigation).
	Safety zones during the construction, maintenance and decommissioning phases are supported, however it should be noted that operational safety zones may have a maximum 50m radius from the individual turbines. A detailed justification would be required for a 50m operational safety zone, with significant evidence from the construction phase in addition to the baseline NRA required supporting the case.	A safety zone application will be produced and agreed with the MCA post consent, noting that the application for safety zones is assumed as embedded mitigation in section 22. This may include provision for operational safety zones around manned platforms.
	An approved ERCoP will need to be in place prior to construction. A SAR checklist will be discussed as the project progresses to track all requirements detailed in MGN 543. The checklist will be adapted to suit EA2.	Noted, an ERCoP will be produced post consent and agreed with the MCA as per section 22. The SAR checklist will be discussed and agreed with the MCA post consent.

	MCA would like to see continuous construction which is progressive across the windfarm with no opportunity for two separate areas to be constructed with a gap in the middle.	East Anglia TWO considers that the effects of disparate construction sites are mitigated, notably through the use of aids to navigation during the entire construction phase. Embedded mitigation is listed in section 22.

5.4 Regular Operator

41. Regular commercial operators were identified from the marine traffic survey data (see section 12), and sent information regarding the offshore development area, and a request for a consultation response.

42. A summary of the operators contacted, and the responses received are provided in *Table 5.3*. Further details (including a template of the communication sent to each operator) are provided in *Appendix 14.6 Regular Operator Consultation*.

Table 5.3 Regular Operator Consultation

Date Sent	Consultee	Comment	East Anglia TWO Approach
13/04/2018	AdMare Ship Management	No Response	n/a
	Amasus Shipping	No Response	n/a
	Arklow Shipping	No Response	n/a
	Carl F. Peters	No Response	n/a
	Carnival	Responded on 23/04/2018. East Anglia TWO will have some impact on Carnival UK routeing when transiting from Norwegian Ports to Southampton. Consider this impact manageable therefore not significant concern.	Noted

Date Sent	Consultee	Comment	East Anglia TWO Approach
		In order to avoid the development area, vessels would be required to use deep water route which is not normally part of their passage.	
	Cobelfret Ferries	No response but accepted Hazard Workshop invite on 25/04/2018	n/a
	British Marine Aggregate Producers Association (BMAPA)	Forwarded email on to BMAPA representatives. Cemex responded on 17/04/2018 with request for GIS layer of offshore development area.	n/a
	DFDS Seaways	Response on 26/04/2018. Sent through figure with routeing of DFDS vessels within vicinity of East Anglia TWO and accepted Hazard Workshop invite.	Noted the DFDS vessel routes. These are presented in section 12.2.8.
	Döhle Group	No Response	n/a
	German Tanker Shipping	No Response	n/a
	Hanson Aggregate Marine	No Response	n/a
	Hav Ship Management	No Response	n/a
	Herning Shipping	No Response	n/a
	HJH Shipmanagement	No Response	n/a
	James Fisher Everard	No response but accepted Hazard Workshop invite on 26/04/2018.	n/a

Date Sent	Consultee	Comment	East Anglia TWO Approach
	JT Essberger	No Response	n/a
	Nordic Tankers	No Response	n/a
	Scotline	No Response	n/a
	Seatrans Ship Management	No Response	n/a
	Stena Line	No Response	n/a
	Stolt Tankers	No Response	n/a
	UECC	No Response	n/a
	Unibaltic Shipping	No Response	n/a
	W&R Shipping	No Response	n/a
	Wagenborg Shipping	No Response	n/a
	Warnecke Schiffahrt	No Response	n/a
	Wilson	No Response	n/a

5.5 Hazard Log Consultation

Table 5.4 Hazard Log Consultation

Consultee	Comment	East Anglia TWO Approach
CoS	Queried whether lines of orientation for the East Anglia TWO offshore development area and East Anglia ONE North offshore development	Due to the distance between the sites, this is unlikely.

Consultee	Comment	East Anglia TWO Approach
	area would be parallel.	
	Questioned why accommodation platforms have been included within the envelope.	Accommodation (construction, operation and maintenance) platforms have been included as they are part of the worst case scenario.
Cobelfret Ferries	Queried capability of wind turbines to be shut down	MGN 543 requires wind turbines to have the capability to be shut down and locked in position. Such measures will be detailed post consent in the ERCoP.
	Concern regarding the increased use of fuel resulting from deviations which may be required due to East Anglia TWO. The loss of a turbine(s) may theoretically be balanced by the reduction in fuel used.	Noted.
CA	Stated that individual safety zones[1] do not provide any concern to recreational craft.	Noted.
	Concern regarding the length of internal turbine rows and that low visibility can be an issue for recreational craft.	East Anglia TWO will have large spacing between turbines (see *Table 4.2*) and markings to allow recreational craft to safely navigate the windfarm.
	The level of AIS usage by recreational craft further inshore will be low and contribute to the variation in recreational traffic between seasons.	Additional data sources have been utilised to assess the level of recreational activity such as the RYA Coastal Atlas (RYA 2016).
	Queried the risk to recreational craft involved in sailing races.	Embedded mitigation measures such as marine coordination and

[1] Individual safety zones around each individual structure.

Consultee	Comment	East Anglia TWO Approach
		compliance with International Regulations for Preventing Collisions at Sea (COLREGS) will reduce the risk to recreational craft. Multiple windfarms are operational in key recreational areas with no reported effects on sailing vessels to date.
	Queried which ports will be used for operations and the level of marine traffic which could be expected.	This will be determined post consent. Windfarm vessels will be managed by marine coordination to ensure they avoid third party vessels (with consideration of COLREGS).
Brown & May Marine	Potting and whelking activity is more likely to occur at East Anglia TWO than East Anglia ONE North due to the presence of wrecks. Pots can be left for two to three days and should be clearly marked but this is not always the case. Angling charter vessels are also common out of Lowestoft and Southwold.	Noted.

6 Data Sources

43. This section lists the data sources that have been used as input to this NRA, and hence the subsequent FSA. The primary input was the marine traffic surveys, undertaken to assess the baseline traffic patterns within the vicinity of the East Anglia TWO windfarm site. These data have been collected as per MGN 543 (as demonstrated in the MGN 543 checklist available in *Appendix 14.6*), and the collection approach was agreed with the MCA. An additional survey has been undertaken in summer 2018 to ensure an up to date assessment is provided within this ES (post PEIR). Further details of the marine traffic surveys are presented in section 12 (which establishes the marine traffic baseline), with other relevant data sources considered listed below (used to supplement the marine traffic baseline, and to establish the navigational feature baseline in section 8 of this NRA).

44. Marine incident data from Marine Accident Investigation Branch (MAIB) (2005 to 2014) and maritime incident data from the Royal National Lifeboat Institution (RNLI) (2005 to 2014). Although all UK commercial vessels are required to report accidents to the MAIB, non-UK vessels do not have to report unless they are in a UK port or within 12nm territorial waters and carrying passengers to a UK port. There are also no requirements for non-commercial recreational craft to report accidents to the MAIB;

- AIS marine traffic data for DFDS vessels recorded from a Met Mast (1st January to 31st December 2017);
- Admiralty Sailing Directions – Dover Strait Pilot, NP28 United Kingdom Hydrographic Office (UKHO), 2017;
- BMAPA Routes (BMAPA, 2018);
- Admiralty Sailing Directions – North Sea West Pilot, NP54 United Kingdom Hydrographic Office (UKHO), 2016;
- UKHO Admiralty Charts 1183, 1406, 1408, 1503, 1504, 1610, 1630, 1631, 1632, 2182A and 4140;
- Department for Transport (DfT) Port Vessel Arrivals (2018);
- DFDS Seaways Vessel Routeing (2018);
- RYA UK Coastal Atlas of Recreational Boating (2016); and
- Metocean data – Health and Safety Executive (HSE) Weather Database (see section 9 for more details).

7 Lessons Learned

45. There is considerable benefit to developers in the sharing of lessons learned within the offshore industry. The NRA, and in particular the hazard assessment, includes general consideration for lessons learned and expert opinion from previous offshore windfarm projects and other sea users.

46. These include:

- Anatec. (2012) NRA: East Anglia ONE Offshore Windfarm, Anatec: Aberdeen;
- Anatec. (2015) NRA: East Anglia THREE Offshore Windfarm, Anatec: Aberdeen;
- Anatec. (2017) Norfolk Vanguard NRA, Anatec: Aberdeen;
- MCA. (2005) Offshore Wind Farm Helicopter SAR – Trials Undertaken at the North Hoyle Wind Farm Report of helicopter SAR Trials undertaken with Royal Air Force Valley 'C' Flight 22 Squadron on March 22nd 2005, Southampton: MCA;
- Nautical Offshore Renewable Energy Liaison (NOREL Group). (2005) A Report compiled by the Port of London Authority based on experience of the Kentish Flats Wind Farm Development, NOREL Work Paper, WP4 (2nd NOREL);
- Renewables UK. (2014 issue 2) Guidelines for Health and Safety in the Wind Energy Industry, Renewables UK: London;
- RYA and CA. (2004) Sharing the Wind – Identification of recreational boating interests in the Thames Estuary, Greater Wash and North West (Liverpool Bay), Southampton: RYA;
- The Crown Estate. (2012) Strategic Assessment of Impacts on Navigation of Shipping and Related Effects on Other Marine Activities Arising from the Development of Offshore Wind Farms in the UK REZ, The Crown Estate: London;
- SPR and Vattenfall. (2012) East Anglia ONE Offshore Windfarm ES Volume 2 Offshore, Chapter 15 – Shipping and Navigation, SPR: Glasgow; and
- SPR and Vattenfall. (2015) East Anglia THREE ES Volume 1 Chapter 15 Shipping and Navigation, SPR: Glasgow.

8 Existing Environment

8.1 Introduction

47. This section presents the navigational baseline assumed within this NRA which has been established based on the data sources outlined in section 6. This is primarily based on assessment of the Admiralty Sailing Directions (UKHO 2016) and Admiralty Charts covering the East Anglia sea area.

48. Each of the navigational features within the vicinity of the East Anglia TWO windfarm site and offshore cable corridor is discussed in the following subsections.

8.2 Other Windfarm Projects

49. The key navigational features within the study area of the East Anglia TWO windfarm site are the commissioned Galloper Offshore Wind Farm and Greater Gabbard Offshore Wind Farm, the consented East Anglia ONE offshore development area and the East Anglia ONE North offshore development area. These are shown in *Figure 8.1*.

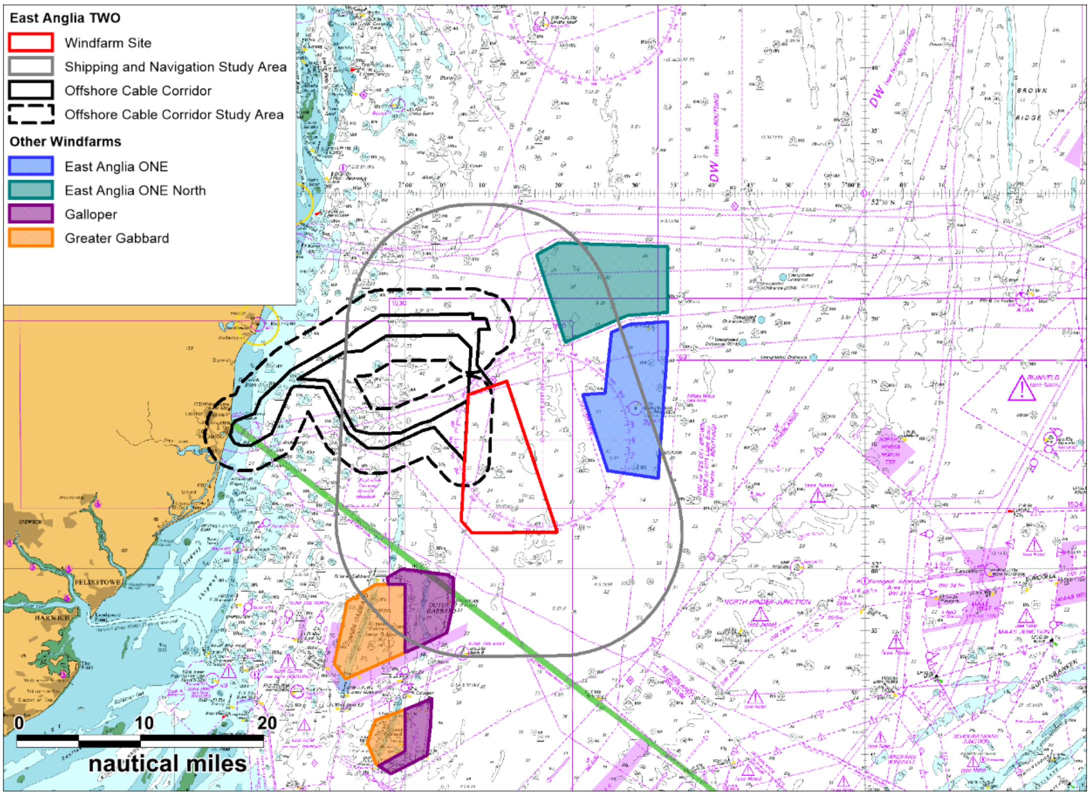


Figure 8.1 Other Windfarms in the Vicinity of the Offshore Development Area

8.3 IMO Routeing Measures

There are a number of IMO routeing measures in place within the vicinity of the East Anglia TWO windfarm site and offshore cable corridor. These are presented in *Figure 8.2*. The presence of these routeing measures would dictate a number of the vessel routes recorded within the shipping and navigation study area. These include the Sunk Traffic Separation Scheme (TSS), the North Hinder Junction and the Deep Water Route (DWR) connecting the Off Brown Ridge TSS and Off Botney Ground TSS.

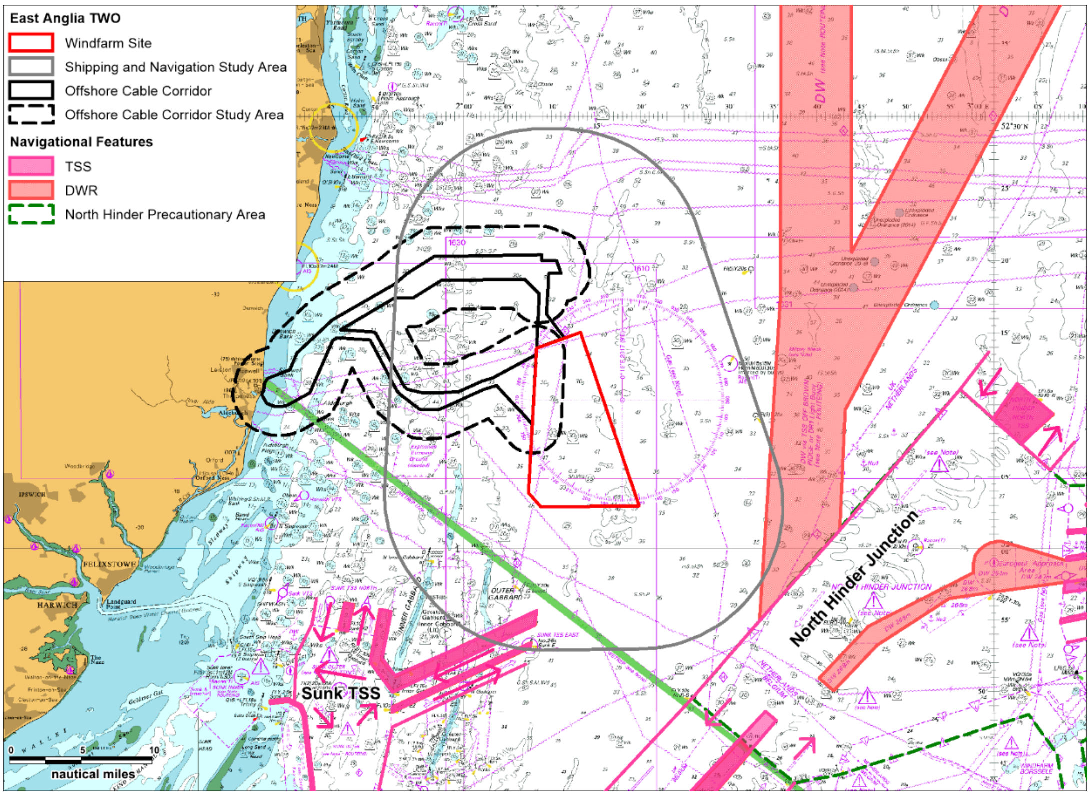


Figure 8.2 IMO Routeing Measures in the Vicinity of the Offshore Development Area

8.4 Aids to Navigation

50. There are a number of pre-existing AtoN located in proximity to the East Anglia TWO windfarm site and the offshore cable corridor as presented in *Figure 8.3*. Positions and details of the presented AtoNs are based on assessment of UKHO Admiralty Charts. It is noted that the figure includes AtoNs (cardinal and special mark buoys) placed to mark the boundaries of the Galloper Offshore Wind Farm and Greater Gabbard Offshore Wind Farm and the Sunk Traffic Separation Scheme (TSS) situated between their two sites. The Galloper Offshore Wind Farm became operational as of spring 2018. The Greater Gabbard Offshore Wind Farm has been operational since 2013.

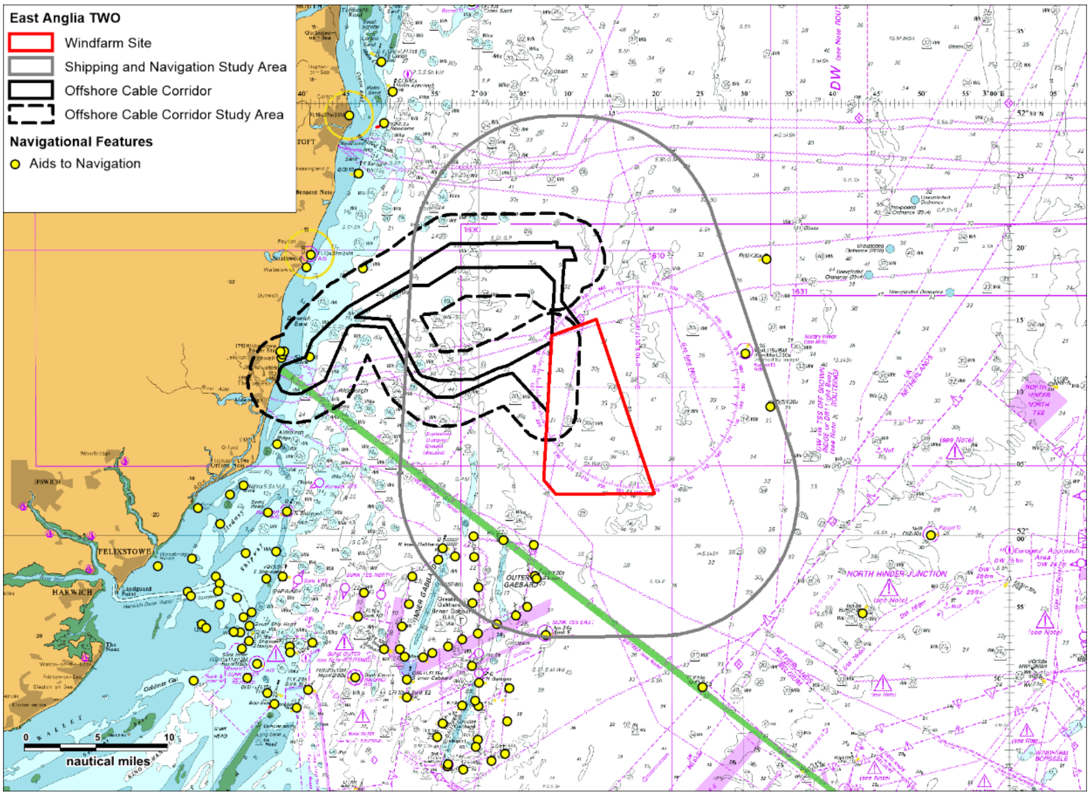


Figure 8.3 Navigational Aids Relative to the Offshore Development Area

8.5 Anchorage Areas

51. *Figure 8.4* includes charted and uncharted anchorages listed as providing suitable anchoring conditions within the Admiralty Sailing Directions (UKHO 2013 and 2016) and UKHO Admiralty Charts (1504, 1408). These are as follows:

- Corton Road, between Holm Sand and the coast, with blue clay and mud in depths of 8 to 12m (uncharted);
- Lowestoft North Road, between Holm Sand and the coast, sand and gravel in depths of approximately 10 to 13m (uncharted);
- Four miles south, south-east of Lowestoft harbour entrance, in depths between 15 to 21m;
- Eight cables east, south-east of Southwold harbour entrance; and
- Hollesley Bay, within Whiting Bank in depths between 6 to 10m, bottom mud and clay but sand close to Whiting Bank where the greatest depths are found (uncharted).

52. A number of anchorages within the sea area between Harwich and the Sunk TSS were also recorded as follows:

- Sunk Deep Water anchorage, recommended for vessels over 240m Length Overall (LOA) or with draughts greater than 10.5m;

- Sunk Inner anchorage, recommended for vessels under 240m LOA or with draughts less than 10.5m;
- Bawdsey anchorage, recommended for vessels up to 180m LOA and with draughts of 9m. This anchorage is for vessels carrying hazardous and polluting cargoes;
- Cork anchorage, recommended for vessels up to 130m LOA and with draughts of 5.5m;
- Platters anchorage is a short term or emergency anchorage for vessels up to 225m LOA and with draughts of 8m or vessels up to 170m LOA with draughts of 9m; and
- Parkeston anchorage, recommended for vessels up to 85m LOA and with draughts of 4.5m. Larger vessels may use this anchorage for a short period with prior permission of the Harbour Master.

53. The Southwold Oil Transhipment Area is also presented in *Figure 8.4*. It is located between the two arms of the offshore cable corridor, approximately 5.5nm west of the East Anglia TWO windfarm site.

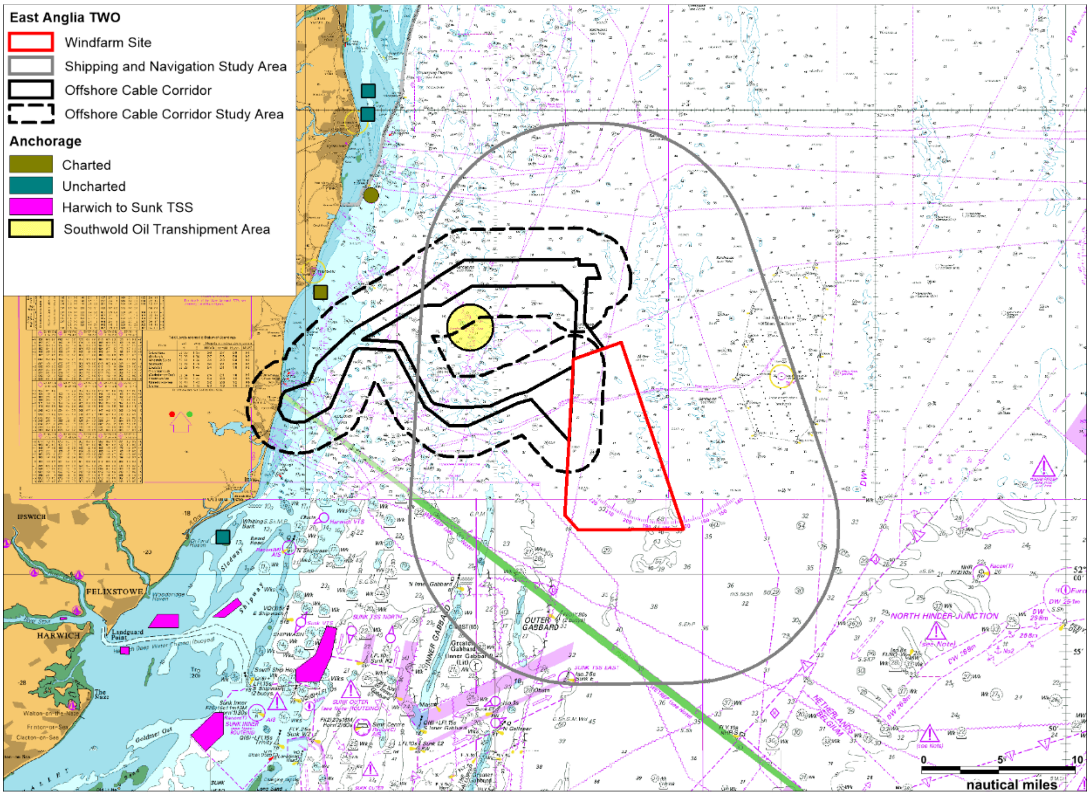


Figure 8.4 Charted and Uncharted Anchorages within the Vicinity of the Offshore Development Area

8.6 Ports

54. Major ports and harbours in the vicinity of the East Anglia TWO windfarm site are Felixstowe, Harwich, Great Yarmouth and Lowestoft. The numbers of vessel arrivals to the principal ports in the coastal area (DfT, 2018) are presented in *Figure 8.5*. It should be noted that there was no data available for the port of Southwold. These statistics

exclude some movements which occur within the port or harbour limits, however they are considered to provide a good indication of the relative traffic levels and trends.

55. Lowestoft and Southwold are the closest harbours to the East Anglia TWO windfarm site and are located approximately 20nm to the north-west and 18nm west of the East Anglia TWO windfarm site, respectively. Southwold is the closest port to the offshore cable corridor, approximately 5nm north-west.

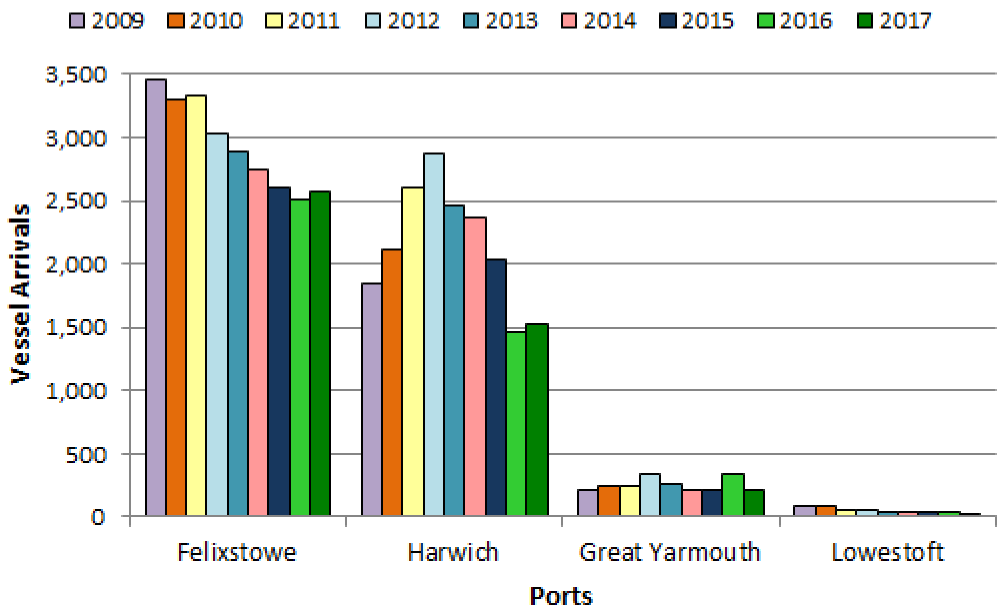


Figure 8.5 Vessel Arrivals to Principal Ports (2009 to 2017) (DfT, 2018)

8.7 Ministry of Defence (MoD) Practice and Exercise Areas (PEXAs)

56. There are no designated PEXAs within the sea area surrounding the East Anglia TWO windfarm site. The nearest area is located approximately 44nm south-east of the East Anglia TWO windfarm site.

8.8 Oil and Gas Infrastructure

57. The Bacton to Zeebrugge natural gas pipeline intersects the shipping and navigation study area and passes east of the East Anglia TWO windfarm site (approximately 5.1nm). This is presented in Figure 8.6.

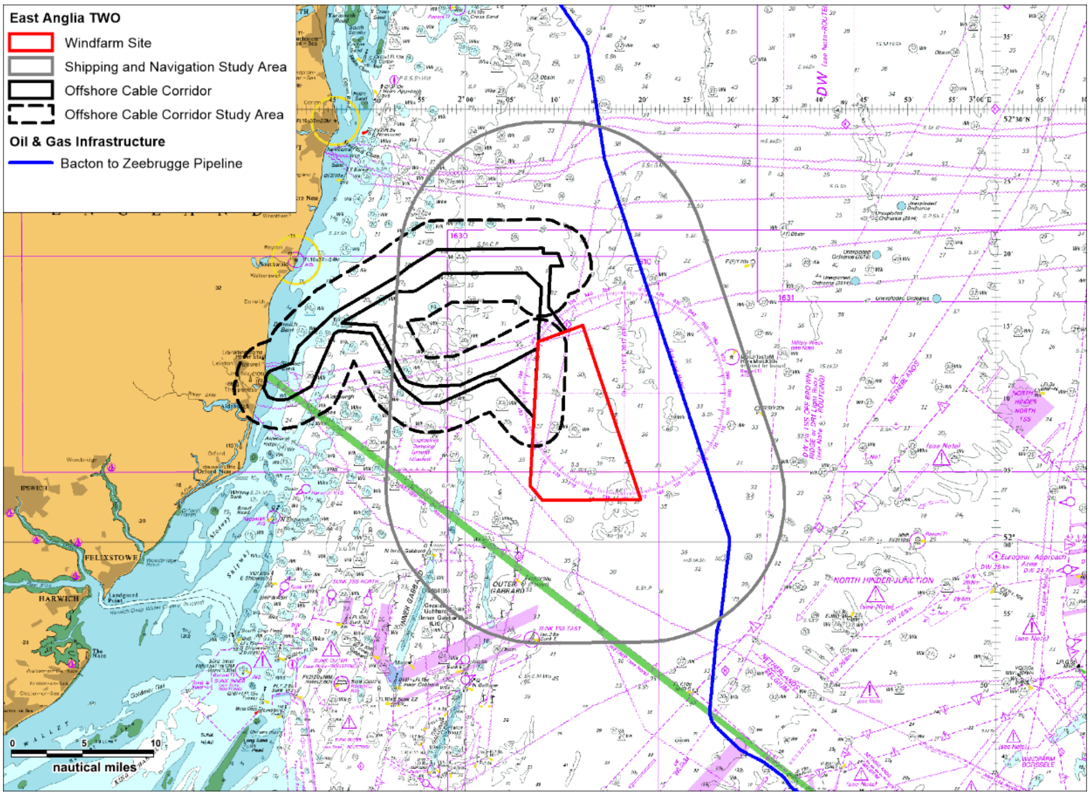


Figure 8.6 Oil and Gas Infrastructure within the Vicinity of the Offshore Development Area

8.9 Marine Aggregate Dredging Areas

58. *Figure 8.7* presents an overview of the nearby marine aggregate dredging areas and BMAPA routes in the vicinity of the East Anglia TWO windfarm site. There are five marine aggregate production areas within the study area, two of which are operated by more than one company. Outside of the study area, there are 11 marine aggregate production areas north of the East Anglia TWO windfarm site and five south-west of the East Anglia TWO windfarm site. There are no marine aggregate dredging areas within the offshore cable corridor.

59. It should be noted that a disused explosives dumping ground is recorded approximately 1.6nm south of the offshore cable corridor and 4.8nm west of the East Anglia TWO windfarm site.

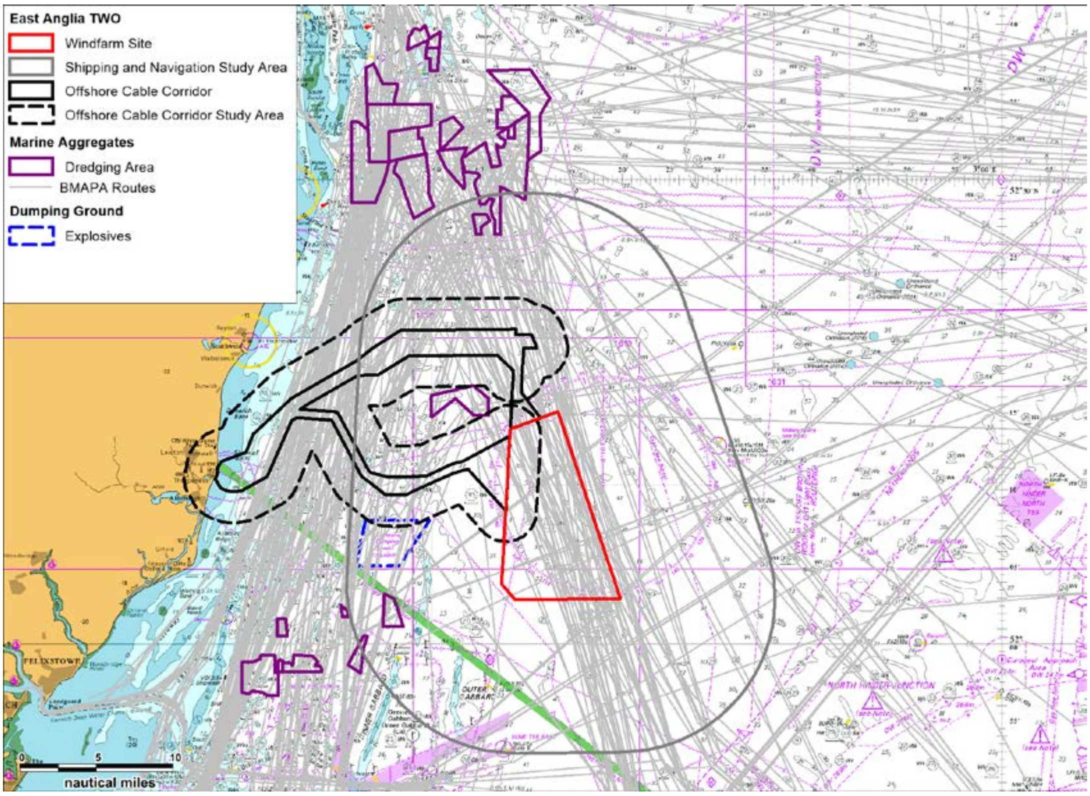


Figure 8.7 Marine Aggregate Dredging Areas, BMAPA Routes and Explosive Dumping Ground within the Vicinity of the Offshore Development Area

8.10 Cables

60. The cables in the vicinity of the East Anglia TWO windfarm site and offshore cable corridor are presented in *Figure 8.8*.

    The Greater Gabbard power cables and the Britned HVDC power cable have been plotted based on UKHO Admiralty Charts. The Greater Gabbard power cables intersect the offshore cable corridor. The Galloper Wind Farm export cables also intersect the offshore cable corridor. There are 11 telecommunication cables recorded within the shipping and navigation study area. Of these, two intersect the East Anglia TWO windfarm site and three intersect the offshore cable corridor. Two of the intersecting cables (Aldeburgh to Zandvoort and the Atlantic Crossing) are no longer active.

61. It should be noted that the offshore cable corridor route for East Anglia ONE (which is currently under construction) and the offshore cable corridor route for East Anglia THREE both intersect the offshore development area.

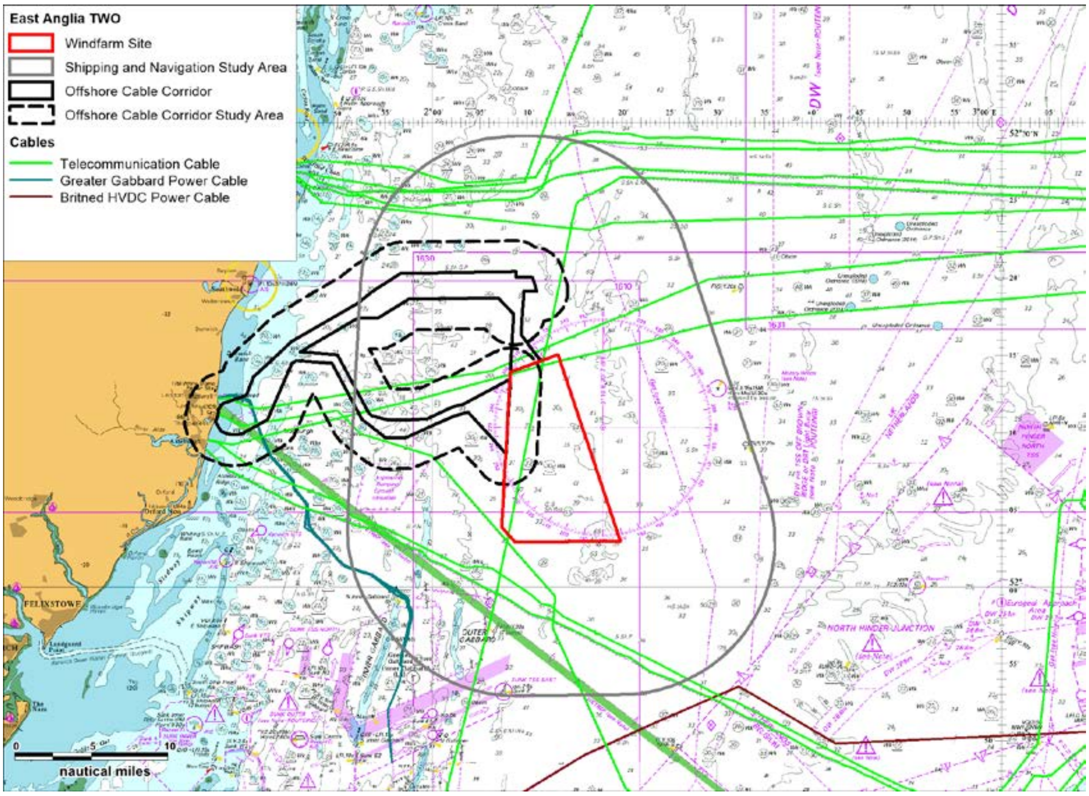


Figure 8.8 Cables within the Vicinity of the Offshore Development Area

8.11 Marine Environmental High Risk Areas (MEHRAs)

62. There are no MEHRAs in the immediate vicinity of the East Anglia TWO windfarm site; with the nearest being the Harwich and Felixstowe MEHRAs located approximately 26nm south-west of the East Anglia TWO windfarm site, on the south-east coast of England. The MEHRAs consist of a medium concentration of vulnerable seabirds and a range of fishing and amenity / economic activities. The MEHRAs lie on both sides of the entrance to Harwich and Felixstowe, both very active ports. Parts of the area off the ports are not covered by an existing vessel traffic service system and vessels entering or leaving the Thames Estuary pass the area.

8.12 Marine Wrecks

63. There are 67 charted wrecks within the study area with two charted wrecks within the East Anglia TWO windfarm site itself as presented in *Figure 8.9*. There are eight charted wrecks within the offshore cable corridor. There are not anticipated to be any navigational safety risks associated with these wrecks.

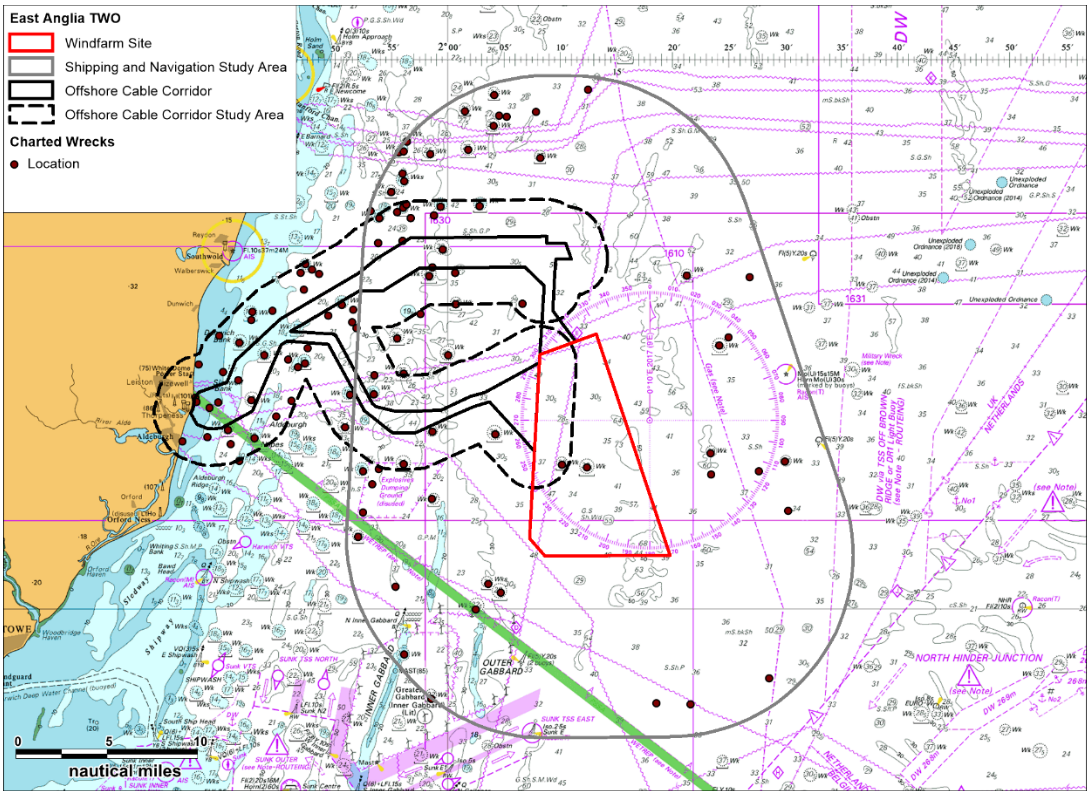


Figure 8.9 Charted Wrecks Relative to the Offshore Development Area

9 Metocean Data

9.1 Introduction

64. According to the Admiralty Sailing Directions (UKHO 2016), the East Anglia TWO windfarm site has a generally mild climate with winds mostly from between the south and north-west. Strong winds and gales are common in the winter months and, in summer, gales become less frequent although winds are often fresh or strong.

65. During winter, rain and snow are common, although precipitation amounts are not large. There is little seasonal variation in rainfall and the summer months are often cloudy and cool. Fog occasionally affects the east coast, particularly in the north.

66. Metocean data from the HSE weather database was used as input to the collision risk modelling process. This provided information on the following:

- Wind direction;
- Sea state; and
- Visibility.

9.2 Wind Direction

67. Wind direction proportions for the area are presented in *Table 9.1*. The prevalent wind direction was from the southwest.

Table 9.1 Wind Direction Proportions

Wind Direction (°)	Proportion (%)
0	6.8%
30	6.7%
60	6.2%
90	5.3%
120	5.4%
150	6.5%
180	8.8%
210	13.5%
240	14.4%
270	11.3%
300	8.3%
330	6.8%

9.3 Sea State

68. Sea state proportions for the area are presented in *Table 9.2*. The prevalent sea states were calm and moderate.

Table 9.2 Sea State Proportions

Sea State	Proportion (%)
Calm (<1m)	50%
Moderate (1–5m)	50%
Severe (>5m)	0%

9.4 Visibility

69. The HSE Weather Database assumes the proportion of poor visibility (defined as the proportion of a year where the visibility can be expected to be less than 1km) is 3%. This is based upon information available within the Admiralty Sailing Directions for the region.

9.5 Tidal Streams

70. Tidal data used as input to the collision and allision modelling is based upon the information available from UK Admiralty charts 2052, 1543, 1504, 1610 and 1630. *Table 9.3* presents the peak flood and ebb direction and speed values for each of the charted tidal diamonds in proximity to the East Anglia TWO windfarm site.

Table 9.3 UK Admiralty Chart Tidal Data

Tidal Diamond and Chart	Flood		Ebb	
	Direction (°)	Speed (knots)	Direction (°)	Speed (knots)
A (2052)	216	2.1	36	2.3
B (2052)	208	2.3	32	2.2
C (1610)	205	2.2	26	2.1
D (1630)	207	1.8	208	1.9
M (1543)	179	2.8	13	2.8
P (1543)	184	2.2	6	2.3
Q (1543)	195	2.5	18	2.6
R (1543)	188	3.1	9	2.4
S (1543)	194	2.7	15	2.8
U (1543)	197	2.4	19	2.4

Tidal Diamond and Chart	Flood		Ebb	
	Direction (°)	Speed (knots)	Direction (°)	Speed (knots)
V (1543)	197	2.7	15	2.5
S (1504)	198	1.8	20	1.8
T (1504)	192	2.0	17	1.8

10 Emergency Response

10.1 Introduction

71. This section summarises the existing SAR resources in proximity to the offshore development area. It is noted that the East Anglia TWO windfarm site would be required to consider self-help capabilities for its own personnel and vessels.

10.2 SAR Helicopters

72. In March 2013, the Bristow Group were awarded the contract by the MCA (as an executive agency of DfT) to provide helicopter SAR operations in the UK over a ten-year period. Bristow have now been operating the service since April 2015. There are ten base locations for the SAR helicopter service. The nearest SAR helicopter base to the East Anglia TWO windfarm site is the Lydd base which is approximately 80nm south-west. This base operates two Agusta Westland AW189 aircraft.

10.3 RNLI

73. The RNLI is organised into six divisions, with the relevant region for the offshore development area being the East Division. Based out of more than 230 stations, there are more than 350 lifeboats across the RNLI fleet, including both all-weather lifeboats (ALBs) and inshore lifeboats (ILBs). Based on the offshore position of the East Anglia TWO windfarm site it is likely that ALBs from Lowestoft would respond to an incident in proximity to the offshore development area. Locations of RNLI lifeboat stations along the south-east coast of England and details of the types of lifeboats operating out of these stations are given in *Table 10.1*. At each station, lifeboats are available on a 24-hour basis throughout the year.

Table 10.1 UK Lifeboats Operated from Southern North Sea RNLI Stations

Station	Lifeboats	ALB Class	ILB Class	Approximate Distance to East Anglia TWO windfarm site (nm)
Lowestoft	ALB	Shannon	-	20
Southwold	ILB	-	B Class Atlantic	17.5
Aldeburgh	ALB and ILB	Mersey	D Class	19.3
Great Yarmouth & Gorleston	ALB and ILB	Trent	B Class Atlantic	25.7
Harwich	ALB and ILB	Severn	B Class Atlantic	31.

10.4 Her Majesty (HM) Coastguard Stations

74. HM Coastguard, a division of the MCA, is responsible for requesting and tasking SAR resources made available to other authorities and for coordinating the subsequent SAR operations (unless they fall within military jurisdiction).

75. The HM Coastguard coordinates SAR through a network of 11 Coastguard Operations Centres (CGOC), including a National Maritime Operations Centre (NMOC) based in Hampshire. A corps of over 3,500 volunteer Coastguard Rescue Officers (CROs) around the UK form over 352 local Coastguard Rescue Teams (CRT) involved in coastal rescue, searches and surveillance.

76. All of the MCA's operations, including SAR, are divided into three geographical regions. The England Region covers the south-east coast of England, and therefore covers the area around the East Anglia TWO windfarm site.

77. Each region is divided into four districts with its own CGOC, which coordinates the SAR response for maritime and coastal emergencies within its district boundaries. The nearest rescue coordination centre to the offshore development area is the Dover CGOC based in Dover, located approximately 64nm (118km) from the East Anglia TWO windfarm site.

10.5 Third Party Assistance

78. Companies operating offshore typically have resources of vessels, helicopters and other equipment available for normal operations that can assist with emergencies offshore. Alongside that all vessels under IMO obligations set out in the International Convention for the Safety of Life at Sea (SOLAS) (IMO 1974) as amended, are required to render assistance to any person or vessel in distress if safely able to do so.

79. Notably, vessels associated with the nearby East Anglia ONE offshore development area, and the Galloper Offshore Windfarm would therefore be able to offer assistance to vessels in trouble within the area.

11 Maritime Incidents

11.1 Introduction

80. This section provides details of marine incidents that have occurred within the vicinity of the offshore development area over the latest available ten year period data. The analysis is intended to provide an indication as to the baseline level of incidents within the general area and show the common causes and vessel types involved. Incident data has been collected and reviewed from two sources:

- MAIB; and
- RNLI.

81. It is noted that the same incident may be recorded by both sources.

11.2 MAIB

82. All UK commercial vessels are required to report accidents they are involved in to the MAIB. Non-UK vessels do not have to report unless they are in a UK port, or within 12nm territorial waters and carrying passengers to a UK port. There are also no requirements for non-commercial recreational craft to report accidents to the MAIB.

11.2.1 East Anglia TWO Windfarm Site

83. The locations of accidents, injuries and hazardous incidents reported to the MAIB within the shipping and navigation study area for the ten year period between January 2005 and December 2014 are presented in *Figure 11.1* and are colour-coded by incident type. It should be noted that the MAIB aim for at least 97% accuracy in reporting locations of incidents.

84. A total of 19 unique incidents were reported within the shipping and navigation study area, corresponding to an average of approximately two incidents per year. None of the incidents occurred within the East Anglia TWO windfarm site.

85. The most frequently recorded incident type was “Accident to Person”, representing 37% of the total number of incidents.

86. *Figure 11.2* presents the same set of recorded incidents colour-coded by vessel type. Passenger Cargo vessels were the most frequently recorded casualty types, representing approximately 32% of the total number of incidents throughout the ten year period.

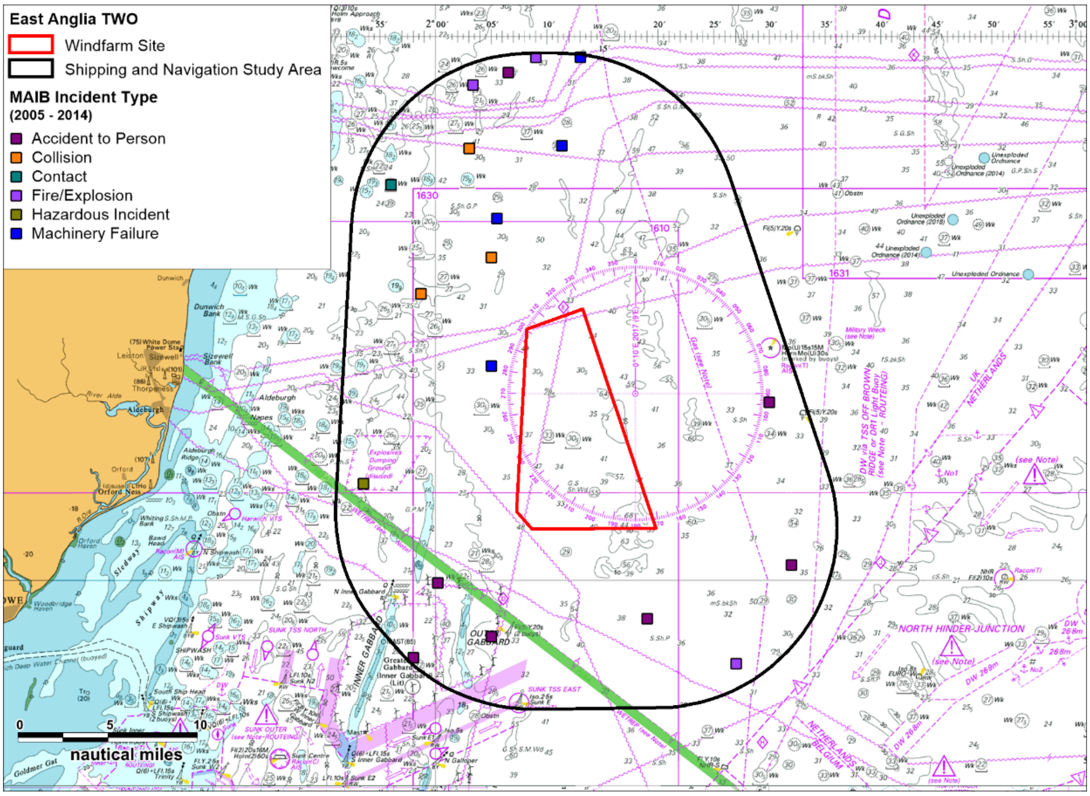


Figure 11.1 MAIB Incident Locations by Incident Type within Shipping and Navigation Study Area (2005 to 2014)

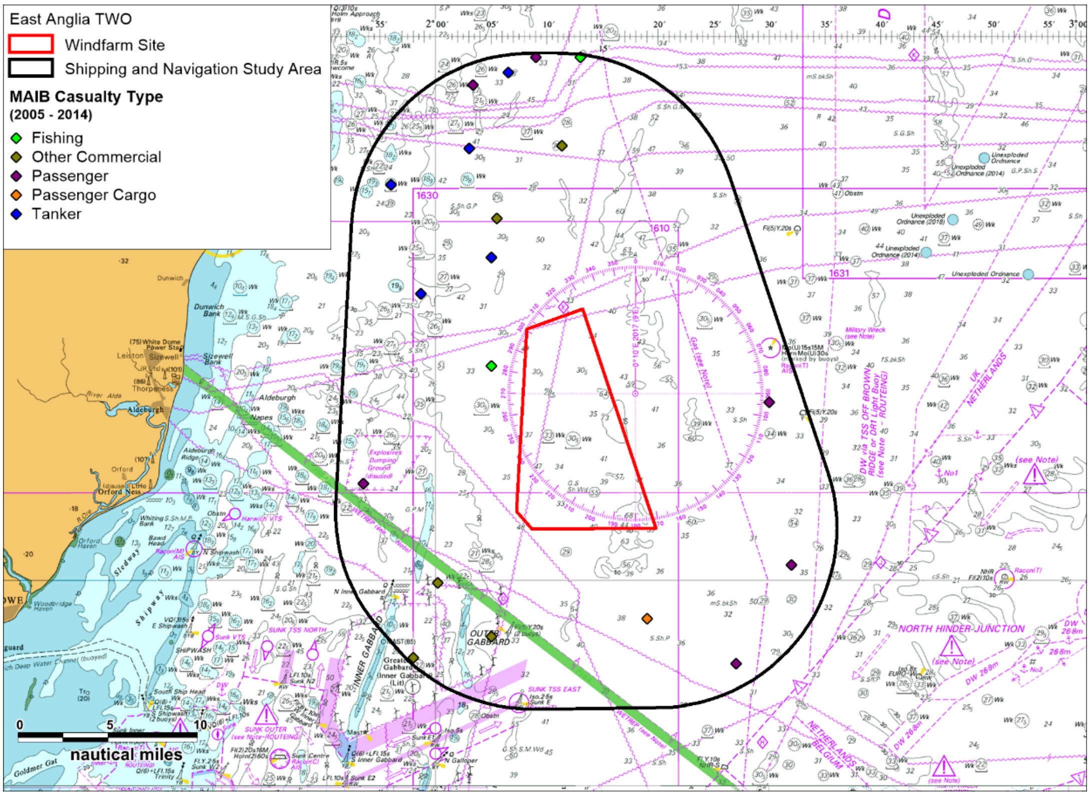


Figure 11.2 MAIB Incident Locations by Casualty Type within Shipping and Navigation Study Area (2005 to 2014)

11.2.2 Offshore Cable Corridor

87. The locations of accidents, injuries and hazardous incidents reported to the MAIB within the offshore cable corridor study area for the ten year period between January 2005 and December 2014 are presented in *Figure 11.3* and are colour-coded by incident type. It should be noted that the MAIB aim for at least 97% accuracy in reporting locations of incidents.

88. A total of 13 unique incidents were reported within the offshore cable corridor study area, corresponding to an average of approximately one incident per year. Five of the incidents occurred within the offshore cable corridor.

89. The most frequently recorded incident type was "Machinery Failure", representing 54% of the total number of incidents.

90. *Figure 11.4* presents the same set of recorded incidents colour-coded by vessel type. Fishing vessels were the most frequently recorded casualty types, representing approximately 46% of the total number of incidents throughout the ten year period.

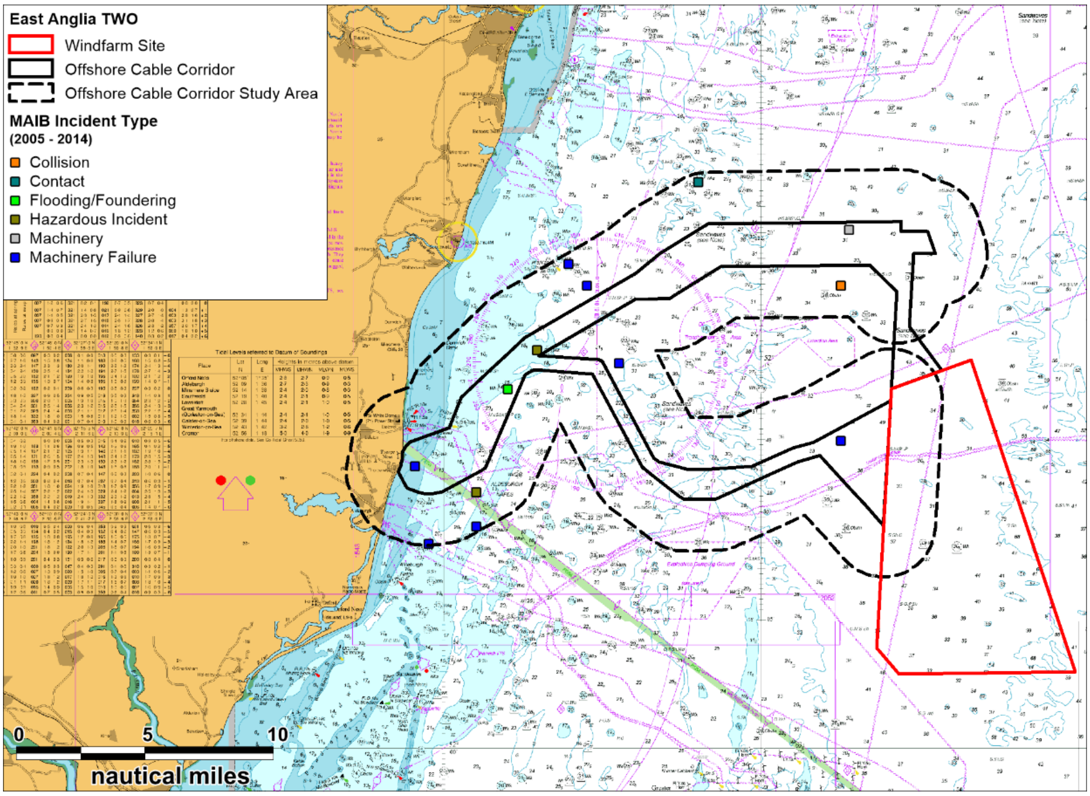


Figure 11.3 MAIB Incident Locations by Incident Type within Offshore Cable Corridor Study Area (2005 to 2014)

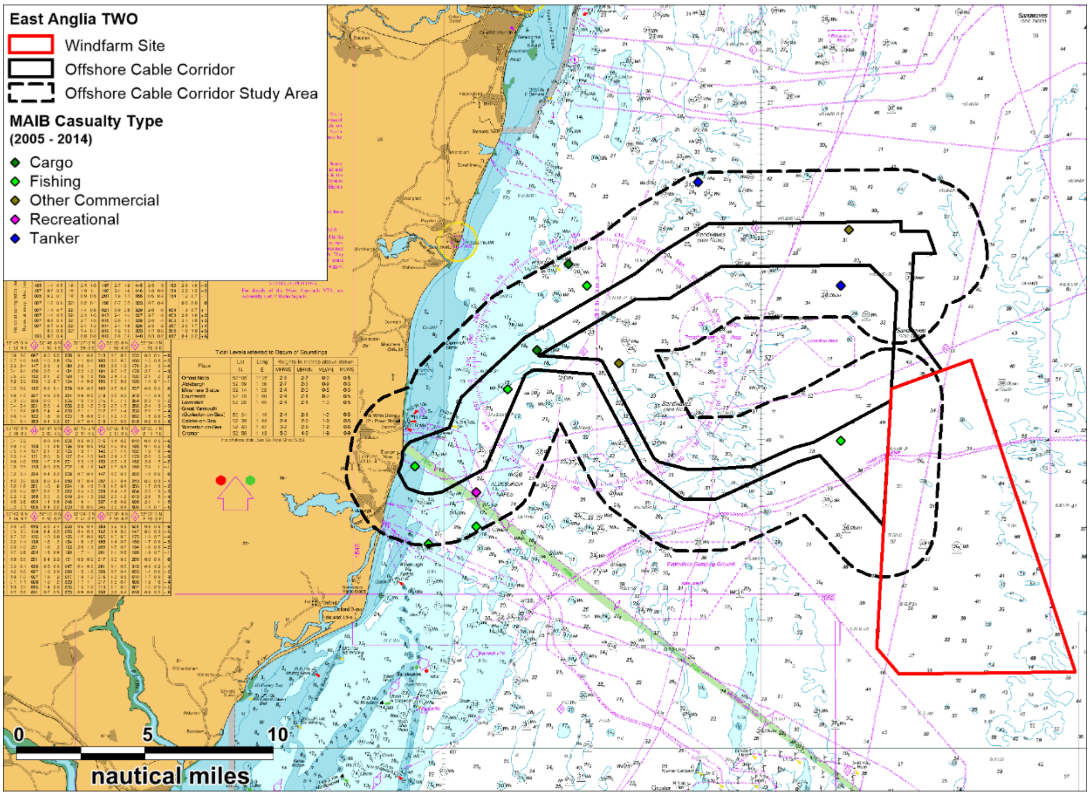


Figure 11.4 MAIB Incident Locations by Casualty Type within Offshore Cable Corridor Study Area (2005 to 2014)

11.3 RNLI

11.3.1 East Anglia TWO Windfarm Site

91. Data on RNLI lifeboat responses within the East Anglia TWO windfarm site and study area for the ten year period between 2005 and 2014 were analysed, with cases of a hoax or false alarm excluded. The results are presented below. It should be noted that this analysis only includes incidents to which the RNLI were alerted, and subsequently responded to.

92. The locations of incidents responded to by the RNLI (excluding hoaxes and false alarms) within the shipping and navigation study area for the ten year period between January 2005 and December 2014 are presented in *Figure 11.5* and are colour-coded by incident type.

93. A total of 40 launches were reported to incidents within the shipping and navigation study area, corresponding to an average of four per year. One of the launches was to a location within the East Anglia TWO windfarm site, to assist a recreational vessel in adverse weather conditions.

94. The most frequently recorded incident type was "Machinery Failure", representing approximately 58% of the total number of incidents. Recreational vessels were the most frequently recorded casualty types, representing 75% of the total number of incidents throughout the ten year period analysed.

95. *Figure 11.6* presents the same set of launch locations colour-coded by vessel type.

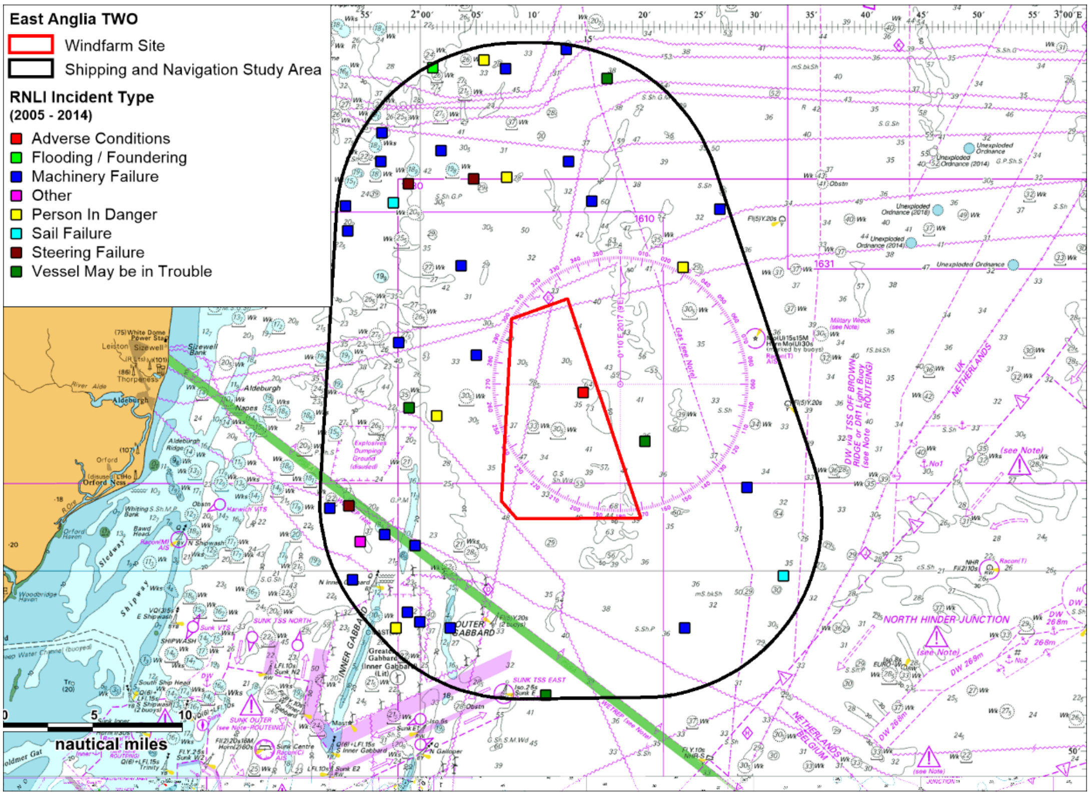


Figure 11.5 RNLI Incident Locations by Incident Type within Shipping and Navigation Study Area (2005 – 2014)

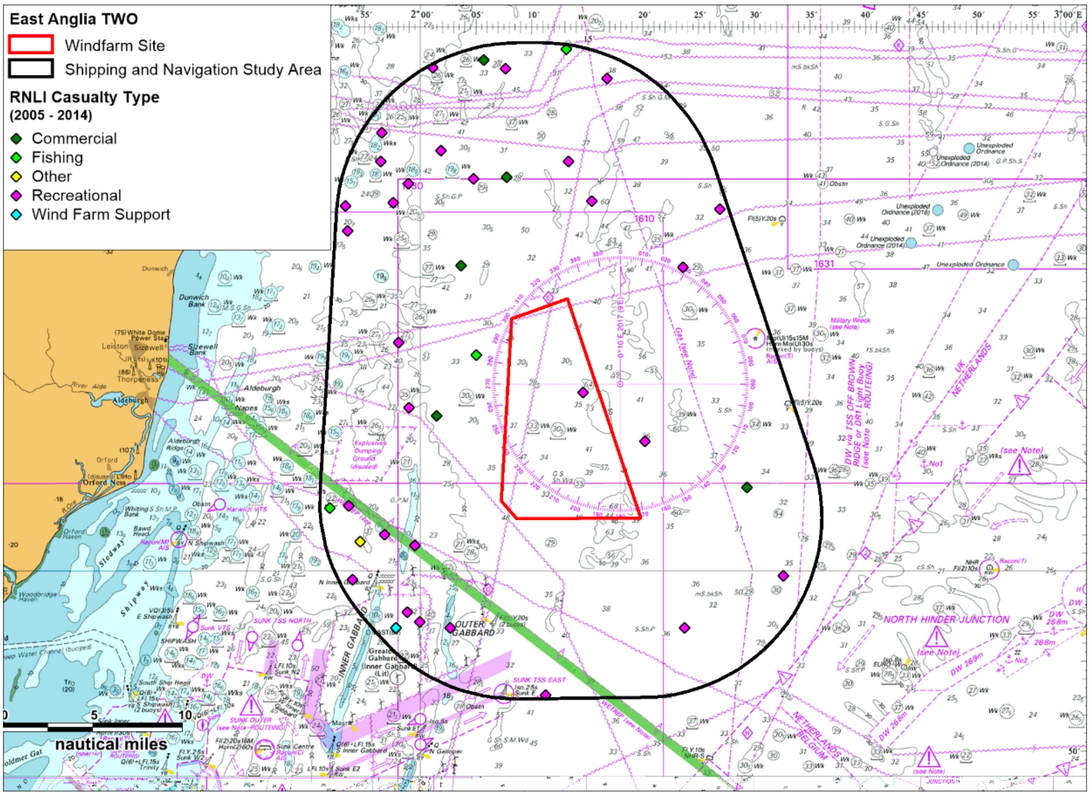


Figure 11.6 RNLI Incident Locations by Casualty Type within Shipping and Navigation Study Area (2005 – 2014)

11.3.2 Offshore Cable Corridor

96. Data on RNLI lifeboat responses within the offshore cable corridor study area for the ten year period between 2005 and 2014 were analysed, with cases of a hoax or false alarm excluded. The results are presented below. It should be noted that this analysis only includes incidents to which the RNLI were alerted, and subsequently responded to.

97. The locations of incidents responded to by the RNLI (excluding hoaxes and false alarms) within the offshore cable corridor study area for the ten year period between January 2005 and December 2014 are presented in *Figure 11.7* and are colour-coded by incident type.

98. A total of 60 launches were reported to incidents within the offshore cable corridor study area, corresponding to an average of six per year. Of the launches recorded, 14 were within the offshore cable corridor.

99. The most frequently recorded incident type was "Machinery Failure", representing approximately 42% of the total number of incidents. Recreational vessels were the most frequently recorded casualty types, representing 42% of the total number of incidents throughout the ten year period analysed.

100. *Figure 11.8* presents the same set of launch locations colour-coded by vessel type.

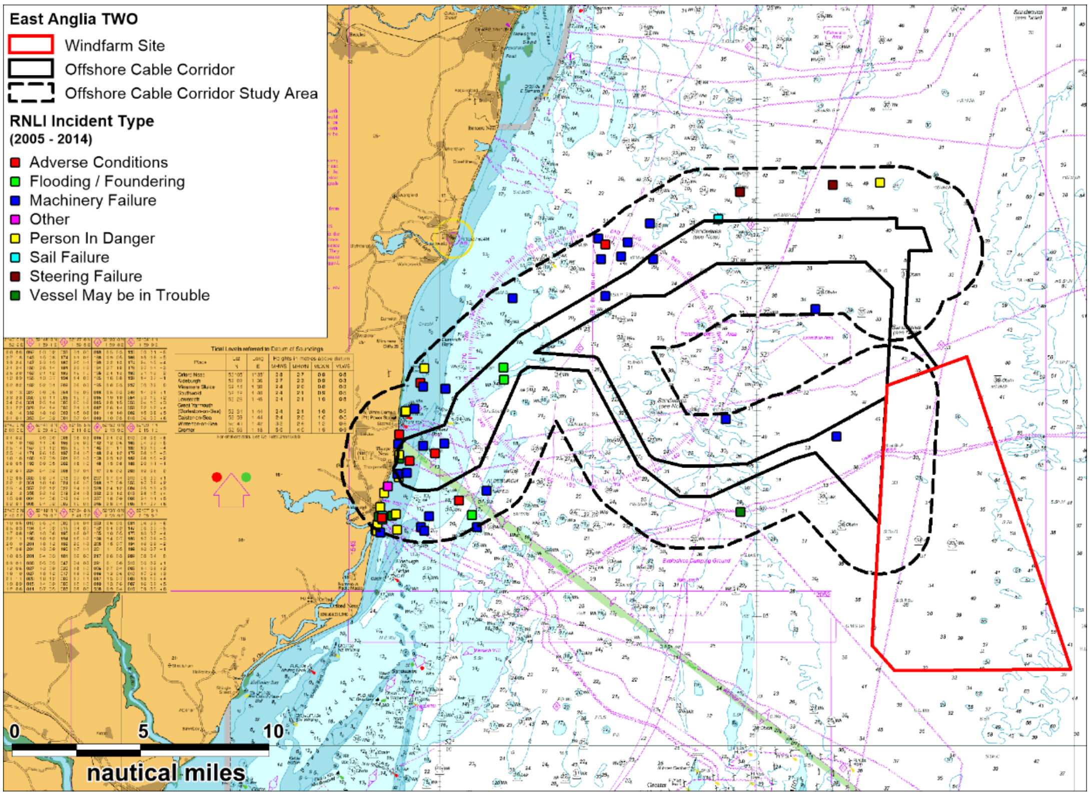


Figure 11.7 RNLI Incident Locations by Incident Type within Offshore Cable Corridor Study Area (2005 – 2014)

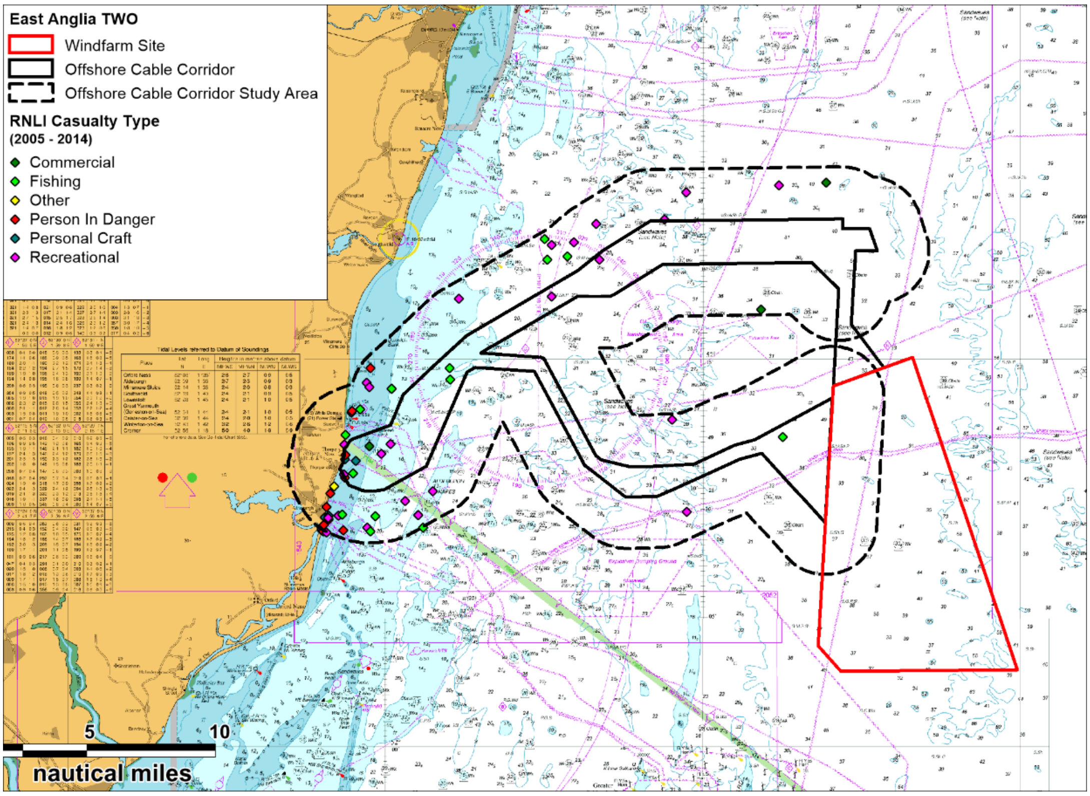


Figure 11.8 RNLI Incident Locations by Casualty Type within Offshore Cable Corridor Study Area (2005 – 2014)

12 East Anglia TWO Windfarm Site Marine Traffic Survey

12.1 Introduction

101. This section presents shipping data in relation to the East Anglia TWO windfarm site. A summer survey was undertaken in 2017 and a second summer survey undertaken in 2018 which recorded marine traffic data via AIS and Radar collection. AIS data for a winter period in 2017 was recorded from a Met Mast to account for seasonal variations. The survey periods are as follows:

- Summer 2017 (Radar and AIS)
  - 24th May to 31st May 2017 (8 days);
  - 14th to 19th June 2017 (6 days);
- Winter 2017 (AIS only)
  - 20th November to 3rd December 2017 (14 days); and
- Summer 2018 (Radar and AIS)
  - 17th August to 1st September 2018 (14 days).

102. In total the marine traffic survey consists of 28 days Radar and AIS data and 14 days of AIS only data, giving a combined total of 42 days.

103. As presented in section 6, the PEIR (submitted in 2018) and initial NRA were informed by the summer and winter 2017 surveys. However, given that the summer 2017 survey falls outside of the required timeframe for data detailed in MGN 543 (data collected within 24 months of submission of the ES), the additional summer 2018 survey was undertaken in August and September 2018. This data has been used to validate the findings of the PEIR and associated draft of the NRA (see section 12.3), and to refresh the marine traffic assessment in *Chapter 14 Shipping and Navigation*. The assessment of both summer surveys combined with the winter survey is included within this NRA for reference.

12.2 Summer and Winter 2017 Analysis

12.2.1 Vessel Counts

104. For the 14 days analysed in summer 2017, there was an average of 74 unique vessels per day passing within the shipping and navigation study area, recorded on AIS and Radar. In terms of vessels intersecting the East Anglia TWO windfarm site, there was an average of 21 unique vessels per day (28% of unique vessels).

105. *Figure 12.1* presents the daily number of unique vessels passing through the shipping and navigation study area during summer 2017.

106. The busiest day recorded throughout the summer survey period was the 28th May 2017 when 100 unique vessels were recorded within the shipping and navigation study area.

107. The quietest day recorded throughout the summer survey period was 16th May when 54 unique vessels were recorded within the shipping and navigation study area.

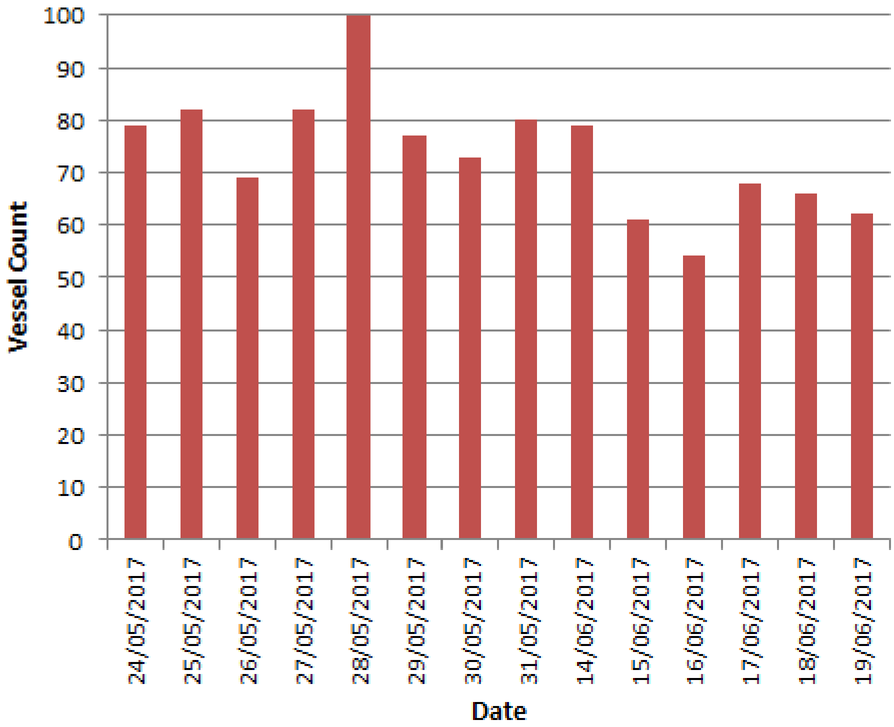


Figure 12.1 Unique Vessels per Day from AIS and Radar within Shipping and Navigation Study Area (14 Days Summer 2017)

108. For the 14 days analysed in winter 2017, there was an average of 71 unique vessels per day passing within the shipping and navigation study area, recorded on AIS. In terms of vessels intersecting the East Anglia TWO windfarm site, there was an average of 12 unique vessels per day (17% of unique vessels).

109. *Figure 12.2* presents the daily number of unique vessels passing through the shipping and navigation study area during winter 2017.

110. The busiest day recorded throughout the winter survey period was the 28th November 2017 when 97 unique vessels were recorded within the shipping and navigation study area.

111. The quietest day recorded throughout the winter survey period was 27th November 2017 when 58 unique vessels were recorded within the shipping and navigation study area.

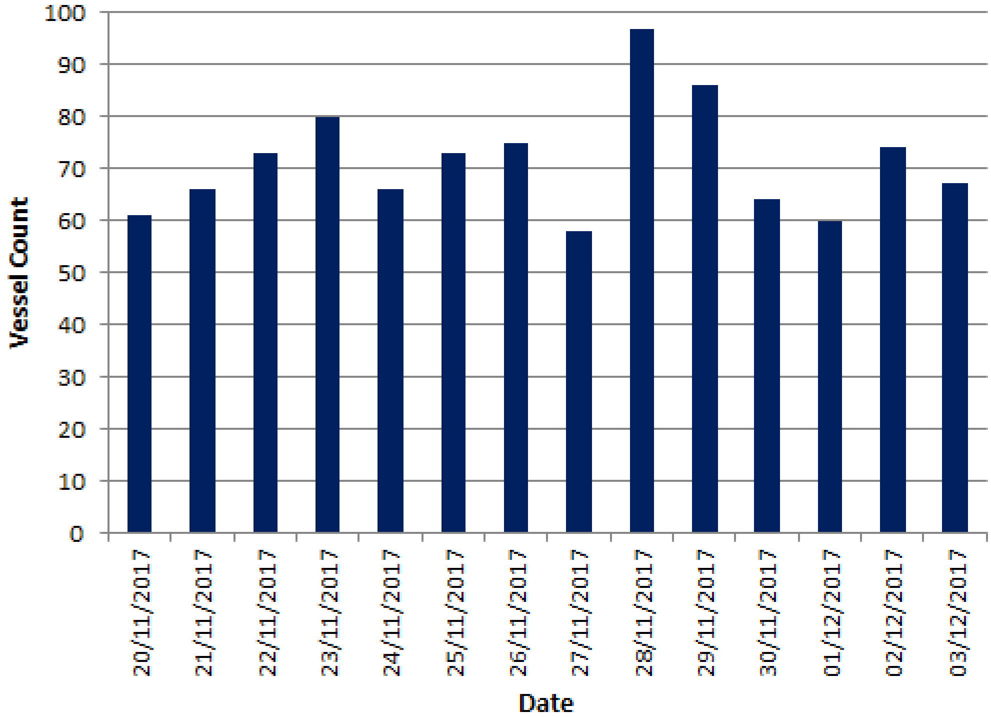


Figure 12.2 Unique Vessels per Day from AIS within Shipping and Navigation Study Area (14 Days Winter 2017)

12.2.2 Vessel Types

112. A number of tracks recorded during the summer survey were classified as temporary (non-routine), including the tracks of the dedicated survey vessel *Ivero.* Temporary traffic was also recorded during the winter period, such as vessels engaged in survey operations or guard duties. These have been excluded from the analysis.

113. Marine traffic associated with the nearby Greater Gabbard Offshore Wind Farm and Galloper Offshore Wind Farm was also recorded during the summer and winter periods. These tracks consisted of traffic involved in the construction of the Galloper Offshore Windfarm and the operation and maintenance of the Greater Gabbard Offshore Wind Farm. These tracks have been excluded from the main analysis given that operational traffic would be reduced (noting that Greater Gabbard Offshore Wind Farm is understood to have required extended maintenance post construction), which may skew the analysis of regular traffic. However, given that the vessels recorded provide an indication of operational requirements (in particular likely vessel routeing from Great Yarmouth and Lowestoft), these vessels have still been considered within the routeing assessments in sections 14 and 16.

114. *Figure 12.3* presents a plot of temporary windfarm vessels recorded within the shipping and navigation study area on AIS and Radar throughout the summer and winter 2017 survey periods.

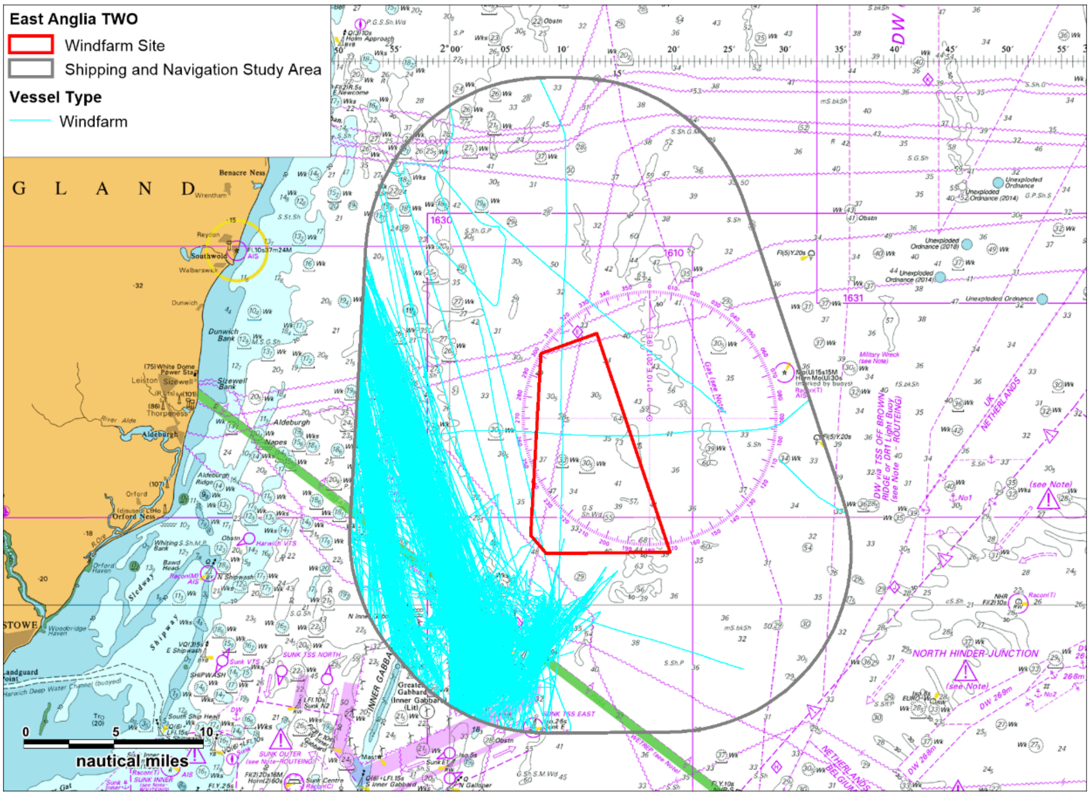


Figure 12.3 AIS and Radar Windfarm Vessels within Shipping and Navigation Study Area (28 Days Summer and Winter 2017)

115. Throughout the combined summer and winter survey period, an average of 16 unique windfarm vessels per day were recorded within the shipping and navigation study area.

116. It can be seen that the windfarm vessels were recorded within the west and south-west of the shipping and navigation study area, either involved in operations at the Greater Gabbard and Galloper Offshore Wind Farm or transiting to and from the two windfarm sites.

117. It should be noted that windfarm traffic transiting through the shipping and navigation study area to other windfarms outwith the shipping and navigation study area has been retained within the analysis.

118. Plots of vessel tracks recorded within the shipping and navigation study area during the summer and winter 2017 period (excluding temporary tracks as defined above), colour-coded by vessel type, are presented in *Figure 12.4* and *Figure 12.5*, respectively. Throughout the summer period, 96% of tracks were recorded on AIS and 4% on Radar.

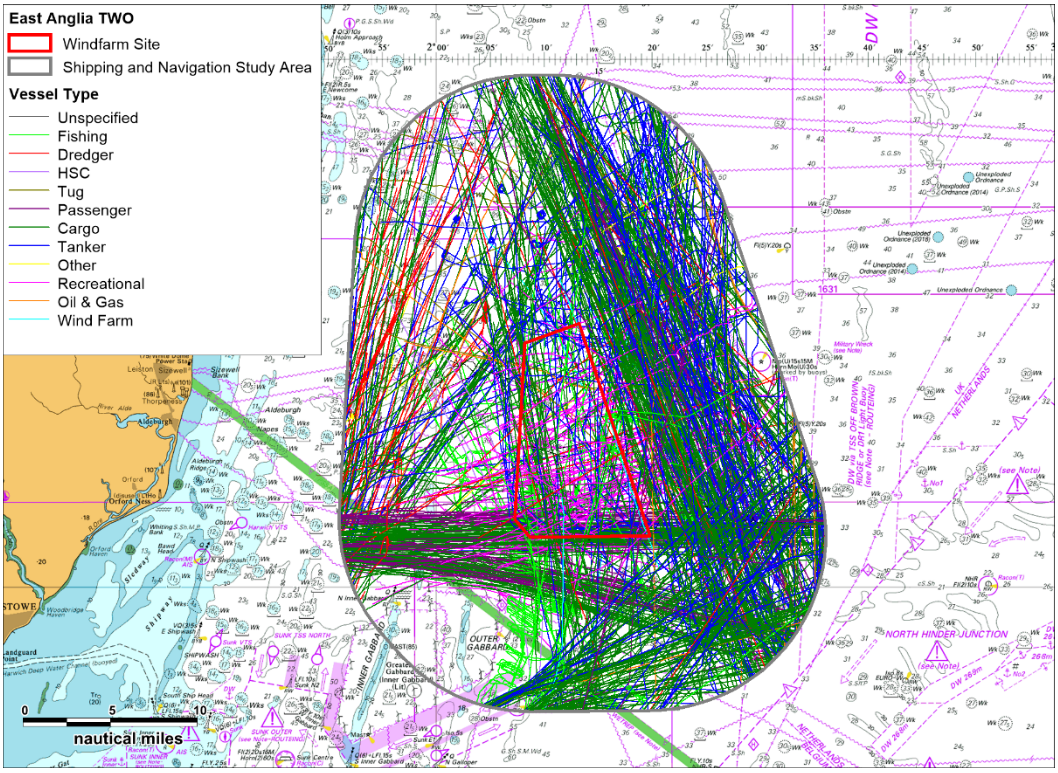


Figure 12.4 Overview of AIS and Radar Data within Shipping and Navigation Study Area Excluding Temporary Tracks (14 Days Summer 2017)

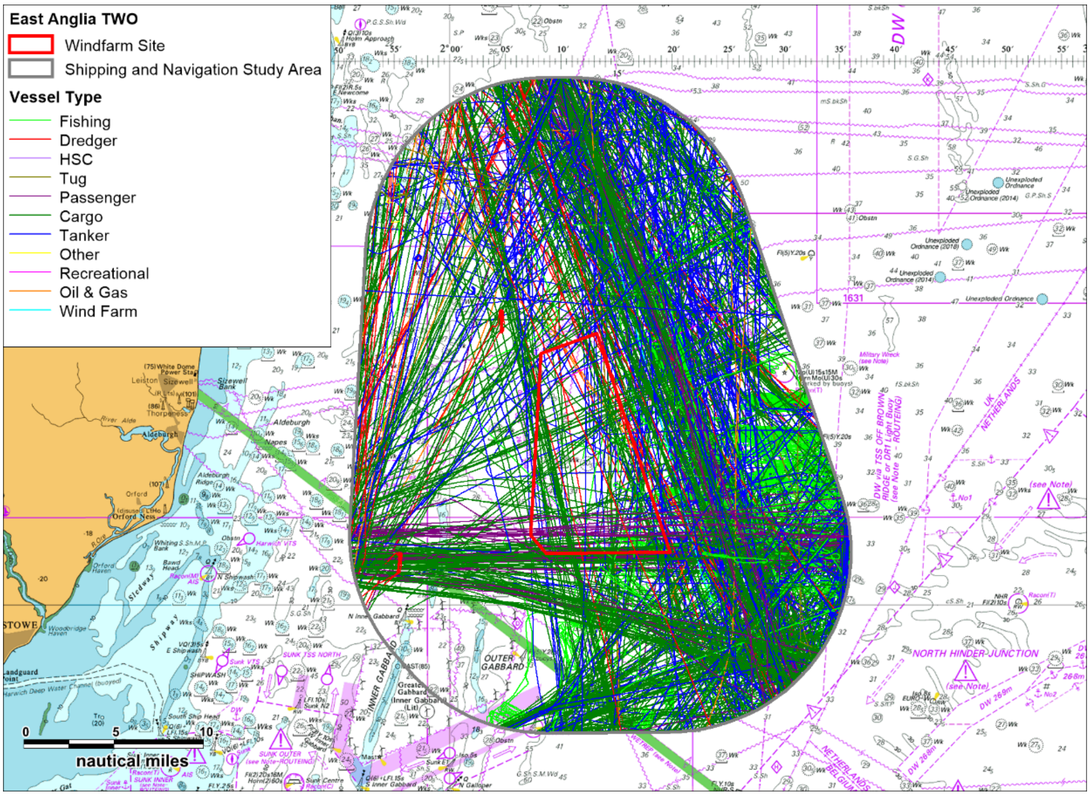


Figure 12.5 Overview of AIS Data within Shipping and Navigation Study Area Excluding Temporary Tracks (14 Days Winter 2017)

119. Analysis of the vessel types recorded passing within the shipping and navigation study area and the East Anglia TWO windfarm site throughout both survey periods are presented in *Figure 12.6*. The category of "other" vessels includes those that are not large enough in quantities to be categorised separately, such as survey vessels, a training vessel and a buoy tender.

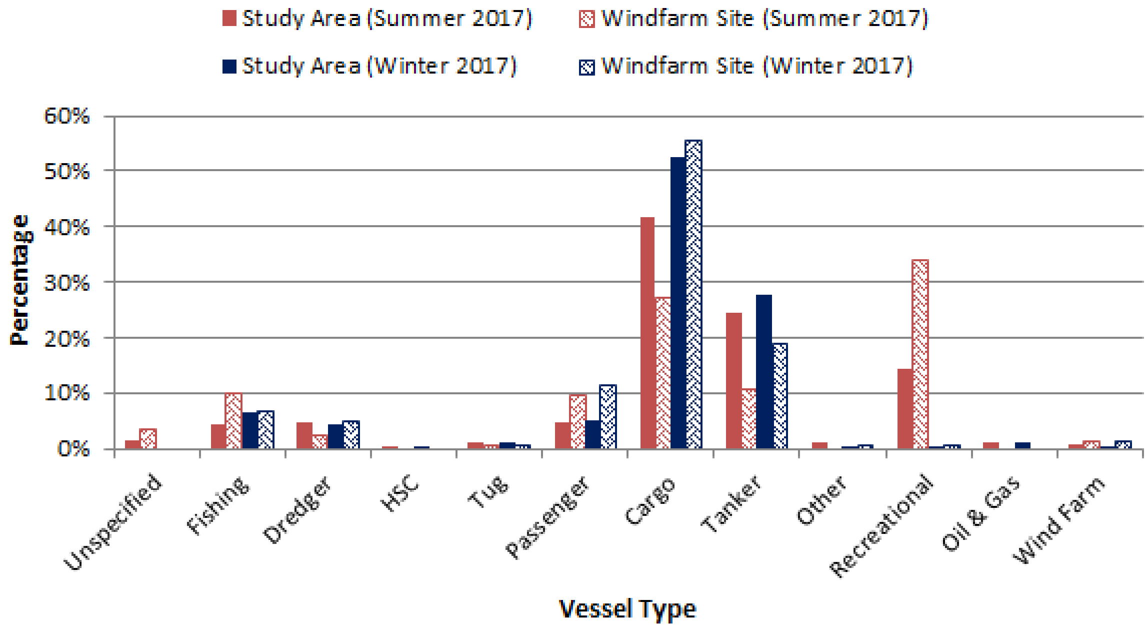


Figure 12.6 Distribution of Vessel Types within Shipping and Navigation Study Area (28 Days Summer and Winter 2017)

120. During the summer period, the majority of tracks recorded on AIS and Radar were cargo vessels (42% within the shipping and navigation study area) and tankers (24%). During the winter period, the majority of tracks were cargo vessels (53% in the shipping and navigation study area) and tankers (28%). It should be noted that the cargo vessel category includes commercial ferries (e.g. DFDS Seaways) operating in the shipping and navigation study area.

121. It can be seen that cargo vessels and tankers were higher during the winter period than summer. This is reflected within the density grid presented in *Figure 12.8* where vessel density is higher within the main commercial vessel channels to the east of the shipping and navigation study area. However, overall vessel density and vessel counts are higher during summer due to increased numbers of recreational craft recorded.

122. Approximately 2% of tracks recorded within the shipping and navigation study area during the summer survey period were unspecified vessels. These consisted of Radar tracks whose types could not be identified.

12.2.3 Vessel Density

Figure 12.7 and *Figure 12.8* present the vessel density (excluding temporary tracks) recorded in the summer and winter 2017 survey periods, respectively. These are based on the number of track intersects per cell of a 1x1nm grid covering the shipping and navigation study area. To allow direct comparison between the summers and winter periods, the same density ranges have been used in both figures.

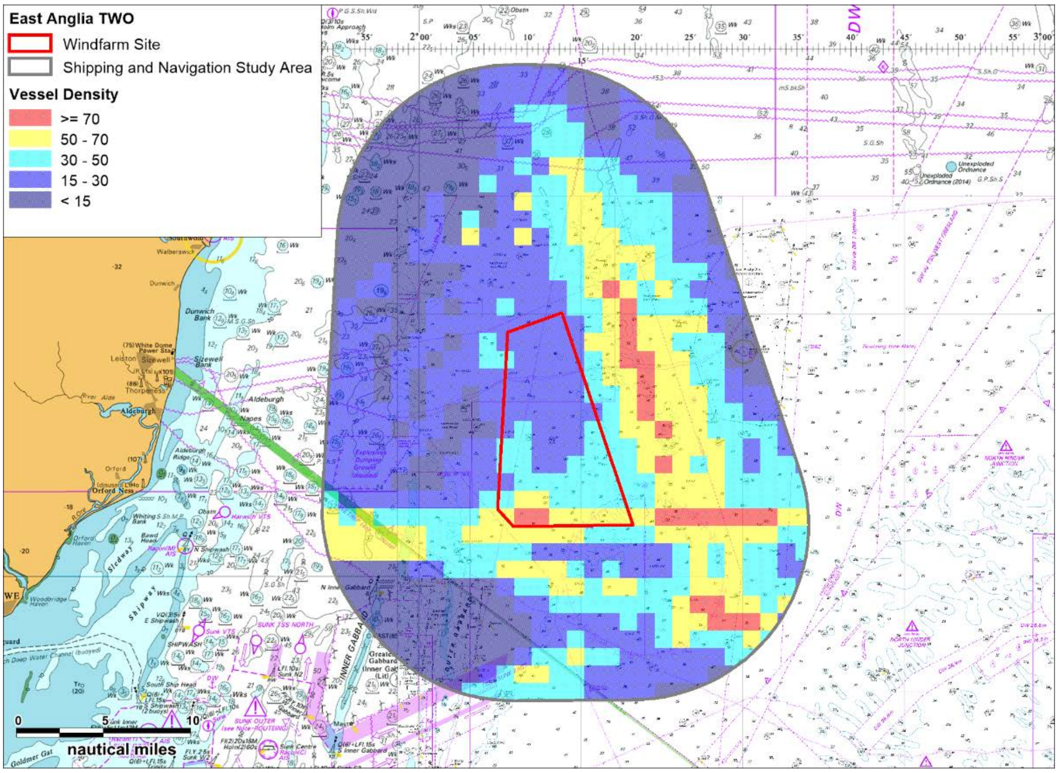


Figure 12.7 Vessel Density from AIS and Radar within Shipping and Navigation Study Area (14 Days Summer 2017)

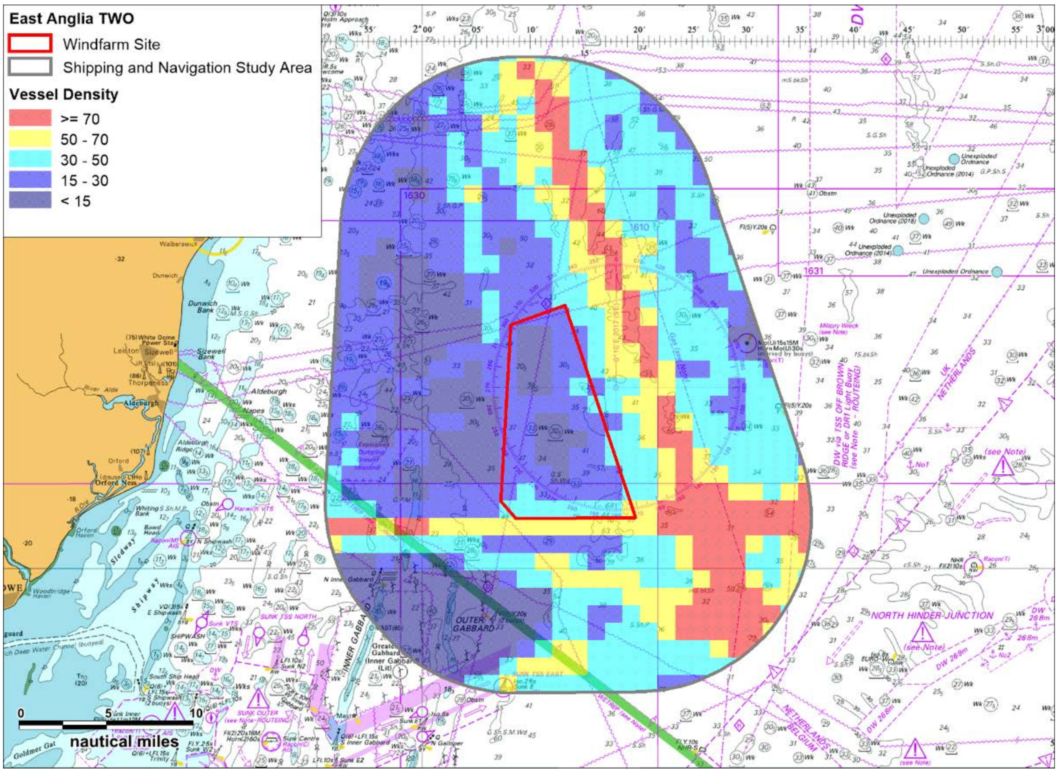


Figure 12.8 Vessel Density from AIS within Shipping and Navigation Study Area (14 Days Winter 2017)

123. During the summer and winter periods, the highest density areas were observed to correspond to vessel routeing within the east of the shipping and navigation study area, passing east of the East Anglia TWO windfarm site.

124. The vessel density within the East Anglia TWO windfarm site was observed to be lower during summer than in winter. This was due to a higher number of cargo vessels recorded during the winter period compared to the summer period. However, it should be noted that the average daily count for winter was lower (average of 71 vessels per day) than that recorded for summer (average of 74 vessels per day).

12.2.4 Cargo Vessels

125. *Figure 12.9* presents a plot of cargo vessels recorded within the shipping and navigation study area during the 2017 survey periods, colour-coded by subtype categories. Following this, *Figure 12.10* presents the distribution of the main cargo vessel subtypes. It should be noted that commercial ferries (Roll on Roll off (Ro Ro) cargo) are included.

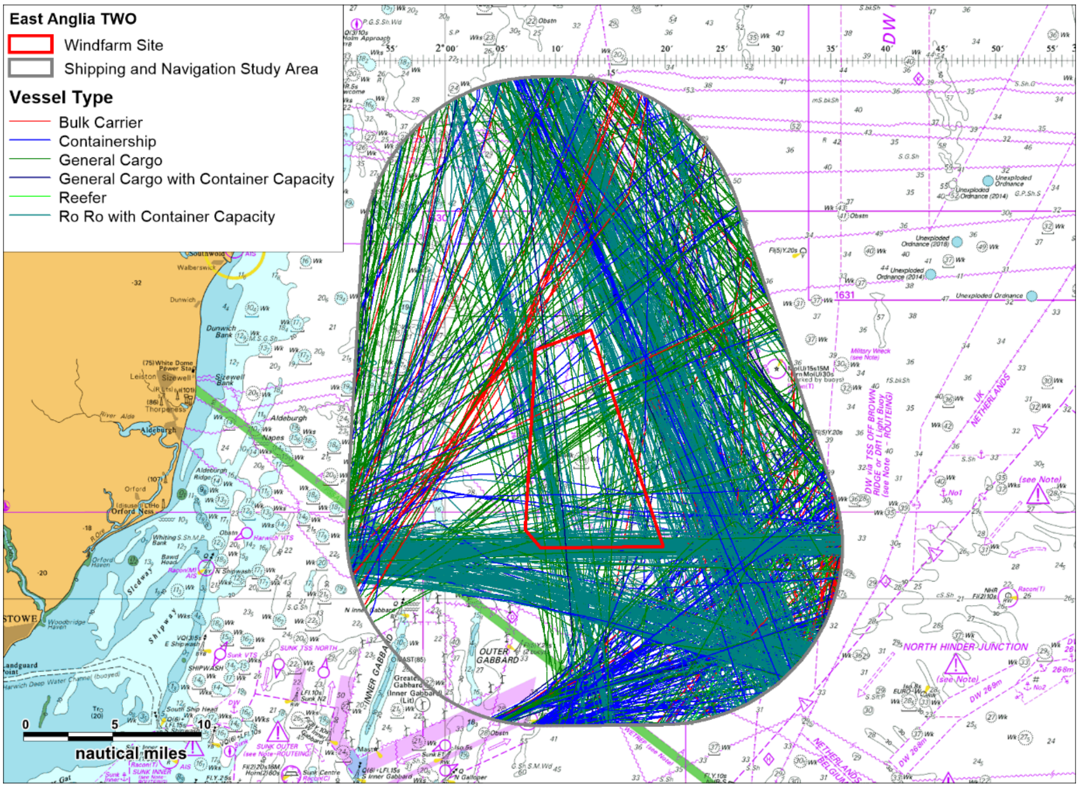


Figure 12.9 AIS and Radar Cargo Vessels by Sub Type within the Shipping and Navigation Study Area (28 Days Summer and Winter 2017)

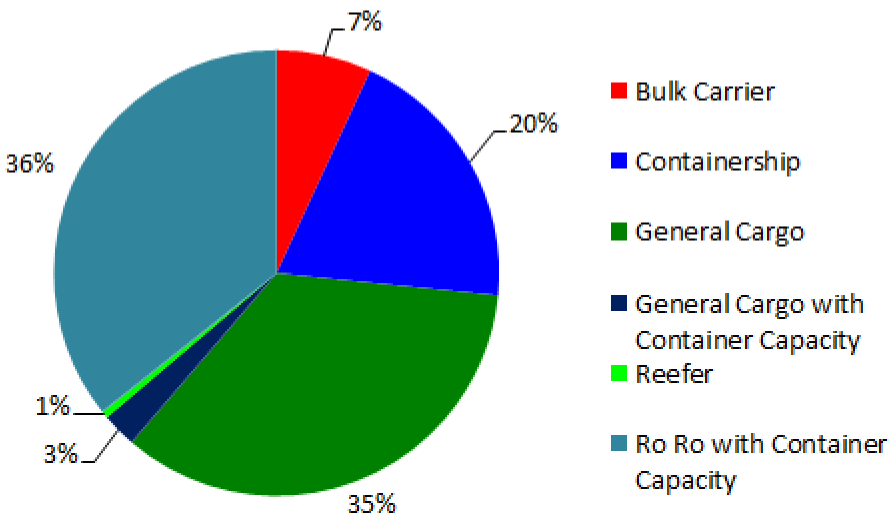


Figure 12.10 Distribution of Main Cargo Vessel Subtypes

126. During the combined summer and winter survey period, an average of 34 unique cargo vessels per day passed within the shipping and navigation study area.

127. It can be seen that the majority of cargo vessels were transiting routes to the east and south of the East Anglia TWO windfarm site as well as the Sunk TSS within the south of the shipping and navigation study area.

128. Ro Ro cargo vessels with container capacity (36%) and general cargo vessels (35%) were the most frequently recorded cargo vessel type transiting through the shipping and navigation study area, followed by containerships (20%). Bulk carriers (7%) were also recorded frequently.

12.2.5 Tankers

129. *Figure 12.11* presents a plot of tankers recorded within the shipping and navigation study area during the 2017 survey periods, colour-coded by subtype categories. Following this, *Figure 12.12* presents the distribution of tanker subtypes.

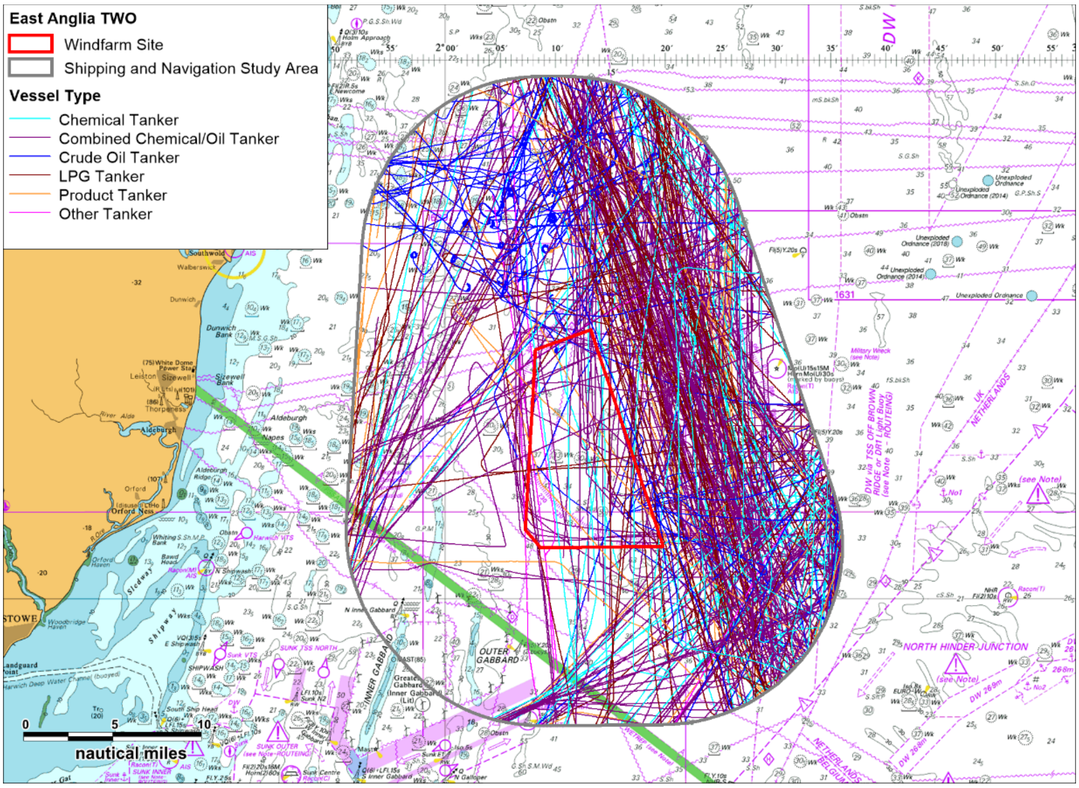


Figure 12.11 AIS and Radar Tankers by Sub Type within the Shipping and Navigation Study Area (28 Days Summer and Winter 2017)

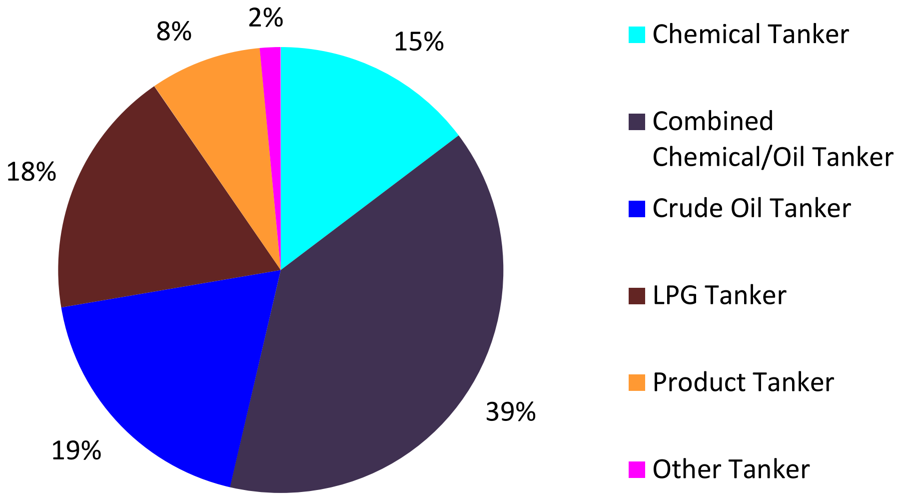


Figure 12.12 Distribution of Tanker Subtypes

130. During the combined summer and winter survey period, an average of 19 unique tankers per day passed within the shipping and navigation study area.

131. It can be seen that the majority of tankers were transiting routes to the east of the East Anglia TWO windfarm site.

132. Combined chemical and oil tankers (39%) were the most frequently recorded tanker type transiting through the shipping and navigation study area, followed by crude oil tankers (19%) and Liquid Petroleum Gas (LPG) carriers (18%).

133. Tankers engaged in non- transiting activity were recorded within the shipping and navigation study area as presented in *Figure 12.13*.

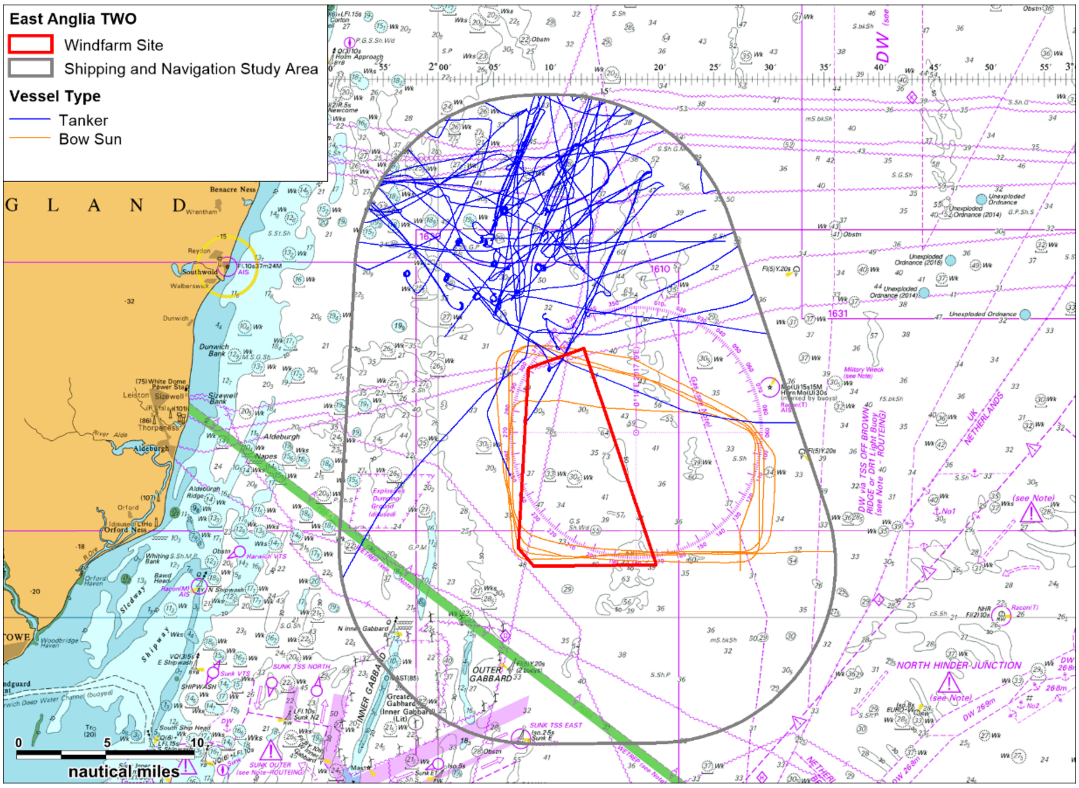


Figure 12.13 AIS and Radar Tanker Activity within the Shipping and Navigation Study Area (28 Days Summer and Winter 2017)

134. There is a designated Southwold Oil Transhipment Area within the UK territorial sea off the coast of Southwold where Ship-to-Ship (STS) transfers can take place. It can be seen that STS transfers were recorded within the north of the shipping and navigation study area with 5% of the tracks recorded intersecting the East Anglia TWO windfarm site. Tankers were also recorded waiting at anchor in the vicinity (see section 12.2.10). The combined chemical / oil tanker *Bow Sun* was also recorded intersecting the East Anglia TWO windfarm site carrying out a manoeuvre. This vessel has been highlighted in a different colour in the figure above.

12.2.6 Oil and Gas Vessels

135. *Figure 12.14* presents a plot of oil & gas associated vessels recorded within the shipping and navigation study area during the survey periods.

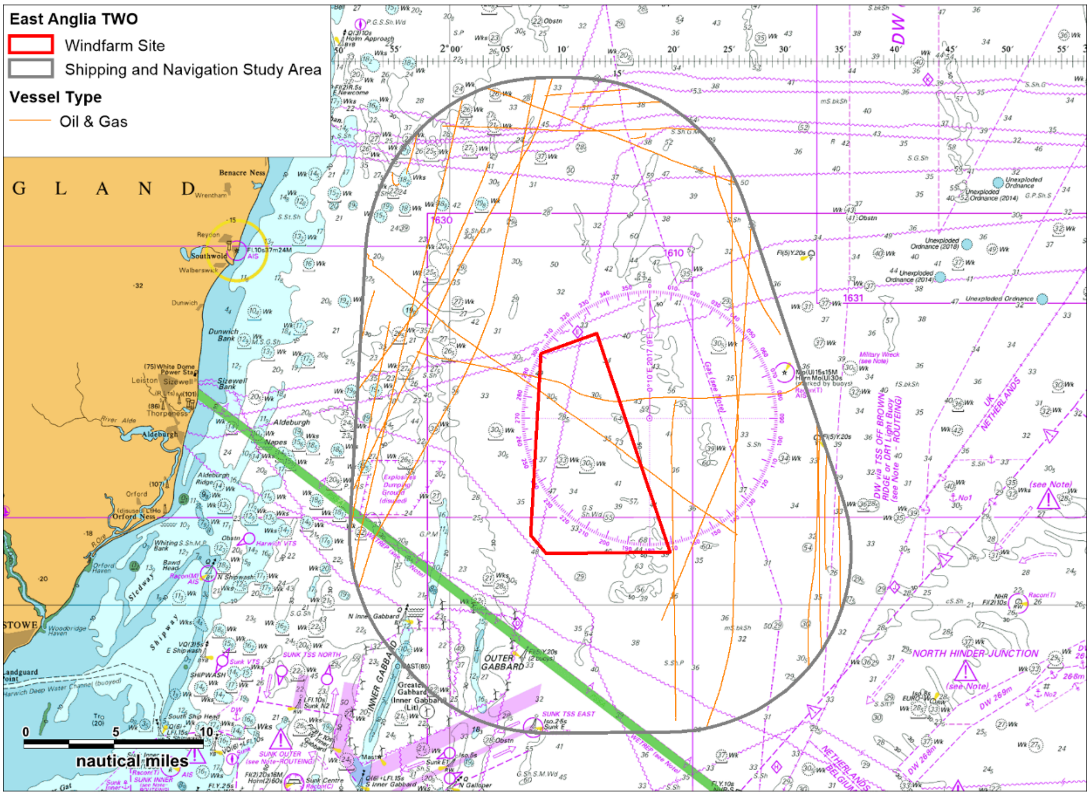


Figure 12.14 AIS and Radar Oil & Gas Vessels within the Shipping and Navigation Study Area (28 Days Summer and Winter 2017)

136. During the combined summer and winter survey period, an average of one unique oil & gas vessel per day passed within the shipping and navigation study area. These vessels were recorded mainly transiting to the Thames Platform, Dutch ports or east UK ports.

12.2.7 Passenger Vessel Activity

137. This section reviews the passenger vessel activity within the shipping and navigation study area based upon the marine traffic surveys.

138. *Figure 12.15* presents a plot of passenger vessels recorded within the shipping and navigation study area on AIS and Radar throughout both the summer and winter survey periods.

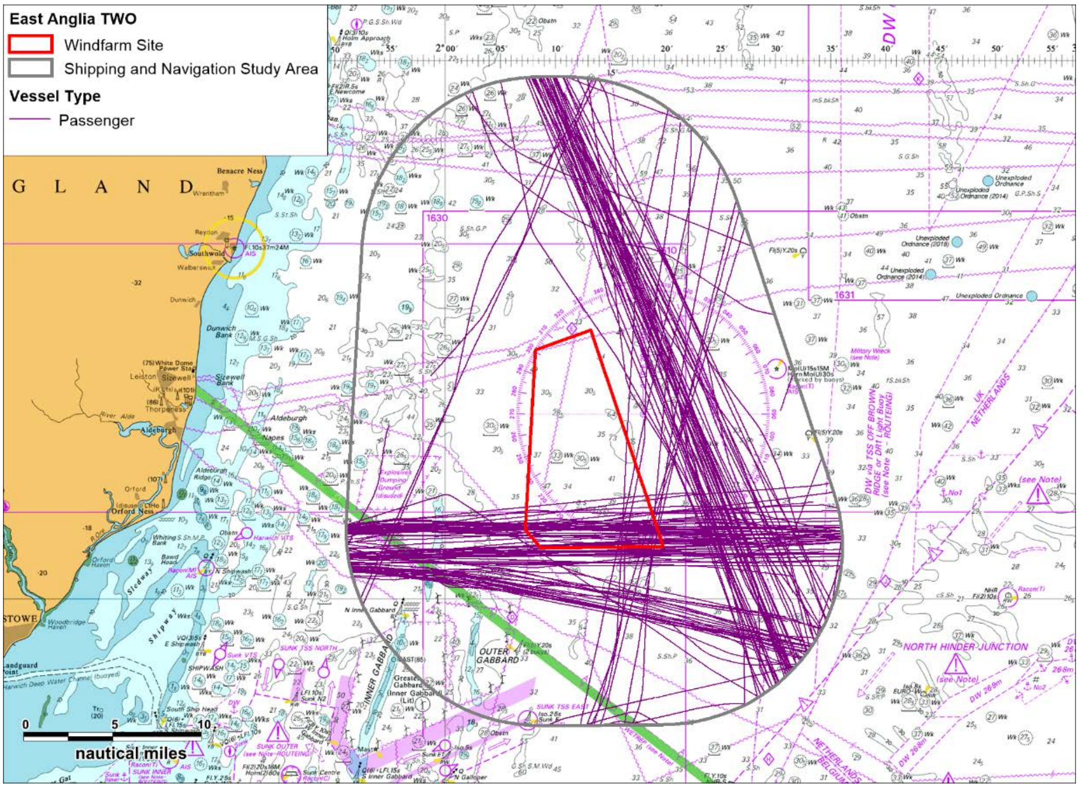


Figure 12.15 AIS and Radar Passenger Vessels within the Shipping and Navigation Study Area (28 Days Summer and Winter 2017)

139. It can be seen that regular passenger vessel transits were recorded to the east and south of the East Anglia TWO windfarm site. The two southern routes transit between the same ports (Harwich and Rotterdam) and have been split by direction.

140. An average of four unique passenger vessels per day were recorded throughout the combined summer and winter survey periods.

141. The destinations of the passenger vessels recorded throughout the summer and winter survey periods are presented in *Table 12.1*. Vessels transiting between Hull-Zeebrugge (P&O Ferries) and Rotterdam-Harwich (Stena Line) were the most frequently recorded.

Table 12.1 Passenger Vessel Destinations (28 Days Summer and Winter 2017)

Vessel Operator	Vessel	Destination(s)
Carnival	*Aurora*	Stavanger to Southampton Skagen to Southampton
	Britannia	Stavanger and Southampton
	Queen Elizabeth	Southampton
Costa Cruises	*Costa Mediterranea*	Amsterdam

Vessel Operator	Vessel	Destination(s)
Fred. Olsen	*Black Watch*	Invergordon
Global Cruise Lines	*Columbus*	Eidfjord
	Magellan	Tilbury
P&O Ferries	*Pride of Bruges* *Pride of York*	Hull - Zeebrugge
Royal Caribbean	*Vision of the Seas*	Edinburgh
Stena Line	*Stena Britannica* *Stena Hollandica*	Rotterdam - Harwich
	Stena Transit	Rotterdam - Humber
V. Ships	*Saga Pearl II*	Stavanger
	Saga Sapphire	Kirkwall
Viking River Cruises	*Viking Star*	Rosyth Greenwich
Other	*Dolly C*	Grenada
	Nahlin	Not Available

12.2.8 DFDS Routeing

142. DFDS Seaways is a ferry operator within European waters, operating both passenger ferries and freight shipping. Following regular operator consultation undertaken during April 2018 (see *Table 5.3*), information on vessel routeing was provided by DFDS Seaways. This is presented in *Figure 12.16.*

143. It is noted when viewing the figure, that since DFDS Seaways were consulted, the East Anglia TWO windfarm site boundary has been reduced therefore the boundary show is the original boundary prior to the reduction of the northern extent. The routeing provided by DFDS Seaways and the following AIS analysis remains relevant as they form part of the baseline assessment.

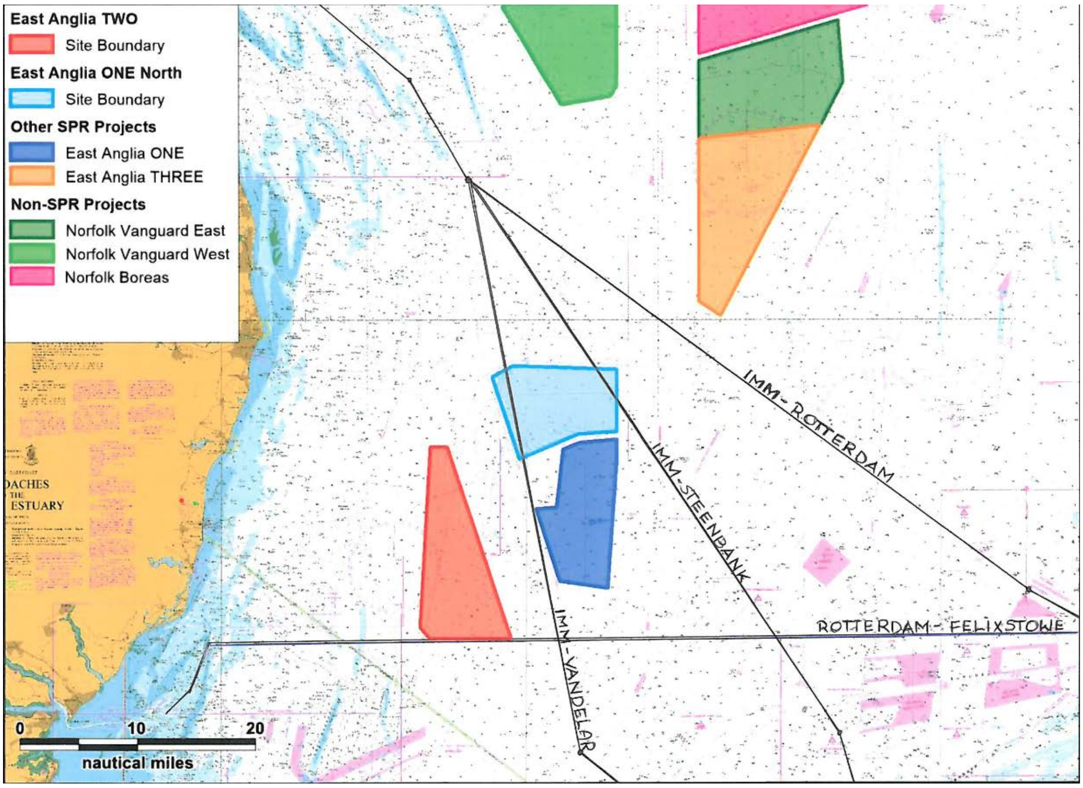


Figure 12.16 DFDS Seaways Vessel Routeing

144. It can be seen that two indicative DFDS vessel routes intersect the East Anglia ONE North windfarm site while the Rotterdam to Felixstowe route intersects the southern boundary of the East Anglia TWO windfarm site.

145. Following the routeing provided by DFDS, one year of AIS data (1st January to the 31st December 2017) was analysed from a Met Mast within the former East Anglia Zone to validate the routeing within the vicinity of the East Anglia ONE windfarm site, East Anglia ONE North windfarm site and East Anglia TWO windfarm site.

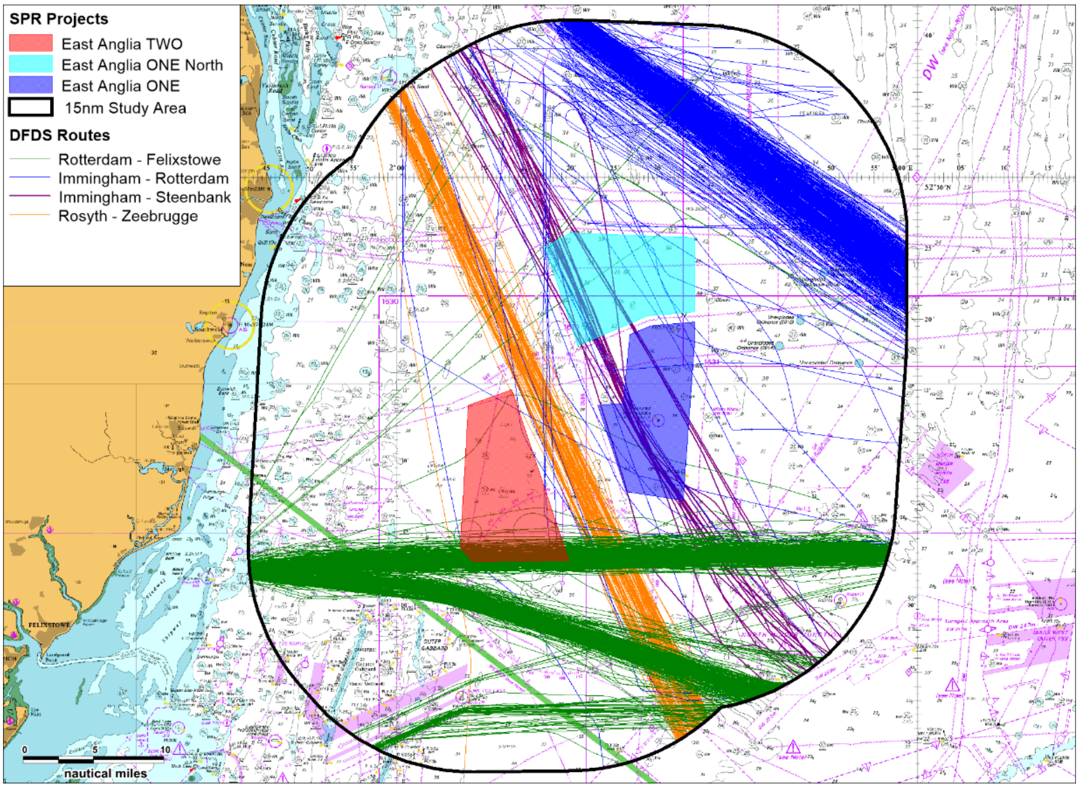


Figure 12.17 DFDS Vessel Routes (Met Mast AIS Data January 1st and 31st December 2017)

146. In comparison to the routeing provided by DFDS, the Rotterdam to Felixstowe route is clearly defined within the AIS data however the route is recorded as split into four rather than one as in *Figure 12.16*. The two higher density routes are recorded transiting eastbound and westbound between the two ports, with the westbound route intersecting the south of the East Anglia TWO windfarm site (approximately 22% of vessel tracks). However two lower density routes are also recorded using the Sunk TSS located within the south-west of the study area in both the eastbound and westbound lanes. It should be noted that vessels with a destination of Felixstowe and Rotterdam were also recorded transiting north of the East Anglia TWO windfarm site and the East Anglia ONE North windfarm site with one track recorded intersecting the northern boundary of the East Anglia TWO windfarm site. These vessel tracks were recorded during the winter period therefore are assumed to be deviations due to adverse weather conditions. One track recorded for the *Britannia Seaways* was transiting the route to Gdansk, Poland rather than Rotterdam or Felixstowe.

147. The Immingham to Rotterdam route provided by DFDS was recorded between the East Anglia THREE windfarm site and East Anglia ONE North windfarm site. AIS data recorded the same route however it should be noted that some vessel tracks intersected the East Anglia THREE windfarm site (approximately 2% of vessels on the route). Vessels with a destination of Immingham and Rotterdam were also recorded transiting through the East Anglia ONE windfarm site, East Anglia ONE North windfarm site and the East

Anglia TWO windfarm site. These are assumed to be due to adverse weather conditions. A small number of DFDS vessels transiting to Cuxhaven or with no destination information were also recorded on the route (approximately 1.36% of vessel tracks).

148. Vandelaar and Steenbank are both pilot stations for the port of Antwerp. The Immingham to Vandelaar route provided by DFDS is not reflected within the AIS data. However, the Immingham to Steenbank (Antwerp) route provided by DFDS was recorded as intersecting the East Anglia ONE North windfarm site. Within the AIS data, this route is recorded as transiting further to the west and intersecting both the East Anglia ONE North windfarm site and East Anglia ONE windfarm site.

149. The Rosyth to Zeebrugge route was recorded in the AIS data transiting the area between the East Anglia TWO windfarm site, East Anglia ONE windfarm site and East Anglia ONE North windfarm site with approximately 0.3% vessel tracks intersecting the East Anglia TWO windfarm site. It was announced by DFDS in April 2018 that they were closing this route.

150. *Table 12.2* presents details of the vessel routes recorded from the Met Mast AIS during 2017.

Table 12.2 DFDS Vessel Routes (Met Mast AIS Data, 2017)

Vessel	Route	Average Vessels per Day[2]
Gardenia Seaways	Rotterdam to Felixstowe	1
Corona Seaways		
Britannia Seaways		
Anglia Seaways		
Tulipa Seaways	Immingham to Rotterdam	2
Anglia Seaways		
Magnolia Seaways		
Ark Germania		
Britannia Seaways		
King Seaways		
Princess Seaways		
Corona Seaways		
Hafnia Seaways		
Fionia Seaways		

[2] Average number of vessels per day using the route based on their unique MMSIs broadcast via AIS.

Vessel	Route	Average Vessels per Day[2]
Jutlandia Seaways		
Gardenia Seaways		
Finlandia Seaways (operations now ceased)	Rosyth to Zeebrugge	1
Anglia Seaways	Immingham to Steenbank	1 every 20 days

151. The most frequently used DFDS route identified during 2017 was the Immingham to Rotterdam route with an average of two vessels recorded per day. The Immingham to Steenbank route was the least used with a vessel transit recorded only once every 20 days.

12.2.9 Miscellaneous Vessels

152. *Figure 12.18* presents a plot of miscellaneous vessels recorded within the shipping and navigation study area throughout the survey periods.

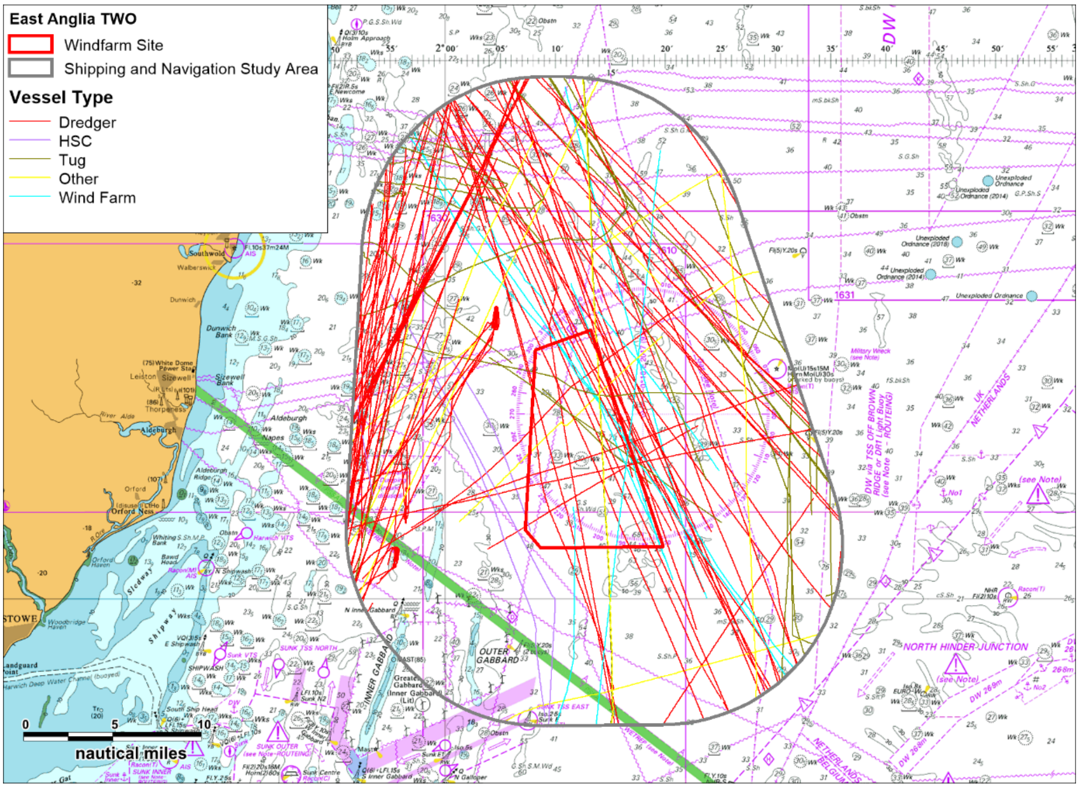


Figure 12.18 AIS and Radar Miscellaneous Vessels within the Shipping and Navigation Study Area (28 Days Summer and Winter 2017)

153. It can be seen that the majority of vessels transiting through the shipping and navigation study area were dredgers (64%), with vessels recorded transiting west of the shipping and navigation study area as well as through the East Anglia TWO windfarm site

while transiting to and from marine aggregate dredge areas. Tugs (16%), High Speed Craft (HSC) (5%), "other" vessels (9%) and windfarm associated vessels (7%) were also recorded. As previously mentioned, "other" vessels include those that are not large enough in quantity to be categorised separately, such as survey vessels, a training vessel and a buoy tender. The windfarm tracks exclude vessels associated with Greater Gabbard and Galloper.

12.2.10 Anchoring

154. This section presents analysis of the anchoring activity in the vicinity of the shipping and navigation study area. *Figure 12.19* presents a plot of the anchored vessels recorded during the combined summer and winter survey periods.

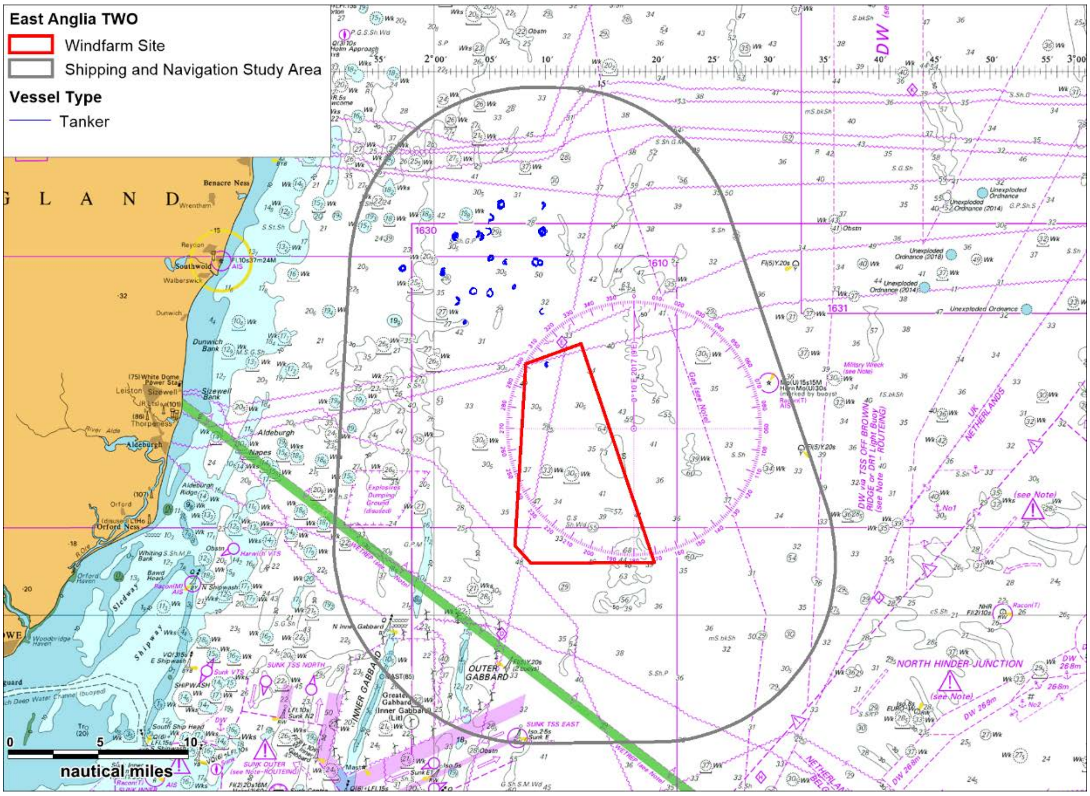


Figure 12.19 AIS and Radar Anchored Vessels within the Shipping and Navigation Study Area (28 Days Summer and Winter 2017)

155. A total of 18 tankers were recorded at anchor during the combined summer and winter survey periods. One tanker was recorded anchoring in the northern part of the East Anglia TWO windfarm site. As mentioned previously, there is a designated area of the UK territorial sea off the coast of Southwold where STS transfers are permitted therefore the anchored tankers within the shipping and navigation study area may have been undertaking a STS transfer or awaiting an STS transfer with another tanker (see section 12.2.5). Other tankers may have been anchored while awaiting further orders.

12.3 Additional Summer 2018 Analysis

156. This section presents the findings of the assessment of the summer 2018 marine traffic survey data combined with the winter 2017 data. Rather than assess the updated summer 2018 data individually, it has been combined with the winter 2017 data which remains valid to allow a direct comparison with the initial marine traffic analysis of the combined summer and winter 2017 data. Discussion of any observed changes in relation to the impact assessment is presented in section 14.

12.3.1 Vessel Count

157. For the 14 days analysed in summer 2018, there were an average of 63 unique vessels per day passing within the shipping and navigation study area, recorded on AIS and Radar. This is compared to an average of 74 unique vessels per day during summer 2017. In terms of vessels intersecting the East Anglia TWO windfarm site, there was an average of 14 unique vessels per day compared to 21 per day during summer 2017 (22% of unique vessels).

158. *Figure 12.20* presents the daily number of unique vessels passing through the shipping and navigation study area during summer 2018.

The busiest day was the 24th August 2018 when 87 unique vessels were recorded within the shipping and navigation study area. The quietest day recorded was the 19th August 2018, when 50 unique vessels were recorded within the shipping and navigation study area.

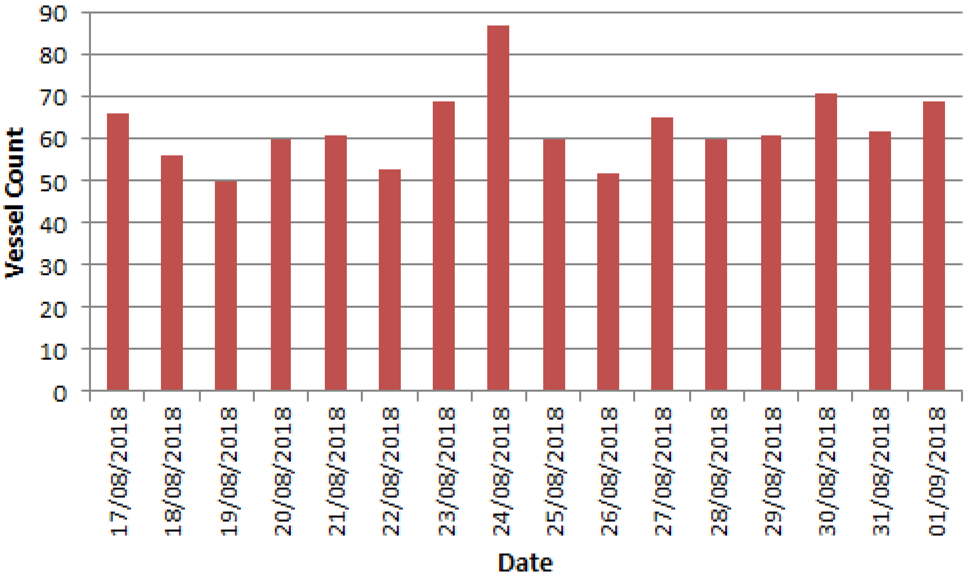


Figure 12.20 Unique Vessels per Day from AIS and Radar within Shipping and Navigation Study Area (14 Days Summer 2018)

12.3.2 Vessel Types

159. Tracks classified as temporary included survey vessels, guard vessels and vessels associated with the construction of the East Anglia ONE windfarm. These were therefore excluded from the following analysis.

160. Unlike the summer and winter 2017 surveys, it is noted that the construction of the Galloper Offshore Wind Farm was completed during the time of the summer 2018 survey. Vessels were recorded transiting to and from the Galloper and Greater Gabbard Offshore Wind Farms however these have been excluded from the summer 2018 traffic to enable the traffic to be comparable with summer 2017.

161. *Figure 12.21* presents the removed windfarm vessels and reveals their distribution is comparable to that recorded during summer and winter 2017 (see *Figure 12.3*).

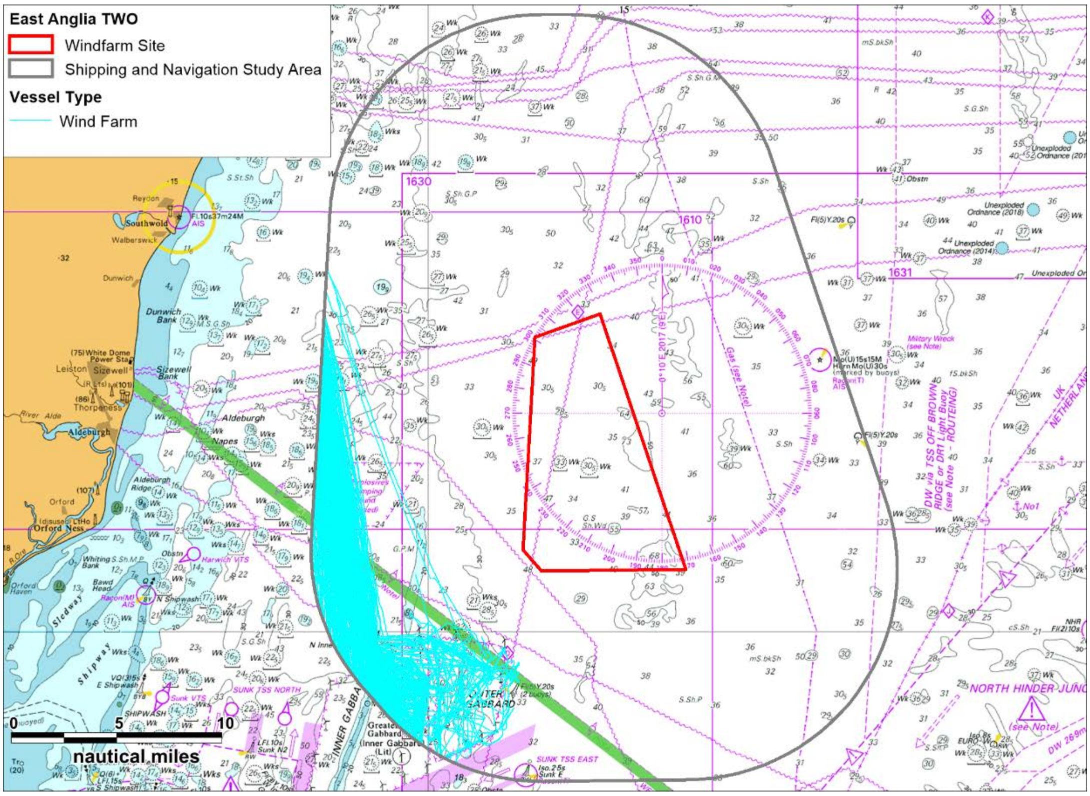


Figure 12.21 AIS and Radar Windfarm Vessels within Shipping and Navigation Study Area (14 Days Summer 2018)

162. *Figure 12.22* presents an overview of the AIS and Radar tracks (excluding temporary tracks and the above windfarm tracks) recorded within the shipping and navigation study area during the summer 2018 survey period, colour-coded by vessel type. Throughout the summer period 98% of tracks were recorded on AIS and 2% on Radar.

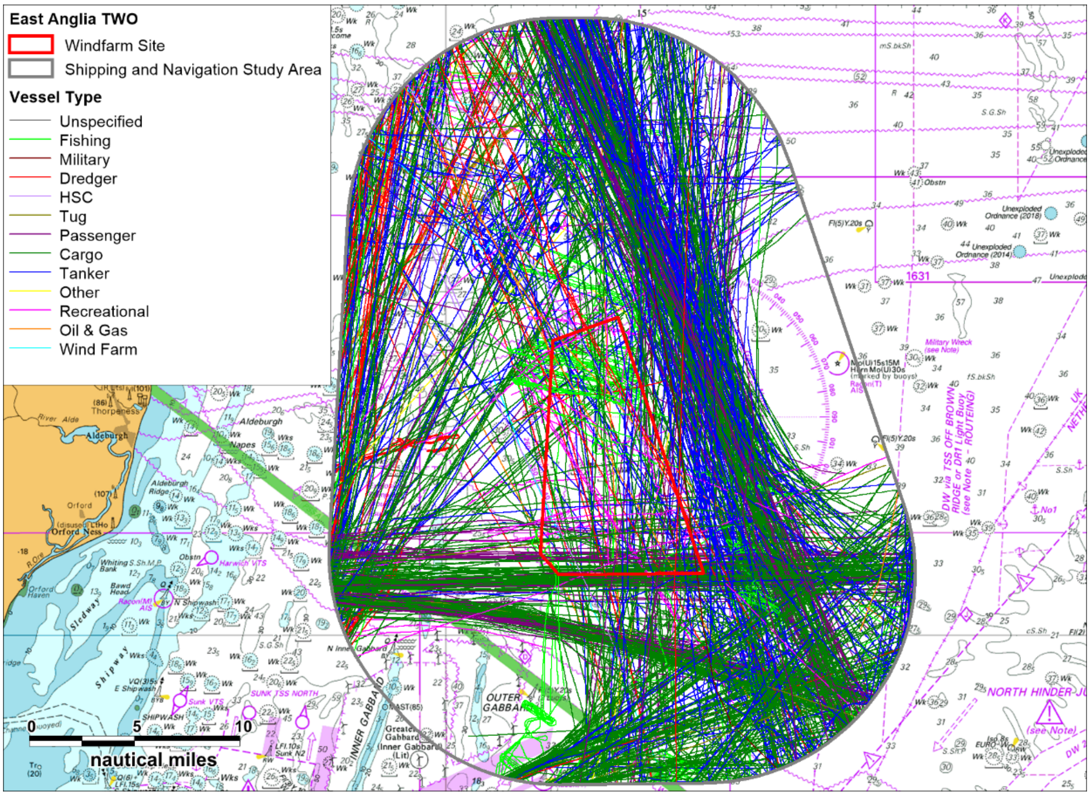


Figure 12.22 Overview of AIS and Radar Data within Shipping and Navigation Study Area Excluding Temporary Tracks (14 Days Summer 2018)

163. *Figure 12.23* presents analysis of the vessel types recorded within the shipping and navigation study area and intersecting the East Anglia TWO windfarm site during the survey period. The category of “other” vessels includes those that are not large enough in quantity to merit their own separate category such as transiting survey vessels, a dive vessel, a fishery patrol vessel and a Rapid Intervention Vessel (RIV).

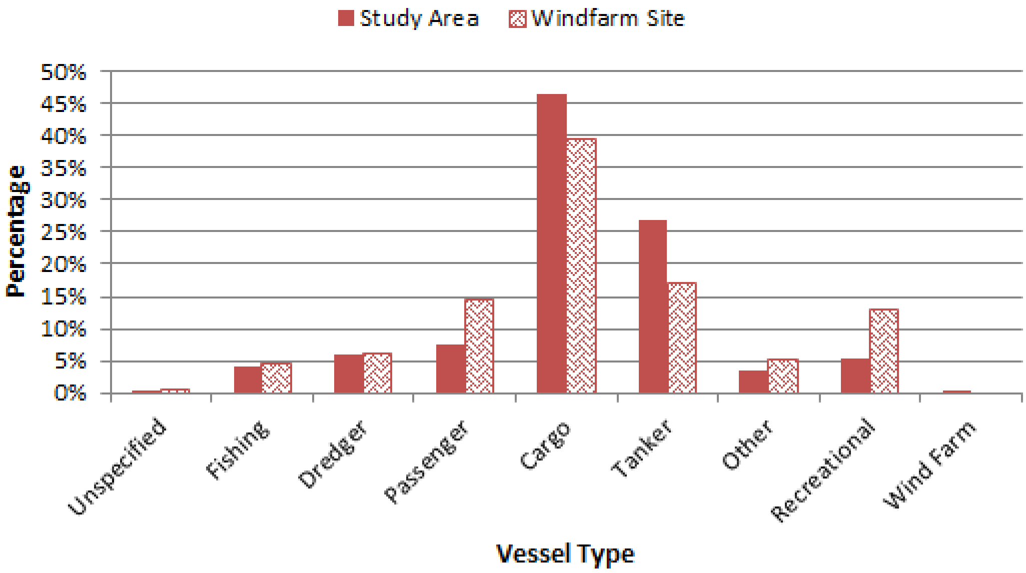


Figure 12.23 Distribution of Vessel Types within Shipping and Navigation Study Area (14 Days Summer 2018)

164. Overall, there was good correlation between the summer 2017 and summer 2018 data sets in terms of vessel type and the distribution of vessels within the shipping and navigation study area. In both 2017 and 2018, cargo vessels and tankers were the most commonly recorded vessel tracks within the shipping and navigation study area. However, there was a reduction in the number of recreational vessels recorded (14% within shipping and navigation study area during 2017 compared to 5% during 2018). This was due to the absence of the Vuurschephen and North Sea yacht races which were ongoing during the summer 2017 survey but absent during the summer 2018 survey due to the differing survey periods.

12.3.3 Vessel Density

165. *Figure 12.24* presents the vessel density (excluding temporary and windfarm tracks) recorded in the summer 2018 survey period. This is based on the number of track intersects per cell of a 1x1nm grid covering the shipping and navigation study area.

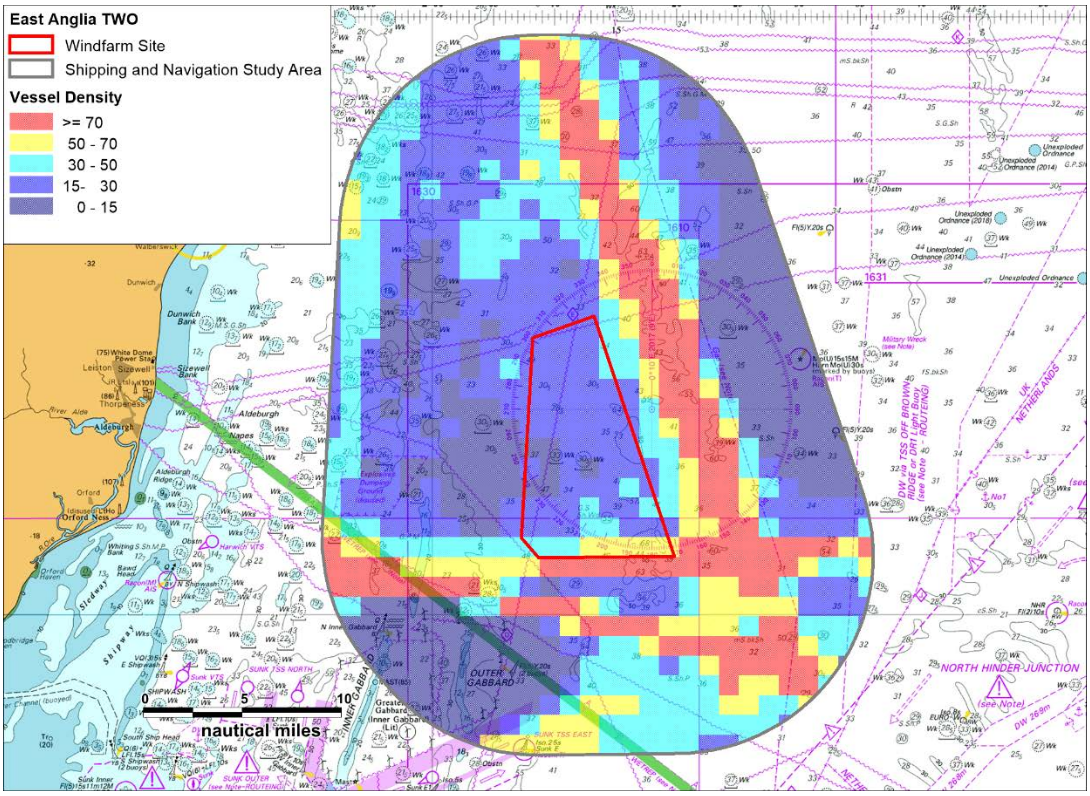


Figure 12.24 Vessel Density from AIS and Radar within Shipping and Navigation Study Area (14 Days Summer 2018)

166. The overall vessel density within the shipping and navigation study area during 2018 was observed to be higher than during 2017 (see section 12.2.3). This is particularly evident within the routeing to the east of the East Anglia TWO windfarm site. This is due to traffic deviating in order to avoid the construction of the East Anglia ONE windfarm site within the east of the shipping and navigation study area therefore traffic is being displaced west. As previously noted, vessels working on the construction of the East Anglia ONE windfarm site have been removed from the analysis therefore density within this area has reduced compared to summer 2017.

12.3.4 Cargo Vessels

167. During the combined summer 2018 and winter 2017 survey period, an average of 33 unique cargo vessels per day passed within the shipping and navigation study area (compared to 34 per day during summer and winter 2017).

168. Similar to that seen within the summer and winter 2017 survey, the majority of cargo vessels were transiting routes to the east and south of the East Anglia TWO windfarm site as well as the Sunk TSS within the south of the shipping and navigation study area.

169. Ro Ro cargo vessels with container capacity (35%) and general cargo vessels (35%) were the most frequently recorded cargo vessel type transiting through the shipping and navigation study area, followed by containerships (21%) and bulk carriers (6%).

12.3.5 Tankers

170. Throughout the combined summer 2018 and winter 2017 survey period, an average of 18 unique tankers per day passed within the shipping and navigation study area (compared to 19 per day during summer and winter 2017).

171. Similar to that seen within the summer and winter 2017 survey, it can be seen that the majority of tankers were transiting routes to the east of the East Anglia TWO windfarm site.

172. Combined chemical and oil tankers (35%) were the most frequently recorded tanker type transiting through the shipping and navigation study area, followed by Liquid Petroleum Gas (LPG) carriers (19%) and crude oil tankers (17%).

12.3.6 Oil and Gas Vessels

173. Throughout the combined summer 2018 and winter 2017, an average of one unique oil & gas vessel per day passed within the shipping and navigation study area (compared to one per day during summer and winter 2017).

12.3.7 Passenger Vessel Activity

174. Throughout the combined summer 2018 and winter 2017 survey period, an average of four unique passenger vessels per day passed within the shipping and navigation study area (compared to four per day during summer and winter 2017)

175. Similar to that seen within the summer and winter 2017 survey, regular passenger vessel transits were recorded to the east and south of the East Anglia TWO windfarm site. Vessels transiting between Hull and Zeebrugge (P&O Ferries) and Rotterdam and Harwich (Stena Line) were the most frequently recorded as was also seen during summer and winter 2017. It is noted that due to the construction of the East Anglia ONE windfarm site during the summer 2018 survey, passenger vessels transiting between Hull and Zeebrugge have been displaced further west towards the proposed East Anglia TWO windfarm site.

12.3.8 Miscellaneous Operational Vessels

176. The majority of miscellaneous vessels transiting through the shipping and navigation study area during the combined summer 2018 and winter 2017 period were dredgers (69%). This is comparable to the combined summer and winter 2017 period. As previously mentioned, “other” vessels include those that are not large enough in quantities to be categorised separately, such as survey vessels, a dive vessel, a fishery patrol vessel and an RIV.

12.3.9 Anchoring

177. A total of 19 vessels were recorded at anchor during the combined summer 2018 and winter 2017 survey period. Similar to the combined summer and winter 2017 survey period, these were mainly tankers to the north west of the East Anglia TWO windfarm site.

178. It should be noted that during summer 2018, three tankers identified as moored alongside anchored tankers have been included within the anchored vessel count as they were likely to have been moored in preparation to take part in an STS with an anchored tanker.

12.4 Fishing Vessel Activity

179. Fishing vessel activity recorded within the shipping and navigation study area during the summer and winter 2017 marine traffic surveys is presented in *Figure 12.25*, colour-coded by fishing gear type.

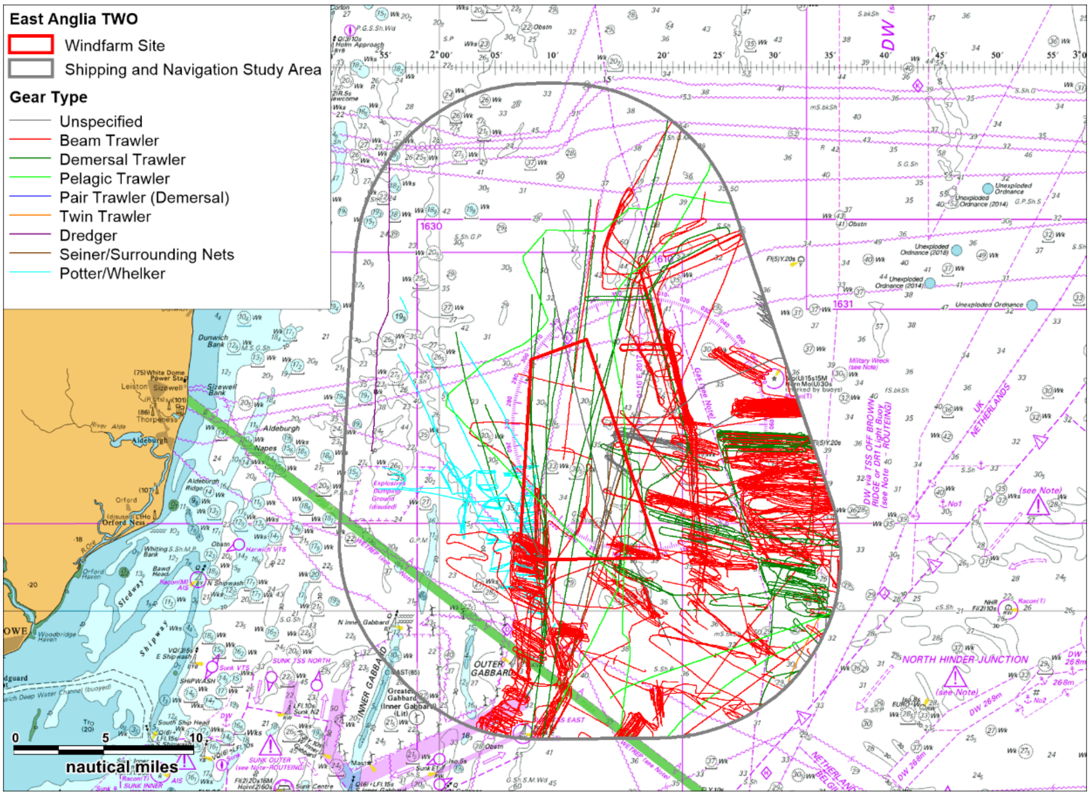


Figure 12.25 AIS and Radar Fishing Vessels within the Shipping and Navigation Study Area (28 Days Summer and Winter 2017)

180. *Figure 12.26* presents the distribution of fishing gear types. This was available for 90% of fishing vessels recorded within the shipping and navigation study area. Of the fishing methods identified, the most common were beam trawlers (59%) followed by demersal trawlers (17%). Other fishing methods recorded included pelagic trawlers

(5%), potter / whelkers (5%) and seiner / surrounding nets (3%). Demersal pair trawlers, twin trawlers and dredgers each accounted for 1% of fishing methods recorded

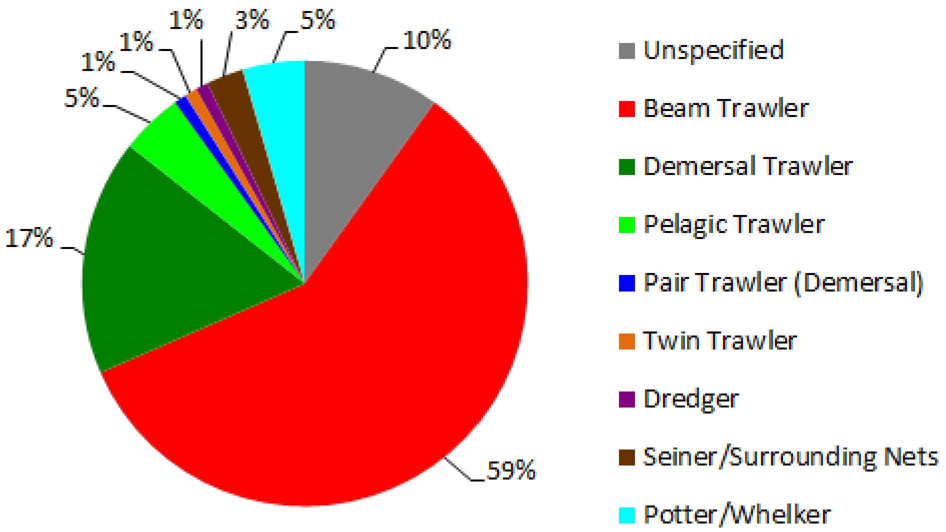


Figure 12.26 Distribution of Fishing Gear Types (Summer and Winter 2017)

181. An average of three unique fishing vessels per day were recorded within the shipping and navigation study area during summer 2017 and an average of five unique fishing vessels were recorded during winter 2017. An average of three unique vessels per day was recorded within the East Anglia TWO windfarm site during summer 2017 and an average of two unique vessels every two days during winter 2017. It can be seen that fishing vessels recorded were recorded engaged in fishing activity and transiting through the shipping and navigation study area.

182. Flag state (nationality) information was available for approximately 98% of fishing vessels recorded within the shipping and navigation study area with the 2% of unspecified nationalities corresponding to Radar tracks. Of the nationalities identified, the most common was the Netherlands (65%) followed by the UK (15%) and France (14%). Other nationalities recorded included Germany, Spain, Norway and Russia, each of which accounted for 1%.

183. *Figure 12.27* presents the tracks recorded during summer 2018 and winter 2017.

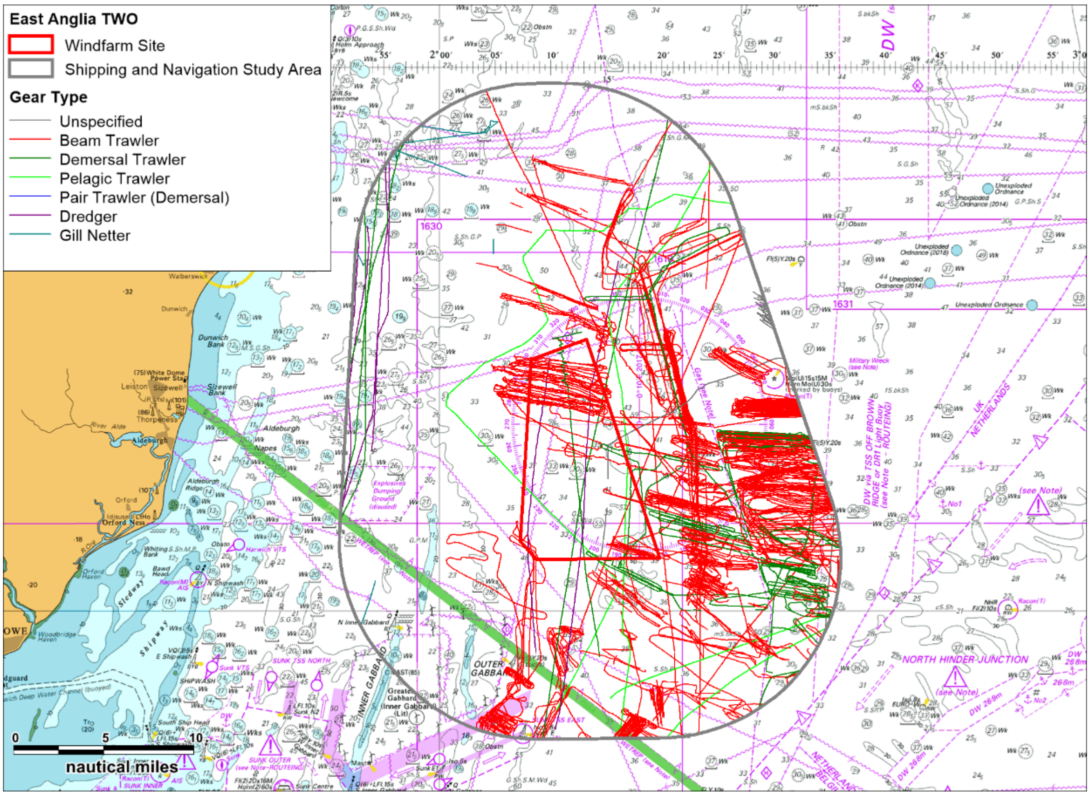


Figure 12.27 AIS and Radar Fishing Vessels within the Shipping and Navigation Study Area (28 Days Summer 2018 and Winter 2017)

184. An average of three unique fishing vessels per day were recorded within the shipping and navigation study area during summer 2018. An average of two unique vessels every three days were recorded within the East Anglia TWO windfarm site.

185. There has been no change in the average number of unique vessels recorded within the shipping and navigation study area and a reduction in the number of vessels intersecting the East Anglia TWO windfarm site between the summer 2017 and summer 2018 survey periods. Fishing vessel gear types and nationalities recorded were similar between the two surveys, with Dutch beam trawlers the most commonly recorded. Vessels actively engaged in fishing were recorded within the East Anglia TWO windfarm site during both 2017 and 2018 however activity was within the south west corner of the site during 2017 compared to the north of the site during 2018. It should be noted that fishing vessel activity can vary year to year depending on fish movements and stock levels.

12.5 Recreational Vessel Activity

186. Recreational vessel activity recorded within the shipping and navigation study area during the summer 2017 and winter 2017 marine traffic surveys is presented in *Figure 12.28*, colour-coded by subtype categories. As per Recreational Craft Regulation 2013 (Directive 2013/53/EU), sailing vessels and motor craft recorded as between 2.5 and 24m in length have been classed as recreational vessels.

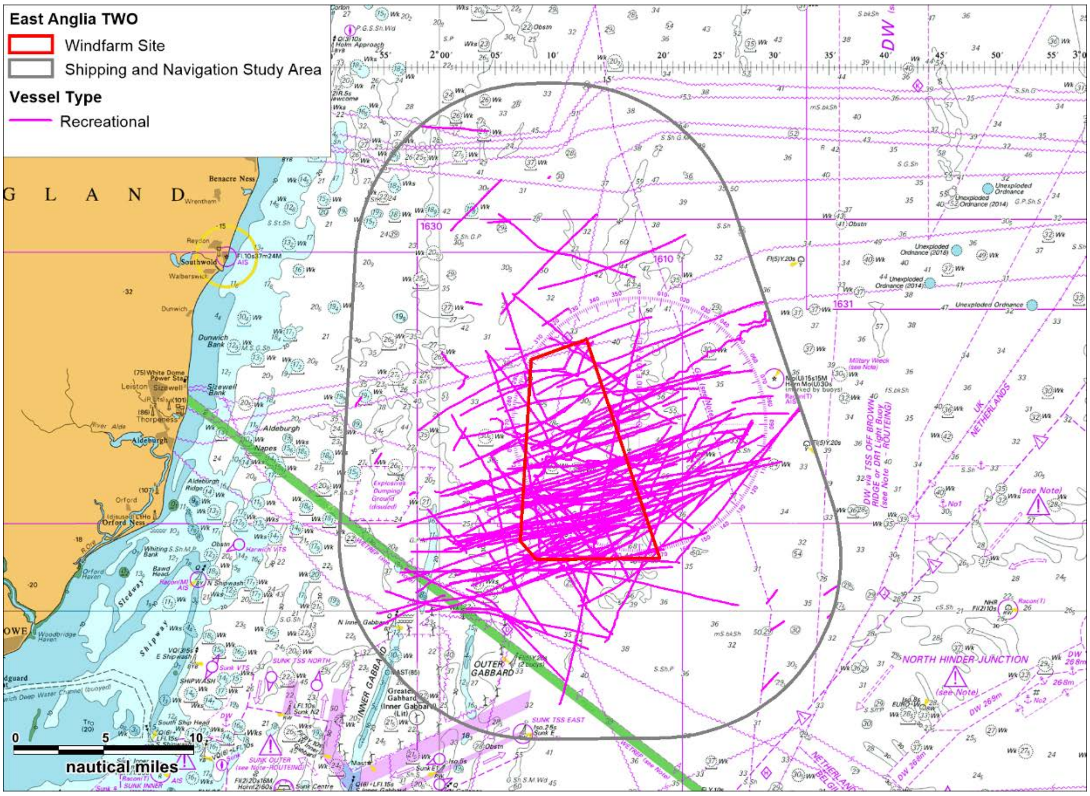


Figure 12.28 AIS and Radar Recreational Vessels within the Shipping and Navigation Study Area (28 Days Summer and Winter 2017)

187. An average of 11 unique recreational vessel transits per day were recorded within the shipping and navigation study area during the summer 2017 period compared to only two unique vessels in total during the entire winter 2017 fortnight (AIS only). An average of seven unique vessels per day were recorded within the East Anglia TWO windfarm site during summer 2017 and a total of one recorded during winter 2017. The majority of recreational vessels recorded were sailing vessels (92%).

188. It should be noted that during summer 2017, two races passed through or in proximity to the East Anglia TWO windfarm site. These were the Vuurschepen yacht race between Scheveningen and Harwich on the 27th and 28th May 2017 and the North Sea yacht race between Harwich and Scheveningen on 30th May 2017. Therefore it is likely that the activity was inflated above typical levels, with vessels transiting to the start point in the days preceding the event, and running the course on the day of the race itself.

189. The tracks recorded during summer 2018 and winter 2017 are presented in *Figure 12.29*.

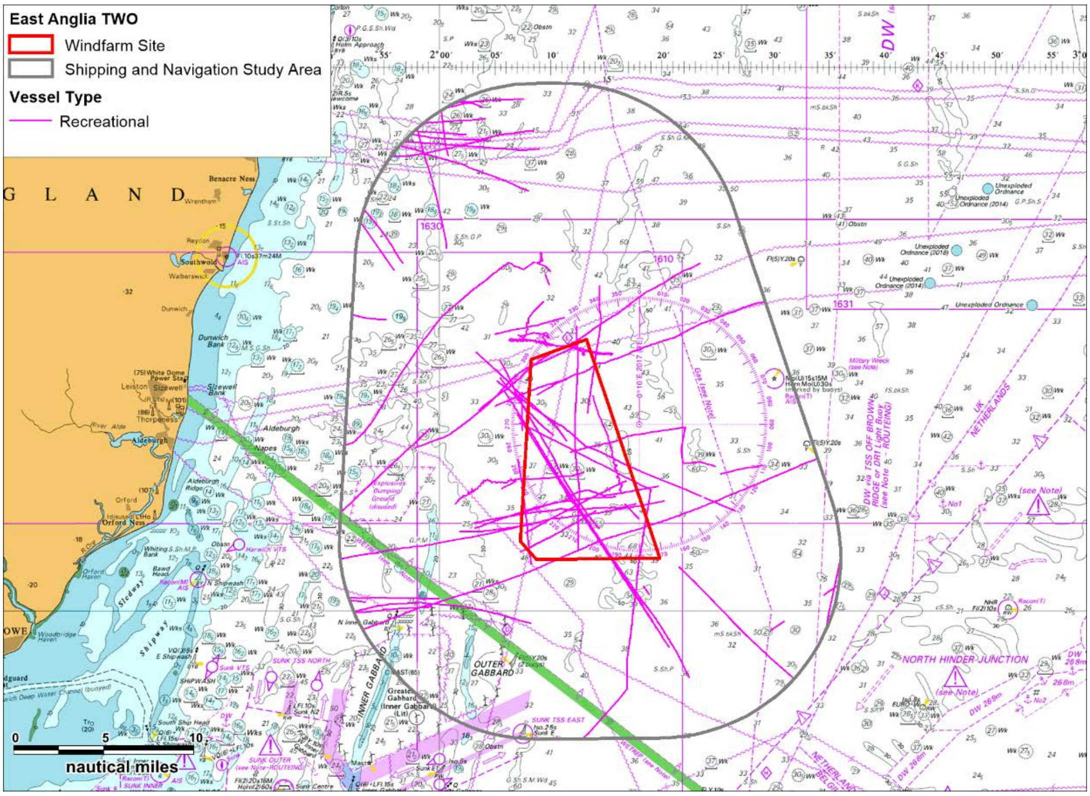


Figure 12.29 AIS and Radar Recreational Vessels within the Shipping and Navigation Study Area (28 Days Summer 2018 and Winter 2017)

190. An average of three unique recreational vessel transits per day were recorded within the shipping and navigation study area during the summer 2018 period. An average of two unique vessels per day were recorded within the East Anglia TWO windfarm site during summer 2018. The majority of recreational vessels recorded were sailing vessels (79%).

191. Comparing the 2017 and 2018 summer data, there was a decrease in the number of recreational vessels recorded. This is due to the summer 2018 survey being later in the year than the summer 2017 survey therefore recreational transits involved in racing were not recorded as they were during 2017.

12.5.1 RYA Coastal Atlas

192. The RYA Coastal Atlas (RYA, 2016) is presented relative to the East Anglia TWO windfarm site in *Figure 12.30*. This includes a recreational density grid up to the 12nm UK territorial limit and the locations of clubs, training centres and marinas. To illustrate offshore routeing, the coastal atlas also provides offshore route indicators showing typical recreational routes.

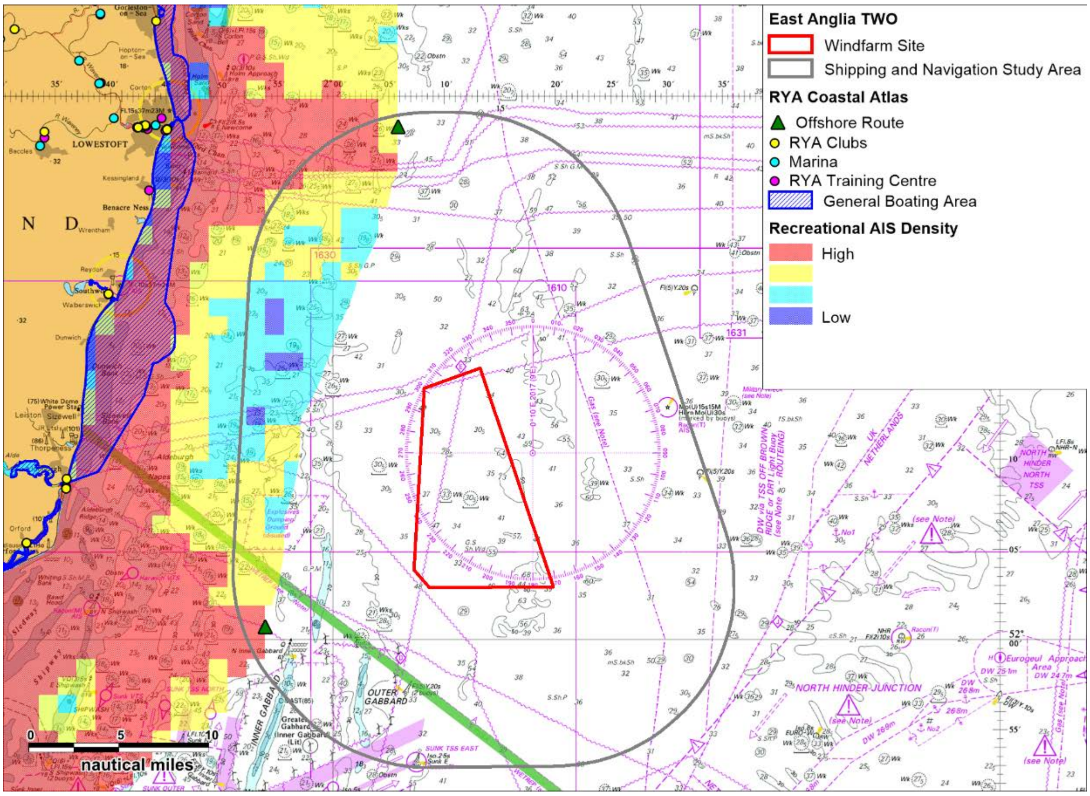


Figure 12.30 RYA Coastal Atlas (2016)

Higher recreational density was observed to be largely coastal, with the west of the shipping and navigation study area categorised as low to medium intensity. There are two offshore route indicators within the shipping and navigation study area, both operating in an eastbound direction.

12.6 Comparison with Summer 2017 Data

193. The key difference between the two summer surveys was observed to be a decreased number of vessels during the summer 2018 survey (63 unique vessels per day in summer 2018 compared to 74 in 2017). This was observed to be due to the following:

- A decrease in recreational vessels within the shipping and navigation study area (no races during 2018 period); and
- Displacement of traffic due to the construction of the East Anglia ONE windfarm site.

194. The vessel density recorded during summer 2018 was higher to the east and south of the East Anglia TWO windfarm site than that recorded during summer 2017. As discussed in section 12.3.3, this is due to the displacement of traffic which previously routed through the sea area where the East Anglia ONE windfarm is being constructed. Construction of the windfarm was not underway during summer 2017.

195. As per section 14, no findings associated with the summer 2018 survey validation exercise are deemed as affecting the outcome of the assessment within the PEIR, and thus the impact assessment in *Chapter 14 Shipping and Navigation* remains unchanged from the PEIR stage.

13 Offshore Cable Corridor Marine Traffic Survey

13.1 Introduction

196. This section presents analysis of marine traffic survey data recorded within the offshore cable corridor study area. As noted in section 3.6.2, the offshore cable corridor study area was initially defined to include the most up to date boundary of the offshore cable corridor available at the time. Since the PEIR stage, the offshore cable corridor has been altered due to the reduction in the East Anglia TWO windfarm site boundary. This new section is therefore not included within the offshore cable corridor study area; however the limited spatial extent of the change means there is negligible impact on the assessment undertaken at the PEIR stage. Regardless, the shipping and navigation study area does capture the affected area.

197. The summer and winter 2017 marine traffic survey data sets used for the analysis was the same as that in section 12 for the East Anglia TWO windfarm site. As per the site analysis, an additional summer 2018 data set has been used to validate the findings of the PEIR and associated draft of the NRA (see section 12.1).

198. It should be noted that due to the distance of the windfarm from shore, the marine traffic survey data collected within the East Anglia TWO windfarm site did not provide good coverage of the entirety of the offshore cable corridor. Therefore, the summer and winter 2017 survey data has been supplemented with AIS data collected from onshore receivers to ensure comprehensive coverage of the entire offshore cable corridor. AIS data collected from the marine coordinator for the East Anglia ONE windfarm site (based in Lowestoft) provided good coverage of the offshore cable corridor study area therefore has been used for the summer 2018 analysis.

13.2 Summer and Winter 2017 Analysis

13.2.1 Vessel Counts

199. For the 14 days analysed in summer 2017, there was an average of 43 unique vessels per day passing within the offshore cable corridor study area, recorded on AIS and Radar. In terms of vessels intersecting the offshore cable corridor, there was an average of 33 unique vessels per day.

200. *Figure 13.1* presents the daily number of unique vessels passing through the offshore cable corridor study area during summer 2017.

201. The busiest day recorded throughout the summer survey period was the 28th May 2017 when 66 unique vessels were recorded within the offshore cable corridor study area.

202. The quietest day recorded throughout the summer survey period was the 18th June 2017 when 32 unique vessels were recorded within the offshore cable corridor study area.

203. Throughout the summer survey period, 70% of traffic recorded within the offshore cable corridor study area intersected the offshore cable corridor.

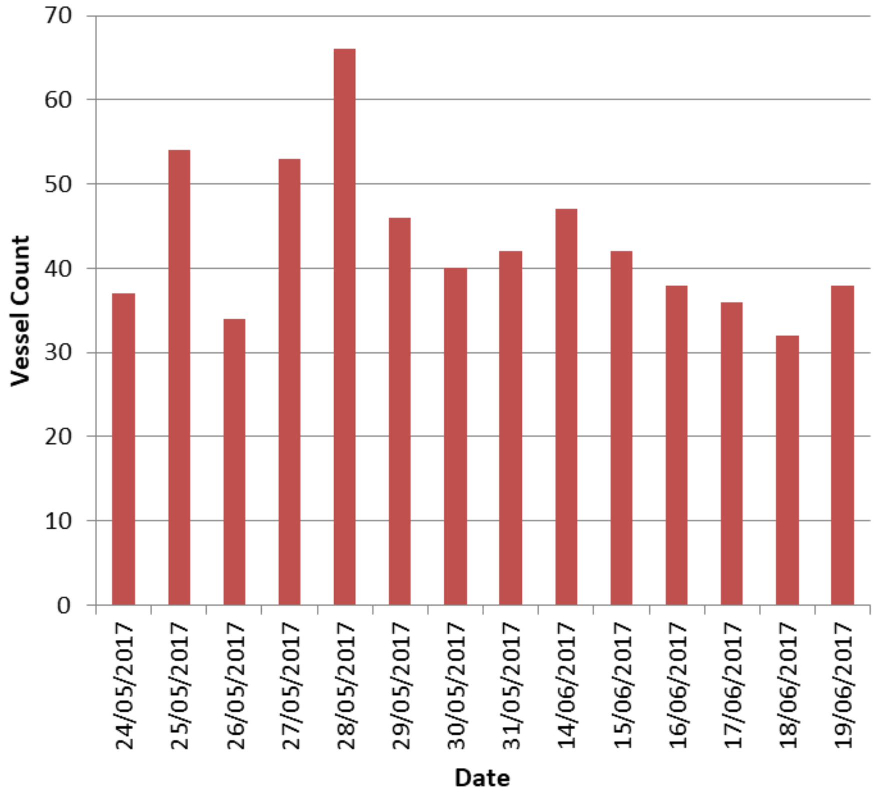


Figure 13.1 Unique Vessels per Day from AIS and Radar within Offshore Cable Corridor Study Area (14 Days Summer 2017)

204. For the 14 days analysed in winter 2017, there was an average of 31 unique vessels per day passing within the offshore cable corridor study area, recorded on AIS. In terms of vessels intersecting the offshore cable corridor, there was an average of 23 unique vessels per day.

205. *Figure 13.2* presents the daily number of unique vessels passing through the offshore cable corridor study area during winter 2017.

206. The busiest days recorded throughout the winter survey period were the 24th November 2017 and 25th November 2017 when 38 unique vessels were recorded within the offshore cable corridor study area.

207. The quietest day recorded throughout the winter survey period was the 29th November 2017 when 18 unique vessels were recorded within the offshore cable corridor study area.

208. Throughout the winter survey period, 64% of traffic recorded within the offshore cable corridor study area intersected the offshore cable corridor.

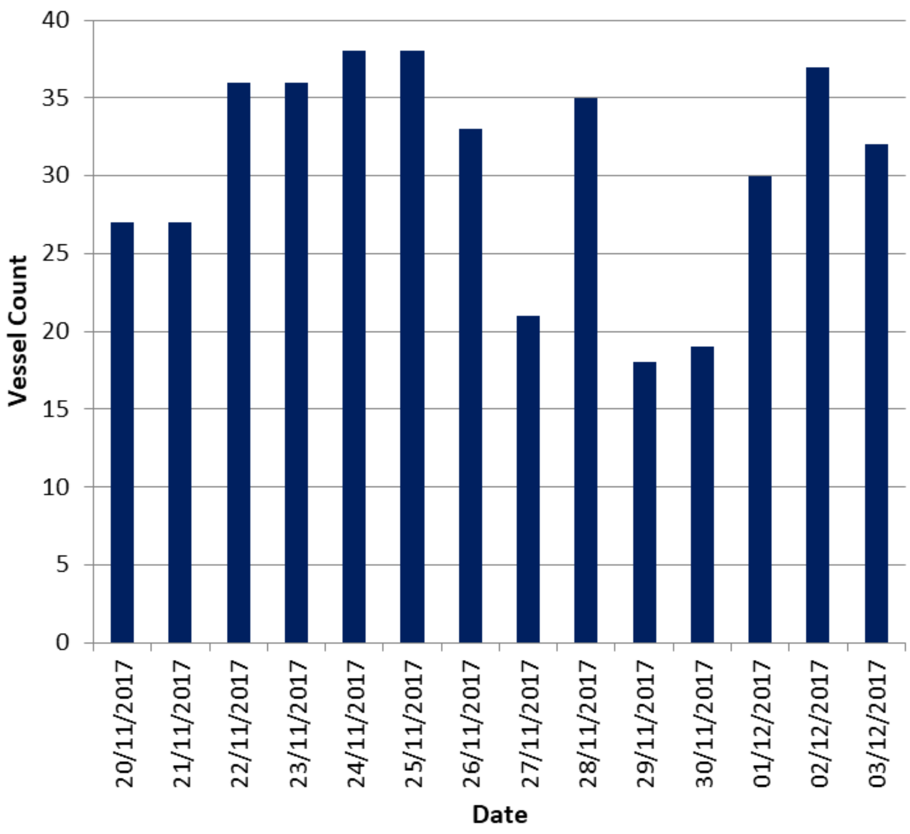


Figure 13.2 Unique Vessels per Day from AIS within Offshore Cable Corridor Study Area (14 Days Winter 2017)

13.2.2 Vessel Types

209. A number of tracks recorded during the summer and winter 2017 surveys were classified as temporary (non-routine), such as the tracks of survey vessels and a cable guard vessel. These have therefore been excluded from the analysis.

210. Marine traffic associated with the nearby Greater Gabbard Offshore Wind Farm and Galloper Offshore Wind Farm was also recorded during the summer and winter 2017 periods. These tracks consisted of traffic involved in the construction of the Galloper Offshore Wind Farm and the operation and maintenance of the Greater Gabbard Offshore Wind Farm. These tracks have been excluded from the main analysis given that operational traffic would be reduced (noting that Greater Gabbard Offshore Wind Farm is understood to have required extended maintenance post construction), which may skew the analysis of regular traffic as it is difficult to define whether or not they are temporary tracks. However, given that the vessels recorded provide an indication of operational requirements (in particular likely vessel routeing from Lowestoft), these vessels have still been assessed separately.

211. *Figure 13.3* presents a plot of temporary windfarm vessels recorded within the offshore cable corridor study area on AIS and Radar throughout both the summer and winter survey periods.

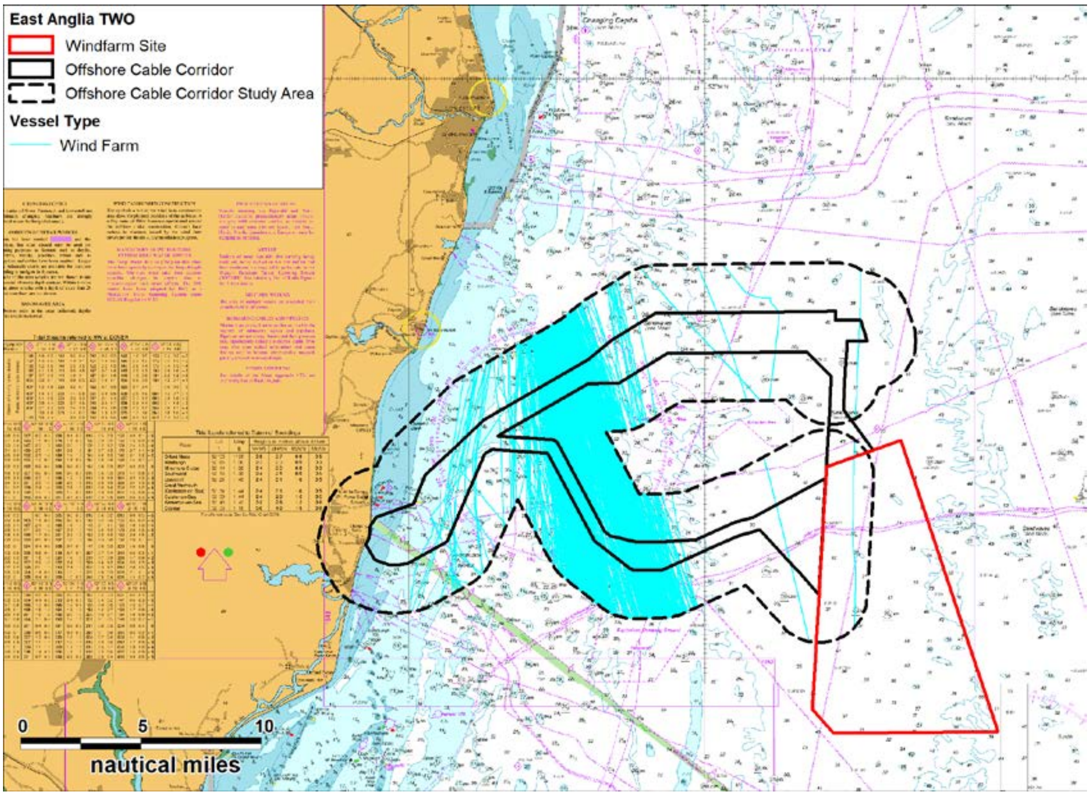


Figure 13.3 AIS and Radar Windfarm Vessels within Offshore Cable Corridor Study Area (28 Days Summer and Winter 2017)

212. During the combined summer and winter survey period, an average of 14 unique windfarm vessels were recorded within the offshore cable corridor study area.

213. It can be seen that the windfarm vessels were recorded within the centre of the offshore cable corridor study area, transiting to and from the Greater Gabbard and Galloper Offshore Wind Farms.

214. It should be noted that windfarm traffic transiting through the offshore cable corridor study area to other windfarms outside the study area has been retained within the analysis.

215. Plots of vessel tracks recorded within the shipping and navigation study area during the summer and winter 2017 period (excluding temporary tracks as defined above), colour-coded by vessel type, are presented in *Figure 13.4* and *Figure 13.5,* respectively. Throughout the summer period, 98% of tracks were recorded on AIS and 2% on Radar.

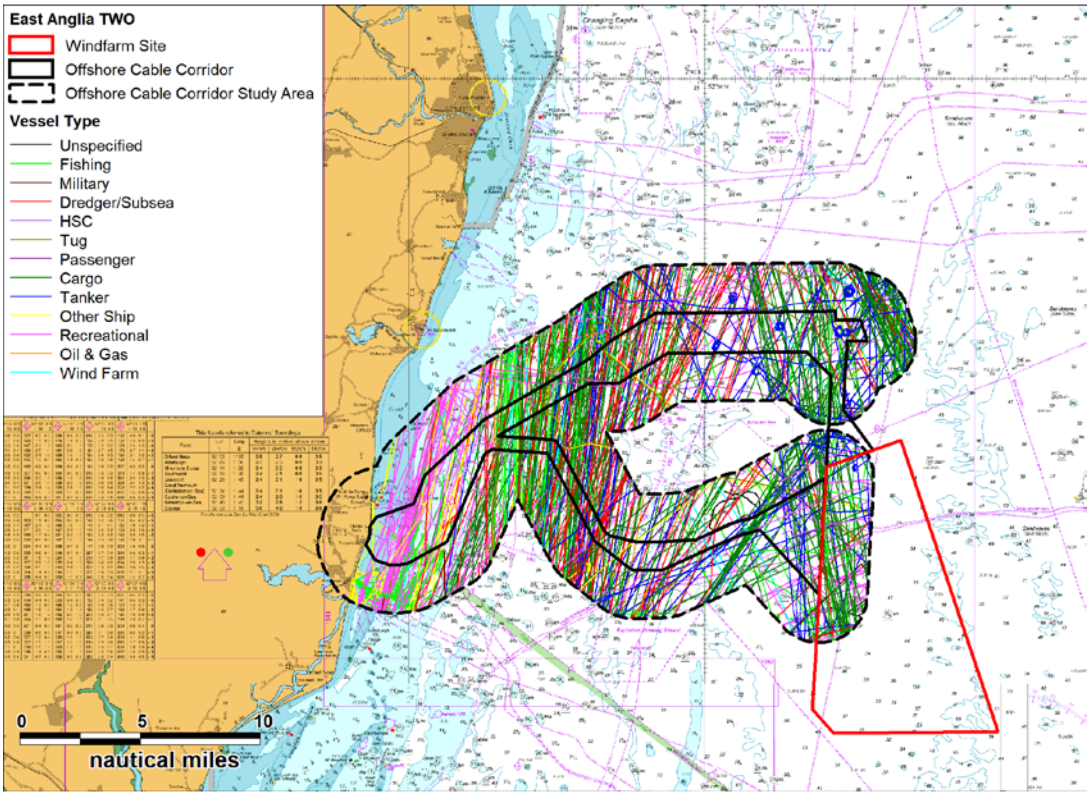


Figure 13.4 Overview of AIS and Radar Data Excluding Temporary Tracks (14 Days Summer 2017)

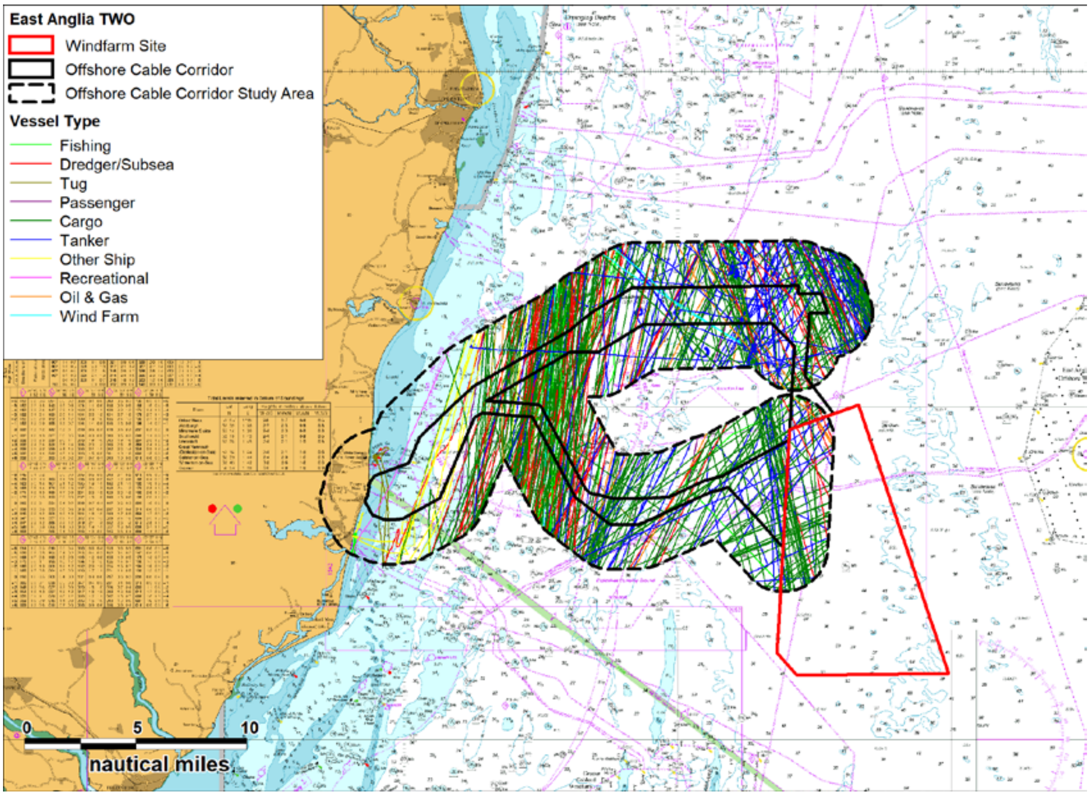


Figure 13.5 Overview of AIS Data Excluding Temporary Tracks (14 Days Winter 2017)

216. The vessel types recorded passing within the offshore cable corridor study area and the offshore cable corridor throughout both survey periods are summarised in *Figure 13.6.* The category of "other" vessels includes those that are not large enough in number to be categorised separately, such as transiting survey vessels, a floating crane, a guard vessel, a dive vessel, a law enforcement vessel, a workboat, a barge vessel, a motorboat, a buoy-laying vessel, RNLI lifeboats, a buoy tender and a training vessel.

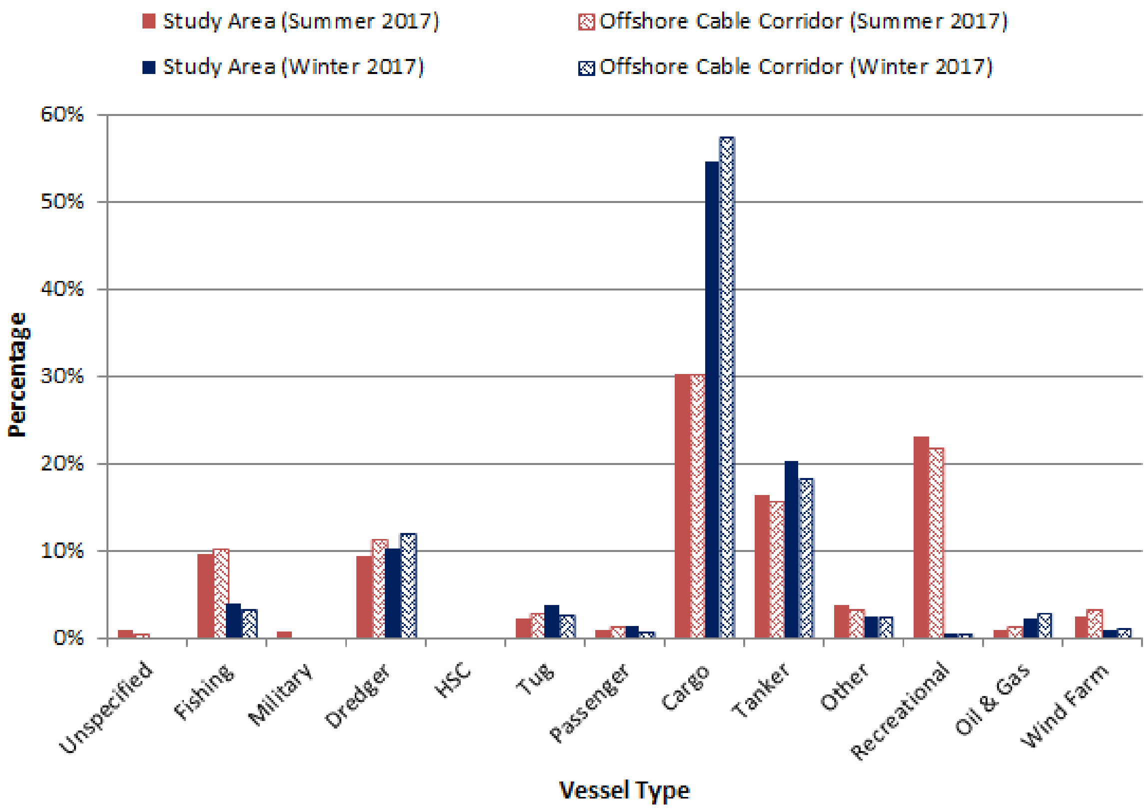


Figure 13.6 Distribution of Vessel Types within Offshore Cable Corridor Study Area (28 Days Summer and Winter 2017)

217. Throughout the summer period, the majority of tracks recorded on AIS and Radar in the offshore cable corridor study area were cargo vessels (30%) and recreational vessels (23%). Throughout the winter period the majority of tracks on AIS in the offshore cable corridor study area were cargo vessels (55%) and tankers (20%). It should be noted that the cargo vessel category includes Ro Ro cargo ferries (e.g. Stena Line) operating in the offshore cable corridor study area.

218. Approximately 1% of tracks recorded within the offshore cable corridor study area throughout the summer survey period were unspecified vessels. These consisted of Radar tracks from which vessel types could not be identified.

13.2.3 Vessel Density

219. *Figure 13.7* and *Figure 13.8* present the vessel density (excluding temporary tracks) recorded in the summer and winter 2017 survey periods, respectively. These are based on the number of track intersects per cell of a 1x1nm grid covering the shipping and navigation study area. To allow direct comparison between the summer and winter periods, the same density ranges have been used in both figures.

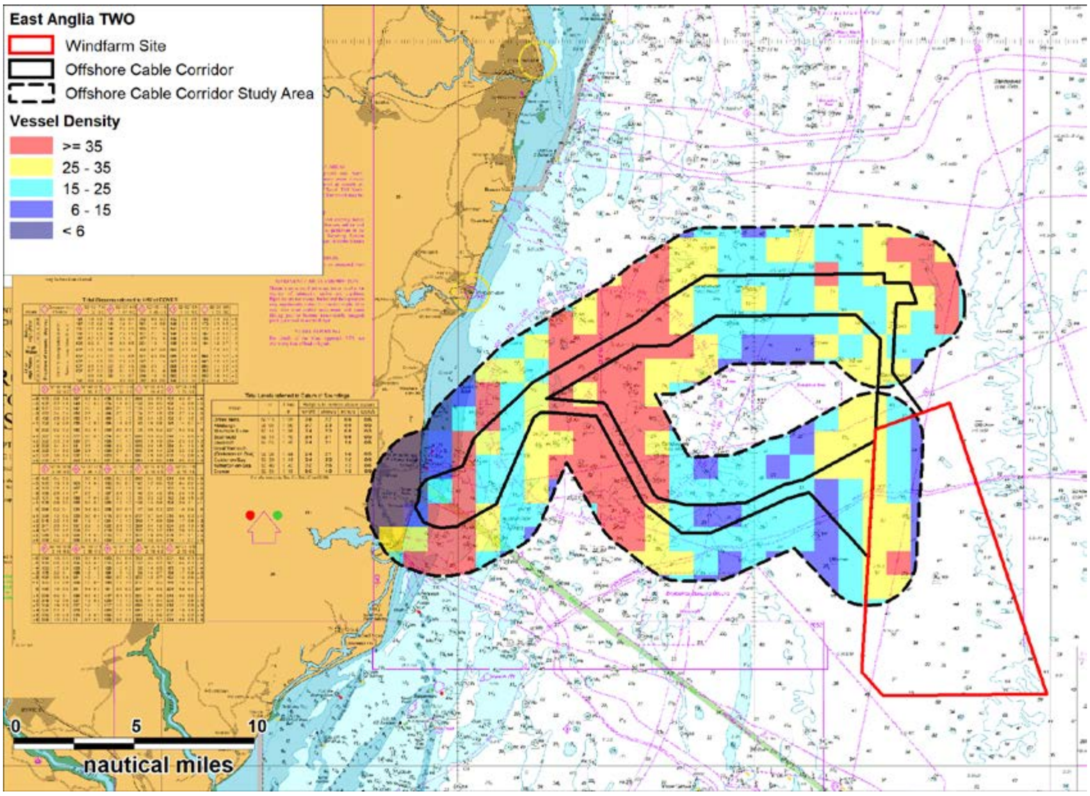


Figure 13.7 Vessel Density from AIS and Radar within Offshore Cable Corridor Study Area (14 Days Summer 2017)

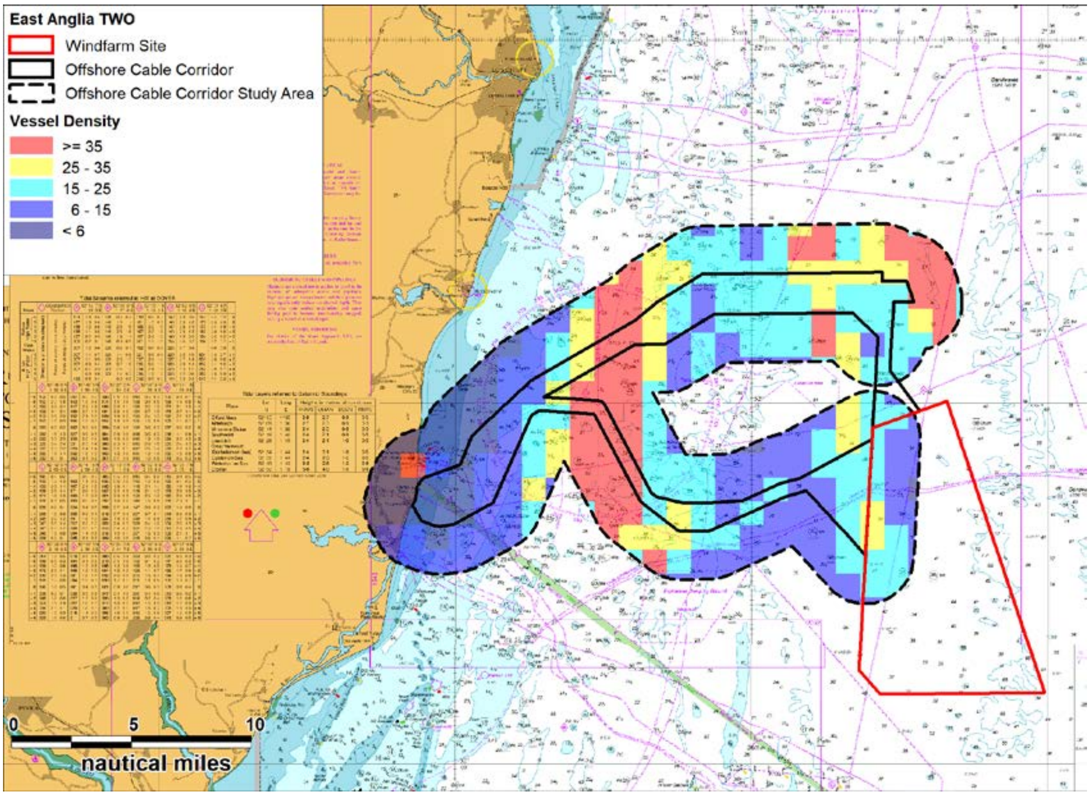


Figure 13.8 Vessel Density from AIS within Offshore Cable Corridor Study Area (14 Days Winter 2017)

220. During the summer and winter periods, the highest density areas were observed within the sea area where the offshore cable corridor branches into two. This was due to high numbers of cargo vessels and tankers recorded transiting northbound and southbound.

221. The vessel density within the offshore cable corridor was observed to be higher during summer than winter. This was due to a higher number of recreational craft and fishing vessels recorded during the summer, particularly nearshore.

13.2.4 Cargo Vessels

222. *Figure 13.9* presents a plot of cargo vessels recorded within the offshore cable corridor study area throughout the survey periods. It should be noted that commercial ferries (Ro Ro cargo) are included.

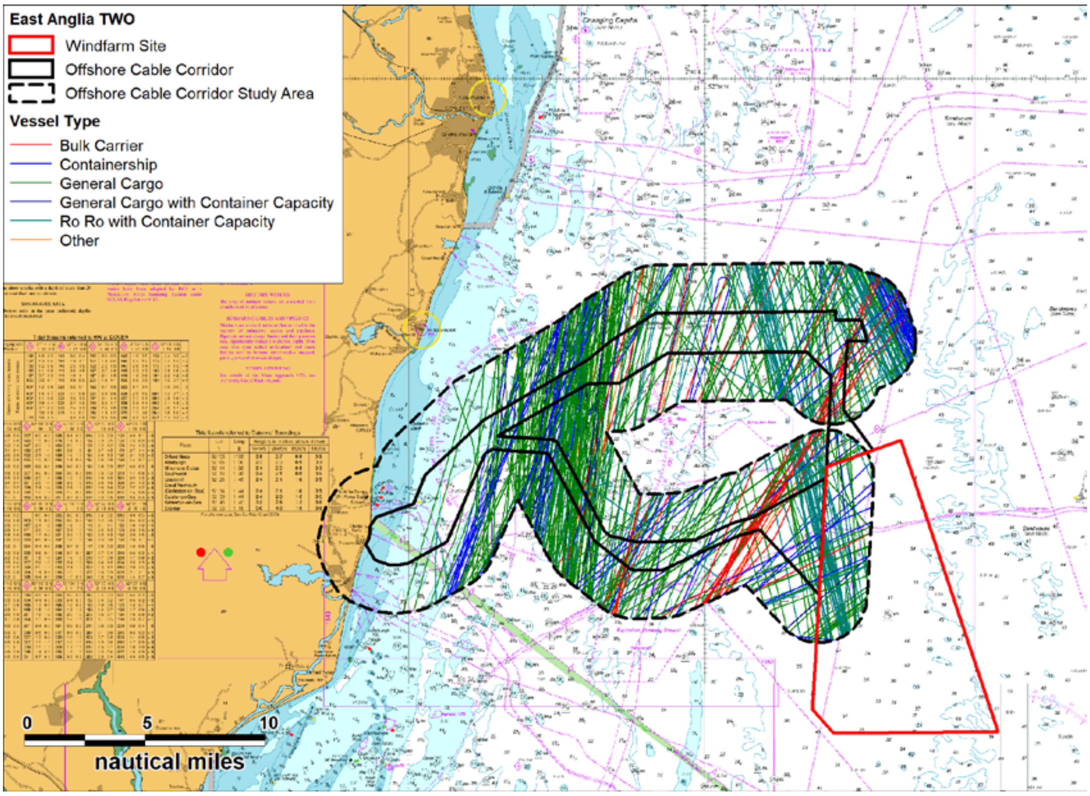


Figure 13.9 AIS and Radar Cargo Vessels by Sub Type within the Offshore Cable Corridor Study Area (28 Days Summer and Winter 2017)

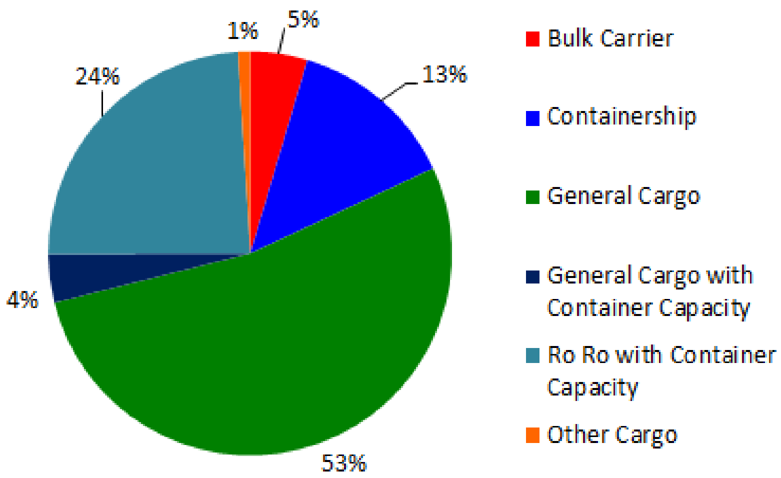


Figure 13.10 Distribution of Main Cargo Vessel Subtypes

223. Throughout the combined summer and winter survey period, an average of 15 unique cargo vessels per day passed within the offshore cable corridor study area.

13.2.5 Tankers

224. *Figure 13.11* presents a plot of tankers recorded within the offshore cable corridor study area throughout the survey periods.

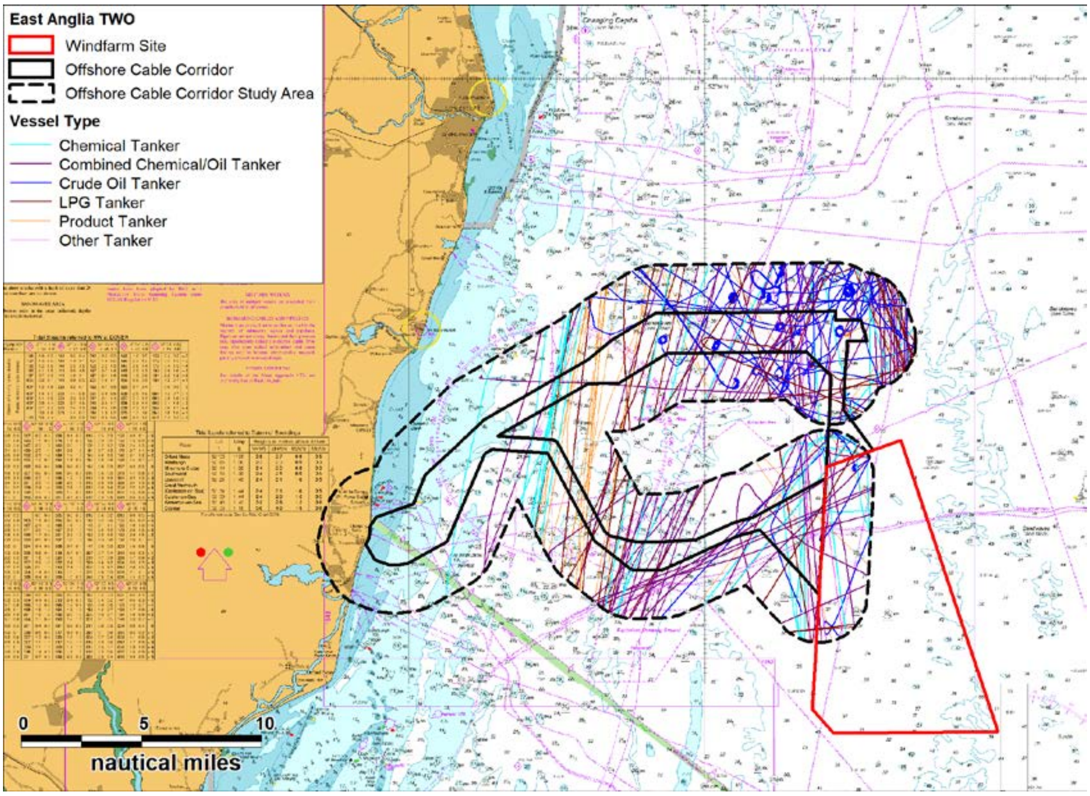
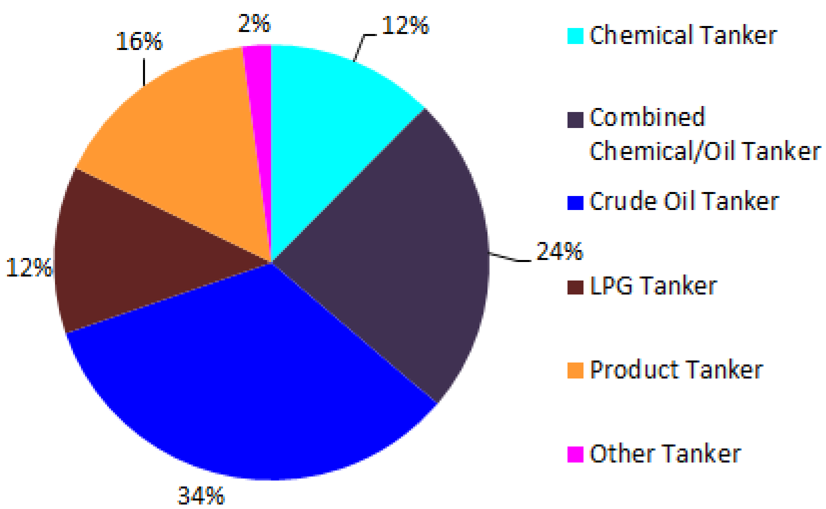


Figure 13.11 AIS and Radar Tankers within the Offshore Cable Corridor Study Area (28 Days Summer and Winter 2017)



225. Throughout the combined summer and winter survey period, an average of seven unique tankers per day passed within the offshore cable corridor study area.

226. Crude oil tankers (34%) were the most frequently recorded tanker type transiting through the offshore cable corridor study area, followed by combined chemical and oil tankers (24%) and product tankers (16%).

13.2.6 Oil and Gas Vessels

Figure 13.12 presents a plot of oil & gas associated vessels recorded within the offshore cable corridor study area throughout the survey periods.

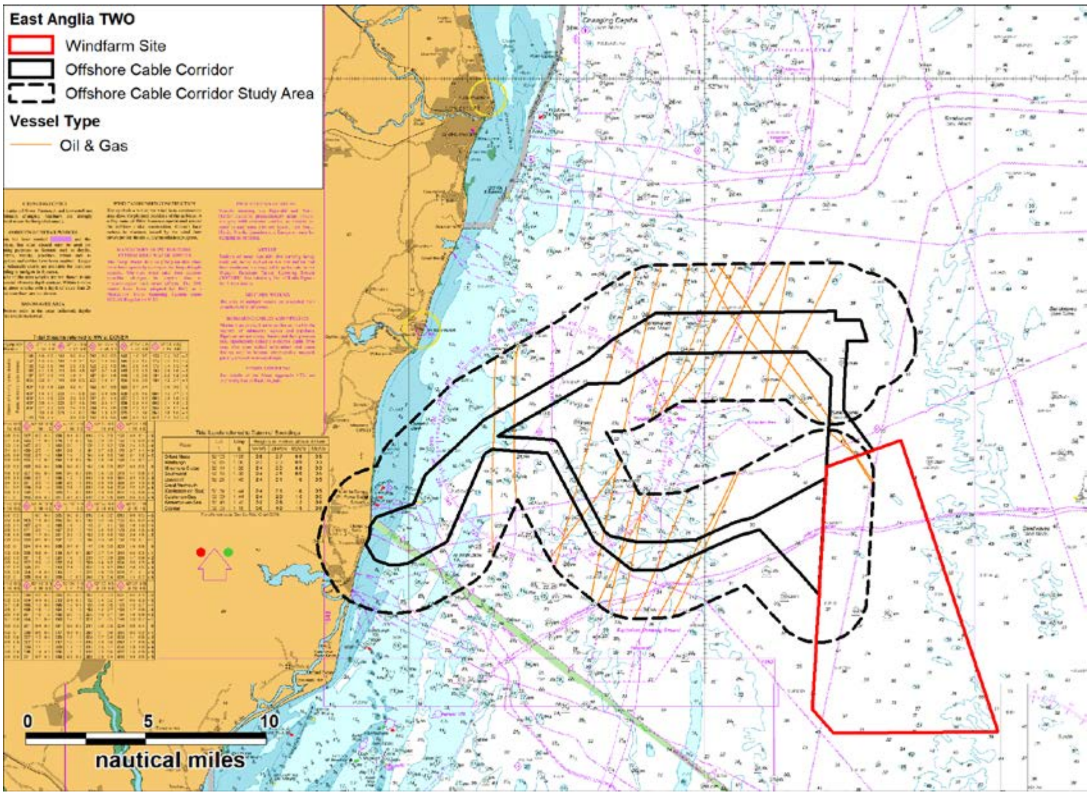


Figure 13.12 AIS and Radar Oil & Gas Vessels within the Offshore Cable Corridor Study Area (28 Days Summer and Winter 2017)

227. During the combined summer and winter survey period, an average of one unique oil & gas vessel every three days passed within the offshore cable corridor study area.

13.2.7 Passenger Vessel Activity

228. *Figure 13.13* presents a plot of passenger vessels recorded within the offshore cable corridor study area on AIS and Radar throughout both the summer and winter survey periods.

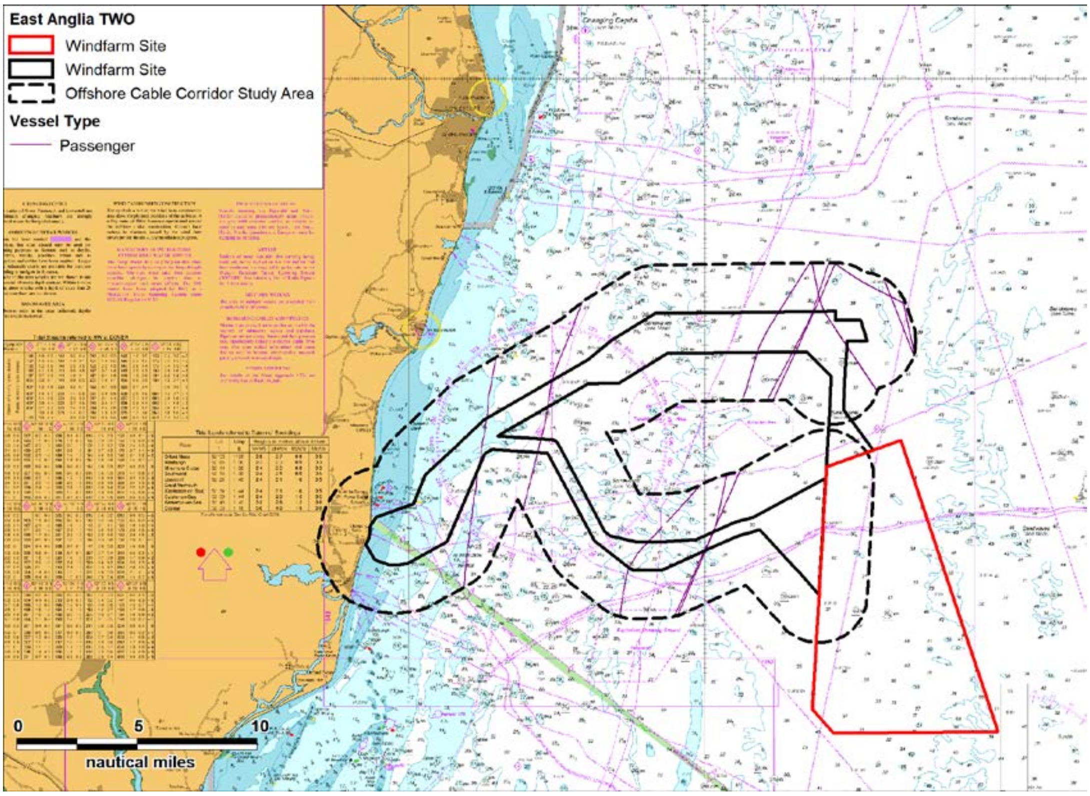


Figure 13.13 AIS and Radar Passenger Vessels within the Offshore Cable Corridor Study Area (28 Days Summer and Winter 2017)

229. It can be seen that occasional transits within the offshore cable corridor study area are made by passenger vessels.

230. An average of one unique passenger vessels every three days was recorded during the combined summer and winter survey periods.

13.2.8 Miscellaneous Vessels

231. *Figure 13.14* presents a plot of miscellaneous vessels recorded within the offshore cable corridor study area throughout the survey periods.

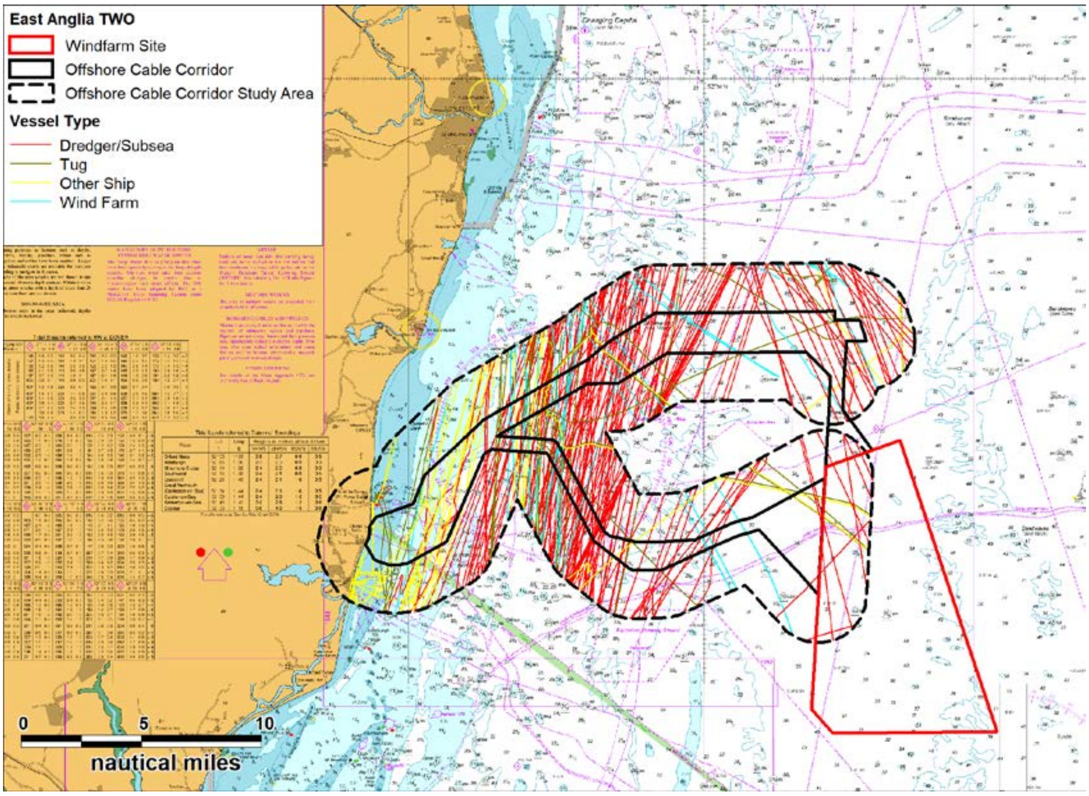


Figure 13.14 AIS and Radar Miscellaneous Vessels within the Offshore Cable Corridor Study Area (28 Days Summer and Winter 2017)

232. An average of six unique miscellaneous vessels per day were recorded within the offshore cable corridor study area.

233. It can be seen that the majority of miscellaneous vessels transiting through the offshore cable corridor study area were dredgers (56%), with the majority of dredgers recorded transiting where the offshore cable corridor branches into two. Tugs (16%), "other" vessels (18%) and windfarm associated vessels (11%) were also recorded. As mentioned previously, "other" vessels includes those that are not large enough in number to be categorised separately.

13.2.9 Anchoring

234. This section presents analysis of the anchoring activity in the vicinity of the offshore cable corridor study area. *Figure 13.15* presents a plot of the anchored vessels recorded during the combined summer and winter survey periods.

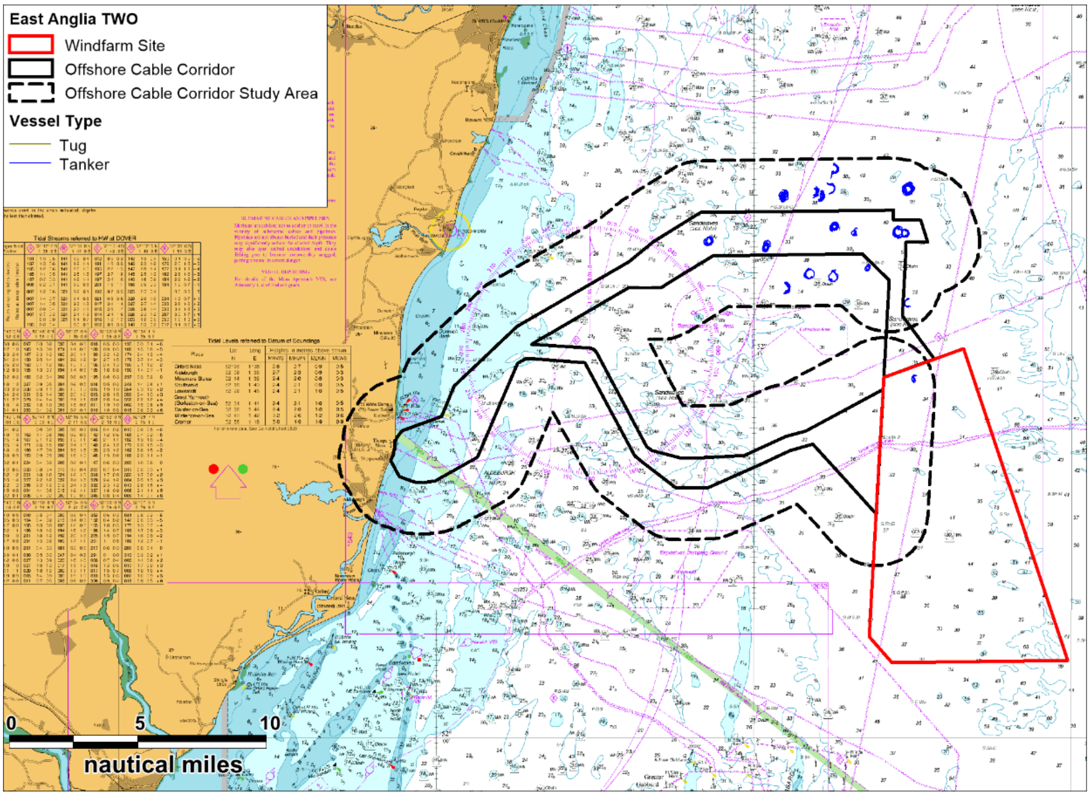


Figure 13.15 AIS and Radar Anchored Vessels within the Offshore Cable Corridor Study Area (28 Days Summer and Winter 2017)

235. A total of 17 unique tankers and one tug were recorded at anchor during the combined summer and winter survey periods. Seven tankers were recorded anchoring within the offshore cable corridor. There is a designated area of the UK territorial sea off the coast of Southwold where STS transfers are permitted therefore the anchored tankers within the offshore cable corridor study area may have been undertaking a STS transfer or awaiting an STS transfer with another tanker. The anchored vessels may also have been anchored while awaiting further orders.

13.3 Additional Summer 2018 Analysis

236. This section presents the findings of the assessment of the summer 2018 marine traffic survey data. The findings have been compared against the summer 2017 data where relevant. No significant changes were observed in relation to the impact assessment as discussed in section 14.

13.3.1 Vessel Count

237. For the 14 days analysed in summer 2018, there were an average of 39 unique vessels per day passing within the offshore cable corridor study area, recorded on AIS. This is compared to an average of 74 unique vessels per day during summer 2017. In terms of vessels intersecting the offshore cable corridor, there were an average of 30

unique vessels per day compared to 33 per day during summer 2017 (77% of unique vessels).

238. *Figure 13.6* presents the daily number of unique vessels passing through the offshore cable corridor study area during summer 2018.

The busiest day recorded throughout the survey period was the 24th August 2018 when 54 unique vessels were recorded within the offshore cable corridor study area. The quietest day recorded was the 22nd August 2018, when 18 unique vessels were recorded within the offshore cable corridor study area.

239.

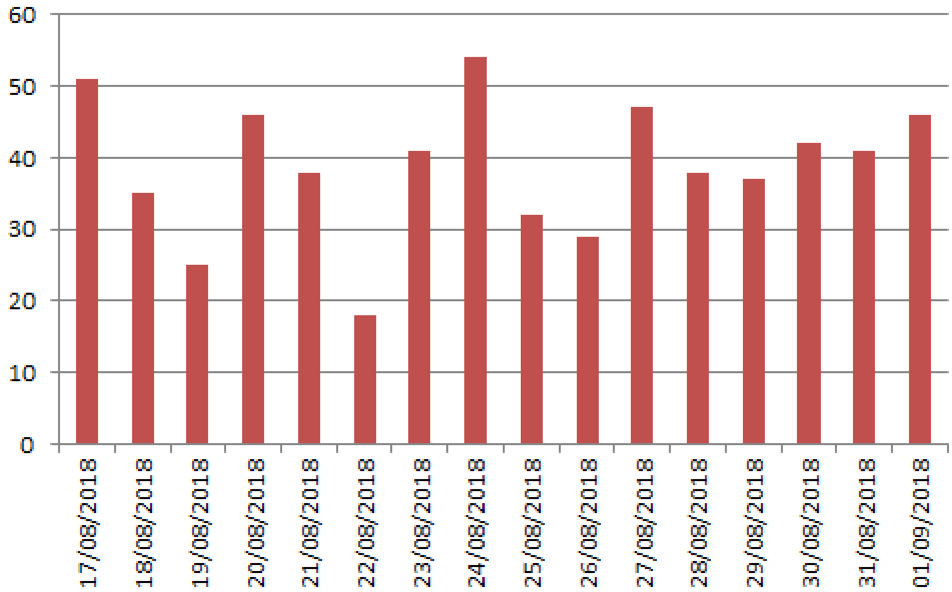


Figure 13.16 Unique Vessels per Day from AIS within Offshore Cable Corridor Study Area (14 Days Summer 2018)

13.3.2 Vessel Types

240. Tracks classified as temporary included survey vessels and vessels associated with the construction of the East Anglia ONE windfarm. These were therefore excluded from the following analysis.

241. Unlike the summer and winter 2017 surveys, it is noted that the construction of the Galloper Offshore Wind Farm was completed during the time of the summer 2018 survey. Vessels were recorded transiting to and from the Galloper and Greater Gabbard Offshore Wind Farms however these have been excluded from the summer 2018 traffic to enable the traffic to be comparable with summer 2017.

242. *Figure 13.17* presents the removed windfarm vessels and reveals their distribution is comparable to that recorded during summer and winter 2017 (see *Figure 13.3*).

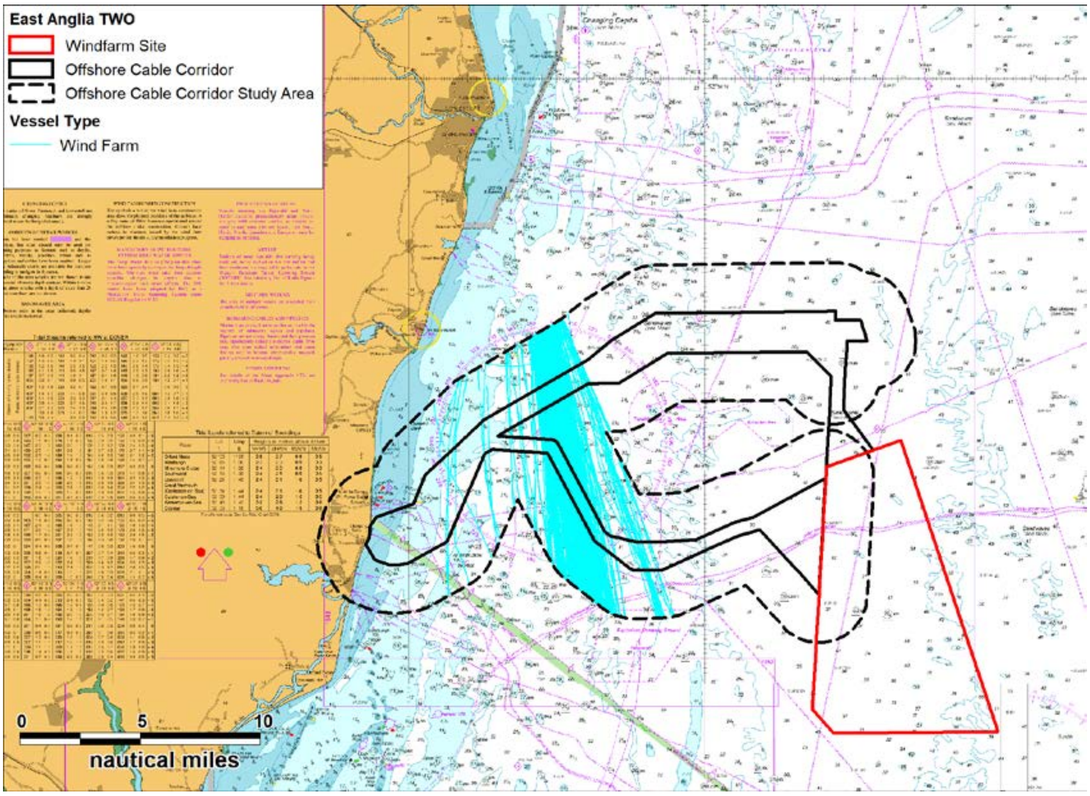


Figure 13.17 AIS Windfarm Vessels within Offshore Cable Corridor Study Area (14 Days Summer 2018)

243. *Figure 13.18* presents an overview of the AIS and Radar tracks (excluding temporary tracks and the above windfarm tracks) recorded within the shipping and navigation study area during the summer 2018 survey period, colour-coded by vessel type.

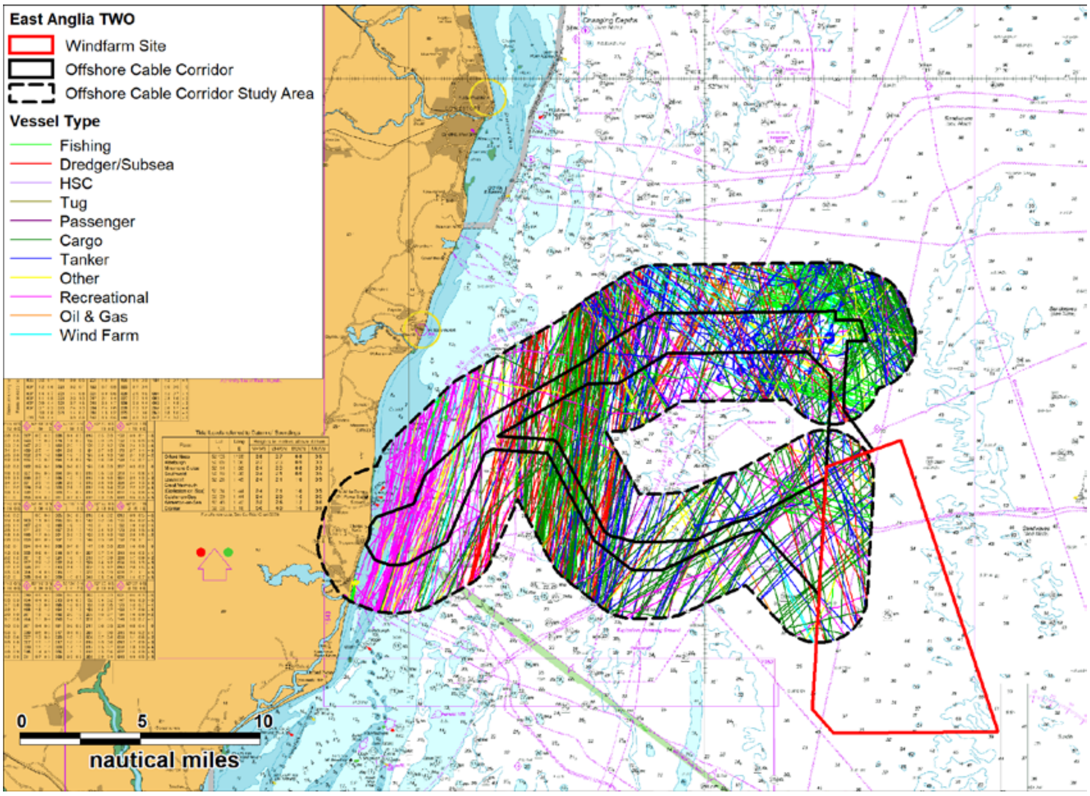


Figure 13.18 Overview of AIS Data Excluding Temporary Tracks (14 Days Summer 2018)

244. *Figure 13.7* presents analysis of the vessel types recorded within the offshore cable corridor study area and intersecting the offshore cable corridor during the survey period. The category of “other” vessels includes those that are not large enough in number to merit their own separate category such as transiting survey vessels, training vessels, buoy-laying vessels, guard vessels, a RIV, a fishery patrol vessel and RNLI lifeboats.

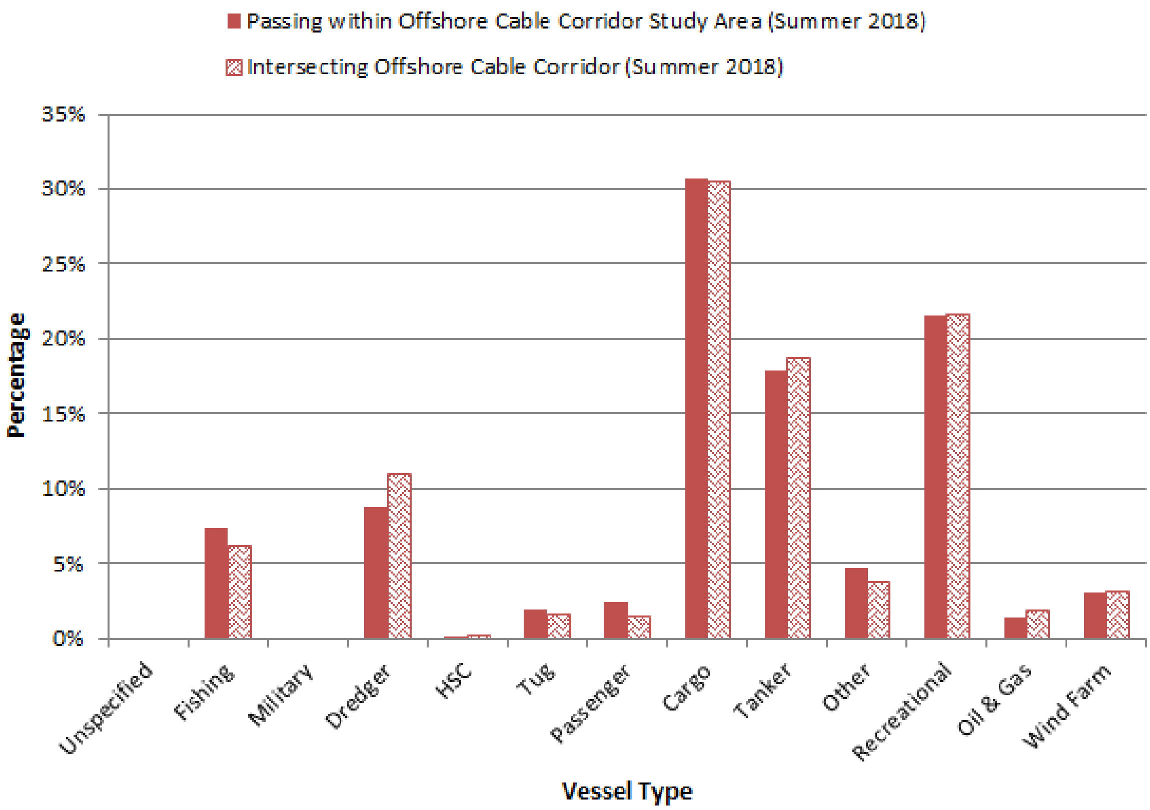


Figure 13.19 Distribution of Vessel Types within Offshore Cable Corridor Study Area (14 Days Summer 2018)

245. Overall, there was good correlation between the summer 2017 and summer 2018 data sets in terms of vessel type and the distribution of vessels throughout the offshore cable corridor study area. In both 2017 and 2018, cargo vessels and recreational vessels were the most commonly recorded vessel tracks within the offshore cable corridor study area and the corridor itself.

13.3.3 Vessel Density

246. *Figure 13.20* presents the vessel density (excluding temporary tracks) recorded in the summer 2018 survey period. This is based on the number of track intersects per cell of a 1x1nm grid covering the offshore cable corridor study area.

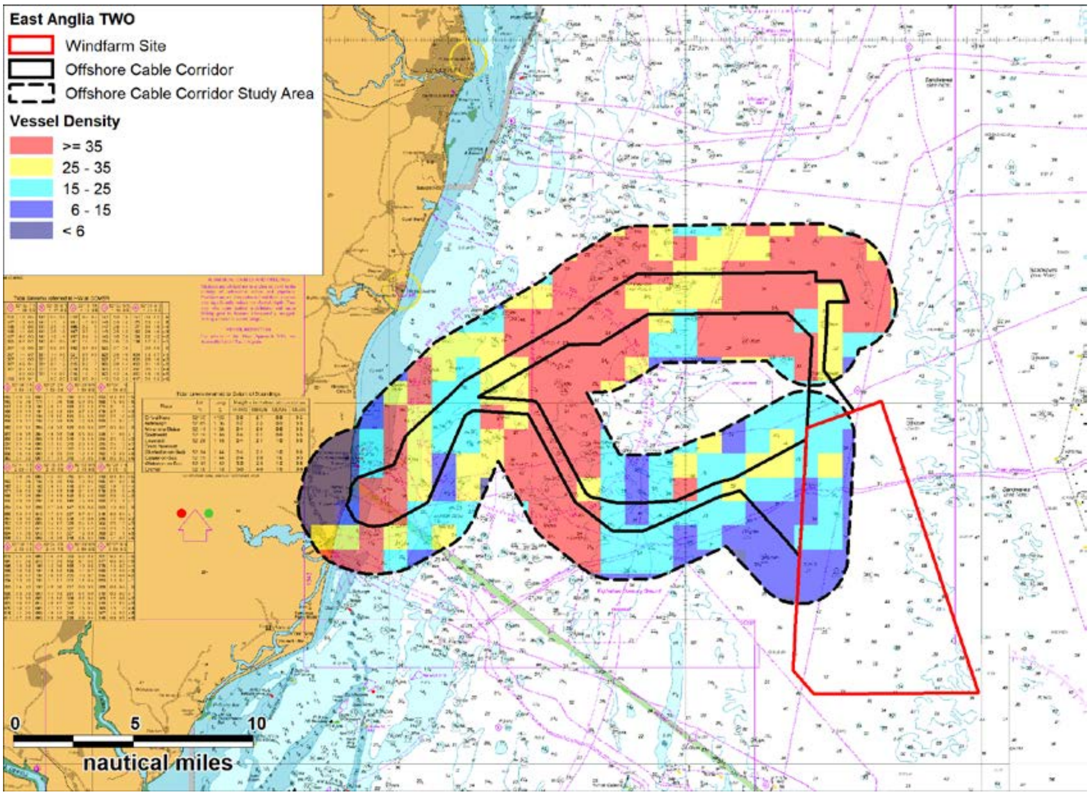


Figure 13.20 Vessel Density from AIS within Offshore Cable Corridor Study Area (14 Days Summer 2018)

247. The distribution of highest vessel density in summer 2018 within the centre of the offshore cable corridor study area can be considered comparable to the summer 2017 vessel densities (see section 13.2.3). However, vessel density within the northern branch of the offshore cable corridor study area during 2018 was higher than that recorded during summer 2017. This is due to an increase in fishing vessel activity in this area during 2018 (see *Figure 13.22*). Fishing activity can vary year to year depending on fish movements and stock levels.

13.3.4 Cargo Vessels

248. During the combined summer 2018 and winter 2017 survey period, an average of 14 unique cargo vessels per day passed within the offshore cable corridor study area (compared to 15 per day during summer and winter 2017).

249. Similar to that seen within the summer and winter 2017 survey, the majority of cargo vessels were general cargo vessels (59%).

13.3.5 Tankers

250. Throughout the combined summer 2018 and winter 2017 survey period, an average of seven unique tankers per day passed within the offshore cable corridor study area (compared to seven per day during summer and winter 2017).

251. Similar to the summer and winter 2017 survey, crude oil tankers (31%) were the most frequently recorded tanker type transiting through the offshore cable corridor study area, followed by combined chemical and oil tankers (27%) and product tankers (16%).

13.3.6 Oil and Gas Vessels

252. Throughout the combined summer 2018 and winter 2017 survey period, an average of one unique vessel every two days passed within the offshore cable corridor study area (compared to one every three days during summer and winter 2017).

13.3.7 Passenger Vessels

253. Throughout the combined summer 2018 and winter 2017 survey period, an average of one unique vessel every two days passed within the offshore cable corridor study area (compared to one every three days during summer and winter 2017).

13.3.8 Miscellaneous Vessels

254. Throughout the combined summer 2018 and winter 2017 survey period, an average of six unique vessels per day passed within the offshore cable corridor study area (an average of six per day was also recorded during summer and winter 2017).

255. The majority of miscellaneous vessels transiting through the offshore cable corridor study area during the combined summer 2018 and winter 2017 period were dredgers (52%). This is comparable to the combined summer and winter 2017 period. As previously mentioned, "other" vessels include those that are not large enough in quantities to be categorised separately, such as survey vessels, training vessels, buoy-laying vessels, guard vessels, a RIV, a fishery patrol vessel and RNLI lifeboats.

13.3.9 Anchoring

256. A total of 22 vessels were recorded at anchor during the combined summer 2018 and winter 2017 survey period (compared 18 per day during summer and winter 2017). Similar to the combined summer and winter 2017 survey period, these were mainly tankers within the northern part of the offshore cable corridor study area.

13.4 Fishing Vessel Activity

257. Fishing vessel activity recorded within the offshore cable corridor study area during the summer and winter 2017 marine traffic surveys is presented in *Figure 13.21*.

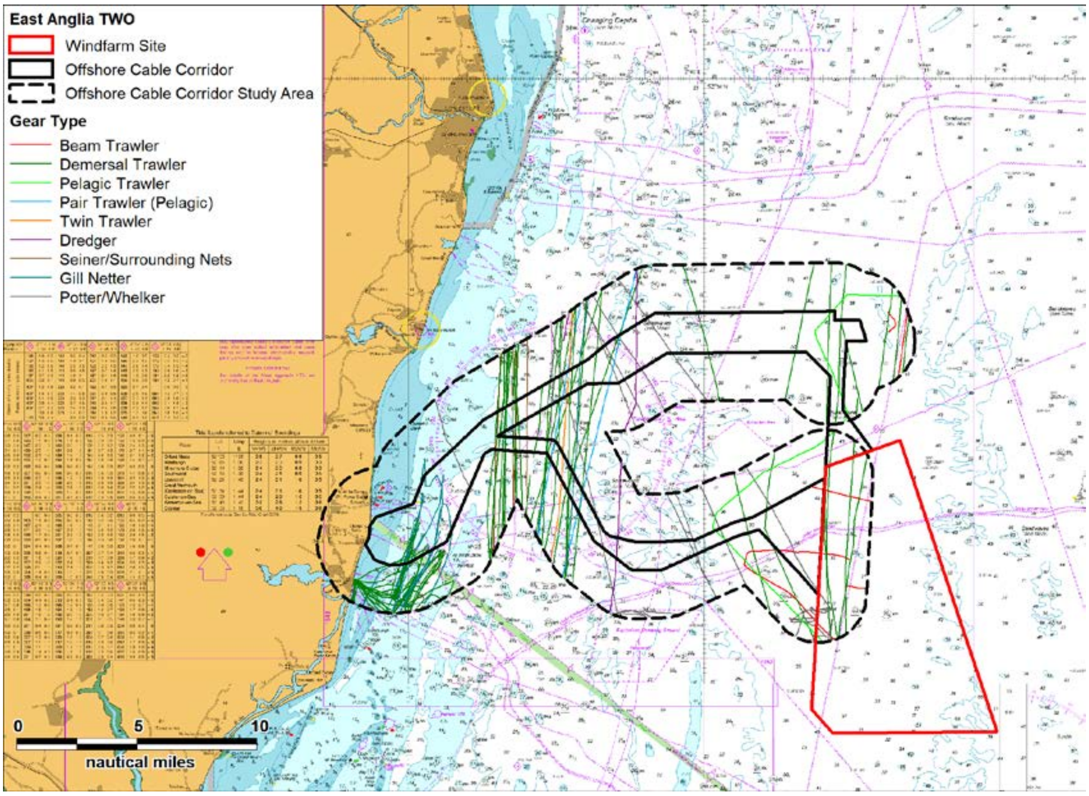


Figure 13.21 AIS and Radar Fishing Vessels within the Offshore Cable Corridor Study Area (28 Days Summer and Winter 2017)

258. During the combined summer and winter 2017 survey periods, an average of three unique fishing vessels per day passed within the offshore cable corridor study area.

259. The most common nationality was UK (50%) followed by France (41%) and the Netherlands (9%).

260. Of the fishing methods, the most common were demersal trawlers (59%) followed by set gillnets (anchored) (11%). Other fishing methods recorded included beam trawlers (8%), potter / whelkers (8%), Danish seines (5%), unspecified trawlers (3%), dredgers (3%), pair trawlers (3%) and pelagic trawlers (1%).

261. *Figure 13.22* presents the tracks recorded during summer 2018 and winter 2017.

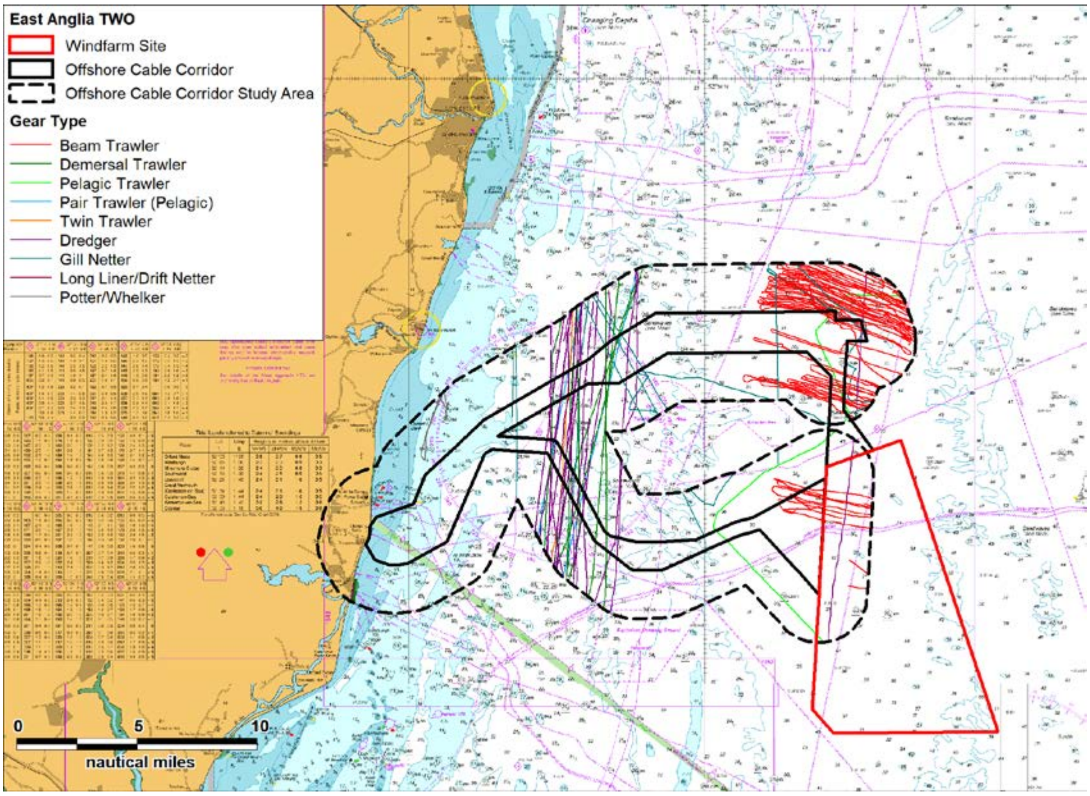


Figure 13.22 AIS Fishing Vessels within the Offshore Cable Corridor Study Area (28 Days Summer 2018 and Winter 2017)

262. An average of three unique fishing vessels per day were recorded within the offshore cable corridor study area during the combined summer 2018 and winter 2017 period.

263. There has been no change in the average number of unique vessels recorded within the offshore cable corridor study area between the combined summer and winter 2017 period and combined summer 2018 and winter 2017 period. Fishing vessel nationalities recorded were similar between the two surveys, with UK vessels the most commonly recorded. In terms of fishing gear types, there was a change between the two survey periods. Demersal trawlers (59%) were the most commonly recorded fishing gear type during the combined summer and winter 2017 period compared to dredgers (25%), demersal trawlers (21%) and long liners / drift netters (16%) during the combined summer 2018 and winter 2017 period.

264. As previously noted, fishing vessel activity can vary by season and year depending on fish movements and stock levels.

13.5 Recreational Vessel Activity

265. Recreational vessel activity recorded within the offshore cable corridor study area during the AIS and Radar marine traffic surveys is presented in *Figure 13.23*. As per Recreational Craft Regulations 2004 (Directive 2013/53/EU), sailing vessels and motor

craft recorded as between 2.5 and 24m in length have been classed as recreational vessels.

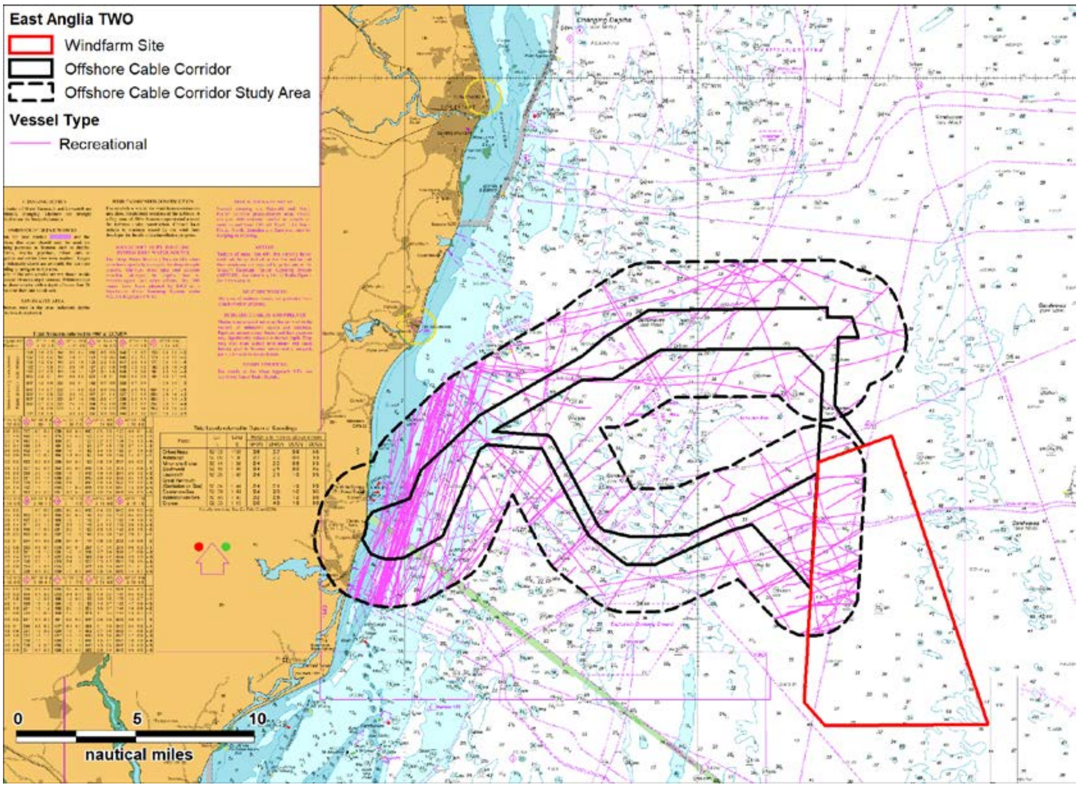
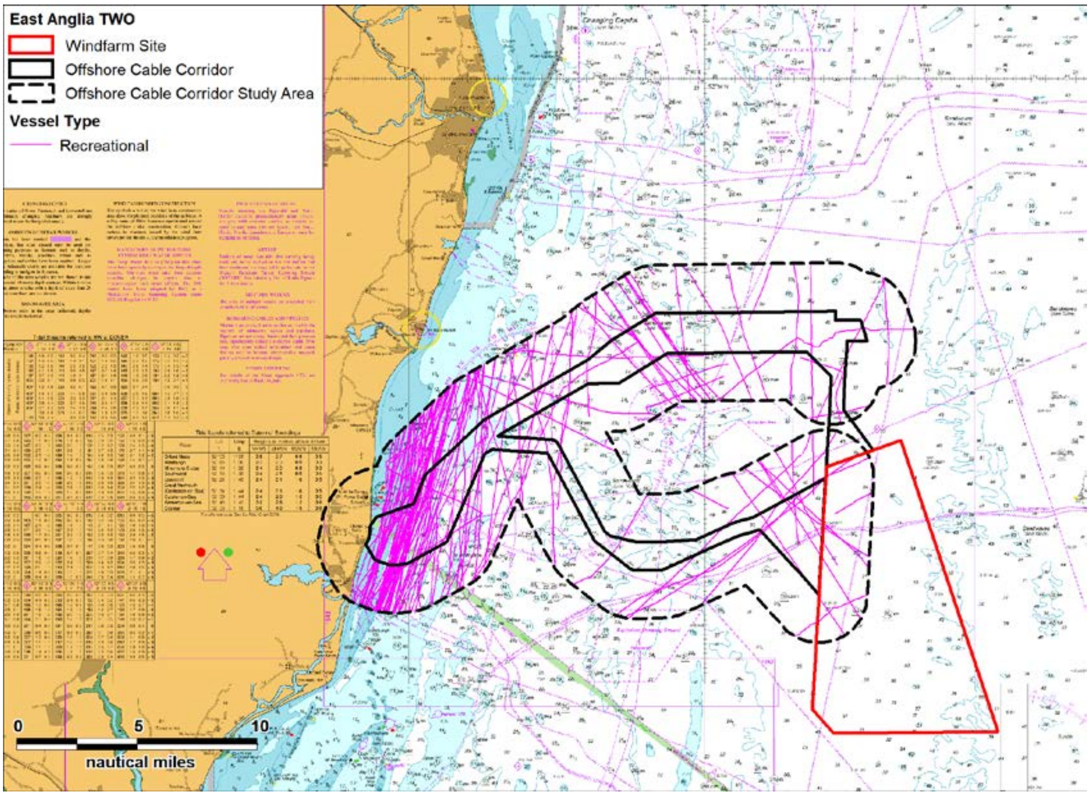


Figure 13.23 AIS and Radar Recreational Vessels within the Offshore Cable Corridor Study Area (28 Days Summer and Winter 2017)

266. Ten unique recreational vessel transits per day were recorded within the offshore cable corridor study area during the summer period and a total of two unique vessels recorded during the entire winter fortnight.

267. It should be noted that during the summer survey period, the Vuurschepen Race between Scheveningen and Harwich and the North Sea Race between Harwich and Scheveningen were held on the 27th May and 28th May and 30th May 2017, respectively.

268. *Figure 13.24* presents the recreational tracks recorded during summer 2018 and winter 2017.



269. Figure 13.24 AIS Recreational Vessels within the Offshore Cable Corridor Study Area (28 Days Summer 2018 and Winter 2017)Nine unique recreational vessel transits per day were recorded within the offshore cable corridor study area during the summer 2018 fortnight.

270. Comparing the 2017 and 2018 summer data, there has been a slight decrease in the number of recreational vessels recorded. This may be due to the survey being held later in the year as well as variations in weather conditions, etc. The Vuurschepen Race and North Sea Race held during summer 2017 have not resulted in a large decrease in recreational vessels recorded between 2017 and 2018 as was seen with the East Anglia TWO windfarm site analysis (see section 12.5). This is likely due to the increase in inshore recreational vessels recorded during the combined summer 2018 and winter 2017 survey period compared to the summer and winter 2017 period.

13.5.1 RYA Coastal Atlas

271. The RYA Coastal Atlas (RYA 2016) is presented relative to the offshore cable corridor in *Figure 13.25*. This includes a recreational density grid up to the 12nm UK territorial limit and the locations of clubs, training centres and marinas. To illustrate offshore routeing, the coastal atlas also provides offshore route indicators showing typical recreational routes.

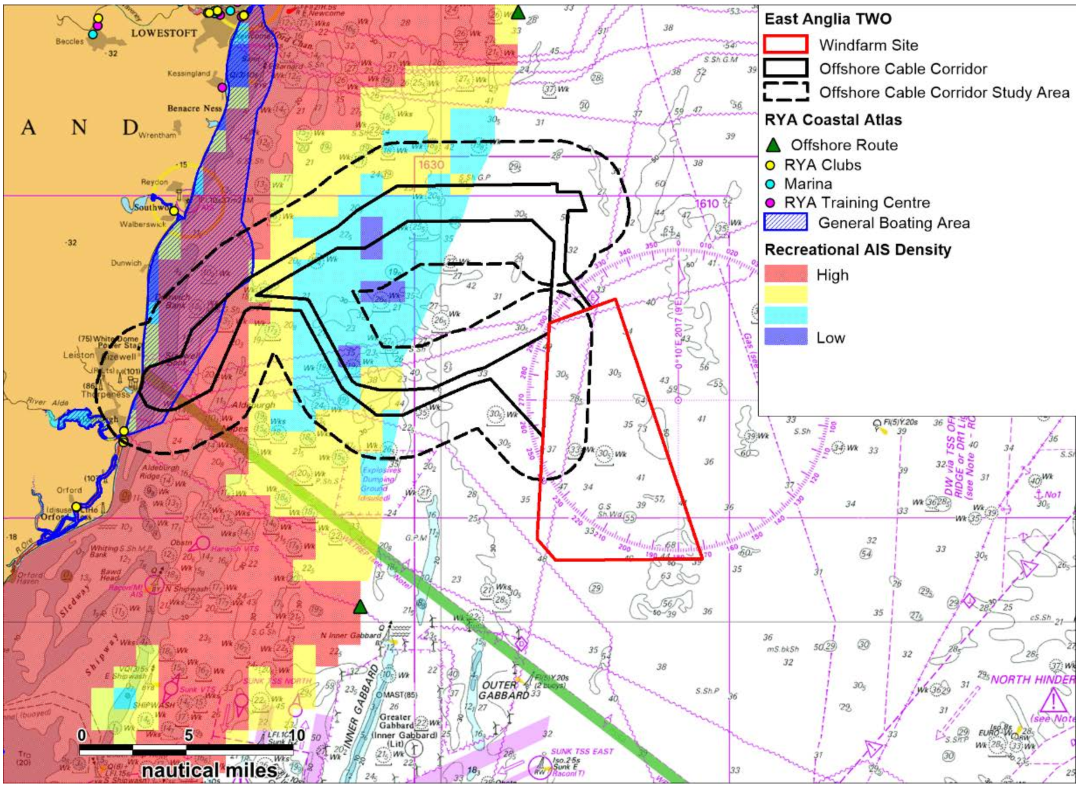


Figure 13.25 RYA Coastal Atlas (2016)

272. Higher recreational density was observed to be largely coastal, with the landfall area categorised as medium to high intensity. No route indicators were observed within the offshore cable corridor study area.

13.6 Comparison with Summer 2017 Data

273. A decrease in vessel numbers was observed during the combined summer 2018 and winter 2017 survey period when compared to the combined summer and winter 2017 period, with the unique number of vessels per day in the offshore cable corridor study area decreasing from 43 to 39. This is not considered a significant decrease and is deemed as having no effect on the impact assessment already undertaken.

274. The vessel density recorded during summer 2018 was higher within the northern branch of the offshore cable corridor study area than that recorded during summer 2017. As discussed in section 13.3.3, this is due to increased fishing vessel activity within this area during summer 2018. However, as previously noted the overall average number of fishing vessels within the offshore cable corridor study area has not changed between the two periods.

275. As per section 14, no findings associated with the summer 2018 survey validation exercise are deemed as affecting the outcome of the assessment within the PEIR, and thus the impact assessment in Chapter 14 Shipping and Navigation remains unchanged from the PEIR stage.

14 PEIR Assessment Validation

276. As per section 6, the impact assessment undertaken at the PEIR stage was based on the summer and winter 2017 marine traffic surveys. This section presents assessment of the updated summer 2018 data combined with the winter 2017 data in relation to each impact assessed within the PEIR, highlighting any key findings of the validation exercise as it pertains to the impact assessment presented in *Chapter 14 Shipping and Navigation*.

14.1 Commercial Vessels

277. As per section 12.3, there was only a minor decrease in the number of cargo vessels and tankers recorded between the combined summer and winter 2017 period and combined summer 2018 and winter 2017 period while the number of passenger vessels recorded remained the same. However, it is noted that the construction of the East Anglia ONE windfarm was observed to deviate commercial vessels west of the construction buoyage. The displacement of routes into the gap between the East Anglia TWO windfarm site and the East Anglia ONE windfarm site was assessed at the PEIR stage.

278. Overall, vessel numbers decreased during the summer 2018 and winter 2017 survey period as per section 12.3.1; this is largely associated with a decrease in recreational vessel transits as described in section 14.4 however is also associated with the commencement of construction of East Anglia ONE. The construction of the East Anglia ONE windfarm site has deviated some traffic to the east of the construction buoyage therefore outside of the shipping and navigation study area resulting in fewer vessels recorded. It is likely that other vessels may have altered their passage plan earlier to avoid the East Anglia ONE windfarm site completely therefore have not been captured within the shipping and navigation study area.

279. No significant changes were observed for commercial vessels within the offshore cable corridor study area.

280. As overall traffic levels have decreased compared to the combined summer and winter 2017 survey period, the PEIR assessment has considered a worst case scenario in terms of traffic and the results of the combined summer 2018 and winter 2017 survey are not deemed as affecting the outcome of the assessment undertaken at the PEIR stage.

14.2 Marine Aggregate Dredgers

281. As per section 12.3.8, no changes in terms of dredger levels or behaviour were observed between the combined summer and winter 2017 period and combined summer 2018 and winter 2017 period. Therefore the outcome of the assessment undertaken at the PEIR stage is still considered valid.

282. No significant changes were observed for dredgers within the offshore cable corridor study area.

14.3 Fishing Vessels

283. As per section 12.4, no changes in terms of fishing vessel levels or behaviour were observed between the combined summer and winter 2017 period and combined summer 2018 and winter 2017 period.

No significant changes were observed for fishing vessels within the offshore cable corridor study area.

284. Therefore, the outcome of the assessment undertaken at the PEIR stage is still considered valid.

14.4 Recreational Vessels

285. As per section 12.5, there was a decrease in the number of recreational vessels recorded during the summer 2017 and summer 2018 periods with a total of two vessels recorded during the winter 2017 period. This reduction is due to the summer 2018 period being later in the year therefore annual recreational racing transits were not recorded as had been during summer 2017. The outcome of the assessment undertaken at the PEIR stage is therefore still considered valid as it has assessed recreational vessels when activity was inflated above typical levels.

286. There were no significant changes observed for recreational vessels within the offshore cable corridor study area.

14.5 Approach to Marine Traffic Data in ES

287. The changes observed in the 2018 summer survey data are not deemed as affecting the impact assessment already undertaken at the PEIR stage. However, the main routes have been reassessed in section 15 due to the change to the East Anglia TWO windfarm site boundary since the PEIR stage as well as the construction of the East Anglia ONE windfarm site which was not previously ongoing during the summer 2017 and winter 2017 survey periods.

15 Base Case Routeing Analysis (Pre Windfarm)

15.1 Introduction

288. The marine traffic survey data shown in section 12 was used to identify the main vessel routes within 10nm of the East Anglia TWO windfarm site. The AIS and Radar information was used to estimate the types and sizes of vessels using each route, and the origin / destination ports. Anatec's internal UK-wide route database and the charted IMO Routeing measures were then used to validate the findings, and to extend the routes beyond the 10nm threshold of the AIS and Radar data.

289. In addition, to being the basis for the 90th percentile analysis provided below, the final routes were also used as input to the collision and allision risk modelling for the offshore development area, as summarised in section 17.

290. It is noted that the summer 2018 data was not available at the PEIR stage (i.e., when the routeing assessment was undertaken), therefore the summer 2017 and winter 2017 marine traffic survey data assessed in section 12.2 was used to identify the main vessel routes within the shipping and navigation study area, and estimate vessel numbers.

291. Subsequent assessment of the summer 2018 data combined with the winter 2017 data indicated that, other than route 5 (presented in section 15.2), vessel numbers on all main routes have either remained static or dropped between 2017 and 2018. Where drops were observed, vessel numbers have not been changed from those estimated at the PEIR stage.

292. Route 5 was observed to increase from an average of ten vessels per day to an average of 11 vessels per day. It is noted that this increase is due to traffic deviating around the construction of the East Anglia ONE windfarm site which is located to the east of route 5. The routeing has therefore been updated to reflect this increase and the modelling has been repeated with this update.

293. It is also noted that due to the construction of the East Anglia ONE windfarm site, three routes were identified as no longer transiting through the shipping and navigation study area (routes 10, 11 and 13, presented in section 15.2). However, these routes were still present within the winter 2017 data therefore the routeing analysis has not been updated to reflect this change in order to present the worst case routeing scenario. Vessels using these routes had either deviated west towards the East Anglia TWO windfarm site and utilised route 5 or deviated east outside of the shipping and navigation study area. It is expected that traffic will shift again post

construction of East Anglia ONE windfarm site but not to levels higher than assessed within this report

294. As described in section 12.2.2, the Galloper Offshore Wind Farm was under construction during the summer and winter 2017 survey period therefore tracks associated with the construction were excluded from the analysis and subsequent routeing assessment. During the 2018 summer survey period, the Galloper Offshore Wind Farm was commissioned. Operation and maintenance vessels associated with the windfarm were recorded engaged in activity at the windfarm within the south west of the shipping and navigation study area having transited from Harwich. Vessels associated with the neighbouring Greater Gabbard Offshore Wind Farm were recorded using the same routeing from Lowestoft as was recorded during summer 2017 therefore route 14 (see section 15.2) remains valid.

15.2 Main Routes

295. The main routes identified are presented in *Figure 15.1*, with a summary of each route then presented in *Table 15.1*. It is noted that the origin and destination ports for each route shown represent the most common destinations by vessels using those routes within the shipping and navigation study area. Actual destinations and origin ports may vary per route.

296. It should be noted that the Rosyth to Zeebrugge route operated by Finlandia Seaways was recorded during the 2017 marine traffic surveys however this route ceased operations in spring of 2018 therefore this route has been excluded from the routeing analysis.

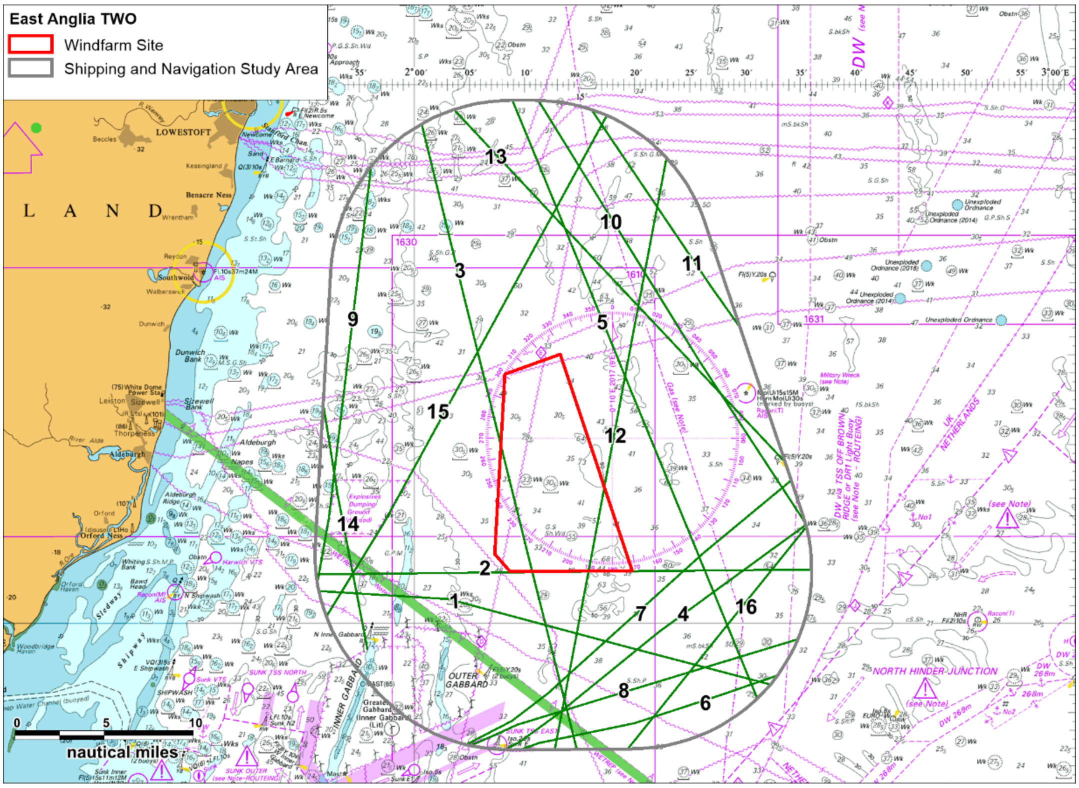


Figure 15.1 Base Case Vessel Routeing

Table 15.1 Main Routes

Route Number	Main Destination and Origin Ports	Average Vessels per Day	Main Vessel Types	Description
1	Harwich and Felixstowe – Hook of Holland	5	Commercial Ferry	Traffic transiting east and south-east from Harwich and Felixstowe to the Hook of Holland.
2	Hook of Holland – Harwich and Felixstowe	7	Commercial Ferry	Traffic transiting west from the Hook of Holland to Harwich and Felixstowe.
3	Zeebrugge – Humber	2	Cargo and Commercial Ferry	Traffic transiting both northbound and southbound between Zeebrugge and the Humber.
4	Thames – East Europe Ports	1	Cargo and Tanker	Traffic transiting north-east between

Route Number	Main Destination and Origin Ports	Average Vessels per Day	Main Vessel Types	Description
				ports within the Thames and east Europe ports. Uses the Sunk TSS.
5	Zeebrugge and Flushing – Main UK East Coast	11	Cargo, Commercial Ferry and Tanker	Traffic transiting both northbound and southbound between Zeebrugge / Flushing and ports along the main UK east coast. Marine aggregate dredgers may also transit this route as reflected within the BMAPA routes presented in Figure 8.7.
6	Sunk – Germany and Netherlands	2	Cargo	Traffic transiting north-east between the Sunk TSS and Germany / Netherlands.
7	East Europe Ports – Thames	1	Cargo and Tanker	Traffic transiting south-east between east Europe ports and ports within the Thames via the Sunk TSS.
8	Germany and Netherlands – Sunk	2	Cargo	Traffic transiting south-east between Germany / Netherlands and the Sunk TSS.
9	Humber – Sunk	3	Cargo, Dredger and Tanker	Inshore route with traffic transiting both northbound and southbound between the Humber and the

Route Number	Main Destination and Origin Ports	Average Vessels per Day	Main Vessel Types	Description
				Sunk TSS.
10	Humber – Netherlands and Antwerp	1	Cargo and Tanker	Traffic transiting both north-west and south-east between the Humber and the Netherlands and Antwerp. Split into two separate routes due to deviation around Racon.
11	Humber – Netherlands and Antwerp	1	Cargo and Tanker	
12	Newcastle upon Tyne – Dover Strait	1	Cargo, Commercial Ferry and Tanker	Traffic transiting northbound and southbound between Newcastle upon Tyne and the Dover Strait.
13	Hull – Antwerp	1	Cargo and Dredger	Traffic transiting north-west and south-east between Hull and Antwerp.
14	Lowestoft – Greater Gabbard Offshore Wind Farm	6	Windfarm Support	Northbound and southbound windfarm support traffic associated with the operational Greater Gabbard Offshore Wind Farm.
15	Thames – Norway and Sweden	1	Cargo and Tanker	Traffic transiting north-east and south-west between ports within the Thames and Norway / Sweden.
16	Thames – Scandinavian Ports	1	Cargo and Tanker	Traffic transiting north-east and south-west between ports within the Thames and Scandinavian ports.

15.3 Main Route 90th Percentiles

297. The AIS and Radar data was used to estimate the 90th percentiles of routes within the study area surrounding the East Anglia TWO windfarm site (as per the requirements of MGN 543 (MCA 2016)). The 90th percentiles within which boundary 90% of the traffic is contained are presented in *Figure 15.2*.

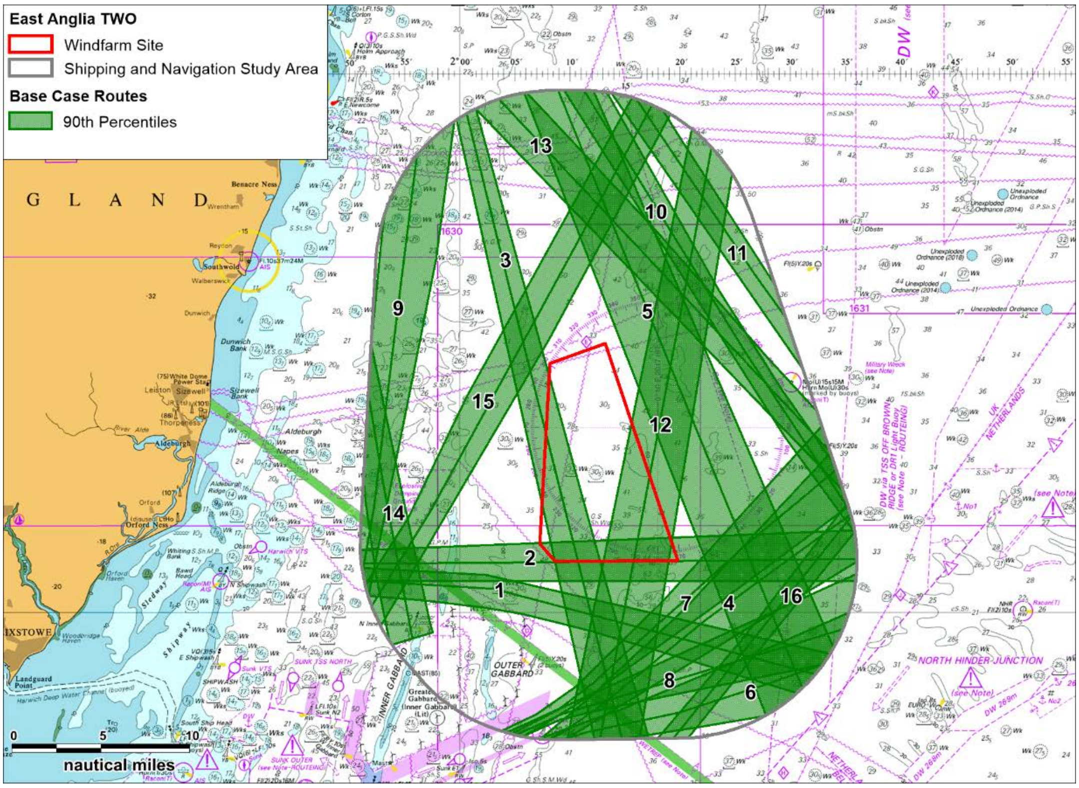


Figure 15.2 Base Case Routeing 90th Percentiles

16 Post Windfarm Routeing Analysis

16.1 Introduction

298. This section assesses the potential impacts of the East Anglia TWO windfarm site on each of the main routes identified in section 14. For each route which may deviate, the worst case from a modelling perspective has been presented when considering East Anglia TWO windfarm site in isolation.

299. It has been assumed that deviated vessels will keep a distance of at least one nautical mile from the East Anglia TWO windfarm site boundary. The anticipated post windfarm routes are presented in Figure 16.1 on that basis. It is noted that the deviated routes are worst case, and assume that a vessel will seek to return to its normal route as quickly as possible, rather than rerouting on a different course or making earlier course adjustments as part of their passage plan.

300. Based on the marine traffic presented in section 12, it is considered that three main routes could be potentially affected by the East Anglia TWO windfarm site. These three routes are presented in *Figure 16.1* and described in more detail below. The cumulative impact of East Anglia TWO windfarm site with other offshore windfarm developments on vessel routeing has been assessed in section 20.

301. It should be noted that any base case routes which do not intersect the East Anglia TWO windfarm site but are recorded as intersecting the East Anglia ONE windfarm site (located to the east of the East Anglia TWO windfarm site) have not been deviated as the focus of the post windfarm routeing analysis is the East Anglia TWO windfarm site. As noted in section 15.1, three routes recorded during summer and winter 2017 were no longer reflected in the summer 2018 data due to the construction of the East Anglia ONE windfarm deviating them to the east. However, the three routes have not been removed from the analysis as they are still present within the winter 2017 data therefore a worst case scenario has been presented. The routeing has been updated to reflect the increase in average number of vessels per day on route 5 due to vessels deviating west of the East Anglia ONE windfarm site.

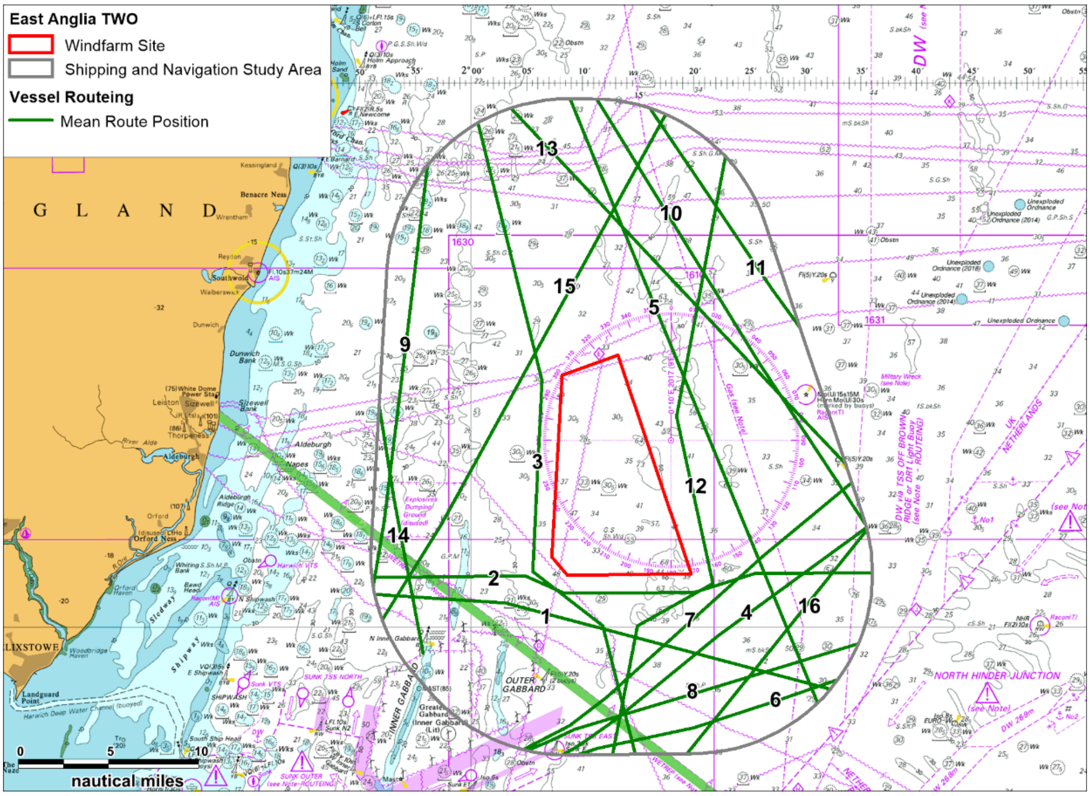


Figure 16.1 Main Routes – Showing Post Windfarm Worst Case Deviations

16.2 Individual Worst Case Route Deviations

302. The deviations shown in the following sections are worst case whereby a vessel leaves and returns to its original course as soon as possible. These deviations are shown to demonstrate the worst case increase in time and distance, however in reality vessels are likely to passage plan to smooth out the change, such as to deviate sooner from their existing course and return later, thus reducing voyage time and distance changes.

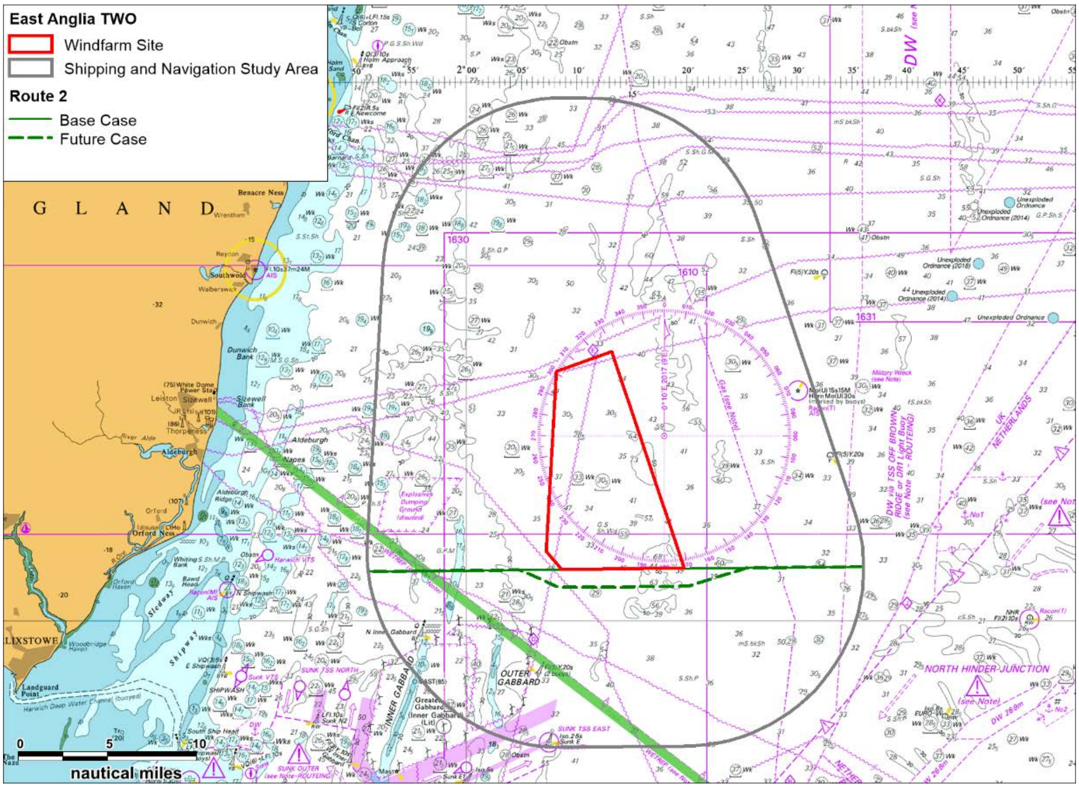


Figure 16.2 Route 2 Deviation

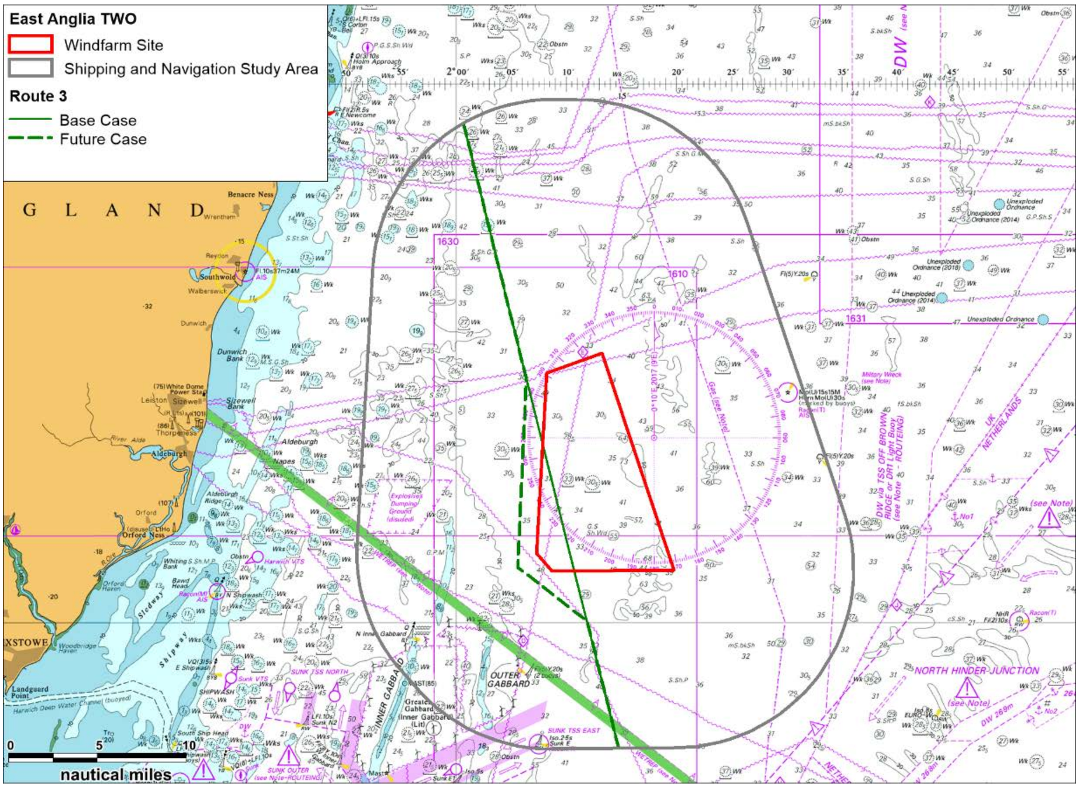


Figure 16.3 Route 3 Deviation

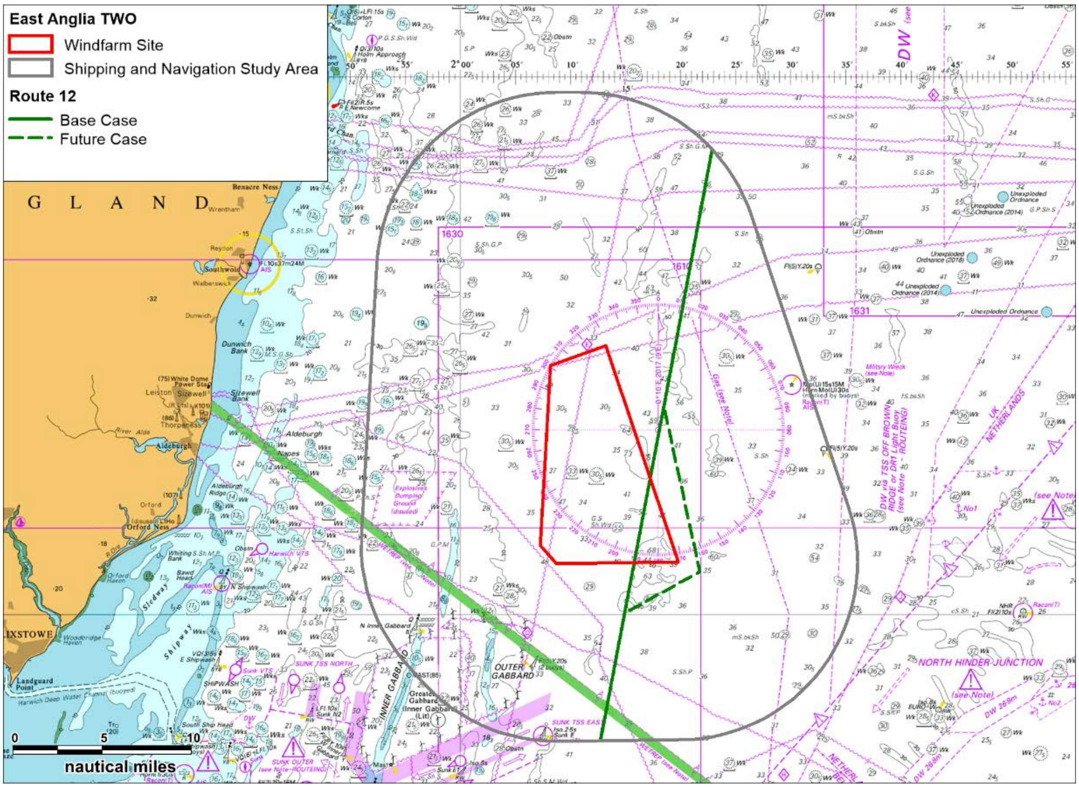


Figure 16.4 Route 12 Deviation

16.3 Simulated AIS – Future Case

303. To illustrate the anticipated vessel activity from regular routed traffic, the deviated routes presented in *Figure 16.1* were used as input to Anatec's AIS simulator. As previously mentioned in section 15.1, the routeing has been based on the summer 2017 and winter 2017 marine traffic but with route 5 updated to reflect the slight increase in vessel numbers recorded on this route during the 2018 summer survey (increased from 10 to 11 vessels per day on average). This program creates randomised AIS tracks on each input route, based on the mean route positions, standard deviations, and vessel numbers. The results for a 28 day period are presented in *Figure 16.5*. It is noted that deviations are presented as worst case (based on amended routes above) but in reality vessels would passage plan and distance themselves appropriately from the East Anglia TWO windfarm site, in line with MGN 543 (MCA, 2016), depending on weather (notably visibility) and sea state.

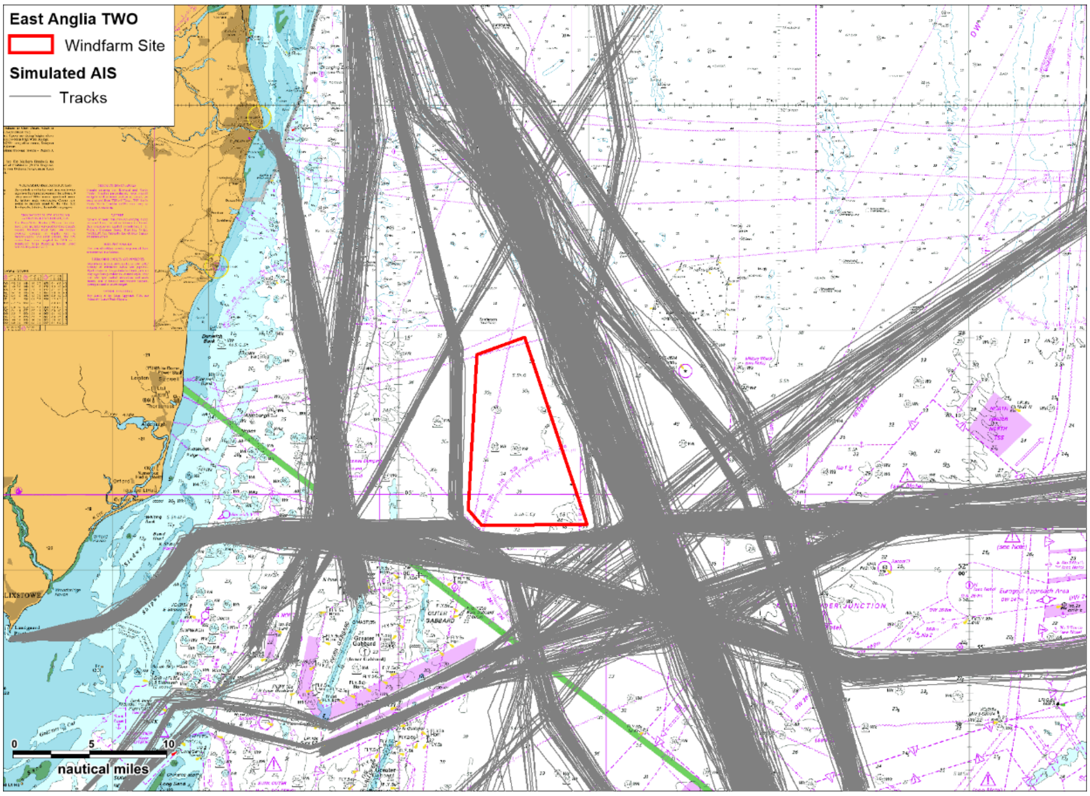


Figure 16.5 Simulated AIS Post Windfarm for East Anglia TWO in Isolation (28 Day Period)

17 Collision and Allision Risk Modelling Overview

17.1 Introduction

304. The following sections provide quantitative assessment of the major hazards associated with the development of the East Anglia TWO offshore development area. This is divided into a base case and a future case assessment without and with the development and includes major hazards associated with:

- Increased vessel to vessel collision risk;
- Additional powered vessel to structure allision risk;
- Additional fishing vessel to structure allision risk;
- Additional allision risk associated with vessels NUC.

305. The base case assessment used the marine traffic survey data in combination with the consultation responses and other baseline data sources to estimate the current encounter probability, and vessel to vessel collision risk. Conservative assumptions of shipping level increases were then made to model future case results.

306. A pre windfarm assessment is provided in section 18, with the post windfarm scenario then assessed in section 19.

17.2 Potential Traffic Increases (Future Case)

307. There is the potential for traffic levels to increase during the lifespan of the East Anglia TWO windfarm site, which may lead to increases in allision and collision risk within the area. Accurate forecasts of traffic increases are difficult, as a large number of variables require consideration. For this reason, an indicative increase of 10% for all vessel types has been assessed within this NRA, in addition to an assessment of risk should traffic levels remain constant. This increase is in line with the assessments undertaken for other UK offshore windfarms, including East Anglia ONE Offshore Windfarm and Norfolk Vanguard Offshore Windfarm and therefore ensures a consistent approach with existing assessments. It is noted that this value relates to the number of vessels, rather than increases in overall tonnage.

308. The increase was implemented by increasing the total vessel numbers per route shown in *Table 15.1* by 10%, whilst maintaining the breakdowns by vessel type and size. The updated vessel numbers were then rounded to the nearest whole number on an annual basis.

17.3 Modelled Layout and Structure Dimensions

309. The worst case indicative layout which has been used as input to the modelling process is presented in *Figure 4.2* (section 4.3). The wind turbine, offshore substation and construction, operation and maintenance platform dimensions which have been modelled are presented in *Table 17.1*.

310. The orientation modelled consisted of the long side facing into the predominant wind direction (240°).

Table 17.1 Modelled Dimensions

Structure	Shape	Dimensions
Wind Turbine including Foundation	Square	55.5m x 55.5m
Offshore Substation	Rectangle	50m x 70m
Construction, Operation and Maintenance Platform	Rectangle	50m x 70m

18 Pre East Anglia TWO Windfarm Site in Isolation Assessment

18.1 Encounters

18.1.1 Introduction

311. An assessment of current vessel to vessel encounters has been carried out by replaying at high speed the 28 days of 2017 AIS and Radar data collected for the East Anglia TWO windfarm site. An encounter distance of 1nm has been considered, i.e. two vessels passing within 1nm of each other has been classed as an encounter. This helps to illustrate where existing shipping congestion is highest and therefore where offshore developments, such as windfarms, could potentially increase congestion and therefore also increase the risk of encounters and / or collisions.

312. It is also noted that encounters involving recreational vessels partaking in the Vuurschepen yacht race and / or the North Sea yacht race have been excluded from the encounters analysis as this racing activity likely inflated recreational transits above typical levels, with vessels transiting to the start point in the days preceding the event, and running the course on the day of the race itself.

18.1.2 Encounters Overview

313. The vessel density from the tracks of the encounters identified within 10nm of the East Anglia TWO windfarm is presented in *Figure 18.1*.

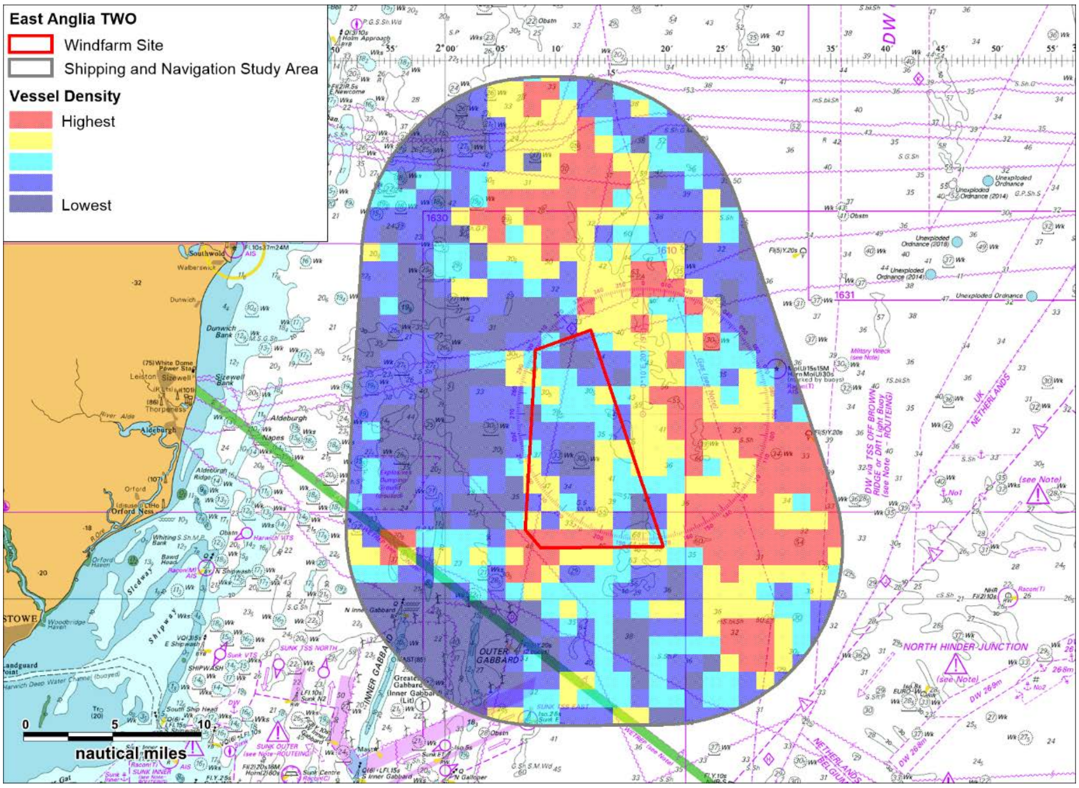


Figure 18.1 Vessel Encounters relative to 1x1nm Grid

314. The majority of encounters occurred to the east and north of the East Anglia TWO windfarm site. In comparison there were relatively few encounters within the west of the shipping and navigation study area. Within the East Anglia TWO windfarm site, the majority of encounters occurred to the south. The ‘hotspots’ for encounters correspond with areas where the base case main routes intersect (see *Figure 15.1*).

18.1.3 Daily Counts

315. The number of encounters recorded during the combined summer and winter survey periods is presented in *Figure 18.2*.

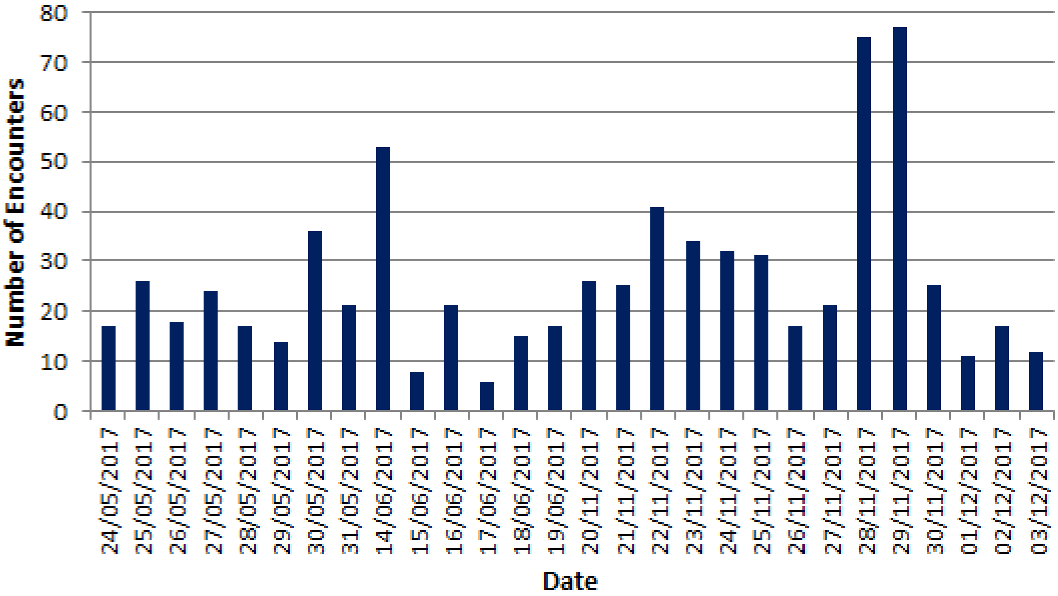


Figure 18.2 Number of Encounters – 28 Day Summer and Winter Period (AIS and Radar)

316. The busiest day in terms of encounters was the 29th November 2017, when 77 encounters were identified.

317. It is noted that encounter levels were lower in summer than in winter (an average of 21 per day during summer, compared to 32 during winter).

18.1.4 Vessel Type Distribution

318. *Figure 18.3* presents the distribution of vessel types involved in encounters within 10nm of the East Anglia TWO windfarm site.

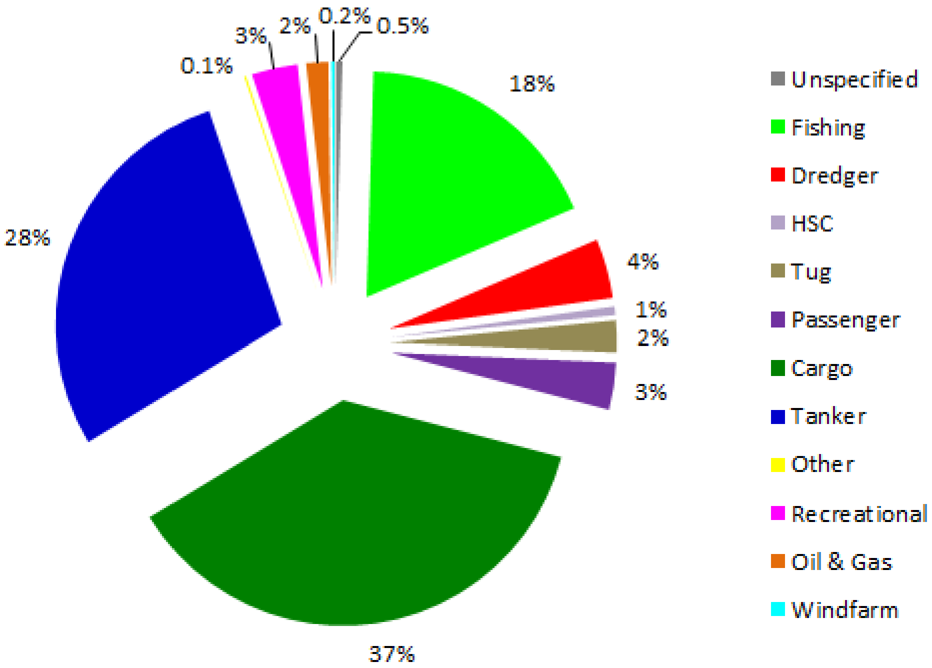


Figure 18.3 Vessel Types involved in Encounters

319. Cargo vessels were the most common vessel type involved in encounters followed by tankers and fishing vessels.

18.2 Vessel to Vessel Collisions

320. The baseline routeing and encounter levels in the area were used as input to the vessel to vessel collision model within Anatec's CollRisk model suite to estimate the base case vessel to vessel collision risk within the vicinity of the East Anglia TWO windfarm site. The model was then run again assuming a 10% increase in traffic levels (future case traffic). The results are presented as density grids in *Figure 18.4* and *Figure 18.5* respectively.

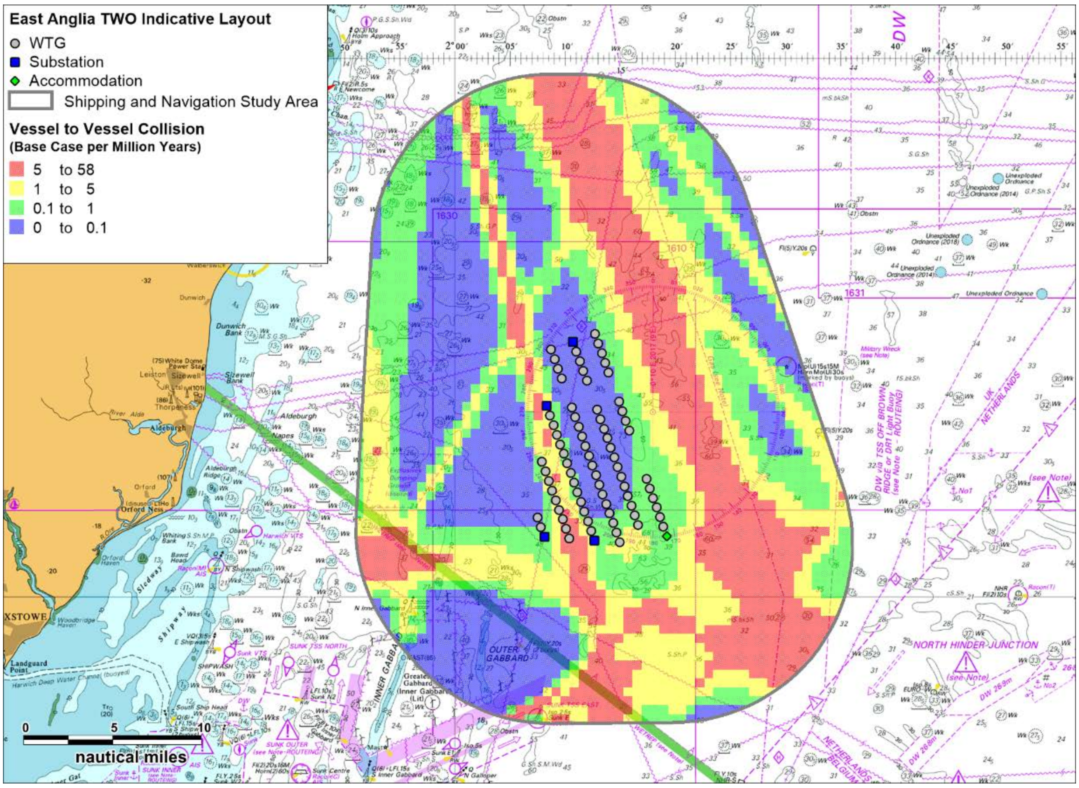


Figure 18.4 Vessel to Vessel Collision Frequency – Pre Windfarm Base Case Traffic

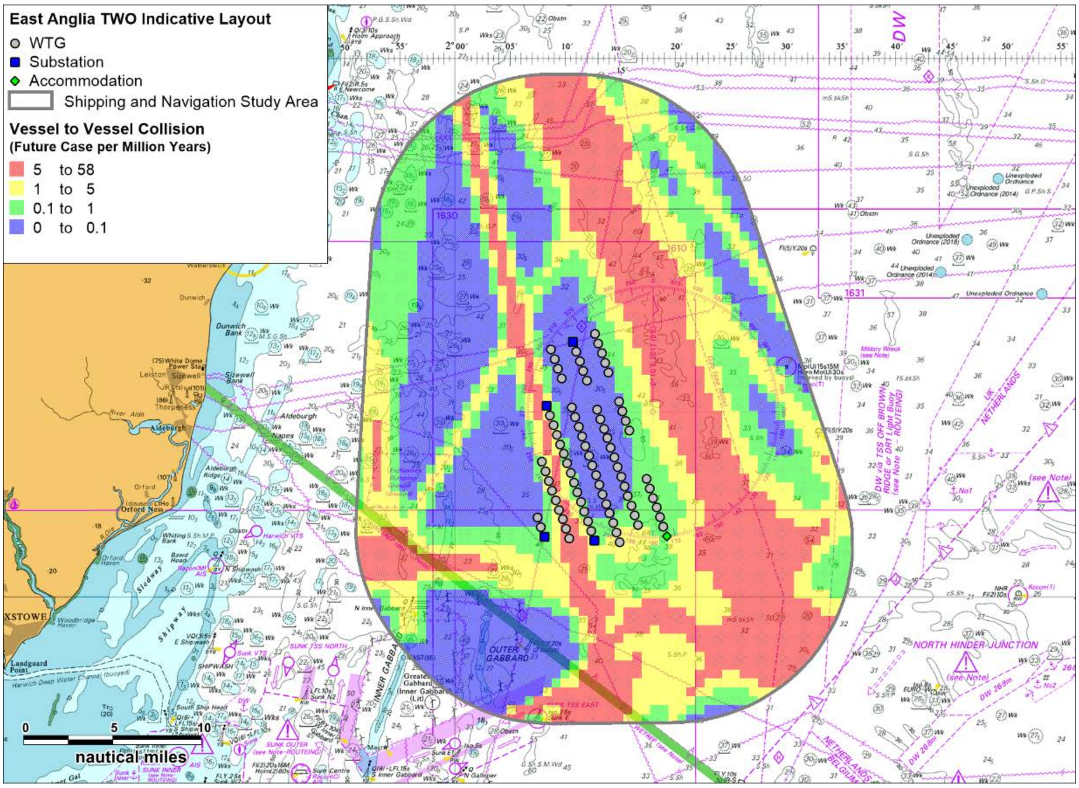


Figure 18.5 Vessel to Vessel Collision Frequency – Pre Windfarm Future Case Traffic

19 Post East Anglia Two Windfarm Site in Isolation

19.1 Vessel to Vessel Collisions

321. The revised routeing shown in section 16 was used as input to the vessel to vessel collision model within Anatec's CollRisk model suite to estimate the potential change in vessel to vessel collisions as a result of the East Anglia TWO windfarm site. The results are compared with the base case in *Table 19.1.*

Table 19.1 Vessel to Vessel Collision Rate

Scenario	Annual Collision Frequency	Return Period (Years)	Increase from Pre Windfarm Case
Pre Windfarm – Base Case	1.11×10^{-2}	90 years	n/a
Post Windfarm – Base Case	1.25×10^{-2}	80 years	13%
Pre Windfarm – Future Case	1.35×10^{-2}	74 years	n/a
Post Windfarm – Future Case	1.52×10^{-2}	66 years	13%

322. Assuming current traffic levels (base case), it was estimated that post windfarm a vessel would be involved in a collision once every 80 years. This represents an increase of 13% from the base case pre windfarm scenario. If traffic levels were to increase by 10% (future case), it was estimated that collision rates would also increase by 13% from the future case post windfarm scenario.

19.2 Vessel Allision with Structure

323. Based on the vessel routeing identified for the area, the anticipated change in routeing due to the offshore development area, and assumptions that effective mitigation measures are in place, the frequency of an errant vessel under power deviating from its route to the extent that it comes into proximity with a structure is not considered to be a probable outcome.

324. From experience at other UK windfarms it is assumed that merchant vessels would not navigate between wind turbine rows due to the restricted internal sea room but would be directed by the navigational aids in the area to keep outside and maintain a safe distance in line with MGN 372 (MCA, 2008).

325. The post-windfarm routes presented in *Figure 16.1* were used as input to the powered allision function of Anatec's CollRisk modelling suite. This model estimates the likelihood that a vessel would allide with one of the windfarm structures whilst under power.

19.2.1 Powered Vessel Allision

326. A powered allision is defined as a vessel making contact with a structure whilst under power. This model estimates the likelihood that vessels would allide with one of the windfarm structures whilst under power. It is noted that the result presented was run with no shielding (worst case).

327. The results are presented in *Table 19.2*.

Table 19.2 Vessel to Structure Allision Risk - Powered

Scenario	Annual Frequency	Return Period (Years)
Post Windfarm – Base Case	4.56×10^{-3}	219
Post Windfarm – Future Case	5.03×10^{-3}	199

328. The structures most at risk were observed to be the periphery wind turbines on the east of the East Anglia TWO windfarm site, as a result of two routes passing close to the eastern boundary, in particular route 5 which was recorded with a high density of traffic (see section 14). Traffic passing to the west and south of the East Anglia TWO windfarm site passed at a large enough distance to avoid significant risk to wind turbines. This is illustrated in *Figure 19.1*, which shows a graduated plot of risk to the structures based on the base case results. The future case risk will have the same allision risk distribution however the frequency will be 10% higher.

329. It should be noted that position of the construction, operation and maintenance platform and substations may be changed (see *Figure 4.2*). However, as previously mentioned the layout modelled is indicative and the worst case scenario.

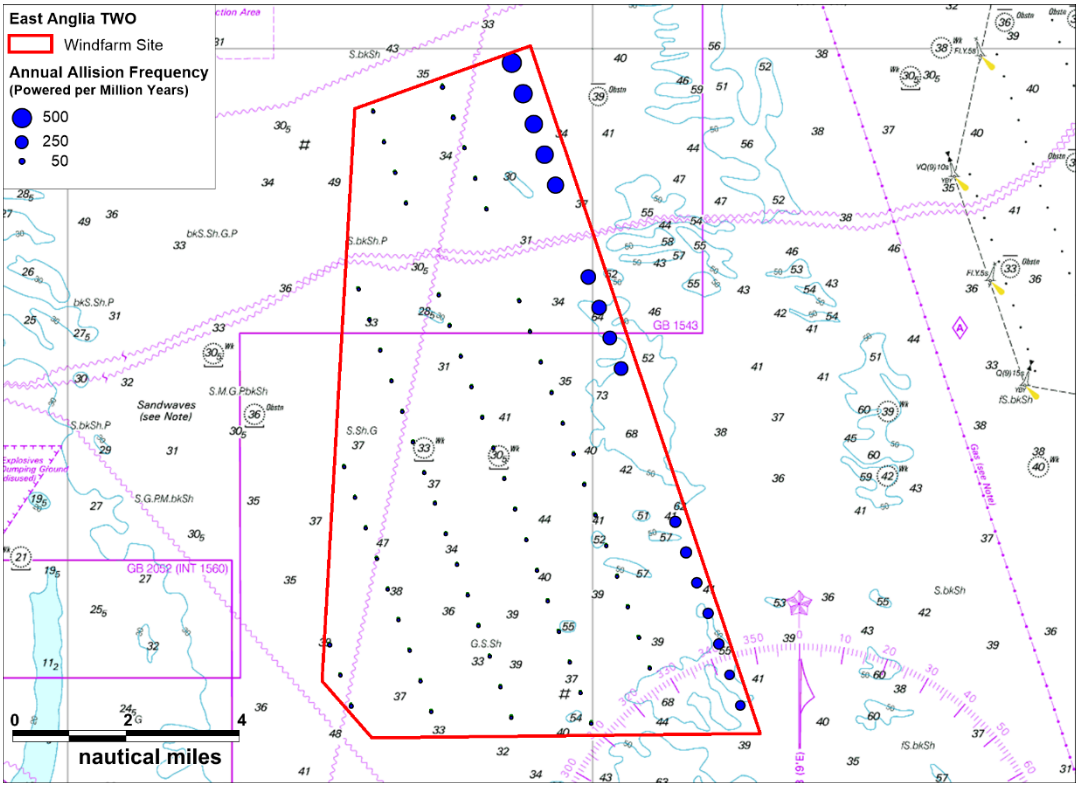


Figure 19.1 Powered Allision – 0% Traffic Growth (Base Case)

19.2.2 Drifting Vessel Allision

330. This model is based on the premise that propulsion on a vessel must fail before a vessel would drift, and takes account of the type and size of the vessel, number of engines, average time to repair, and differing weather conditions. The model assumes that the first structure to be hit is the only one hit by the drifting vessel in that direction and that the other structures would be shielded by the first structure from an allision.

331. The exposure times for a drifting scenario are based on the vessel hours spent in proximity to the East Anglia TWO windfarm site. These were estimated based on the traffic levels, speeds and revised routeing pattern. The exposure was divided by vessel type and size, to ensure these factors, which based on analysis of historical accident data have been shown to influence accident rates, were taken into account within the modelling.

332. Using this information the overall rate of breakdown within the area surrounding the East Anglia TWO windfarm site was estimated. The probability of a vessel drifting towards a structure and the drift speed are dependent on the prevailing wind, wave and tidal conditions at the time of the accident.

333. The following drift scenarios were modelled:

- Wind;

- Peak spring flood tide; and
- Peak spring ebb tide.

334. The probability of vessel recovery from drift is estimated based on the speed of drift and hence the time available before reaching the windfarm structure. Vessels that do not recover within this time are assumed to allide.

335. The ebb tide based scenario was observed to produce the worst case results therefore this scenario was chosen for presentation. The results for the base case and future case traffic levels are presented in *Table 19.3*. It is noted that the wind turbines at risk during an actual drifting allision incident will vary based on a combination of wind and tide.

Table 19.3 Vessel to Structure Allision Results - Drifting

Scenario	Annual Allision Frequency	Return Period (Years)
Base Case – Post Windfarm	1.67×10^{-3}	600 years
Future Case – Post Windfarm	1.83×10^{-3}	545 years

336. The structures most at risk in an ebb tide (north-easterly drift) were observed to be periphery wind turbines on the south and south-west of the East Anglia TWO windfarm site as well as internal wind turbines within the south of the array, as a result of two routes transiting close to the southern boundary. This is illustrated in *Figure 19.2*, which shows a graduated plot of risk to the structures due to ebb tide. In reality, the turbines exposed would vary depending upon the prevailing weather and tidal conditions at the time of the drifting incident.

337. It should be noted that the risk bands differ from those used to illustrate the powered allision results shown in *Figure 19.1* and therefore direct comparison of allision frequency should not be made between the figures. However, comparison between the “hot spot” allision frequency locations can be made.

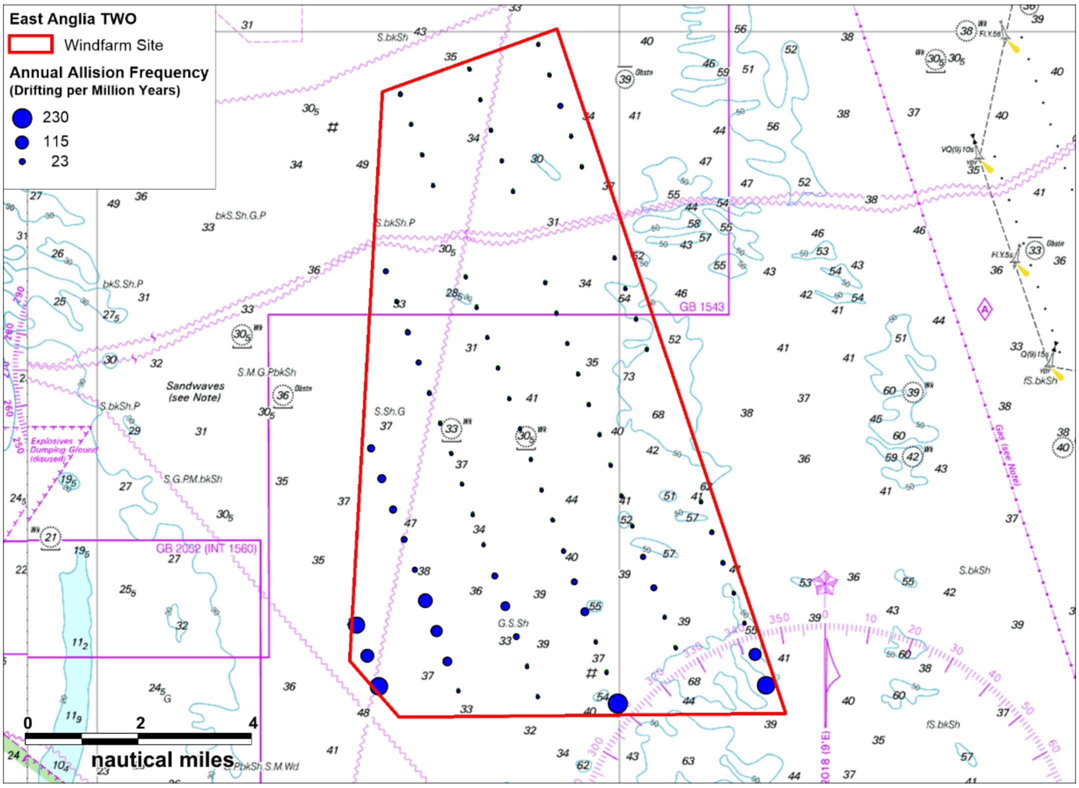


Figure 19.2 Drifting Allision – 0% Traffic Growth (Base Case)

19.3 Fishing Vessel Allision

338. Anatec's CollRisk fishing vessel risk model has been calibrated using fishing vessel activity data along with offshore installation operating experience in the UK (oil and gas) and the experience of allisions between fishing vessels and UKCS offshore installations (published by the HSE).

339. The two main inputs to the model are the fishing vessel density for the area and the structure details including the number and dimensions of the structures. The fishing vessel density in the area of the East Anglia TWO windfarm site was based upon the 2017 marine traffic data, consisting of AIS and Radar data.

340. The results are presented in *Table 19.4.*

Table 19.4 Vessel to Structure Allision Results - Fishing

Scenario	Annual Allision Frequency	Return Period (Years)
Base Case – Post Windfarm	6.60×10^{-2}	15
Future Case – Post Windfarm	7.26×10^{-2}	14

341. The fishing allision results are high when compared to the results of the allision assessment of regular routed vessels provided in section 19.2. This reflects the

assumption that the presence of the structures within the East Anglia TWO windfarm site would have no impact on current fishing activity both inside and outside the site (i.e. takes no account of vessels deviating around the structures, whereas it has been assumed that regular routed commercial traffic would deviate to avoid the East Anglia TWO windfarm site). It is also noted that any allision from a fishing vessel within the East Anglia TWO windfarm site is expected to be low speed (the estimated average speed of fishing vessels intersecting the East Anglia TWO windfarm site was approximately five knots during the combined summer 2017 and winter 2017 period and an average of six knots during the combined summer 2018 and winter 2017 period), and therefore lower risk to the crew, vessel, and structure.

19.4 Modelling Results Summary

342. A summary of the collision and allision risk frequency modelling results for the East Anglia TWO windfarm site is provided in *Table 19.5*.

Table 19.5 Allision and Collision Risk Results Summary

Scenario	Base Case		Future Case	
	Pre Windfarm	Post Windfarm	Pre Windfarm	Post Windfarm
Vessel to Vessel	1.11×10^{-2} (90 years)	1.25×10^{-2} (80 years)	1.35×10^{-2} (74 years)	1.52×10^{-2} (66 years)
Allision – Powered	n/a	4.56×10^{-3} (219 years)	n/a	5.03×10^{-3} (199 years)
Allision – Drifting	n/a	1.67×10^{-3} (600 years)	n/a	1.83×10^{-3} (545 years)
Allision – Fishing	n/a	6.60×10^{-2} (15 years)	n/a	7.26×10^{-2} (14 years)
Total	1.11×10^{-2} (90 years)	8.47×10^{-2} (12 years)	1.35×10^{-2} (74 years)	9.46×10^{-2} (11 years)

343. The overall annual level of collision risk is calculated based on the combined risk results from the four scenarios above. This gives an estimate that the annual level of risk would increase due to the East Anglia TWO windfarm site to approximately one in 12 years (base case) and one in 11 years (future case). The vast majority of this increase is attributed to the higher fishing vessel allision risk in both cases (15 years and 14 years respectively).

19.5 Consequences

344. The consequences associated with the probable outcomes of a collision or allision are expected to be minor. However, the worst case outcomes could have severe

consequences, including events with the potential for multiple fatalities. This section presents a summary of the consequences assessment; the full assessment is presented in *Appendix 14.4 Consequences Assessment*. The consequences assessment is primarily based on the results of the allision and collision modelling undertaken in this NRA.

345. An allision involving a larger vessel may result in the collapse of a wind turbine with limited damage to the vessel. Breach of a vessel's fuel tank is considered unlikely and in the case of vessels carrying hazardous cargoes, e.g., tanker or gas carrier, the additional safety features associated with these vessels will further mitigate the risk of pollution (for example double hulls). Similarly, in a drifting allision, the windfarm structures are likely to absorb the majority of the impact energy, with some energy also being retained by the vessel in terms of rotational movement (glancing blow).

346. In terms of smaller vessels such as fishing and recreational craft, the worst case scenario would be risk of vessel damage leading to foundering of the vessel and Potential Loss of Life (PLL).

347. The overall increase in PLL estimated due to the East Anglia TWO windfarm site is 3.78×10^{-4} fatalities per year (base case), which equates to approximately one fatality per 2,648 years. The annual increase in PLL due to the impact of the East Anglia TWO windfarm site for the future case is estimated to be 4.17×10^{-4}, which equates to one additional fatality in 2,396 years.

348. In terms of individual risk to people, the incremental increase for commercial vessels (approximately 9.78×10^{-8} for the base case) is negligible compared to the background risk level for the UK sea transport industry of 2.9×10^{-4} per year.

349. For fishing vessels, the change in individual risk attributed to the East Anglia TWO windfarm site is higher than commercial vessels (approximately 9.43×10^{-6} for the base case), but still minor compared to the background risk level for the UK sea fishing industry of 1.2×10^{-3} per year.

350. The overall total annual tonnes of oil spilled due to the East Anglia TWO windfarm site is estimated at 0.55 tonnes per year for the base case and at 0.62 tonnes per year for the future case (see *Appendix 14.4 Consequences Assessment* for the full assessment). From research undertaken as part of the DfT MEHRA project (DfT 2001) the average annual tonnes of oil spilled in the waters around the British Isles, due to marine accidents in the 10-year period from 1989 to 1998 was 16,111. Therefore, the overall increase in pollution estimated for the East Anglia TWO windfarm site is very low compared to the historical average pollution quantities from marine accidents in the UK waters (less than 0.01%).

351. The impact of the East Anglia TWO windfarm site on people and the environment is relatively low compared to the existing background risk levels in UK waters. However, it

should be noted that this is the localised impact of the East Anglia TWO windfarm site. There may be additional maritime risks associated with other offshore windfarm developments in and around the southern North Sea and the UK as a whole, however, the purpose of the EIA is to consider the East Anglia TWO windfarm site in isolation; with cumulative impacts where interaction is identified.

352. Impacts associated with the allision and collision modelling are considered within *Chapter 14 Shipping and Navigation*.

353. Further detail on the consequences assessment is presented in *Appendix 14.4 Consequences Assessment.*

19.6 Impacts of Structures on Wind Masking / Turbulence or Shear

354. The offshore wind turbines have the potential to affect vessels under sail when passing through the East Anglia TWO windfarm site from impacts such as wind shear, masking and turbulence.

355. From previous windfarm studies it has been concluded that wind turbines do reduce wind velocity by the order of 10% downwind of a wind turbine. The temporary effect is not considered as being significant and similar to that experienced passing a large vessel or close to other large structures (e.g. bridges) or the coastline. In addition, practical experience to date from RYA members taking vessels into other sites indicates that this is not likely to be an issue. A number of windfarms are operational within UK waters and no impacts have been reported by recreational users.

20 East Anglia Two Cumulative Assessment

20.1 Introduction

356. This section provides an assessment of likely cumulative vessel routeing in the vicinity of the East Anglia TWO windfarm site, if other potential nearby projects are taken into consideration. Data from the marine traffic surveys has been used as the input to the cumulative routeing assessment. This assessment feeds into the CIA undertaken in *Chapter 14 Shipping and Navigation.*

20.2 Methodology of Assessing Cumulative Impacts

357. Cumulative impacts have been considered for shipping and navigation receptors, this includes other offshore projects, as well as activities associated with other marine operations. However, it should be noted that fishing, recreation and marine aggregate dredging transits have been considered as part of the baseline assessment.

358. Other developments which may increase the impacts to shipping and navigation receptors when considered with the offshore development area were assessed, and screened in or out depending upon the outcome of the assessment.

359. Cumulative impacts identified through the Scoping Report (SPR 2017) have then been assessed when considered with the developments scoped in during the screening stage undertaken as part of the NRA process. As raised during consultation, the key cumulative impact was considered to be vessel routeing when considered with the other southern North Sea windfarm developments, however all impacts presented have been considered cumulatively in *Chapter 14 Shipping and Navigation.*

360. There is not considered to be any cumulative routeing impacts from oil and gas platforms and fields. Should any future surface gas developments be applied for within the area they would be subject to their own navigational risk assessments, including at a cumulative level.

20.3 Cumulative Screening

361. *Appendix 14.3 Cumulative Impact Assessment* presents the cumulative screening process and highlights projects within 100nm where a potential cumulative impact has been identified. *Table 20.1* presents the projects screened into the assessment as a result of this.

362. For the PEIR, cumulative impacts were initially considered within a 10nm study area around the East Anglia TWO windfarm site. As mentioned in section 3.6, since the PEIR was first undertaken, the northern extent of the East Anglia TWO windfarm site boundary has been reduced. Despite this change, the shipping and navigation study area has remained the same in order to allow cumulative routeing at this ES stage to remain

comparable to that undertaken at the PEIR stage. As per the PEIR, this 10nm study area has then been extended to 100nm where applicable to encompass vessel routeing. This includes consideration of transboundary offshore windfarm projects and shipping routes. However, for a cumulative or transboundary windfarm to be considered in the cumulative routeing assessment a vessel route needs to be impacted by both the screened windfarm and the offshore development area i.e. a route must pass through or in proximity to the windfarm being considered.

363. It should be noted that any projects which are currently dormant or any projects with development zones have not been included within the cumulative screening.

Table 20.1 Summary of Projects Included for the CIA in Relation to Shipping and Navigation

Development	Distance from East Anglia TWO Windfarm Site	Status	Rationale
UK Windfarms			
East Anglia ONE	5.4nm	Under construction	Creation of gap between East Anglia TWO, East Anglia ONE North and East Anglia ONE
East Anglia ONE North	5.6nm	Concept and early planning	
East Anglia THREE	25.7nm	Consented	Close to DWR used by cumulative routeing
Galloper	3.9nm	Fully commissioned	Reduction of available sea room between East Anglia TWO, Greater Gabbard and Galloper
Hornsea Project One	94.3nm	Under construction	Route 12 cumulatively deviates between Hornsea Project Three, Hornsea Project One and Hornsea Project Two
Hornsea Project Two	97.3nm	Pre-construction	Route 12 impacted by both Hornsea Project Two and East Anglia TWO
Hornsea Project	89nm	Application submitted	Route 12

Development	Distance from East Anglia TWO Windfarm Site	Status	Rationale
Three			cumulatively deviates between Hornsea Project Three, Hornsea Project One and Hornsea Project Two
Norfolk Boreas	39nm	Concept and early planning	Route 12 impacted by both Norfolk Boreas and East Anglia TWO
Norfolk Vanguard	34nm	Application submitted	Route 12 impacted by both Norfolk Vanguard and East Anglia TWO
EU Windfarms			
Mermaid	24nm	Pre-construction	Route 5 impacted by both Mermaid and East Anglia TWO
Northwester 2	26nm	Pre-construction	Route 5 impacted by both Northwester 2 and East Anglia TWO
Poseidon P60 - Mermaid	25nm	Concept and early planning	Route 5 impacted by both Poseidon P60 - Mermaid and East Anglia TWO

20.4 Cumulative Routeing

364. The routes that are impacted by other windfarms (including transboundary developments) are routes 2, 3, 5 and 12 which are cumulatively impacted by the offshore development area and other projects. Cumulative re-routeing taking account of UK and transboundary windfarms is discussed in the following subsections. It should be noted that some of the projects are not yet consented. However, given the future potential for the project to be constructed and potential cumulative impact on vessel routeing, the development has been considered throughout the following subsections.

20.4.1 Cumulative Deviations

365. An overview of the anticipated cumulative vessel routes (obtained by deviating the base case routes from section 14 and taking into account cumulative routeing proposed

as part of the Southern North Sea Offshore Wind Forum (SNSOWF) in 2013 (SNSOWF 2013) to account for the projects considered) are presented in *Figure 20.1*. Following this, *Figure 20.2* presents the cumulative routeing within the vicinity of the shipping and navigation study area. The route ID numbering shown in the figures corresponds to that presented in section 14 and section 16)

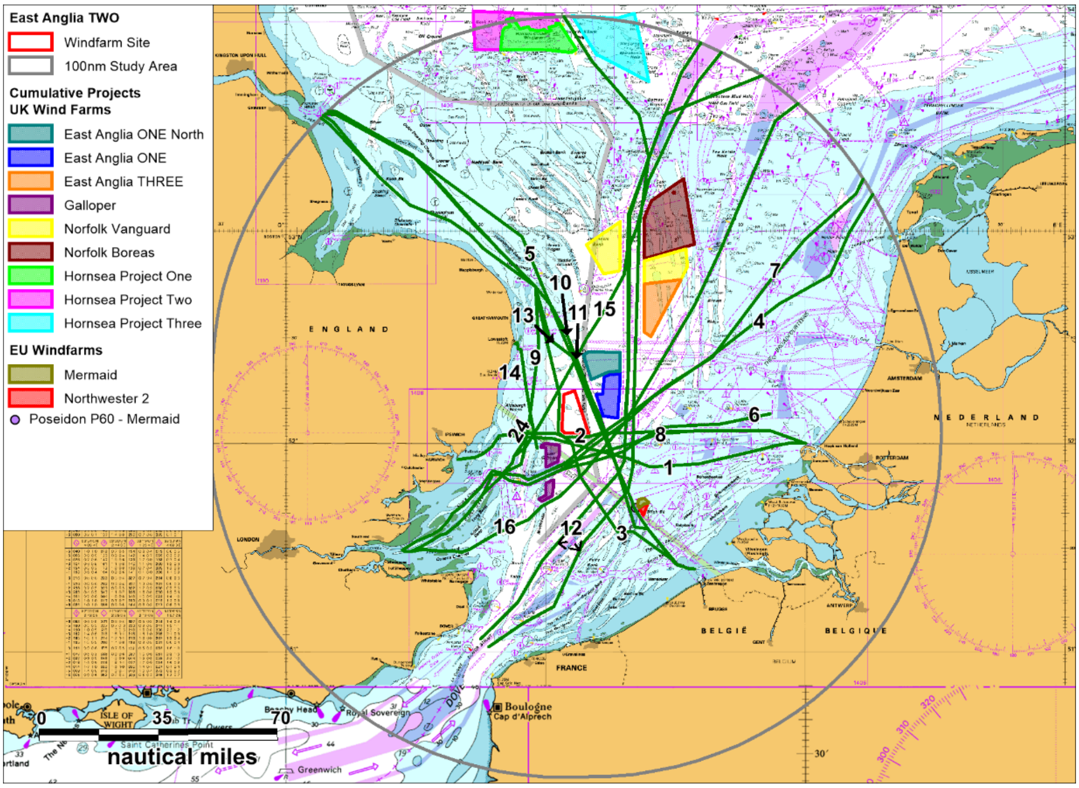


Figure 20.1 Cumulative Routeing within 100nm Study Area

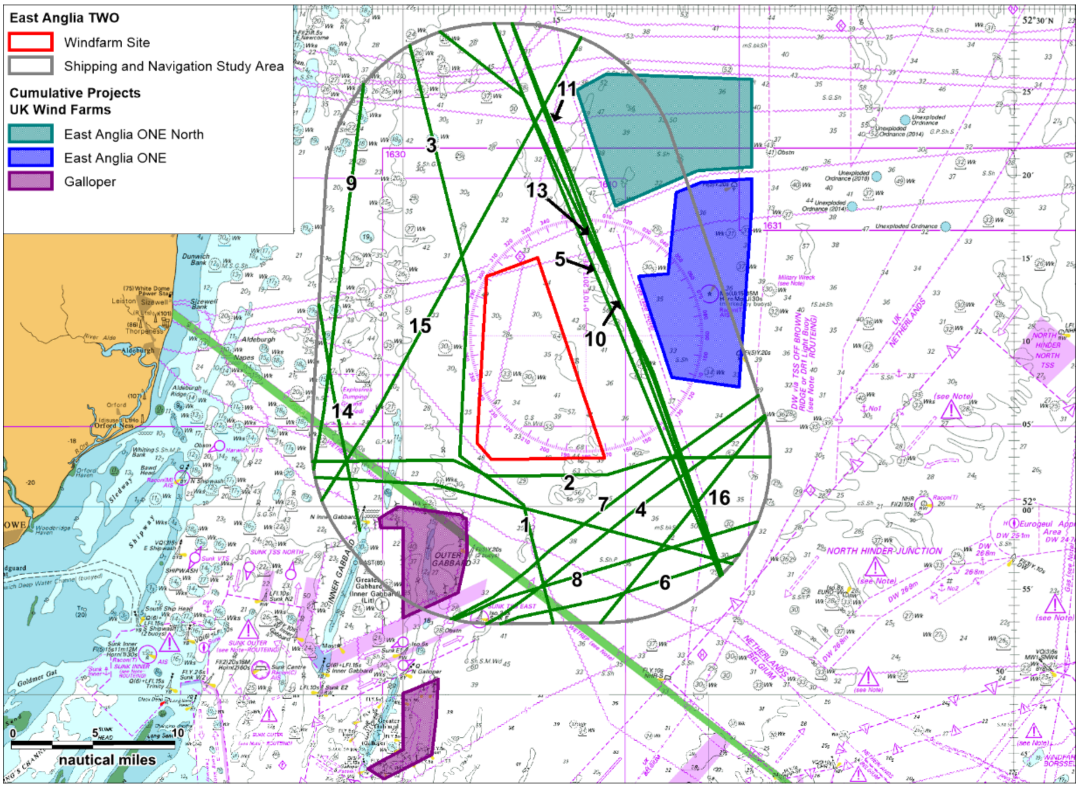


Figure 20.2 Cumulative Routeing within Shipping and Navigation Study Area

366. Based on cumulative routeing proposed as part of the SNSOWF (SNSOWF 2013), route 12 is predicted to deviate at the TSS far south of the East Anglia TWO windfarm site and route around the boundaries of the East Anglia ONE North offshore development area and the East Anglia ONE offshore development area (see *Figure 20.1*). This results in route 12 no longer transiting within the shipping and navigation study area.

367. It should be noted that the boundaries used are indicative and should any navigational corridor be developed between the East Anglia ONE North offshore development area, East Anglia TWO offshore development area and the East Anglia ONE offshore development area it will comply with MCA and TH requirements.

368. *Table 20.2* presents the projects which affect each individual route.

Table 20.2 Routes Affected by Cumulative Projects

Route ID	East Anglia TWO	East Anglia ONE	East Anglia ONE North	East Anglia THREE	Galloper	Hornsea Project One	Hornsea Project Two	Hornsea Project Three	Norfolk Boreas	Norfolk Vanguard	Mermaid	Northwester 2	Poseidon P60 - Mermaid
1	x	x	x	x	✓	x	x	x	x	x	x	x	x
2	✓	x	x	x	✓	x	x	x	x	x	x	x	x
3	✓	x	x	x	✓	x	x	x	x	x	x	x	x
4	x	x	x	x	✓	x	x	x	x	x	x	x	x
5	✓	✓	✓	x	x	x	x	x	x	x	✓	✓	✓
6	x	x	x	x	✓	x	x	x	x	x	x	x	x
7	x	x	x	x	✓	x	x	x	x	x	x	x	x
8	x	x	x	x	✓	x	x	x	x	x	x	x	x
9	x	x	x	x	x	x	x	x	x	x	x	x	x
10	x	✓	✓	x	x	x	x	x	x	x	✓	✓	✓
11	x	✓	✓	x	x	x	x	x	x	x	✓	✓	✓
12	✓	✓	✓	✓	x	✓	✓	✓	✓	✓	x	x	x

Route ID	East Anglia TWO	East Anglia ONE	East Anglia ONE North	East Anglia THREE	Galloper	Hornsea Project One	Hornsea Project Two	Hornsea Project Three	Norfolk Boreas	Norfolk Vanguard	Mermaid	Northwester 2	Poseidon P60 - Mermaid
13	x	✓	✓	x	x	x	x	x	x	x	✓	✓	✓
14	x	x	x	x	x	x	x	x	x	x	x	x	x
15	x	x	x	x	x	x	x	x	✓	✓	x	x	x
16	x	x	x	✓	✓	x	x	x	x	x	x	x	x

20.5 Spacing between Cumulative Projects

369. Annex 3 of MGN 543 (MCA 2016) provides a template from which the required width of shipping lanes located in a 'corridor' between two or more windfarm sites can be calculated. Where such a lane exists, the MCA require that there is room within the corridor between the windfarms for a vessel to deviate up to 20°. The East Anglia TWO offshore development area, East Anglia ONE North offshore development area and East Anglia ONE offshore development area create a gap, and it was therefore necessary to check this gap against the guidance.

370. Given a gap is only formed if the East Anglia ONE North offshore development area and East Anglia ONE offshore development area are also considered, the calculations have been undertaken cumulatively, with the gap defined as running between the southernmost point of the East Anglia ONE offshore development area, and the northernmost point of the eastern East Anglia TWO windfarm site boundary. This ensures the East Anglia TWO windfarm site is incorporated into the calculations given its eastern boundary (i.e. the boundary forming the western edge of the corridor) is accounted for. This should be considered a conservative approach given that the northern and southern extents of the gap as defined for the purpose of this assessment are bordered by wind turbines on both sides.

371. The gap is required to be of width at least 2.3nm, based on length of 6.4nm, and the required 20° deviation. The actual width of the gap is 5.4nm, and therefore is compliant with the MGN 543 corridor guidance.

20.6 CIA within the EIA

372. Cumulative impacts have been assessed in *Chapter 14 Shipping and Navigation* and take the projects listed in section 20.3 into account.

21 Hazard Log

21.1 Introduction

373. As per the required MCA methodology (MCA 2015), a Hazard Log has been created detailing the potential hazards to shipping and navigation receptors that may arise from the construction, operation, and decommissioning of the East Anglia TWO windfarm site. The Hazard Log itself is included in *Appendix 14.2*, with this section providing an overview of the methodology used to create the log, and a summary of the results.

374. It should be noted that since the creation of the Hazard Log, the northern extent of the East Anglia TWO windfarm site boundary has been reduced and the offshore cable corridor has been altered to incorporate this change.

21.2 Hazard Workshop

375. Key to the creation of a Hazard Log is the incorporation of comment and experience of both local and national shipping and navigation stakeholders relevant to the offshore development area. For this reason a Hazard Workshop was held in London on the 9th May 2018 for the purpose of gathering the knowledge and experience of the attendees to use as input to the final Hazard Log. The workshop invitees are listed in *Table 21.1*, including those parties invited but who were unable to attend.

Table 21.1 Hazard Workshop Invitees

Stakeholder	Attended
Brown & May Marine	Yes
CoS	Yes
CA	Yes
Cobelfret Ferries	Yes
DFDS	Yes
James Fisher Everard	Yes
Associated British Ports	No
BMAPA	No
DfT	No
Hanson Marine	No
Harwich Haven Authority	No
MCA	No

Stakeholder	Attended
National Federation of Fishermen's Organisations	No
Port of London Authority	No
Rederscentrale (Belgian Fisheries)	No
RNLI	No
Royal Yachting Association	No
Stena Line	No
Trinity House	No
VISNED	No

376. The attendees were provided with an overview of the offshore development area, including the intended timeline, and the key relevant parameters. Following this, potential hazards to shipping and navigation receptors associated with the offshore development area were identified and discussed. This included discussion of potential mitigation measures that could be implemented to reduce risk to ALARP where appropriate.

377. Post-workshop, the Hazard Log was drafted and distributed to all attendees, with the final version incorporating the feedback received. The final, agreed version of the Hazard Log is presented in *Appendix 14.2.*

21.3 Results

378. A total of 15 hazards were identified and included in the Hazard Log. These are summarised in *Table 21.1* (noting that construction and decommissioning impacts were grouped on the basis that these phases presented similar scenarios). All hazards assessed were deemed to be Broadly Acceptable or Tolerable with mitigation.

Table 21.2 Summary of Impacts Identified in Hazard Log

Phase(s)	Hazard Title	Hazard Detail
Construction, operation and decommissioning	Displacement of vessels.	Activities within the East Anglia TWO windfarm site may lead to the displacement of established commercial vessel routes and third party marine activity.
Construction, operation and decommissioning	Displacement of vessels during periods of adverse weather.	Activities within the East Anglia TWO windfarm site may lead to the displacement of established commercial vessel adverse weather routes.

Phase(s)	Hazard Title	Hazard Detail
Construction, operation and decommissioning	Increased collision risk between two third party vessels.	The displacement of vessels due to activities within the East Anglia TWO windfarm site may lead to an increasing number of encounters between third party vessels and therefore an increase in vessel collision risk between third party vessels.
Construction, operation and decommissioning	Increased collision risk between a third party vessel and project vessel.	The displacement of vessels due to activities within the East Anglia TWO windfarm site may lead to an increasing number of encounters between a third party vessel and project vessel and therefore an increase in vessel collision risk between a third party vessel and project vessel.
Construction and decommissioning	Creation of allision risk associated with partially constructed / decommissioned windfarm structures.	The presence of a partially constructed or decommissioned windfarm structure may create an allision risk.
Construction and decommissioning	Creation of allision risk for vessels NUC associated with partially constructed / decommissioned windfarm structures.	The presence of a partially constructed or decommissioned windfarm structure may create an allision risk for vessels NUC.
Operation	Creation of allision risk for commercial vessels associated with unmanned windfarm structures.	The presence of windfarm infrastructure may create an allision risk for passing commercial vessels.
Operation	Creation of allision risk for commercial vessels NUC associated with unmanned windfarm structures.	The presence of windfarm infrastructure may create an allision risk for commercial vessels NUC.
Operation	Creation of allision risk for commercial fishing vessels associated with unmanned windfarm structures.	The presence of windfarm infrastructure may create an allision risk for commercial fishing vessels.
Operation	Creation of allision risk for recreational vessels associated with unmanned windfarm structures.	The presence of windfarm infrastructure may create an allision risk for recreational vessels.
Construction, operation and decommissioning	Creation of allision risk for project vessels associated with unmanned windfarm structures.	The presence of windfarm infrastructure may create an allision risk for vessels associated with the project and operating in proximity to structures.
Operation	Creation of allision risk associated with manned platforms.	The presence of manned construction, operation and maintenance platforms may create an allision risk.

Phase(s)	Hazard Title	Hazard Detail
Construction, operation and decommissioning	Anchor interaction with sub-sea cables or structures during normal anchoring operations.	A vessel may drop anchor or drag anchor over sub-sea structures including a sub-sea cable.
Construction, operation and decommissioning	Anchor interaction with sub-sea cables during emergency anchoring operations.	A vessel may drop anchor or drag anchor over sub-sea structures including a sub-sea cable in an emergency situation.
Construction, operation and decommissioning	Diminished emergency response capability within the region.	The increased activity associated with the project may lead to an increase in incidents requiring an emergency response resulting in a reduction in SAR resources available within the region.

22 Next Steps and Embedded Mitigation Measures

379. Following identification of both future case impacts and the outcomes of the FSA, an impact assessment in line with EIA guidance has been undertaken. The impact assessment considers the identified impacts from the NRA with regards to shipping and navigation receptors and assumes embedded mitigation measures will be in place. This EIA is presented in *Chapter 14 Shipping and Navigation*.

380. The EIA requires compiling and reviewing available data. For shipping and navigation this includes the marine traffic surveys, base case assessment and a NRA. The likely impacts of the offshore development area during the construction, operation and decommissioning stages are assessed and feedback provided to the design and engineering teams to mitigate or modify the offshore development area in order to avoid, prevent, reduce and, where possible, offset any significant adverse impacts. Following this is the identification of any residual effects and any further mitigation measures that may be required.

381. Those measures assumed to be embedded mitigation are listed below. The EIA has been undertaken on the understanding that these measures will be in place.

- Application for and use of safety zones during construction, major maintenance work during operations and decommissioning;
- Cable Burial Risk Assessment undertaken pre-construction, including consideration of under keel clearance. All sub-sea cables will be suitably protected based on risk assessment, and the protection will be monitored and maintained as appropriate;
- Compliance from all vessels associated with the offshore development area with international maritime regulations as adopted by the relevant flag state (most notably COLREGS (IMO 1972) and SOLAS (IMO 1974));
- Consideration of MGN 543 – including the SAR annex;
- An ERCoP will be developed and implemented for the construction, operational & maintenance and decommissioning phases. The ERCoP is based on the standard MCA template and will consider the potential for self-help capability as part of the ongoing process;
- Information relevant to the offshore development area will be promulgated via Notice to Mariners and other appropriate media;
- Marine traffic coordination;
- Suitable lighting and marking of the East Anglia TWO windfarm site complying with IALA Recommendations O-139 (IALA 2013), to be finalised in consultation with TH and the MCA;
- Use of guard vessels when deemed appropriate following risk assessment;
- Wind turbines will have at least 22m clearance above MHWS as required by MGN 543 (MCA 2016) and RYA (RYA 2015) requirements; and

- Wind turbines, cables and substations marked on Admiralty Navigational Charts and Admiralty Sailing Directions.

23 Future Monitoring

23.1 Safety Management Systems (SMS) and Emergency Response Planning

382. Health and safety documentation, including a policy statement, SMS and emergency response plans will be in place for the offshore development area post consent and prior to construction. This will be continually updated throughout the development process. The following sections provide an overview of documentation and how it will be maintained and reviewed with reference where required to specific marine documentation.

383. Monitoring, reviewing and auditing will be carried out on all procedures and activities and feedback actively sought. Any designated person, managers and supervisors are to maintain continuous monitoring of all marine operations and determine if all required procedures and processes are being correctly implemented.

23.2 Future Monitoring of Marine Traffic

384. Secured under the conditions of the draft DML is the requirement to provide traffic monitoring in accordance with the Outline Navigation Monitoring Strategy. For construction traffic monitoring, this will be by AIS, including continual collection of data from a suitable location at the East Anglia TWO windfarm site with an assessment of a minimum of 28 days submitted to the MCA annually. This is likely to continue through to the first year of operation to ensure mitigations put in place are effective.

23.3 Sub-sea Cables

385. The sub-sea cable routes will be subject to periodic inspection to monitor the cable protection, including burial depths.

23.4 Hydrographic Surveys

386. As required by MGN 543, detailed and accurate hydrographic surveys will be undertaken periodically at agreed intervals.

23.5 Decommissioning Plan

387. A decommissioning plan will be developed. With regards to impacts on shipping and navigation this will also include consideration of the scenario where, on decommissioning and on completion of removal operations, an obstruction is left on site (attributable to the windfarm) which is considered to be a danger to navigation and which it has not proved possible to remove. Such an obstruction may require marking until such time as it is either removed or no longer considered a danger to navigation, the continuing cost of which will need to be met by the operator.

24 Summary

24.1 Marine Traffic

388. Two 14 day marine traffic surveys were undertaken for the offshore development area, with periods chosen to cover seasonal variations (May / June 2017 and November / December 2017). These data sets have informed the marine traffic assessment undertaken in this NRA and within *Chapter 14 Shipping and Navigation* of the PEIR. A summer 2018 survey undertaken in August / September 2018 has been presented alongside this data in order to validate the May / June 2017 marine traffic assessment within this NRA and *Chapter 14 Shipping and Navigation* of the ES.

389. Based on the survey data recorded during summer 2017 it was estimated that 74 unique vessels per day passed within 10nm of the East Anglia TWO windfarm site, and 43 within 2nm of the offshore cable corridor. During winter 2017, this reduced to 71 unique vessels per day within 10nm of the East Anglia TWO windfarm site, and 31 within 2nm of the offshore cable corridor. For comparison, an average of 63 unique vessels passed within 10nm of the East Anglia TWO windfarm site during the summer 2018 survey, with an average of 39 per day within 2nm of the offshore cable corridor. It is likely that the drop in vessel numbers is due to fewer recreational vessels within the shipping and navigation study area during summer 2018 (there were no recreational races during the survey period) and also due to vessels avoiding the construction of the East Anglia ONE windfarm site which was ongoing during the summer 2018 survey but absent during the summer and winter 2017 periods.

390. The majority of vessels recorded during both summer surveys and the winter survey were commercial vessels (cargo and tanker), however, a high number of recreational vessels were also recorded during summer 2017 due to the Vuurschepen race and North Sea race. Four routes were identified as requiring deviation due to the offshore development area.

391. Passenger vessels were also identified within the shipping and navigation study area. The two most frequently operated routes during both summer surveys and the winter survey were:

- Between Harwich and Rotterdam (*Stena Britannica* and *Stena Hollandica*, passing south of windfarm site); and
- Between Hull and Zeebrugge (*Pride of Bruges* and *Pride of York* passing east of windfarm site).

392. A number of DFDS Seaways freight ferry routes were recorded throughout 2017 with vessels on the Rotterdam to Felixstowe route recorded intersecting the south of the East

Anglia TWO windfarm site (23% of total DFDS vessel tracks). The most frequently used DFDS route during 2017 was the Immingham to Rotterdam route (average of two unique vessels per day) which was recorded to the north-east of the East Anglia TWO windfarm site.

393. The majority of fishing activity recorded during both summer surveys and the winter survey in the shipping and navigation study area was from beam trawlers. The majority of fishing recorded in the vicinity of the offshore cable corridor during the combined summer and winter 2017 survey period was from demersal otter trawlers. During the combined summer 2018 and winter 2017 survey period this changed to dredgers, demersal trawlers and long liners / drift netters.

394. Regular windfarm traffic to the Greater Gabbard Offshore Wind Farm and Galloper Wind Farm was recorded from Lowestoft (UK). It is noted that as Galloper Wind Farm was still under construction during the summer and winter 2017 marine traffic surveys, the associated activity may not be representative of the traffic during its operational phase. During summer 2018, construction of the Galloper Offshore Wind Farm was complete. Traffic was still recorded transiting between Greater Gabbard Offshore Wind Farm and Lowestoft as well as between Harwich and Galloper Offshore Wind Farm. This traffic is likely to be more representative of the operational phase. The location of the East Anglia TWO windfarm site was identified as not impacting the routeing to and from the Galloper and Greater Gabbard windfarm sites during both survey periods.

395. Anchoring was observed to occur within the East Anglia TWO windfarm site itself, and to the north and north-west of the windfarm site. Anchored vessels were mostly tankers. This area is not charted as a designated anchorage; however there is a designated area of the UK territorial sea off the coast of Southwold where STS transfers are permitted therefore the anchored tankers may be anchored in preparation for or during STS transfer.

24.2 Allision and Collision Modelling

396. It was estimated that the construction of the offshore development area would raise current vessel to vessel collision rates by approximately 13% (assuming no growth in traffic) and 13% (assuming a 10% growth in traffic).

397. It was estimated that a vessel would allide with a windfarm structure under power once every 219 years assuming no growth in traffic. An allision from an NUC vessel was estimated to occur once every 600 years assuming current traffic. It was estimated that an allision between a fishing vessel and a windfarm structure would occur once every 15 years, however it is noted that this assumes fishing levels and grounds would remain unchanged following construction of the offshore development area.

24.3 Cumulative Impacts

398. Cumulative impacts have been considered for the offshore development area including the impacts on shipping and navigation arising from other proposed offshore wind developments. This includes consideration for projects within 10nm of the East Anglia TWO windfarm site and then extended to 100nm to consider cumulative routeing.

399. Following a cumulative screening process in *Appendix 14.3 Cumulative Impact Assessment*, the following projects have been taken forward to the EIA:

- East Anglia ONE;
- East Anglia ONE North;
- East Anglia THREE;
- Galloper;
- Hornsea Project One;
- Hornsea Project Two;
- Hornsea Project Three;
- Norfolk Boreas;
- Norfolk Vanguard;
- Mermaid;
- Northwester 2; and
- Poseidon P60 – Mermaid.

24.4 Hazard Log

400. Following a hazard workshop, a hazard log was drafted by Anatec to detail all hazards identified following a review of the baseline assessment. Each hazard was ranked in terms of significance, and further mitigation proposed where required. The initial draft was distributed to the relevant shipping and navigation stakeholders, and any responses were taken into consideration in the final version. The final log was then used to inform the significance rankings used within the FSA in the PEIR and the ES, in addition to the modelling results and expert opinion.

24.5 Receptors Carried forward to the EIA

401. Following consideration of the results of the NRA including baseline data, consultation, the hazard log and modelling results, the following receptors identified in the Scoping Report (SPR 2017) were taken forward for consideration in the EIA:

- Commercial vessels;
- Commercial fishing vessels;
- Marine aggregate dredgers;
- Recreational craft; and

- Emergency response.

402. Impacts on communications, navigation and marine radar interference have been scoped out of the assessment at this stage following consultation with the MCA (0).

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