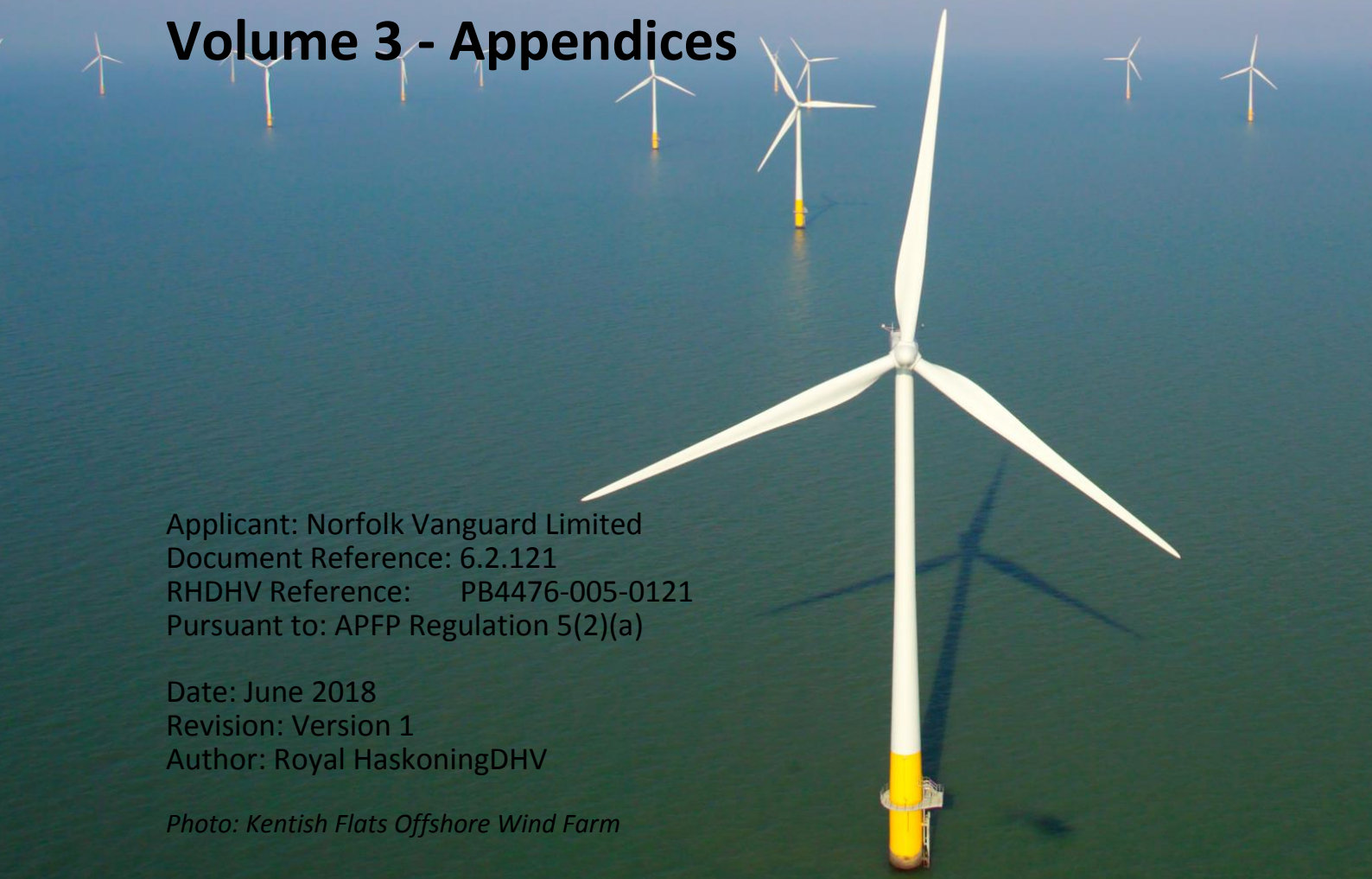
Norfolk Vanguard Offshore Wind Farm

Appendix 12.1

Marine Mammal Survey Report

Environmental Statement

Volume 3 - Appendices



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Environmental Impact Assessment
Environmental Statement

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June 2018

For and on behalf of Norfolk Vanguard Limited

Approved by: Ruari Lean and Rebecca Sherwood

Signed: [redacted]

Date: 8th June 2018

For and on behalf of Royal HaskoningDHV

Drafted by: Gemma Starmore and Jennifer Learmonth

Approved by: Alistair Davision

Signed: [redacted]

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Contents

Tables

Figures

Glossary

CF	Correction Factor
CI	Confidence Intervals
cm	Centimetre
CV	Coefficient of Variation
EA4	East Anglia FOUR
ES	Environmental Statement
GSD	Ground Sampling Distance
JCP	Joint Cetacean Protocol
km	kilometre
km^2	kilometre squared
m	metre
NE	Natural England
NV East	Norfolk Vanguard East
NV OWF sites	Norfolk Vanguard Offshore Wind Farm sites (i.e. NV East and NV West)
NV West	Norfolk Vanguard West
OWF	Offshore Wind Farm
SMRU	Sea Mammal Research Unit

Terminology

Array cables	Cables which link the wind turbines and the offshore electrical platform.
Interconnector cables	Buried offshore cables which link the offshore electrical platforms
Landfall	Where the offshore cables come ashore at Happisburgh South
Offshore accommodation platform	A fixed structure (if required) providing accommodation for offshore personnel. An accommodation vessel may be used instead
Offshore cable corridor	The corridor of seabed from the Norfolk Vanguard OWF sites to the landfall site within which the offshore export cables would be located.
Offshore electrical platform	A fixed structure located within the wind farm area, containing electrical equipment to aggregate the power from the wind turbines and convert it into a more suitable form for export to shore.
Offshore export cables	The cables which bring electricity from the offshore electrical platform to the landfall.
Offshore project area	The overall area of Norfolk Vanguard East, Norfolk Vanguard West and the offshore cable corridor
Safety zones	A marine zone outlined for the purposes of safety around a possibly hazardous installation or works / construction area under the Energy Act 2004.
Scour protection	Protective materials to avoid sediment being eroded away from the base of the foundations as a result of the flow of water.
The Applicant	Norfolk Vanguard Limited
The OWF sites	The two distinct offshore wind farm areas, Norfolk Vanguard East and Norfolk Vanguard West
The project	Norfolk Vanguard Offshore Wind Farm, including the onshore and offshore infrastructure

12.1 MARINE MAMMAL SURVEY DATA

12.1.1 Introduction

1. This appendix summarises the marine mammal data collected during the marine mammal site specific surveys within the Norfolk Vanguard Offshore Wind Farm (OWF) sites (Norfolk Vanguard East (NV East) and Norfolk Vanguard West NV West)) with a 4km buffer area (Plate 12.1). The purpose of these surveys is to assess the temporal and spatial variation in marine mammal abundance and distribution in and around the Norfolk Vanguard OWF sites.

2. The following monthly aerial surveys have been undertaken of the Norfolk Vanguard OWF sites to characterise the site for marine mammals:

   - Aerial survey data of the former East Anglia FOUR (EA4) site (now NV East) with 4km buffer between March 2012 and February 2014;
   - Aerial survey data of NV East with 4km buffer from September 2015 to April 2016; and
   - Aerial survey data of NV West with 4km buffer from September 2015 to August 2017.

3. The information included in this appendix to support the ES is based on the East Anglia Four (EA4) site surveys (March 2012 – February 2014), the NV East site surveys (September 2015 – April 2016) and two years site specific survey data for NV west (September 2015 – August 2017).

4. The digital aerial survey approach has many advantages over alternative methods. It is performed from an altitude at which disturbance to target species is minimal, and is not subject to the bias of repulsion (i.e. inducing flee responses in marine mammals, such as harbour porpoise (*Phocoena phocoena*), that can influence the numbers recorded and affect their apparent distribution) or attraction (i.e. some marine mammal species, such as bottlenose dolphin (*Tursiops truncatus*) may be attracted to boats and ride the bow wave formed by the vessel). The aerial survey approach also provides very accurate positioning data, and can be interpreted to provide information on swimming direction and the distance between animals in a pod. Furthermore, owing to the speed of the aircraft, it is possible to cover large areas in a single day of survey, meaning within-survey temporal variance is minimised. Images collected can be scrutinised post hoc, are subject to Quality Assurance, and provide a permanent record for future interpretation.

5. A major advantage of collecting many digital still images is the resulting statistical power. Each image is a representative sample of marine mammal distribution and abundance, and can be considered independent from every other image due to the

500m separation between image centres. In this way, a systematic grid of many independent estimates of the abundance is formed, resulting in increased precision of abundance estimates.

6. It is also necessary to understand certain restrictions and limitations associated with aerial survey for marine mammals. For example, it is often difficult to identify individuals to species level from the imagery and higher level groupings are frequently used for classification, which influences the information available for individual species that can be taken forward for further assessment (see section 12.1.2.3). Although submerged individuals near the surface can be observed, water clarity could introduce bias in the results with more individuals likely to be recorded during calm weather with greater water clarity than e.g. following a storm when water is potentially more turbid. Marine mammals spend a large proportion of time underwater and individuals present which are too deep to be captured by the imagery will not be recorded, requiring the application of a correction factor (see section 12.1.2.4).

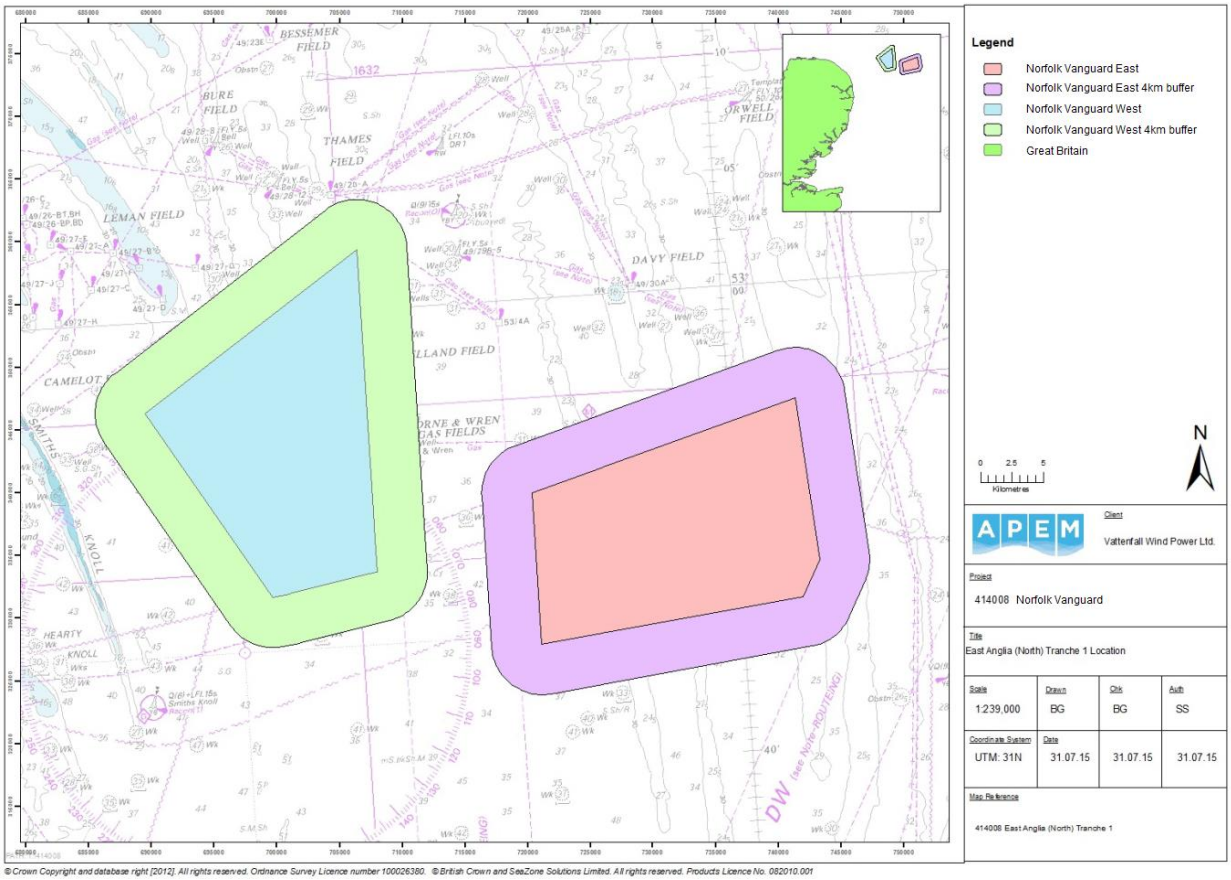

Plate 12.1 Location of the NV East and West aerial surveys and 4km buffer zones

12.1.2 Methodology

12.1.2.1 Data collection

7. APEM collected high resolution aerial digital still imagery over the Norfolk Vanguard OWF sites (EA4, NV East and NV West) with a 4km buffer area, covering a total of 645km^2. The monthly surveys collected imagery data at 2cm Ground Sampling Distance (GSD) on a 500m by 400m grid irregular grid-based survey to achieve a minimum of 10% coverage in each survey period (each month). Coverage of the two OWF sites and 4km buffer was between approximately 12% and 13% per month. Plate 12.1 shows the survey areas for NV East and NV West.

8. The aerial surveys were completed using a Vulcanair P68 C Observer or Britten-Norman Islander twin-engine survey aircraft using a bespoke GPS-linked flight management system to ensure the survey tracks were completed with high accuracy.

9. All images were analysed to enumerate marine mammals to species level, where possible. Internal QA was carried out by APEM on each survey. Images were assessed in batches with a different staff member responsible for each batch. Each image containing marine mammals was reviewed and checked by APEM's dedicated QA Manager, ensuring that 100% of marine mammals recorded were subject to internal QA to ensure the species identification is correct. Images containing no marine mammals were removed and kept separately for further internal QA. Of these 'blank' images, 10% were randomly selected for internal QA by a different staff member to that which initially analysed the imagery. If there was less than 90% agreement, the entire batch would be re-analysed as part of the QA procedures. Following internal QA, external QA was carried out by the Sea Mammal Research Unit (SMRU), who provided an independent third party assessment of the marine mammals recorded in each survey.

12.1.2.2 Data analysis

10. APEM supplied the raw data and MacArthur Green conducted the initial data analysis.

11. Raw data were supplied to MacArthur Green as plane GPS track logs, containing details for each image location and observation logs, containing details of all objects (seabird, marine mammal, vessel, etc.) recorded. The datasets were merged using the image ID to obtain a single dataset. All non-marine mammal records were removed prior to analysis of marine mammal density and abundance estimates. Analysis was conducted for each survey separately. Marine mammal locations were assigned to the following sub-zones; wind farm, wind farm plus 2 km buffer and wind farm plus 4km buffer (not that each buffer width also included the wind farm data).

12. Density and abundance can be estimated in two ways using these data, referred to as design based and model based methods. Design based methods apply a straightforward extrapolation, with density estimated for the surveyed area (i.e. the sum of all the image footprints) and multiplied up to the total area to obtain abundance. This makes the assumption that the surveyed sample is representative of the unsurveyed region, thus the design of survey is important (hence 'design based'). A design based estimate has no spatial variation in the estimated density or abundance.

13. Model based methods use explanatory data (e.g. spatial coordinates, sea depth, etc.) fitted to observations to estimate the expected number of observation in unsurveyed regions. Model based estimates can therefore generate variable density surfaces reflecting the relationships between data and covariates. However, to obtain reliable model based estimates it is necessary to have a reasonably large number of observations to permit robust parameter estimation. Thus, this can only be conducted for more numerous species.

14. For the current preliminary assessment, only design based methods have been used. Model based methods will also be undertaken for species-survey combinations which meet the minimum sample size requirements (as an approx. guide a minimum of 50 observations per survey is typically required). These will be included, if possible, in the final submission.

15. Design based confidence intervals for each species were obtained using a bootstrap resampling method. For each survey, images were drawn randomly (with replacement) from the dataset until the same number of images as the original sample was obtained (e.g. if the survey comprised 350 images, each resampled dataset also contained 350 images, drawn from the original dataset). This process was repeated 1,000 times and the density and abundance calculated for each resampled dataset. The upper and lower 95% confidence limits were calculated across the 1,000 samples to estimate sampling variation.

12.1.2.3 Species identification

16. In some instances, an image had sufficient clarity to identify an individual to species level, whereas for other individuals the clarity may not have been sufficient to identify to species levels and it was necessary instead to categorise the individual at a lower identification level e.g. unidentified patterned dolphin species (see Table 12.1 for the different levels of identification of individuals).

17. Sightings were assigned to a specific species where possible, or to one of the following categories:

- Unidentified cetacean species;
- Phocid species (seals);
- Unidentified dolphin or porpoise (small cetacean);
- Unidentified dolphin; and
- Unidentified patterned dolphin.

Table 12.1 Marine mammals identification levels according to species and species groups used within baseline report

<table>
<tr><th>Identification level 1</th><th>Identification level 2</th><th>Identification level 3</th><th>Identification level 4</th><th>Identification level 5</th></tr>
<tr><td rowspan="7">Unidentified cetacean species</td><td rowspan="7">Unidentified dolphin / porpoise</td><td colspan="3">Harbour porpoise Phocoena phocoena</td></tr>
<tr><td rowspan="6">Unidentified dolphin species</td><td colspan="2">Risso’s dolphin Grampus griseus</td></tr>
<tr><td colspan="2">Bottlenose dolphin Tursiops truncatus</td></tr>
<tr><td rowspan="4">Unidentified patterned dolphin species</td><td>White-beaked dolphin Lagenorhynchus albirostris</td></tr>
<tr><td>Atlantic white-sided dolphin Lagenorhynchus acutus</td></tr>
<tr><td>Common dolphin Delphinus delphis</td></tr>
<tr><td>Striped dolphin Stenella coeruleoalba</td></tr>
<tr><td rowspan="2">Phocid species</td><td colspan="4">Grey seal Halichoerus grypus</td></tr>
<tr><td colspan="4">Harbour seal Phoca vitulina</td></tr>
</table>

18. The surveys within the OWF sites indicate that harbour porpoise is the most abundant marine mammal species. It is therefore assumed that a large number of unidentified small cetaceans are likely to be harbour porpoise. As a worst-case scenario (i.e. maximum possible density estimate) for harbour porpoise has been obtained by adding the number of harbour porpoise recorded to the number of unidentified small cetaceans. For this reason, two estimates for harbour porpoise were obtained:

- Identified harbour porpoise; and
- Identified harbour porpoise plus unidentified small cetacean (dolphin or porpoise).

19. The maximum estimate based on identified harbour porpoise plus unidentified small cetacean is used in the impact assessment.

12.1.2.4 Correction factors

20. It is possible for aerial imagery to capture marine mammals at the sea surface and just below, therefore correction factors must be applied to the raw data counts for each species to account for individuals that could be below the sea surface.

Harbour porpoise

21. The colour and size of harbour porpoise (small in comparison to other marine mammal species) make them relatively easy to identify from aerial imaging. They can be seen on the waters surface and within the top 2m of the water column (Teilmann *et al*., 2007, 2013; Williamson *et al*., 2016). Correction factors are used to account for the probability of harbour porpoise being below the water surface or detection zone (i.e. below 2m for harbour porpoise) and being undetectable by aerial surveys.

22. Voet *et al*. (2017) determined correction factors for harbour porpoise in the North Sea is based on published marine mammal dive profile data. Teilmann *et al.* (2013) tagged 35 harbour porpoise in the waters around Denmark using satellite transmitters. The satellite transmitters recorded data for a period of on average 135 days, the minimum and maximum days of contact were 25 days and 349 days, respectively (Teilmann *et al.*, 2013).

23. The percentage of time that each harbour porpoise spent between 0 and 2m water depth (including the time that the dorsal fin was above the water surface) was analysed, with no significant differences being found between male and female porpoise, the size of the individual (used as a proxy for age) or in the location that the individual was tagged.

24. There were, however, significant differences in the time of year, with the spring and summer having a higher average time spent between 0 and 2m compared autumn and winter. These seasonal average surface times are based on documented dive profile data of a large number of animals covering a wide range of ages and both sexes. Therefore, to take this into account, Teilmann *et al.* (2013) suggest that aerial survey data should be corrected for time submerged as well as for seasonal effects.

25. Taking into account the seasonal average surface times presented in Teilmann *et al*. (2013), Voet *et al*. (2017) established seasonal correction factors for harbour porpoise to use to determine abundance and density estimates obtained from aerial digital surveys (Table 12.2).

Table 12.2 Harbour porpoise seasonal correction factors

Season	Correction Factor
Spring (Mar – May)	0.571
Summer (Jun – Aug)	0.547
Autumn (Sept – Nov)	0.455
Winter (Dec - Feb)	0.472

26. The seasonal correction factors in Table 12.2 were applied to the monthly data to take into account for the probability of harbour porpoise being below the water surface or detection zone (i.e. below 2m for harbour porpoise) and being undetectable by aerial surveys.

27. Turbidity can affect the ability to detect marine mammals in the 2m detection zone below the surface. However, as outlined in Chapter 8 Marine Geology, Oceanography and Physical Processes and Chapter 9 Marine Water Quality and Sediment Quality, measurements of suspended sediment concentrations were carried out at the Acoustic Wave and Current (AWAC) station in NV East between December 2012 and December 2013. Overall, suspended sediment concentrations were between 0.3 and 108mg/l throughout that year. Concentrations were less than 30mg/l for 95% of the time and less than 10mg/l for 70% of the time.

28. Water clarity (Secchi depth) in the North Sea varies with water depth and distance from the coast (Dupont and Aksnes, 2013). Long-term overall measurements of Secchi depth for the southern and central North Sea in the area of Norfolk Vanguard indicate means of between 5.52m-1 (SD = 1.06) and 3.27m-1 (SD=2.22) in summer, 2.70m-1 (SD = 2.41) in spring / autumn and 1.66m-1 (SD = 0.93) in winter (Capuzzo et al., 2015).

29. Therefore, there is no indication of any limitations in observing marine mammals up to 2m below the surface. The correction factors take into account the number of animals that could be below 2m from the surface and not detected during the aerial surveys.

30. Correction factors are based on individual species and typically cannot be applied to species groups (such as unidentified small cetaceans). However, as it is assumed that all individuals in the 'harbour porpoise and unidentified small cetacean' group are harbour porpoise, the correction factor for harbour porpoise was applied to this group.

Other marine mammal species

31. The average time spent at the water surface is not as well studied for other marine mammal species as it is for harbour porpoise.

32. For grey and harbour seal, the Sea Mammal Research Unit (SMRU) used tagging studies of 44 grey seals (1997) and 17 harbour seals (2003-2004) in the Pentland Firth and Orkney (SMRU, 2011). For grey seal, data collected from 22,012 dives found an average of 27.09% time spent at the waters surface, and for harbour seal, data collected from 44,156 dives found an average of 18.32% if time spent at the waters surface. This did not account for the time that the seals would be just below the waters surface and so would still be detectable in aerial surveys.

33. A study into the dive profiles of white-beaked dolphin (Rasmussen *et al*., 2013) found that of the two tagged free-ranging individuals (tagged in Icelandic waters in 2006), the female spent 18% of its time close to the waters surface (0-2m). A study in the Gulf of Maine (Mate *et al.,* 1994) found that one tagged Atlantic white-sided dolphin male individual was found to spend 11% of its time at the waters surface. A study conducted for bottlenose dolphin in Tampa Bay, Florida found that one female individual spent 12.9% of its time at the water surface (Mate *et al*., 1995).

34. Table 12.3 describes the meant time spent at the water surface for the other marine mammal species determined by the limited studies described above.

Table 12.3 Mean time other marine mammal species spend at the water surface (derived from SMRU, 1997 and 2004, Rasmussen *et al*., 2013 and Mate *et al*. 1994 and 1995).

Species	Mean time spent at surface (%)
Grey seal	27.09
Harbour seal	18.32
White-beaked dolphin	18
Bottlenose dolphin	12.9
Atlantic white-sided dolphin	11

12.1.3 Survey Effort

35. The next sections summarise the monthly survey effort for both NV East and NV West.

12.1.3.1 Norfolk Vanguard East

36. For NV East, monthly coverage was between 11.83 and 12.44% of the OWF site and 4km buffer area, covering between 28 and 47 transects per month (Table 12.4).

Table 12.4 Monthly survey coverage and effort for Norfolk Vanguard East

Month of Survey	Number of Transects	Coverage	Number of Images	Weather Conditions
September 2015	47	12.44%	3,346	10% cloud cover Visibility >10km Wind speeds 15-20 knots Wind Direction Easterly Sea states 2-3 / 1

Month of Survey	Number of Transects	Coverage	Number of Images	Weather Conditions
October 2015	47	12.18%	975	Overcast Visibility >10km Wind speeds 10 knots Wind Direction Southerly Sea states 2-3
November 2015	28	12.18%	976	Overcast Visibility >10km Wind speeds 10 knots Wind Direction North westerly Sea states 3
December 2015	28	11.97%	959	Overcast Visibility >10km Wind speeds 30 knots Wind Direction South westerly Sea states 4
January 2016	28	12.18%	976	Overcast Visibility >10km Wind speeds 45 knots Wind Direction South westerly Sea states 4
February 2016	28	11.83%	948	Clear Visibility >10km Wind speeds 15 knots Wind Direction Westerly Sea states 3
March 2016	28	12.18%	976	Mostly clear Visibility >10km Wind speeds 30 knots Wind Direction Easterly Sea states 4
April 2016	28	12.02%	963	Mostly clear Visibility >10km Wind speeds 30 knots Wind Direction Easterly Sea states 4

12.1.3.2 Norfolk Vanguard West

37. For Norfolk Vanguard West, monthly coverage was between 11.96 and 13.18% of the OWF site and 4km buffer area, covering between 31 and 52 transects per month (Table 12.5).

Table 12.5 Monthly survey coverage and effort for Norfolk Vanguard West

Month of Survey	Number of Transects	Coverage	Number of Images	Weather Conditions
September 2015	51	13.18%	5,324	10% cloud cover Visibility >10km Wind speeds 20 / 5 knots Wind Direction Easterly Sea states 2 / 1

Month of Survey	Number of Transects	Coverage	Number of Images	Weather Conditions
October 2015	52	12.22%	1,948	Overcast Visibility >10km Wind speeds 10 knots Wind Direction South easterly Sea states 2-3
November 2015	34	12.68%	1,895	Overcast Visibility >10km Wind speeds 25 knots Wind Direction Westerly Sea states 3
December 2015	31	12.06%	1,922	Overcast Visibility >10km Wind speeds 40 knots Wind Direction South westerly Sea states 4
January 2016	31	12.2%	1,944	Overcast Visibility >10km Wind speeds 20 knots Wind Direction Westerly Sea states 4
February 2016	31	11.96%	953	Broken clouds Visibility >10km Wind speeds 20 knots Wind Direction North westerly Sea states 3
March 2016	31	12.21%	973	Broken clouds Visibility 9-10km Wind speeds 10 knots Wind Direction North westerly Sea states 3
April 2016	31	12.08%	963	Mostly clear Visibility >10km Wind speeds 1 knots Wind Direction Easterly Sea states 2
May 2016	31	12.10%	964	Mostly clear Visibility >10km Wind speeds 15 knots Wind Direction South easterly Sea states 2
June 2016	31	12.05%	960	50% and 70% cloud cover Visibility >10km Wind speeds 15-18 knots Wind Direction Southerly Sea states 3-4
July 2016	31	11.45%	913	90% cloud cover Visibility >10km Wind speeds 20-25 knots Wind Direction Southerly Sea states 2

Month of Survey	Number of Transects	Coverage	Number of Images	Weather Conditions
August 2016	51	13.18%	2662	10-20% cloud cover Visibility >10km Wind speeds 20 knots Wind Direction Westerly Sea states 2-3
September 2016	31	12%	960	15-80% cloud cover Visibility >10km Wind speeds 5 knots Wind Direction North to North easterly Sea states 2
October 2016	31	12%	960	30% cloud cover Visibility >10km Wind speeds 23-30 knots Wind Direction Easterly Sea states 3
November 2016	31	12.21%	973	100% cloud cover Visibility 6-10km Wind speeds 30 knots Wind Direction Westerly Sea states 3-4
December 2016	31	12.18%	971	30-70% cloud cover Visibility >10km Wind speeds 20-25 knots Wind Direction Westerly Sea states 1-2
January 2017	31	12.18%	973	20-60% cloud cover Visibility >10km Wind speeds 2 knots Wind Direction South-south-westerly Sea states 2-3
February 2017	31	12.18%	974	90% cloud cover Visibility >10km Wind speeds 28 knots Wind Direction Easterly Sea states 2
March 2017	31	12.18%	974	Partially cloudy to overcast with cloud cover of 25-95% Visibility >10km Wind speeds 5-10 knots Wind Direction easterly/south-easterly Sea states 1-3
April 2017	31	12.18%	1,074	Mostly overcast with cloud cover of 35-100% Visibility 8-10km Wind speeds 5-10 knots Wind Direction north-westerly Sea states 1

Month of Survey	Number of Transects	Coverage	Number of Images	Weather Conditions
May 2017	31	12.18%	973	Mostly overcast with cloud cover of 70-99% Visibility >10km Wind speeds 15-20 knots Wind Direction south-easterly/south-south-easterly Sea states 1-2
June 2017	31	12.21%	973	Mostly overcast with cloud cover of 30-90% Visibility >10km Wind speeds 15-20 knots Wind Direction westerly to south-westerly Sea states 1-2
July 2017	31	12.21%	973	Mostly overcast with cloud cover of 75-95% Visibility >10km Wind speeds 15knots Wind Direction westerly Sea states 1-2
August 2017	31	12.21%	973	Mostly overcast with cloud cover of 75-95% Visibility >10km Wind speeds 18-30 knots Wind Direction south-westerly Sea states 3-4

12.1.4 Results

38. Table 12.14 in Annex 1 shows the full raw data count for surveys completed for EA4 (March 2012 to February 2014) and NV East (September 2015 to April 2016) and NV West (September 2015 to August 2017), with harbour porpoise counts and harbour porpoise and unidentified small cetacean counts. The data is split between the OWF site only, the OWF and 2km buffer and the OWF and 4km buffer area.

12.1.4.1 Raw data counts

39. Table 12.6 summarises the raw data count for NV East, including the EA4 surveys, from March 2012 to April 2016 for the OWF area and 4km buffer.

Table 12.6 NV East raw data count for all surveys, including EA4 surveys, undertaken between March 2012 and April 2016 for the OWF area and 4km buffer

Date	Harbour porpoise	Dolphin / porpoise	Common dolphin	White-beaked dolphin	Patterned dolphin sp.	Dolphin species	Seal species
March 2012	15	3	0	0	0	0	0
April 2012	1	12	0	0	0	2	0
May 2012	1	12	0	1	0	1	0

Date	Harbour porpoise	Dolphin / porpoise	Common dolphin	White-beaked dolphin	Patterned dolphin sp.	Dolphin species	Seal species
June 2012	3	4	0	0	0	1	0
July 2012	0	1	2	0	0	0	2
August 2012	0	10	0	0	0	1	0
September 2012	6	4	0	0	0	0	0
October 2012	2	3	0	0	0	0	0
November 2012	5	15	0	0	0	1	1
December 2012	9	7	0	0	0	0	0
January 2013	22	28	0	0	0	1	0
February 2013	14	10	0	0	2	0	0
March 2013	19	12	0	0	0	0	1
April 2013	7	7	0	0	0	0	0
May 2013	6	8	0	0	0	0	0
June 2013	3	5	0	0	0	0	0
July 2013	5	5	0	0	0	0	0
August 2013	7	0	0	0	0	0	0
September 2013	17	7	0	0	0	0	0
October 2013	2	5	0	0	0	0	0
November 2013	13	14	0	0	0	0	0
December 2013	15	16	0	0	0	0	0
January 2014	1	4	0	0	0	0	0
February 2014	0	0	0	0	0	0	0
September 2015	26	11	0	0	0	0	0
October 2015	4	10	0	0	0	0	0
November 2015	11	25	0	0	0	0	0
December 2015	0	7	0	0	0	0	1
January 2016	3	10	0	0	0	0	0
February 2016	22	64	0	2	0	0	0
March 2016	10	40	0	0	0	0	0
April 2016	0	14	0	0	0	0	0
Total	249	373	2	3	2	7	5

40. Table 12.7 summarises the raw data count for NV West from September 2015 to August 2017 for the OWF area and 4km buffer.

Table 12.7 NV West raw data count for all surveys undertaken between September 2015 and August 2017 for the OWF area and 4km buffer

Date	Harbour porpoise	Dolphin / porpoise	White-beaked dolphin	Dolphin species	Grey seal	Seal species
September 2015	45	22	0	11	0	0
October 2015	2	10	0	0	0	0
November 2015	20	29	0	0	0	0
December 2015	0	21	0	0	0	0
January 2016	5	40	0	0	0	0
February 2016	7	26	0	0	0	0
March 2016	3	4	0	1	0	0
April 2016	7	4	0	0	0	0
May 2016	0	3	0	0	0	1
June 2016	0	0	0	0	0	0
July 2016	1	1	0	0	0	0
August 2016	5	15	0	0	0	0
September 2016	11	10	0	0	0	0
October 2016	0	4	0	0	0	0
November 2016	1	5	0	0	0	0
December 2016	0	9	0	0	0	0
January 2017	20	37	0	1	1	0
February 2017	4	20	0	0	0	1
March 2017	0	6	0	0	0	0
April 2017	0	5	0	0	0	0
May 2017	0	9	0	0	0	0
June 2017	2	14	4	0	1	0
July 2017	11	22	0	0	0	0
August 2017	0	1	0	0	0	0
Total	144	317	4	13	2	2

12.1.4.2 Corrected data

41. To correct the final counts to account for the availability bias for individuals at the waters surface, the count is divided by the correction factor (mean time spent at surface). The updated seasonal correction factors as outlined in Table 12.2 have

been used. See Table 12.8 for the corrected data for NV East and Table 12.9 for NV West.

Table 12.8 Correction Factors applied to the NV East and EA4 data for the NV East OWF site and 4km buffer

Date	Harbour porpoise		Unidentified small cetacean (assumed to be harbour porpoise)		Dolphin species (species if known)		Seal species	
	Raw data count	With seasonal CF (see Table 12.2)	Raw data count	With seasonal CF (see Table 12.2)	Raw data count	With dolphin sp. CF (0.18)	Raw data count	With CF for seal sp. (0.1832)
March 2012	15	26.27	3	5.25	0	0	0	0
April 2012	1	1.75	12	21.02	2	11.11	0	0
May 2012	1	1.75	12	21.02	2 (1 white-beaked dolphin)	11.11	0	0
June 2012	3	5.25	4	7.00	1	5.56	0	0
July 2012	0	0.000	1	1.75	2 (common dolphin)	11.11	2	10.92
August 2012	0	0.000	10	17.51	1	5.56	0	0
September 2012	6	10.51	4	7.00	0	0	0	0
October 2012	2	3.50	3	5.25	0	0	0	0
November 2012	5	8.76	15	26.27	1	5.56	1	5.46
December 2012	9	15.76	7	12.26	0	0	0	0
January 2013	22	38.53	28	49.04	1	5.56	0	0
February 2013	14	24.52	10	17.51	2 (patterned dolphin)	11.11	0	0
March 2013	19	33.28	12	21.02	0	0	1	5.46
April 2013	7	12.26	7	12.26	0	0	0	0
May 2013	6	10.51	8	14.01	0	0	0	0
June 2013	3	5.25	5	8.76	0	0	0	0

Date	Harbour porpoise		Unidentified small cetacean (assumed to be harbour porpoise)		Dolphin species (species if known)		Seal species	
	Raw data count	With seasonal CF (see Table 12.2)	Raw data count	With seasonal CF (see Table 12.2)	Raw data count	With dolphin sp. CF (0.18)	Raw data count	With CF for seal sp. (0.1832)
July 2013	5	8.76	5	8.76	0	0	0	0
August 2013	7	12.26	0	0.00	0	0	0	0
September 2013	17	29.77	7	12.26	0	0	0	0
October 2013	2	3.50	5	8.76	0	0	0	0
November 2013	13	22.77	14	24.52	0	0	0	0
December 2013	15	26.27	16	28.02	0	0	0	0
January 2014	1	1.75	4	7.00	0	0	0	0
February 2014	0	0.00	0	0.00	0	0	0	0
September 2015	26	22.77	11	24.18	0	0	0	0
October 2015	4	1.75	10	21.98	0	0	0	0
November 2015	14	1.75	30	65.93	0	0	0	0
December 2015	0	1.75	7	14.83	0	0	1	5.46
January 2016	3	0.00	11	23.30	0	0	0	0
February 2016	23	0.00	78	165.25	2 (white-beaked dolphin)	11.11	0	0
March 2016	10	5.25	41	71.80	0	0	0	0
April 2016	0	3.50	14	24.52	0	0	0	0

Table 12.9 Correction Factors applied to the NV West data for the NV West OWF site and 4km buffer

Date	Harbour porpoise		Unidentified small cetacean (assumed to be harbour porpoise)		Dolphin species (species if known)		Seal species (species if known)	
	Raw count	With seasonal CF	Raw count	With seasonal CF	Raw count	With worst-case CF for dolphins sp. (0.11)	Raw Count	With worst-case CF for seal sp. (0.1832)
September 2015	45	98.90	22	48.35	11	100	0	0
October 2015	2	4.40	10	21.98	0	0	0	0
November 2015	20	43.96	29	63.74	0	0	0	0
December 2015	0	0	21	44.49	0	0	0	0
January 2016	5	10.59	40	84.75	0	0	0	0
February 2016	7	14.83	26	55.08	0	0	0	0
March 2016	3	5.25	4	7.00	1	9.09	0	0
April 2016	7	12.26	4	7.00	0	0	0	0
May 2016	0	0	3	5.25	0	0	1	5.46
June 2016	0	0	0	0.00	0	0	0	0
July 2016	1	1.83	1	1.83	0	0	0	0
August 2016	5	9.14	15	27.42	0	0	0	0
September 2016	11	24.18	10	21.98	0	0	0	0
October 2016	0	0	4	8.79	0	0	0	0
November 2016	1	2.20	5	10.99	0	0	0	0
December 2016	0	0	9	19.07	0	0	0	0
January 2017	20	42.37	37	78.39	1	9.09	0	0

Date	Harbour porpoise		Unidentified small cetacean (assumed to be harbour porpoise)		Dolphin species (species if known)		Seal species (species if known)	
	Raw count	With seasonal CF	Raw count	With seasonal CF	Raw count	With worst-case CF for dolphins sp. (0.11)	Raw Count	With worst-case CF for seal sp. (0.1832)
February 2017	4	8.47	20	42.37	0	0	1	5.46
March 2017	0	0	6	10.51	0	0	0	0
April 2017	0	0	5	8.76	0	0	0	0
May 2017	0	0	9	15.76	0	0	0	0
June 2017	2	3.66	14	25.59	4 (white-beaked dolphin)	36.36	1 (grey seal)	5.46
July 2017	11	20.11	22	40.22	0	0	0	0
August 2017	0	0	1	1.83	0	0	0	0

12.1.4.3 Abundance estimates

42. The abundance of harbour porpoise and unidentified small cetaceans were estimated from the raw data counts. Correction factors were then applied to the data to account for the presence of individuals below 2m water depth (the depth at which it is no longer possible to detect marine mammals from aerial imagery). Figure 12.1 to Figure 12.4 show the abundance estimates for harbour porpoise and harbour porpoise and unidentified dolphin / porpoise across NV East (including EA4 data) and NV West with 4km buffers.

43. Section 12.1.2.2 outlines the approach used for the abundance estimates.

44. There were consistently higher counts in the winter and spring months across all surveys and areas, with lower counts for the summer period.

Norfolk Vanguard East

45. The highest number of harbour porpoise for NV East (including data for EA4) was recorded in January 2013 and March 2013 for the OWF area and 4km buffer, with 236 and 246 individuals, respectively, resulting in abundance estimates of 500 and 432 with the seasonal correction factor, respectively (Figure 12.1). When unidentified small cetaceans were included, the highest raw abundance count was in February 2016 with an estimate of 808 individuals, resulting in an abundance estimate of 1,711 with the seasonal correction factor (Figure 12.2).

Norfolk Vanguard West

46. Within the Norfolk Vanguard West OWF site, the highest number of harbour porpoise was recorded in September 2015 for the OWF area and 4km buffer, with 354 individuals, resulting in an abundance estimate of 778 with the seasonal correction factor (Figure 12.3). When unidentified small cetaceans were included, the highest raw abundance count was in January 2017 with an estimate of 539, resulting in abundance estimate of 1,142 with the seasonal correction factor (Figure 12.4).

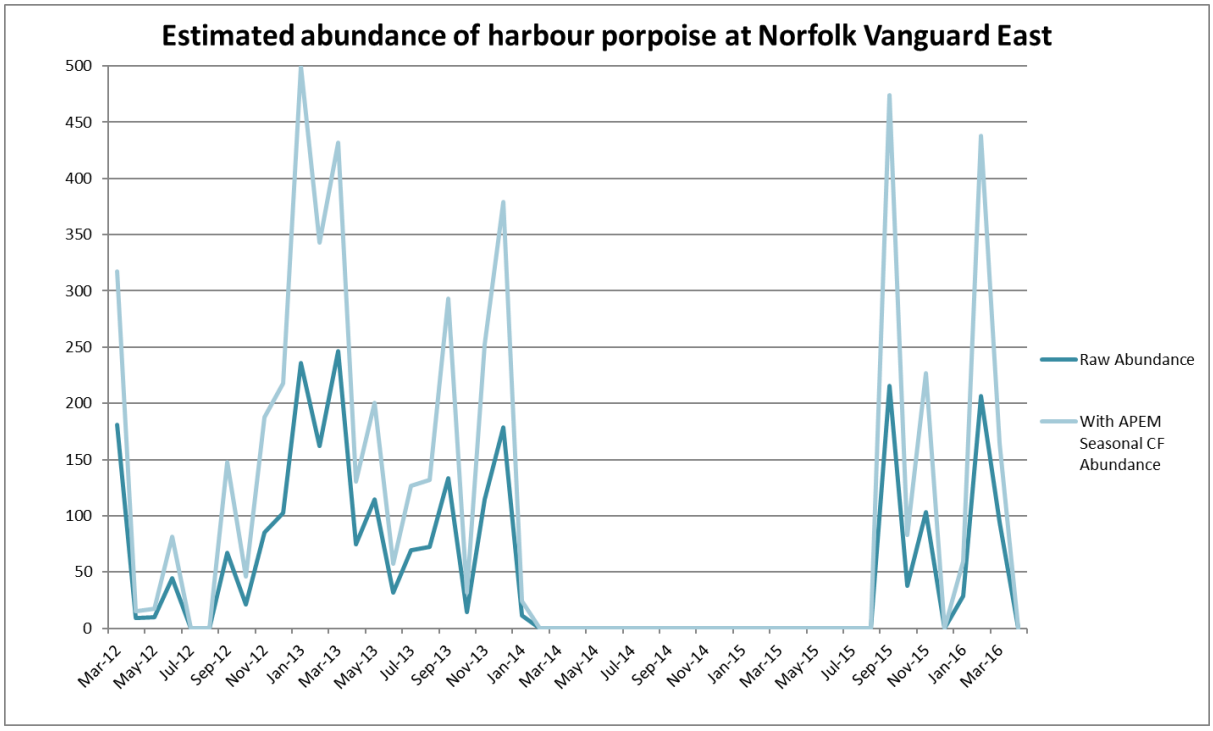

Figure 12.1 The estimated abundance of harbour porpoise across Norfolk Vanguard East (including EA4 survey data) with seasonal correction factor applied (no data was collected between February 2014 and September 2015)

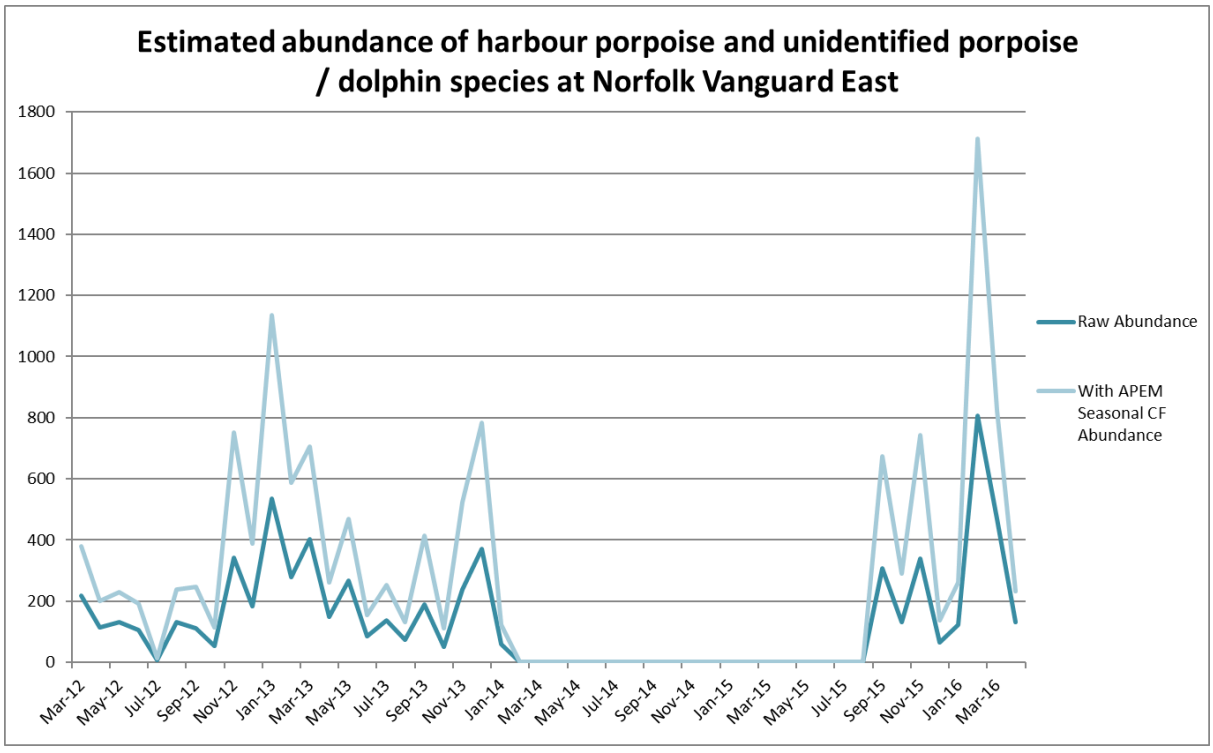

Figure 12.2 The estimated abundance of harbour porpoise and unidentified small cetaceans across Norfolk Vanguard East (including EA4 survey data) with seasonal correction factor applied (no data was collected between February 2014 and September 2015)

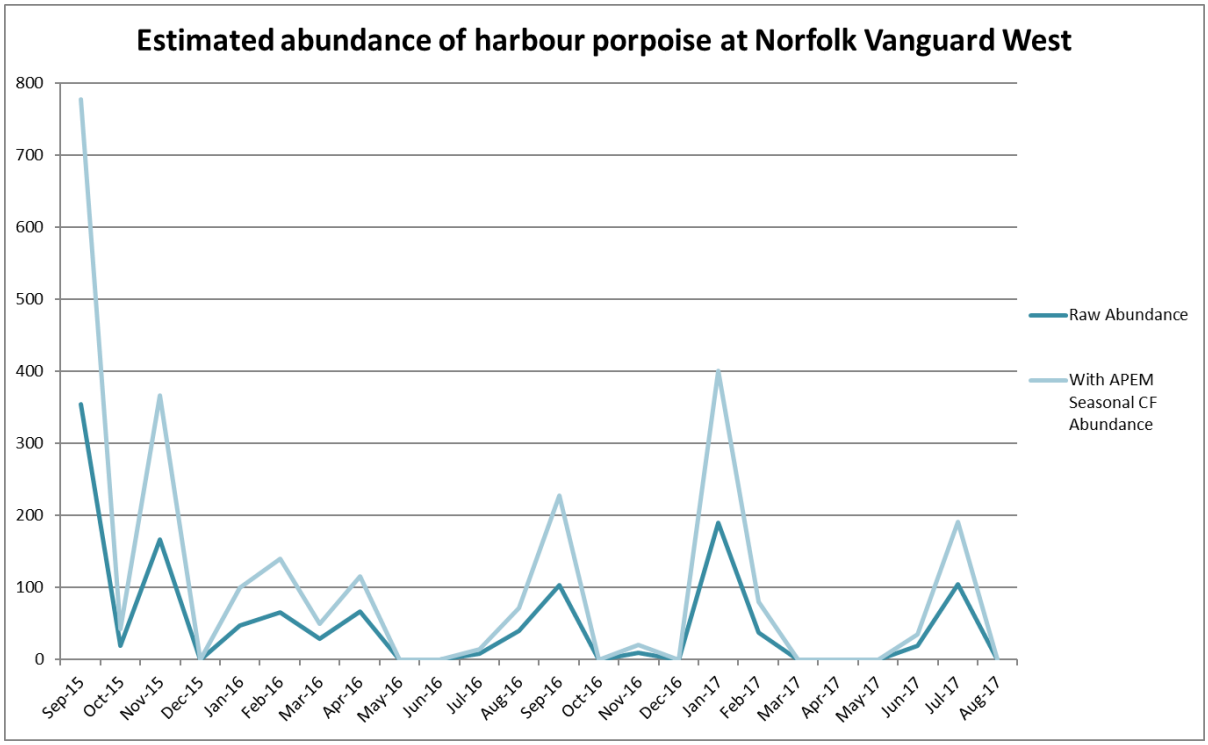

Figure 12.3 The estimated abundance of harbour porpoise across Norfolk Vanguard West with seasonal correction factor applied

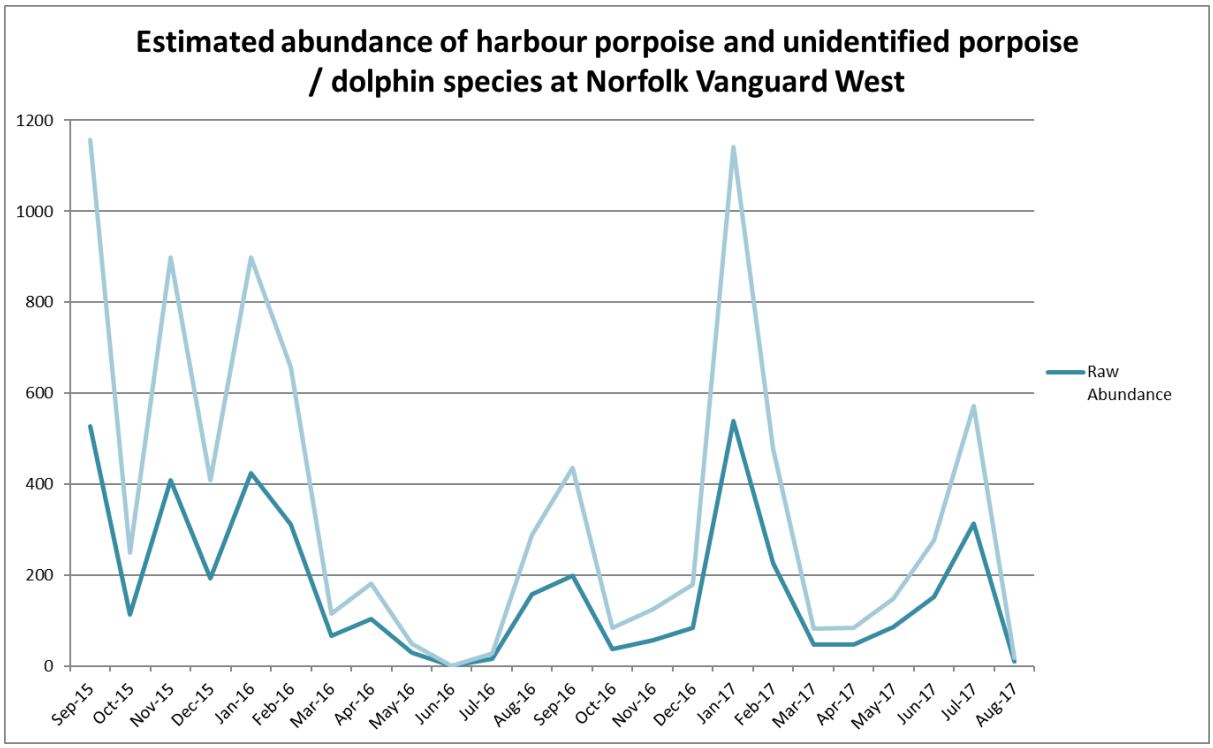

Figure 12.4 The estimated abundance of harbour porpoise and unidentified small cetaceans across Norfolk Vanguard West with seasonal correction factor applied.

12.1.4.4 Density estimates

Norfolk Vanguard East

47. Table 12.10 presents the estimated densities for harbour porpoise only at NV East (without buffer as this is the worst-case scenario). When unidentified small cetaceans are included with the harbour porpoise data (Table 12.11), the highest density estimate was in February, with an uncorrected density estimate of 1.73/km^2 (CI = 1.16-2.32); the corrected density estimates when using the seasonal correction factor is 3.65/km^2 for the OWF site (without buffer as this is the worst-case scenario). However, the other monthly density estimates for harbour porpoise, including unidentified small cetaceans, are considerably lower than the February estimate (Table 12.11).

48. The annual mean density estimate when using the seasonal correction factor is 1.26/km^2 for the OWF site (without buffer as this is the worst-case scenario).

49. The density estimate during summer (April to September) is 0.73/km^2 and during the winter (October to March) the estimated density is 1.8/km^2 at NV East.

Table 12.10 The highest density estimates for Norfolk Vanguard East for harbour porpoise only

By Month	Density Estimate (individuals / km^2) based on raw data (CI)	Density Estimate (individuals / km^2) with seasonal CF
Jan	0.58 (0.31-0.86)	1.24
Feb	0.47 (0.25-0.72)	1.00
Mar	0.57 (0.31-0.92)	0.99
Apr	0.14 (0.05-0.25)	0.24
May	0.26 (0.06-0.52)	0.45
Jun	0.07 (0-0.17)	0.22
Jul	0.11 (0.02-0.22)	0.34
Aug	0.11 (0.03-0.22)	0.36
Sep	0.34 (0.21-0.49)	0.75
Oct	0.06 (0.02-0.15)	0.14
Nov	0.26 (0.10-0.44)	0.58
Dec	0.47 (0.24-0.75)	1.00
Annual	**0.29 (0.13-0.48)**	**0.61**

Table 12.11 The highest density estimates for Norfolk Vanguard East for harbour porpoise and unidentified small cetaceans

By Month	Density Estimate (individuals / km^2) based on raw data (97.5% CI)	Density Estimate (individuals / km^2) with seasonal CF
Jan	1.06 (0.55-1.61)	2.25
Feb	1.73 (1.16-2.32)	3.65
Mar	0.79 (0.50-1.35)	1.38
Apr	0.27 (0. 11-0.56)	0.48

By Month	Density Estimate (individuals / km^2) based on raw data (97.5% CI)	Density Estimate (individuals / km^2) with seasonal CF
May	0.45 (0.15-0.97)	0.79
Jun	0.19 (0.02-0.37)	0.59
Jul	0.22 (0.04-0.46)	0.69
Aug	0.24 (0.09-0.42)	0.74
Sep	0.49 (0.29-0.80)	1.07
Oct	0.21 (0.08-0.36)	0.46
Nov	0.60 (0.31-0.91)	1.31
Dec	0.83 (0.35-1.34)	1.75
Annual	**0.59 (0.31-0.96)**	**1.26**

Norfolk Vanguard West

50. Table 12.12 presents the estimated densities for harbour porpoise only at Norfolk Vanguard West OWF site (without buffer as this was the worst-case scenario). When unidentified small cetaceans are included with the harbour porpoise data

51. Table 12.13), the highest density estimate was in September, with an uncorrected density estimate of 1.04/km^2 (CI = 0.61-1.29); the corrected density estimate when using the seasonal correction factor is 2.29/km^2 for the OWF area (without buffer as this was the worst-case scenario). However, the other monthly density estimates for harbour porpoise, including unidentified small cetaceans, are considerably lower than the September estimate (Table 12.13).

52. The annual mean density estimate when using the seasonal correction factor is 0.79/km^2 for the OWF area (without buffer as this was the worst-case scenario).

Table 12.12 The highest densities for Norfolk Vanguard West for harbour porpoise only

By Month	Density Estimate (individuals / km^2) based on raw data (CI)	Density Estimate (individuals / km^2) with seasonal CF
Jan	0.30 (0.18-0.45)	0.63
Feb	0.25 (0.09-0.43)	0.52
Mar	0.04 (0-0.10)	0.08
Apr	0.15 (0.04-0.31)	0.27
May	0 (0-0)	0.00
Jun	0.03 (0-0.09)	0.10
Jul	0.25 (0.09-0.43)	0.77
Aug	0.06 (0.01-0.11)	0.19
Sep	0.72 (0.48-0.99)	1.59
Oct	0.06 (0-0.07)	0.14
Nov	0.38 (0.19-0.60)	0.84
Dec	0.25 (0.09-0.43)	0.52
Annual	**0.21 (0.10-0.34)**	**0.47**

Table 12.13 The highest densities for Norfolk Vanguard West for harbour porpoise and unidentified small cetaceans

By Month	Density Estimate (individuals / km^2) based on raw data (CI)	Density Estimate (individuals / km^2) with seasonal CF
Jan	0.85 (0.55-1.18)	1.80
Feb	0.62 (0.28-1.02)	1.31
Mar	0.12 (0-0.31)	0.22
Apr	0.28 (0.06-0.56)	0.49
May	0.06 (0-0.14)	0.11
Jun	0 (0-0)	0.00
Jul	0.03 (0-0.10)	0.06
Aug	0.25 (0.11-0.40)	0.45
Sep	1.04 (0.61-1.29)	2.29
Oct	0.18 (0.06-0.33)	0.39
Nov	0.76 (0.38-1.20)	1.67
Dec	0.33 (0.18-0.47)	0.69
Annual	**0.38 (0.19-0.58)**	**0.79**

12.1.5 References

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12.1.5.1 APEM Monthly Survey Reports

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Annex 1 - Raw Data

Table 12.14 Raw count for the marine mammal surveys undertaken for Norfolk Vanguard East and West, including East Anglia FOUR surveys

OWF Site	Species	Area	Month/Year	Count	Density	Lower 97.5%	Upper 97.5%	Abundance
Norfolk Vanguard East								
Harbour porpoise								
EA4	Harbour porpoise	OWF	Mar-12	11	0.43569	0.19804	0.71295	129.46
EA4	Harbour porpoise	OWF	Apr-12	1	0.02924	0	0.08771	8.6869
EA4	Harbour porpoise	OWF	May-12	0	0	0	0	0
EA4	Harbour porpoise	OWF	Jun-12	1	0.05219	0	0.15657	15.508
EA4	Harbour porpoise	OWF	Jul-12	0	0	0	0	0
EA4	Harbour porpoise	OWF	Aug-12	0	0	0	0	0
EA4	Harbour porpoise	OWF	Sep-12	2	0.0789	0	0.19725	23.444
EA4	Harbour porpoise	OWF	Oct-12	2	0.06128	0	0.1532	18.208
EA4	Harbour porpoise	OWF	Nov-12	2	0.10864	0	0.27161	32.282
EA4	Harbour porpoise	OWF	Dec-12	7	0.2415	0.069	0.41486	71.758
EA4	Harbour porpoise	OWF	Jan-13	17	0.58352	0.30892	0.85811	173.38
EA4	Harbour porpoise	OWF	Feb-13	6	0.23101	0.077	0.42352	68.641
EA4	Harbour porpoise	OWF	Mar-13	13	0.5669	0.30417	0.91577	168.45
EA4	Harbour porpoise	OWF	Apr-13	3	0.0982	0	0.22914	29.18

OWF Site	Species	Area	Month/Year	Count	Density	Lower 97.5%	Upper 97.5%	Abundance
EA4	Harbour porpoise	OWF	May-13	4	0.25899	0.06475	0.51798	76.955
EA4	Harbour porpoise	OWF	Jun-13	1	0.03601	0	0.10803	10.7
EA4	Harbour porpoise	OWF	Jul-13	1	0.04708	0	0.14123	13.989
EA4	Harbour porpoise	OWF	Aug-13	3	0.09515	0	0.22202	28.273
EA4	Harbour porpoise	OWF	Sep-13	5	0.13073	0.02615	0.23597	38.846
EA4	Harbour porpoise	OWF	Oct-13	0	0	0	0	0
EA4	Harbour porpoise	OWF	Nov-13	9	0.2629	0.08763	0.43816	78.116
EA4	Harbour porpoise	OWF	Dec-13	12	0.4724	0.2362	0.74797	140.37
EA4	Harbour porpoise	OWF	Jan-14	1	0.03887	0	0.11661	11.549
EA4	Harbour porpoise	OWF	Feb-14	0	0	0	0	0
NV East	Harbour porpoise	OWF	Sep-15	8	0.220879398	0.082829774	0.386538947	65.63135974
NV East	Harbour porpoise	OWF	Oct-15	0	0	0	0	0
NV East	Harbour porpoise	OWF	Nov-15	4	0.123278289	0.030819572	0.246556577	36.63049511
NV East	Harbour porpoise	OWF	Dec-15	0	0	0	0	0
NV East	Harbour porpoise	OWF	Jan-16	2	0.063047145	0	0.157617863	18.73361615
NV East	Harbour porpoise	OWF	Feb-16	15	0.470465439	0.250914901	0.72138034	139.7925145
NV East	Harbour	OWF	Mar-16	1	0.03112854	0	0.093385621	9.249429529

OWF Site	Species	Area	Month/Year	Count	Density	Lower 97.5%	Upper 97.5%	Abundance
	porpoise							
NV East	Harbour porpoise	OWF	Apr-16	0	0	0	0	0
EA4	Harbour porpoise	OWF & 2km buffer	Mar-12	13	0.345542	0.159481	0.531603	155.5662
EA4	Harbour porpoise	OWF & 2km buffer	Apr-12	1	0.019416	0	0.058248	8.7413453
EA4	Harbour porpoise	OWF & 2km buffer	May-12	1	0.022236	0	0.066709	10.011032
EA4	Harbour porpoise	OWF & 2km buffer	Jun-12	1	0.033714	0	0.101143	15.178548
EA4	Harbour porpoise	OWF & 2km buffer	Jul-12	0	0	0	0	0
EA4	Harbour porpoise	OWF & 2km buffer	Aug-12	0	0	0	0	0
EA4	Harbour porpoise	OWF & 2km buffer	Sep-12	3	0.076263	0	0.177946	34.334194
EA4	Harbour porpoise	OWF & 2km buffer	Oct-12	2	0.043949	0	0.109872	19.786211
EA4	Harbour porpoise	OWF & 2km buffer	Nov-12	4	0.148297	0.037074	0.296594	66.764783
EA4	Harbour porpoise	OWF & 2km buffer	Dec-12	9	0.211238	0.070413	0.352063	95.101206
EA4	Harbour porpoise	OWF & 2km buffer	Jan-13	19	0.4444	0.257284	0.678295	200.07331
EA4	Harbour porpoise	OWF & 2km buffer	Feb-13	7	0.178861	0.051103	0.332171	80.525109
EA4	Harbour porpoise	OWF & 2km buffer	Mar-13	18	0.510861	0.312193	0.766291	229.99447
EA4	Harbour porpoise	OWF & 2km buffer	Apr-13	6	0.136871	0.045624	0.25093	61.620537
EA4	Harbour porpoise	OWF & 2km buffer	May-13	5	0.212015	0.042403	0.381627	95.451269

OWF Site	Species	Area	Month/Year	Count	Density	Lower 97.5%	Upper 97.5%	Abundance
EA4	Harbour porpoise	OWF & 2km buffer	Jun-13	3	0.070216	0	0.163836	31.611698
EA4	Harbour porpoise	OWF & 2km buffer	Jul-13	3	0.09267	0	0.216229	41.720738
EA4	Harbour porpoise	OWF & 2km buffer	Aug-13	4	0.088199	0	0.176398	39.708143
EA4	Harbour porpoise	OWF & 2km buffer	Sep-13	7	0.121988	0.034854	0.209122	54.920194
EA4	Harbour porpoise	OWF & 2km buffer	Oct-13	1	0.015907	0	0.047721	7.1615302
EA4	Harbour porpoise	OWF & 2km buffer	Nov-13	10	0.194872	0.077949	0.311795	87.733276
EA4	Harbour porpoise	OWF & 2km buffer	Dec-13	14	0.368338	0.184169	0.578817	165.82945
EA4	Harbour porpoise	OWF & 2km buffer	Jan-14	1	0.025647	0	0.076942	11.546606
EA4	Harbour porpoise	OWF & 2km buffer	Feb-14	0	0	0	0	0
NV East	Harbour porpoise	OWF & 2km buffer	Sep-15	16	0.293986682	0.165367509	0.440980024	132.3556438
NV East	Harbour porpoise	OWF & 2km buffer	Oct-15	3	0.06169017	0	0.14394373	27.7735104
NV East	Harbour porpoise	OWF & 2km buffer	Nov-15	8	0.165053656	0.061895121	0.288843897	74.30874986
NV East	Harbour porpoise	OWF & 2km buffer	Dec-15	0	0	0	0	0
NV East	Harbour porpoise	OWF & 2km buffer	Jan-16	2	0.041058802	0	0.102647005	18.48506918
NV East	Harbour porpoise	OWF & 2km buffer	Feb-16	20	0.411949837	0.22657241	0.576729772	185.4637953
NV East	Harbour porpoise	OWF & 2km buffer	Mar-16	6	0.124202876	0.041400959	0.248405752	55.91733427
NV East	Harbour	OWF &	Apr-16	0	0	0	0	0

OWF Site	Species	Area	Month/Year	Count	Density	Lower 97.5%	Upper 97.5%	Abundance
	porpoise	2km buffer						
EA4	Harbour porpoise	OWF & 4km buffer	Mar-12	15	0.288207	0.15371016	0.442397	181.12
EA4	Harbour porpoise	OWF & 4km buffer	Apr-12	1	0.014003	0	0.042008	8.7998
EA4	Harbour porpoise	OWF & 4km buffer	May-12	1	0.016003	0	0.048009	10.057
EA4	Harbour porpoise	OWF & 4km buffer	Jun-12	3	0.071044	0	0.16577	44.647
EA4	Harbour porpoise	OWF & 4km buffer	Jul-12	0	0	0	0	0
EA4	Harbour porpoise	OWF & 4km buffer	Aug-12	0	0	0	0	0
EA4	Harbour porpoise	OWF & 4km buffer	Sep-12	6	0.107043	0.03568096	0.196245	67.269
EA4	Harbour porpoise	OWF & 4km buffer	Oct-12	2	0.03334	0	0.08335	20.952
EA4	Harbour porpoise	OWF & 4km buffer	Nov-12	5	0.135852	0.0271703	0.244533	85.374
EA4	Harbour porpoise	OWF & 4km buffer	Dec-12	9	0.163691	0.05456381	0.291007	102.87
EA4	Harbour porpoise	OWF & 4km buffer	Jan-13	22	0.375413	0.22183509	0.528991	235.92
EA4	Harbour porpoise	OWF & 4km buffer	Feb-13	14	0.257765	0.14729448	0.40506	161.99
EA4	Harbour porpoise	OWF & 4km buffer	Mar-13	19	0.392222	0.22707601	0.578012	246.49
EA4	Harbour porpoise	OWF & 4km buffer	Apr-13	7	0.11819	0.03376864	0.219496	74.275
EA4	Harbour porpoise	OWF & 4km buffer	May-13	6	0.182448	0.06081611	0.334489	114.66
EA4	Harbour porpoise	OWF & 4km buffer	Jun-13	3	0.049967	0	0.11659	31.401

OWF Site	Species	Area	Month/Year	Count	Density	Lower 97.5%	Upper 97.5%	Abundance
EA4	Harbour porpoise	OWF & 4km buffer	Jul-13	5	0.110085	0.02201692	0.220169	69.181
EA4	Harbour porpoise	OWF & 4km buffer	Aug-13	7	0.114931	0.03283739	0.197024	72.226
EA4	Harbour porpoise	OWF & 4km buffer	Sep-13	17	0.21256	0.11253184	0.325092	133.58
EA4	Harbour porpoise	OWF & 4km buffer	Oct-13	2	0.022754	0	0.056886	14.3
EA4	Harbour porpoise	OWF & 4km buffer	Nov-13	13	0.182884	0.09847617	0.28136	114.93
EA4	Harbour porpoise	OWF & 4km buffer	Dec-13	15	0.284503	0.15173497	0.455205	178.79
EA4	Harbour porpoise	OWF & 4km buffer	Jan-14	1	0.018331	0	0.054993	11.52
EA4	Harbour porpoise	OWF & 4km buffer	Feb-14	0	0	0	0	0
NV East	Harbour porpoise	OWF & 4km buffer	Sep-15	26	0.343353071	0.211294198	0.488617832	215.7747558
NV East	Harbour porpoise	OWF & 4km buffer	Oct-15	4	0.060073942	0.015018486	0.120147885	37.75250995
NV East	Harbour porpoise	OWF & 4km buffer	Nov-15	11	0.164408139	0.089677167	0.254458961	103.31967
NV East	Harbour porpoise	OWF & 4km buffer	Dec-15	0	0	0	0	0
NV East	Harbour porpoise	OWF & 4km buffer	Jan-16	3	0.045001042	0	0.105002431	28.28018635
NV East	Harbour porpoise	OWF & 4km buffer	Feb-16	22	0.328816278	0.194300528	0.463705683	206.63934
NV East	Harbour porpoise	OWF & 4km buffer	Mar-16	10	0.149461944	0.059784778	0.254085306	93.92697271
NV East	Harbour porpoise	OWF & 4km buffer	Apr-16	0	0	0	0	0

OWF Site	Species	Area	Month/Year	Count	Density	Lower 97.5%	Upper 97.5%	Abundance
Harbour porpoise and unid. small cetacean								
EA4	Harbour porpoise & unid. cetacean	OWF	Mar-12	13	0.51491	0.19804	0.91099	153
EA4	Harbour porpoise & unid. cetacean	OWF	Apr-12	7	0.20465	0.05847	0.40929	60.808
EA4	Harbour porpoise & unid. cetacean	OWF	May-12	6	0.19981	0.0666	0.36631	59.37
EA4	Harbour porpoise & unid. cetacean	OWF	Jun-12	2	0.10438	0	0.31315	31.016
EA4	Harbour porpoise & unid. cetacean	OWF	Jul-12	0	0	0	0	0
EA4	Harbour porpoise & unid. cetacean	OWF	Aug-12	2	0.09101	0	0.22751	27.041
EA4	Harbour porpoise & unid. cetacean	OWF	Sep-12	4	0.1578	0	0.39449	46.888
EA4	Harbour porpoise & unid. cetacean	OWF	Oct-12	3	0.09192	0	0.24512	27.313
EA4	Harbour porpoise & unid. cetacean	OWF	Nov-12	8	0.43457	0.10864	0.86915	129.13
EA4	Harbour porpoise & unid. cetacean	OWF	Dec-12	10	0.345	0.069	0.65636	102.51
EA4	Harbour porpoise & unid.	OWF	Jan-13	31	1.06406	0.54919	1.61326	316.17

OWF Site	Species	Area	Month/Year	Count	Density	Lower 97.5%	Upper 97.5%	Abundance
	cetacean							
EA4	Harbour porpoise & unid. cetacean	OWF	Feb-13	10	0.38502	0.1155	0.73153	114.4
EA4	Harbour porpoise & unid. cetacean	OWF	Mar-13	18	0.78495	0.34777	1.35185	233.24
EA4	Harbour porpoise & unid. cetacean	OWF	Apr-13	8	0.26188	0.03273	0.55649	77.814
EA4	Harbour porpoise & unid. cetacean	OWF	May-13	7	0.45323	0.06475	0.97121	134.67
EA4	Harbour porpoise & unid. cetacean	OWF	Jun-13	4	0.14404	0	0.3601	42.8
EA4	Harbour porpoise & unid. cetacean	OWF	Jul-13	3	0.14123	0	0.37662	41.966
EA4	Harbour porpoise & unid. cetacean	OWF	Aug-13	3	0.09515	0	0.22202	28.273
EA4	Harbour porpoise & unid. cetacean	OWF	Sep-13	8	0.20917	0.02615	0.419	62.153
EA4	Harbour porpoise & unid. cetacean	OWF	Oct-13	1	0.02397	0	0.0725	7.1211
EA4	Harbour porpoise & unid. cetacean	OWF	Nov-13	16	0.46737	0.17526	0.8179	138.87
EA4	Harbour porpoise & unid.	OWF	Dec-13	21	0.8267	0.3543	1.33847	245.64

OWF Site	Species	Area	Month/Year	Count	Density	Lower 97.5%	Upper 97.5%	Abundance
	cetacean							
EA4	Harbour porpoise & unid. cetacean	OWF	Jan-14	4	0.15547	0	0.38869	46.197
EA4	Harbour porpoise & unid. cetacean	OWF	Feb-14	0	0	0	0	0
NV East	Harbour porpoise & unid. cetacean	OWF	Sep-15	17	0.46937	0.1928	0.80054	139.47
NV East	Harbour porpoise & unid. cetacean	OWF	Oct-15	4	0.12267	0.03	0.245	36.45
NV East	Harbour porpoise & unid. cetacean	OWF	Nov-15	17	0.52393	0.2508	0.86256	155.68
NV East	Harbour porpoise & unid. cetacean	OWF	Dec-15	4	0.12267	0.03	0.245	36.45
NV East	Harbour porpoise & unid. cetacean	OWF	Jan-16	6	0.18914	0.03	0.40962	56.201
NV East	Harbour porpoise & unid. cetacean	OWF	Feb-16	55	1.72504	1.1609	2.32138	512.57
NV East	Harbour porpoise & unid. cetacean	OWF	Mar-16	18	0.56032	0.28	0.87139	166.49
NV East	Harbour porpoise & unid. cetacean	OWF	Apr-16	5	0.15525	0.03	0.311	46.132
EA4	Harbour porpoise & unid.	OWF & 2km buffer	Mar-12	15	0.398702	0.159481	0.664503	179.49946

OWF Site	Species	Area	Month/Year	Count	Density	Lower 97.5%	Upper 97.5%	Abundance
	cetacean							
EA4	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Apr-12	9	0.174745	0.058248	0.310659	78.672108
EA4	Harbour porpoise & unid. cetacean	OWF & 2km buffer	May-12	12	0.266837	0.111182	0.466964	120.13238
EA4	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Jun-12	2	0.067429	0	0.202286	30.357096
EA4	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Jul-12	1	0.016256	0	0.048767	7.3184606
EA4	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Aug-12	8	0.237208	0.088953	0.415114	106.79344
EA4	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Sep-12	6	0.152525	0	0.355892	68.668388
EA4	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Oct-12	5	0.109872	0	0.263693	49.465526
EA4	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Nov-12	13	0.481966	0.148297	0.852708	216.98555
EA4	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Dec-12	14	0.328592	0.093883	0.586771	147.93521
EA4	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Jan-13	40	0.93558	0.537958	1.403369	421.20698
EA4	Harbour porpoise & unid.	OWF & 2km buffer	Feb-13	15	0.383274	0.127758	0.689894	172.5538

OWF Site	Species	Area	Month/Year	Count	Density	Lower 97.5%	Upper 97.5%	Abundance
	cetacean							
EA4	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Mar-13	27	0.766291	0.425717	1.192009	344.9917
EA4	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Apr-13	12	0.273742	0.091247	0.524671	123.24107
EA4	Harbour porpoise & unid. cetacean	OWF & 2km buffer	May-13	10	0.42403	0.084806	0.805658	190.90254
EA4	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Jun-13	8	0.187241	0.023405	0.374483	84.29786
EA4	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Jul-13	7	0.216229	0.03089	0.463348	97.348388
EA4	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Aug-13	4	0.088199	0	0.176398	39.708143
EA4	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Sep-13	12	0.209122	0.052281	0.365964	94.148905
EA4	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Oct-13	6	0.095443	0.015907	0.206792	42.969181
EA4	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Nov-13	20	0.389744	0.155898	0.624078	175.46655
EA4	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Dec-13	27	0.710367	0.342028	1.131325	319.81395
EA4	Harbour porpoise & unid.	OWF & 2km buffer	Jan-14	4	0.102589	0	0.256472	46.186425

OWF Site	Species	Area	Month/Year	Count	Density	Lower 97.5%	Upper 97.5%	Abundance
	cetacean							
EA4	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Feb-14	0	0	0	0	0
NV East	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Sep-15	26	0.47773	0.26	0.753	215.08
NV East	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Oct-15	8	0.16451	0.02	0.35	74.063
NV East	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Nov-15	29	0.59832	0.31	0.908	269.37
NV East	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Dec-15	6	0.12257	0.04	0.225	55.182
NV East	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Jan-16	9	0.18477	0.04	0.349	83.183
NV East	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Feb-16	70	1.44182	1.01	1.875	649.12
NV East	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Mar-16	38	0.78662	0.5	1.138	354.15
NV East	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Apr-16	7	0.14371	0.04	0.267	64.698
EA4	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Mar-12	18	0.345848	0.15371016	0.576893	217.34
EA4	Harbour porpoise & unid.	OWF & 4km buffer	Apr-12	13	0.182036	0.08401679	0.308062	114.4

OWF Site	Species	Area	Month/Year	Count	Density	Lower 97.5%	Upper 97.5%	Abundance
	cetacean							
EA4	Harbour porpoise & unid. cetacean	OWF & 4km buffer	May-12	13	0.208041	0.09601897	0.35207	130.74
EA4	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Jun-12	7	0.16577	0.02368145	0.355222	104.18
EA4	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Jul-12	1	0.01175	0	0.03525	7.3841
EA4	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Aug-12	10	0.206523	0.08260925	0.330437	129.79
EA4	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Sep-12	10	0.178405	0.05352143	0.338969	112.12
EA4	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Oct-12	5	0.08335	0	0.200039	52.38
EA4	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Nov-12	20	0.543406	0.24453273	0.86945	341.49
EA4	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Dec-12	16	0.291007	0.10912763	0.52745	182.88
EA4	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Jan-13	50	0.853212	0.54562901	1.194497	536.19
EA4	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Feb-13	24	0.441883	0.22094172	0.718061	277.69
EA4	Harbour porpoise & unid.	OWF & 4km buffer	Mar-13	31	0.639941	0.35093564	0.970234	402.16

OWF Site	Species	Area	Month/Year	Count	Density	Lower 97.5%	Upper 97.5%	Abundance
	cetacean							
EA4	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Apr-13	14	0.236381	0.06753729	0.438992	148.55
EA4	Harbour porpoise & unid. cetacean	OWF & 4km buffer	May-13	14	0.425713	0.15204026	0.760201	267.53
EA4	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Jun-13	8	0.133246	0.01665577	0.283148	83.736
EA4	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Jul-13	10	0.220169	0.04403385	0.440338	138.36
EA4	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Aug-13	7	0.114931	0.03283739	0.197024	72.226
EA4	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Sep-13	24	0.300085	0.13753892	0.475134	188.58
EA4	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Oct-13	7	0.07964	0.01137717	0.170658	50.049
EA4	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Nov-13	27	0.379837	0.21102037	0.590857	238.7
EA4	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Dec-13	31	0.587973	0.30346995	0.929377	369.5
EA4	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Jan-14	5	0.091655	0.01833095	0.20164	57.599
EA4	Harbour porpoise & unid.	OWF & 4km buffer	Feb-14	0	0	0	0	0

OWF Site	Species	Area	Month/Year	Count	Density	Lower 97.5%	Upper 97.5%	Abundance
	cetacean							
NV East	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Sep-15	37	0.48861	0.29	0.727	307.06
NV East	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Oct-15	14	0.21025	0.08	0.361	132.13
NV East	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Nov-15	36	0.53806	0.31	0.777	338.14
NV East	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Dec-15	7	0.10216	0.03	0.19	64.204
NV East	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Jan-16	13	0.195	0.06	0.36	122.55
NV East	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Feb-16	86	1.28538	0.92	1.66	807.77
NV East	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Mar-16	50	0.74731	0.48	1.046	469.64
NV East	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Apr-16	14	0.21	0.11	0.33	131.97
Norfolk Vanguard West								
Harbour porpoise								
NV West	Harbour porpoise	OWF	Sep-15	27	0.721371758	0.480914505	0.98921442	212.7557919
NV West	Harbour porpoise	OWF	Oct-15	2	0.062257081	0	0.155642702	18.36162055
NV West	Harbour porpoise	OWF	Nov-15	14	0.380314872	0.190157436	0.597637657	112.167119

OWF Site	Species	Area	Month/Year	Count	Density	Lower 97.5%	Upper 97.5%	Abundance
NV West	Harbour porpoise	OWF	Dec-15	0	0	0	0	0
NV West	Harbour porpoise	OWF	Jan-16	4	0.123278289	0.030819572	0.246556577	36.35874242
NV West	Harbour porpoise	OWF	Feb-16	5	0.154097861	0.030819572	0.308195722	45.44842803
NV West	Harbour porpoise	OWF	Mar-16	1	0.03112854	0	0.093385621	9.180810273
NV West	Harbour porpoise	OWF	Apr-16	5	0.154481189	0.030896238	0.308962378	45.56148382
NV West	Harbour porpoise	OWF	May-16	0	0	0	0	0
NV West	Harbour porpoise	OWF	Jun-16	0	0	0	0	0
NV West	Harbour porpoise	OWF	Jul-16	1	0.024163984	0	0.072491951	7.126737936
NV West	Harbour porpoise	OWF	Aug-16	0	0	0	0	0
NV West	Harbour porpoise	OWF	Sep-16	5	0.154866429	0.030973286	0.309732858	45.67510348
NV West	Harbour porpoise	OWF	Oct-16	0	0	0	0	0
NV West	Harbour porpoise	OWF	Nov-16	0	0	0	0	0
NV West	Harbour porpoise	OWF	Jan-17	0	0	0	0	0
NV West	Harbour porpoise	OWF	Dec-16	8	0.247786286	0.092919857	0.433626001	73.08016556
NV West	Harbour porpoise	OWF	Feb-17	2	0.061792476	0	0.154481189	18.22459353
NV West	Harbour porpoise	OWF	Mar-17	0	0	0	0	0
NV	Harbour	OWF	Apr-17	0	0	0	0	0

OWF Site	Species	Area	Month/Year	Count	Density	Lower 97.5%	Upper 97.5%	Abundance
West	porpoise							
NV West	Harbour porpoise	OWF	May-17	0	0	0	0	0
NV West	Harbour porpoise	OWF	Jun-17	1	0.03112854	0	0.093385621	9.180810273
NV West	Harbour porpoise	OWF	Jul-17	8	0.247786286	0.092919857	0.433626001	73.08016556
NV West	Harbour porpoise	OWF	Aug-17	0	0	0	0	0
NV West	Harbour porpoise	OWF & 2km buffer	Sep-15	39	0.677776987	0.469230221	0.886758224	306.607696
NV West	Harbour porpoise	OWF & 2km buffer	Oct-15	2	0.040856209	0	0.102140523	18.48222706
NV West	Harbour porpoise	OWF & 2km buffer	Nov-15	15	0.272514332	0.145340977	0.399687687	123.2780002
NV West	Harbour porpoise	OWF & 2km buffer	Dec-15	0	0	0	0	0
NV West	Harbour porpoise	OWF & 2km buffer	Jan-16	4	0.081847035	0.020461759	0.164205614	37.02535107
NV West	Harbour porpoise	OWF & 2km buffer	Feb-16	5	0.102308794	0.020461759	0.204617588	46.28168884
NV West	Harbour porpoise	OWF & 2km buffer	Mar-16	2	0.040991048	0	0.10247762	18.54322451
NV West	Harbour porpoise	OWF & 2km buffer	Apr-16	6	0.122568628	0.040856209	0.22470915	55.44668117
NV West	Harbour porpoise	OWF & 2km buffer	May-16	0	0	0	0	0
NV West	Harbour porpoise	OWF & 2km buffer	Jun-16	0	0	0	0	0
NV West	Harbour porpoise	OWF & 2km buffer	Jul-16	1	0.016041702	0	0.048125105	7.256825347
NV West	Harbour porpoise	OWF & 2km buffer	Aug-16	0	0	0	0	0

OWF Site	Species	Area	Month/Year	Count	Density	Lower 97.5%	Upper 97.5%	Abundance
NV West	Harbour porpoise	OWF & 2km buffer	Sep-16	11	0.225079347	0.102308794	0.368311658	101.8197154
NV West	Harbour porpoise	OWF & 2km buffer	Oct-16	0	0	0	0	0
NV West	Harbour porpoise	OWF & 2km buffer	Nov-16	1	0.020537888	0	0.061613663	9.290776395
NV West	Harbour porpoise	OWF & 2km buffer	Dec-16	0	0	0	0	0
NV West	Harbour porpoise	OWF & 2km buffer	Jan-17	12	0.246454652	0.123227326	0.390219866	111.4893167
NV West	Harbour porpoise	OWF & 2km buffer	Feb-17	2	0.040991048	0	0.10247762	18.54322451
NV West	Harbour porpoise	OWF & 2km buffer	Mar-17	0	0	0	0	0
NV West	Harbour porpoise	OWF & 2km buffer	Apr-17	0	0	0	0	0
NV West	Harbour porpoise	OWF & 2km buffer	May-17	0	0	0	0	0
NV West	Harbour porpoise	OWF & 2km buffer	Jun-17	1	0.020571905	0	0.061715715	9.306164845
NV West	Harbour porpoise	OWF & 2km buffer	Jul-17	8	0.163424837	0.061284314	0.285993464	73.92890822
NV West	Harbour porpoise	OWF & 2km buffer	Aug-17	0	0	0	0	0
NV West	Harbour porpoise	OWF & 4km buffer	Sep-15	45	0.557157049	0.408581836	0.71811353	353.7615761
NV West	Harbour porpoise	OWF & 4km buffer	Oct-15	2	0.029820618	0	0.074551546	18.93431844
NV West	Harbour porpoise	OWF & 4km buffer	Nov-15	20	0.263023155	0.157813893	0.381383574	167.0040537
NV West	Harbour porpoise	OWF & 4km buffer	Dec-15	0	0	0	0	0
NV	Harbour	OWF &	Jan-16	5	0.074284017	0.014856803	0.148568033	47.1659308

OWF Site	Species	Area	Month/Year	Count	Density	Lower 97.5%	Upper 97.5%	Abundance
West	porpoise	4km buffer						
NV West	Harbour porpoise	OWF & 4km buffer	Feb-16	7	0.103749419	0.029642691	0.17822668	65.87470813
NV West	Harbour porpoise	OWF & 4km buffer	Mar-16	3	0.044623788	0	0.104122171	28.33345017
NV West	Harbour porpoise	OWF & 4km buffer	Apr-16	7	0.104122171	0.044623788	0.193369747	66.11138372
NV West	Harbour porpoise	OWF & 4km buffer	May-16	0	0	0	0	0
NV West	Harbour porpoise	OWF & 4km buffer	Jun-16	0	0	0	0	0
NV West	Harbour porpoise	OWF & 4km buffer	Jul-16	1	0.012084931	0	0.036254792	7.673211997
NV West	Harbour porpoise	OWF & 4km buffer	Aug-16	5	0.061955243	0.012391049	0.111829214	39.33789308
NV West	Harbour porpoise	OWF & 4km buffer	Sep-16	11	0.163229586	0.074195266	0.267102959	103.6410752
NV West	Harbour porpoise	OWF & 4km buffer	Oct-16	0	0	0	0	0
NV West	Harbour porpoise	OWF & 4km buffer	Nov-16	1	0.014834622	0	0.044503867	9.419102574
NV West	Harbour porpoise	OWF & 4km buffer	Dec-16	0	0	0	0	0
NV West	Harbour porpoise	OWF & 4km buffer	Jan-17	20	0.297937933	0.17876276	0.4469069	189.1728607
NV West	Harbour porpoise	OWF & 4km buffer	Feb-17	4	0.059144227	0.014786057	0.13307451	37.5530649
NV West	Harbour porpoise	OWF & 4km buffer	Mar-17	0	0	0	0	0
NV West	Harbour porpoise	OWF & 4km buffer	Apr-17	0	0	0	0	0
NV	Harbour	OWF &	May-17	0	0	0	0	0

OWF Site	Species	Area	Month/Year	Count	Density	Lower 97.5%	Upper 97.5%	Abundance
West	porpoise	4km buffer						
NV West	Harbour porpoise	OWF & 4km buffer	Jun-17	2	0.029758101	0	0.074395254	18.89462385
NV West	Harbour porpoise	OWF & 4km buffer	Jul-17	11	0.164013402	0.074551546	0.253475257	104.1387514
NV West	Harbour porpoise	OWF & 4km buffer	Aug-17	0	0	0	0	0
Harbour porpoise and unid. Small cetacean								
NV West	Harbour porpoise & unid. cetacean	OWF	Sep-15	39	1.041981428	0.641219341	1.470128926	307.3139217
NV West	Harbour porpoise & unid. cetacean	OWF	Oct-15	5	0.155642702	0	0.373542484	45.90405136
NV West	Harbour porpoise & unid. cetacean	OWF	Nov-15	28	0.760629745	0.380314872	1.195275313	224.3342381
NV West	Harbour porpoise & unid. cetacean	OWF	Dec-15	8	0.248405752	0.093152157	0.434710066	73.26286598
NV West	Harbour porpoise & unid. cetacean	OWF	Jan-16	27	0.832128449	0.462293583	1.233553376	245.4215113
NV West	Harbour porpoise & unid. cetacean	OWF	Feb-16	20	0.616391444	0.27737615	1.017045882	181.7937121
NV West	Harbour porpoise & unid. cetacean	OWF	Mar-16	4	0.124514161	0	0.311285403	36.72324109
NV West	Harbour porpoise & unid. cetacean	OWF	Apr-16	9	0.27806614	0.061792476	0.55613228	82.01067087
NV	Harbour	OWF	May-16	0	0	0	0	0

OWF Site	Species	Area	Month/Year	Count	Density	Lower 97.5%	Upper 97.5%	Abundance
West	porpoise & unid. cetacean							
NV West	Harbour porpoise & unid. cetacean	OWF	Jun-16	0	0	0	0	0
NV West	Harbour porpoise & unid. cetacean	OWF	Jul-16	1	0.024163984	0	0.072491951	7.126737936
NV West	Harbour porpoise & unid. cetacean	OWF	Aug-16	2	0.053299345	0	0.133248364	15.71969559
NV West	Harbour porpoise & unid. cetacean	OWF	Sep-16	13	0.402652715	0.123893143	0.743358858	118.755269
NV West	Harbour porpoise & unid. cetacean	OWF	Oct-16	2	0.062101438	0	0.155253595	18.31571649
NV West	Harbour porpoise & unid. cetacean	OWF	Nov-16	3	0.092688713	0	0.216273664	27.33689029
NV West	Harbour porpoise & unid. cetacean	OWF	Dec-16	6	0.186071724	0.062023908	0.372143448	54.87855129
NV West	Harbour porpoise & unid. cetacean	OWF	Jan-17	24	0.743358858	0.371679429	1.207958144	219.2404967
NV West	Harbour porpoise & unid. cetacean	OWF	Feb-17	13	0.401651091	0.154481189	0.710613469	118.4598579
NV West	Harbour porpoise & unid. cetacean	OWF	Mar-17	2	0.061946572	0	0.154866429	18.27004139
NV	Harbour	OWF	Apr-17	1	0.031846891	0	0.095540674	9.392675125

OWF Site	Species	Area	Month/Year	Count	Density	Lower 97.5%	Upper 97.5%	Abundance
West	porpoise & unid. cetacean							
NV West	Harbour porpoise & unid. cetacean	OWF	May-17	4	0.124202876	0.031050719	0.248405752	36.63143299
NV West	Harbour porpoise & unid. cetacean	OWF	Jun-17	9	0.280156863	0.093385621	0.529185185	82.62729246
NV West	Harbour porpoise & unid. cetacean	OWF	Jul-17	24	0.743358858	0.340706143	1.176984859	219.2404967
NV West	Harbour porpoise & unid. cetacean	OWF	Aug-17	1	0.030973286	0	0.092919857	9.135020696
NV West	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Sep-15	54	0.938460443	0.608261398	1.286472857	424.5337329
NV West	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Oct-15	7	0.142996732	0.020428105	0.306421569	64.6877947
NV West	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Nov-15	35	0.635866775	0.363352443	0.944716352	287.6486672
NV West	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Dec-15	16	0.325778035	0.183250145	0.468305925	147.3730367
NV West	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Jan-16	35	0.716161558	0.450158693	1.023599484	323.9718219
NV West	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Feb-16	26	0.532005729	0.286464623	0.838932111	240.664782
NV	Harbour	OWF &	Mar-16	6	0.122973144	0.019983136	0.266441813	55.62967352

OWF Site	Species	Area	Month/Year	Count	Density	Lower 97.5%	Upper 97.5%	Abundance
West	porpoise & unid. cetacean	2km buffer						
NV West	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Apr-16	10	0.204281046	0.061284314	0.388133987	92.41113528
NV West	Harbour porpoise & unid. cetacean	OWF & 2km buffer	May-16	3	0.061486572	0	0.143468669	27.81483676
NV West	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Jun-16	0	0	0	0	0
NV West	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Jul-16	2	0.032083404	0	0.096250211	14.51365069
NV West	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Aug-16	4	0.069515767	0.017378942	0.139031534	31.44702394
NV West	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Sep-16	21	0.429696935	0.204617588	0.716161558	194.3830931
NV West	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Oct-16	2	0.04090667	0	0.102266674	18.50505401
NV West	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Nov-16	5	0.102689439	0.020537888	0.225916765	46.45388198
NV West	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Dec-16	9	0.183701871	0.061233957	0.306169784	83.10168155
NV West	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Jan-17	41	0.842053396	0.513447193	1.211735374	380.9218322
NV	Harbour	OWF &	Feb-17	17	0.348423909	0.163964193	0.573874674	157.6174083

OWF Site	Species	Area	Month/Year	Count	Density	Lower 97.5%	Upper 97.5%	Abundance
West	porpoise & unid. cetacean	2km buffer						
NV West	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Mar-17	2	0.040856209	0	0.102140523	18.48222706
NV West	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Apr-17	5	0.103675189	0.020735038	0.186615339	46.89980822
NV West	Harbour porpoise & unid. cetacean	OWF & 2km buffer	May-17	6	0.122973144	0.040991048	0.225450765	55.62967352
NV West	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Jun-17	12	0.246862859	0.102859525	0.411952396	111.6739781
NV West	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Jul-17	28	0.571986928	0.306421569	0.878408497	258.7511788
NV West	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Aug-17	1	0.020495524	0	0.061486572	9.271612253
NV West	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Sep-15	67	0.82954494	0.581919584	1.114314098	526.7116799
NV West	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Oct-15	12	0.178923711	0.059641237	0.328026803	113.6059106
NV West	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Nov-15	49	0.644406729	0.420837047	0.907429883	409.1599315
NV West	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Dec-15	21	0.303286092	0.187387478	0.433626901	192.5686235
NV	Harbour	OWF &	Jan-16	45	0.66855615	0.415990493	0.93597861	424.4933772

OWF Site	Species	Area	Month/Year	Count	Density	Lower 97.5%	Upper 97.5%	Abundance
West	porpoise & unid. cetacean	4km buffer						
NV West	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Feb-16	33	0.489104404	0.26678422	0.726616467	310.5521954
NV West	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Mar-16	7	0.104122171	0.014874596	0.223118939	66.11138372
NV West	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Apr-16	11	0.163620555	0.059498384	0.32724111	103.8893173
NV West	Harbour porpoise & unid. cetacean	OWF & 4km buffer	May-16	3	0.044677293	0	0.104247018	28.36742313
NV West	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Jun-16	0	0	0	0	0
NV West	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Jul-16	2	0.024169862	0	0.072509585	15.34642399
NV West	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Aug-16	20	0.247820972	0.111519437	0.396823332	157.3515723
NV West	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Sep-16	21	0.311620119	0.133551479	0.504527811	197.8602344
NV West	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Oct-16	4	0.059766797	0.014568157	0.119533595	37.94836032
NV West	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Nov-16	6	0.089007734	0.014834622	0.178015469	56.51461544
NV	Harbour	OWF &	Dec-16	9	0.132797848	0.059021266	0.221698629	84.31873201

OWF Site	Species	Area	Month/Year	Count	Density	Lower 97.5%	Upper 97.5%	Abundance
West	porpoise & unid. cetacean	4km buffer						
NV West	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Jan-17	57	0.849123109	0.551185176	1.176854836	539.142653
NV West	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Feb-17	24	0.35486536	0.192218736	0.547084096	225.3183894
NV West	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Mar-17	6	0.074195266	0.014839053	0.148390533	47.10957963
NV West	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Apr-17	5	0.07527447	0.015054894	0.15054894	47.79480988
NV West	Harbour porpoise & unid. cetacean	OWF & 4km buffer	May-17	9	0.133551479	0.059356213	0.222585799	84.79724333
NV West	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Jun-17	16	0.238064812	0.118660429	0.386855319	151.1569908
NV West	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Jul-17	33	0.492040205	0.268385566	0.715694843	312.4162542
NV West	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Aug-17	1	0.014874596	0	0.044623788	9.444483389
Norfolk Vanguard OWF Sites								
Harbour porpoise								
NV	Harbour porpoise	OWF	Sep-15	35	0.942251156	0.56374428	1.375753367	278.3871517
NV	Harbour porpoise	OWF	Oct-15	2	0.062257081	0	0.155642702	18.36162055
NV	Harbour	OWF	Nov-15	18	0.503593161	0.220977008	0.844194234	148.7976142

OWF Site	Species	Area	Month/Year	Count	Density	Lower 97.5%	Upper 97.5%	Abundance
	porpoise							
NV	Harbour porpoise	OWF	Dec-15	0	0	0	0	0
NV	Harbour porpoise	OWF	Jan-16	6	0.186325434	0.030819572	0.40417444	55.09235857
NV	Harbour porpoise	OWF	Feb-16	20	0.6245633	0.281734473	1.029576061	185.2409425
NV	Harbour porpoise	OWF	Mar-16	2	0.062257081	0	0.186771242	18.4302398
NV	Harbour porpoise	OWF	Apr-16	5	0.154481189	0.030896238	0.308962378	45.56148382
NV	Harbour porpoise	OWF & 2km buffer	Sep-15	55	0.971763669	0.63459773	1.327738248	438.9633397
NV	Harbour porpoise	OWF & 2km buffer	Oct-15	5	0.102546379	0	0.246084253	46.25573746
NV	Harbour porpoise	OWF & 2km buffer	Nov-15	23	0.437567988	0.207236098	0.688531585	197.5867501
NV	Harbour porpoise	OWF & 2km buffer	Dec-15	0	0	0	0	0
NV	Harbour porpoise	OWF & 2km buffer	Jan-16	6	0.122905837	0.020461759	0.266852619	55.51042025
NV	Harbour porpoise	OWF & 2km buffer	Feb-16	25	0.514258631	0.247034169	0.78134736	231.7454841
NV	Harbour porpoise	OWF & 2km buffer	Mar-16	8	0.165193924	0.041400959	0.350883372	74.46055878
NV	Harbour porpoise	OWF & 2km buffer	Apr-16	6	0.122568628	0.040856209	0.22470915	55.44668117
NV	Harbour porpoise	OWF & 4km buffer	Sep-15	71	0.90051012	0.619876034	1.206731362	569.5363319
NV	Harbour porpoise	OWF & 4km buffer	Oct-15	6	0.089894561	0.015018486	0.194699431	56.68682839
NV	Harbour porpoise	OWF & 4km buffer	Nov-15	31	0.427431294	0.247491059	0.635842535	270.3237237

OWF Site	Species	Area	Month/Year	Count	Density	Lower 97.5%	Upper 97.5%	Abundance
NV	Harbour porpoise	OWF & 4km buffer	Dec-15	0	0	0	0	0
NV	Harbour porpoise	OWF & 4km buffer	Jan-16	8	0.119285059	0.014856803	0.253570465	75.44611715
NV	Harbour porpoise	OWF & 4km buffer	Feb-16	29	0.432565697	0.223943219	0.641932363	272.5140481
NV	Harbour porpoise	OWF & 4km buffer	Mar-16	13	0.194085732	0.059784778	0.358207477	122.2604229
NV	Harbour porpoise	OWF & 4km buffer	Apr-16	7	0.104122171	0.044623788	0.193369747	66.11138372
Harbour porpoise and unid. small cetacean								
NV	Harbour porpoise & unid. cetacean	OWF	Sep-15	56	1.511351428	0.834019341	2.270668926	446.7839217
NV	Harbour porpoise & unid. cetacean	OWF	Oct-15	9	0.278312702	0.03	0.618542484	82.35405136
NV	Harbour porpoise & unid. cetacean	OWF	Nov-15	45	1.284559745	0.631114872	2.057835313	380.0142381
NV	Harbour porpoise & unid. cetacean	OWF	Dec-15	12	0.371075752	0.123152157	0.679710066	109.712866
NV	Harbour porpoise & unid. cetacean	OWF	Jan-16	33	1.021268449	0.492293583	1.643173376	301.6225113
NV	Harbour porpoise & unid. cetacean	OWF	Feb-16	75	2.341431444	1.43827615	3.338425882	694.3637121
NV	Harbour porpoise & unid. cetacean	OWF	Mar-16	22	0.684834161	0.28	1.182675403	203.2132411
NV	Harbour	OWF	Apr-16	14	0.43331614	0.091792476	0.86713228	128.1426709

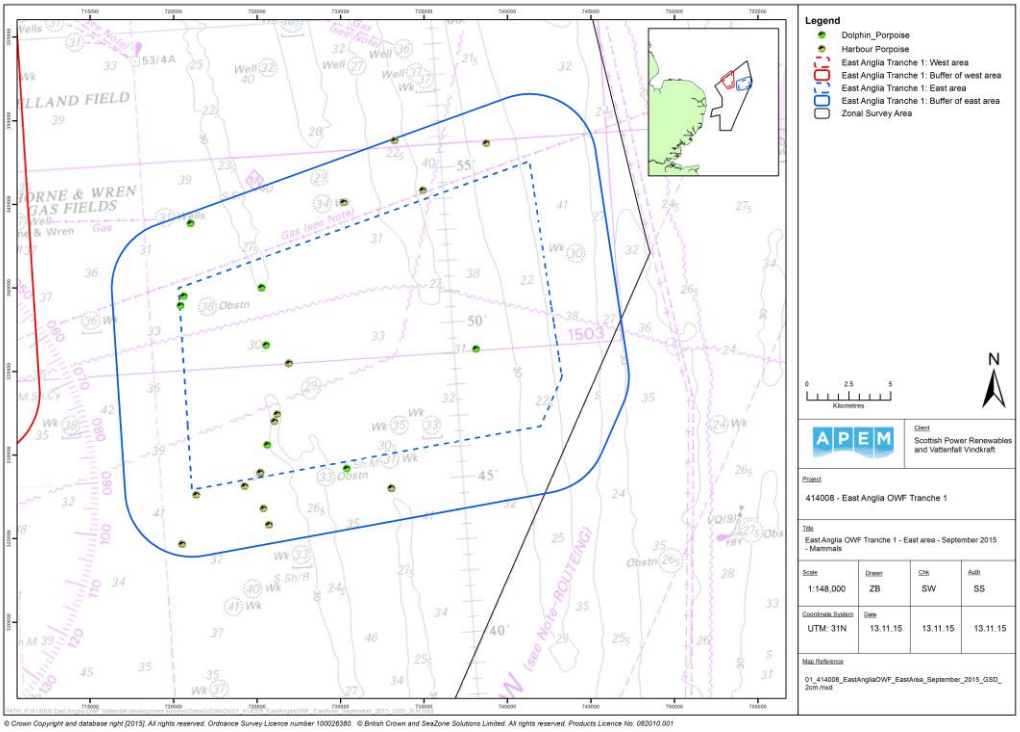
OWF Site	Species	Area	Month/Year	Count	Density	Lower 97.5%	Upper 97.5%	Abundance
	porpoise & unid. cetacean							
NV	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Sep-15	80	1.416190443	0.868261398	2.039472857	639.6137329
NV	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Oct-15	15	0.307506732	0.040428105	0.656421569	138.7507947
NV	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Nov-15	64	1.234186775	0.673352443	1.852716352	557.0186672
NV	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Dec-15	22	0.448348035	0.223250145	0.693305925	202.5550367
NV	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Jan-16	44	0.900931558	0.490158693	1.372599484	407.1548219
NV	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Feb-16	96	1.973825729	1.296464623	2.713932111	889.784782
NV	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Mar-16	44	0.909593144	0.519983136	1.404441813	409.7796735
NV	Harbour porpoise & unid. cetacean	OWF & 2km buffer	Apr-16	17	0.347991046	0.101284314	0.655133987	157.1091353
NV	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Sep-15	104	1.31815494	0.871919584	1.841314098	833.7716799
NV	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Oct-15	26	0.389173711	0.139641237	0.689026803	245.7359106
NV	Harbour	OWF &	Nov-15	85	1.182466729	0.730837047	1.684429883	747.2999315

OWF Site	Species	Area	Month/Year	Count	Density	Lower 97.5%	Upper 97.5%	Abundance
	porpoise & unid. cetacean	4km buffer						
NV	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Dec-15	28	0.405446092	0.217387478	0.623626901	256.7726235
NV	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Jan-16	58	0.86355615	0.475990493	1.29597861	547.0433772
NV	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Feb-16	119	1.774484404	1.18678422	2.386616467	1118.322195
NV	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Mar-16	57	0.851432171	0.494874596	1.269118939	535.7513837
NV	Harbour porpoise & unid. cetacean	OWF & 4km buffer	Apr-16	25	0.373620555	0.169498384	0.65724111	235.8593173

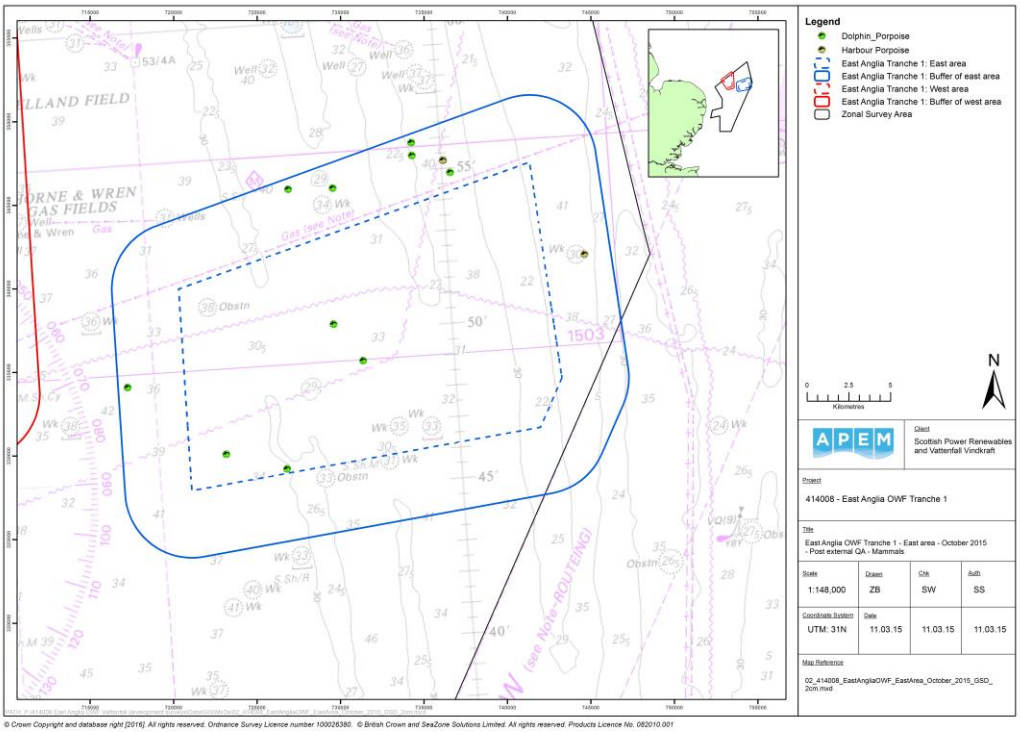
Annex 2 – Marine Mammal Sighting Locations

12.1.6 Norfolk Vanguard East

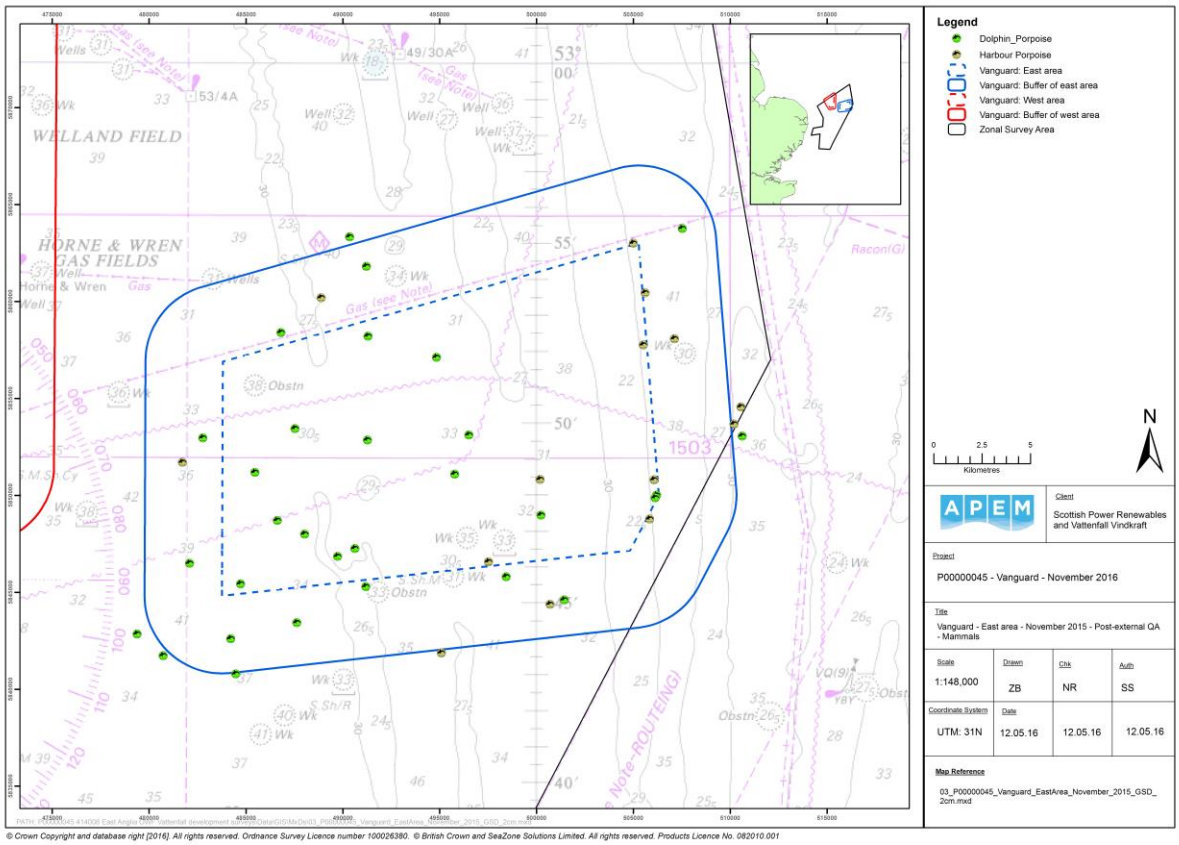
12.1.6.1 September 2015



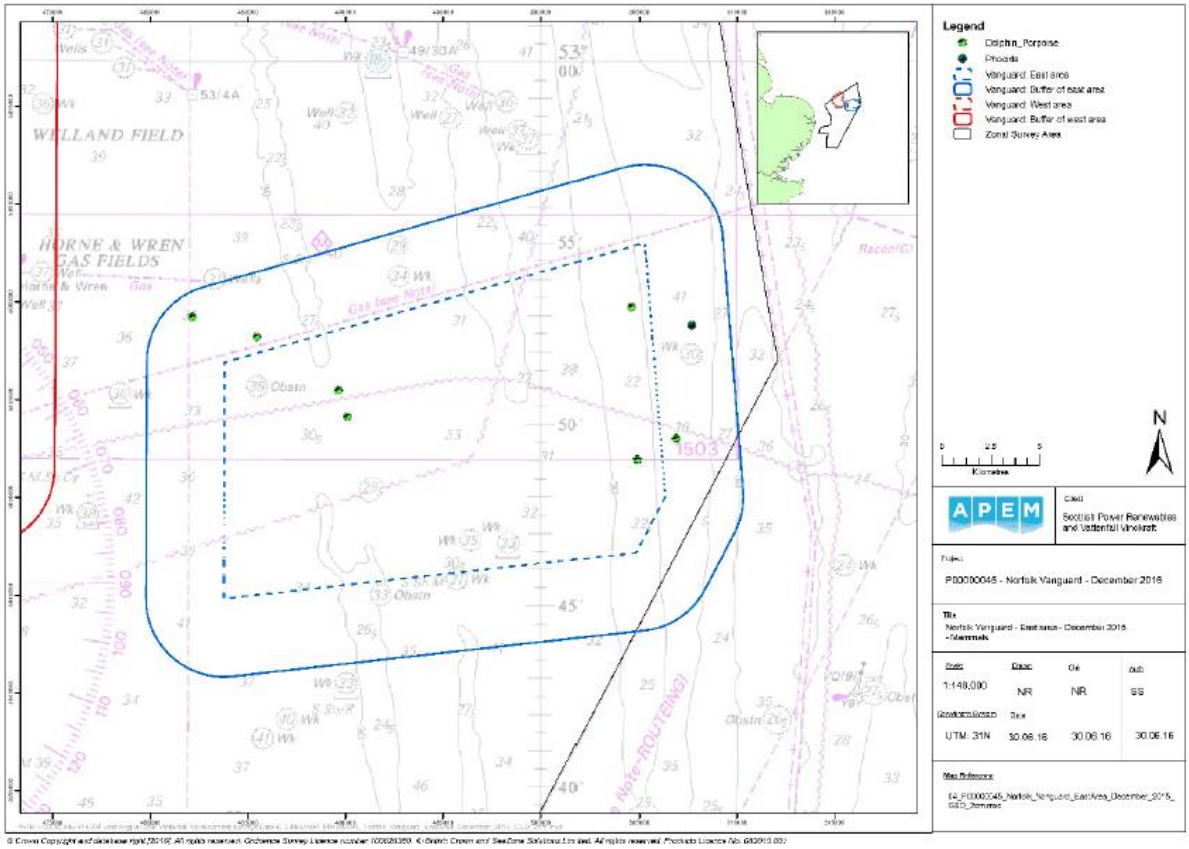
12.1.6.2 October 2015



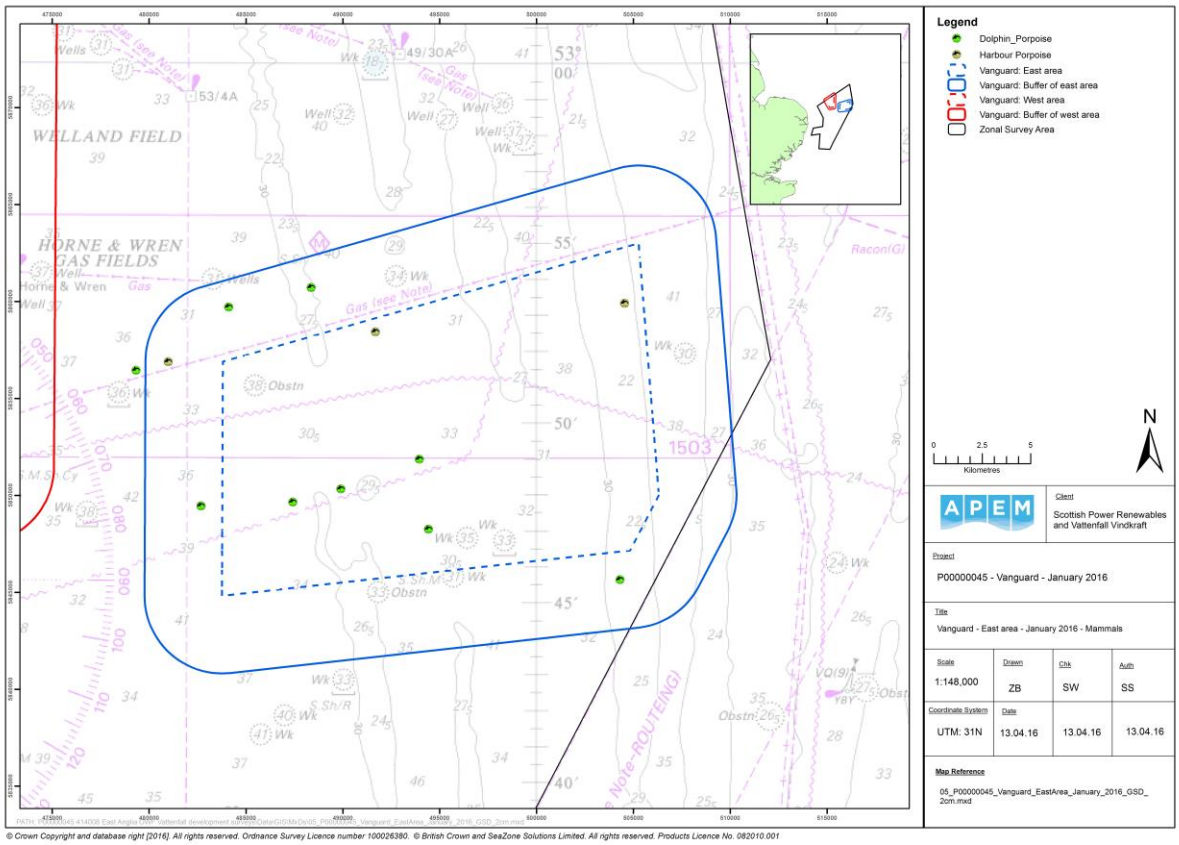
12.1.6.3 November 2015



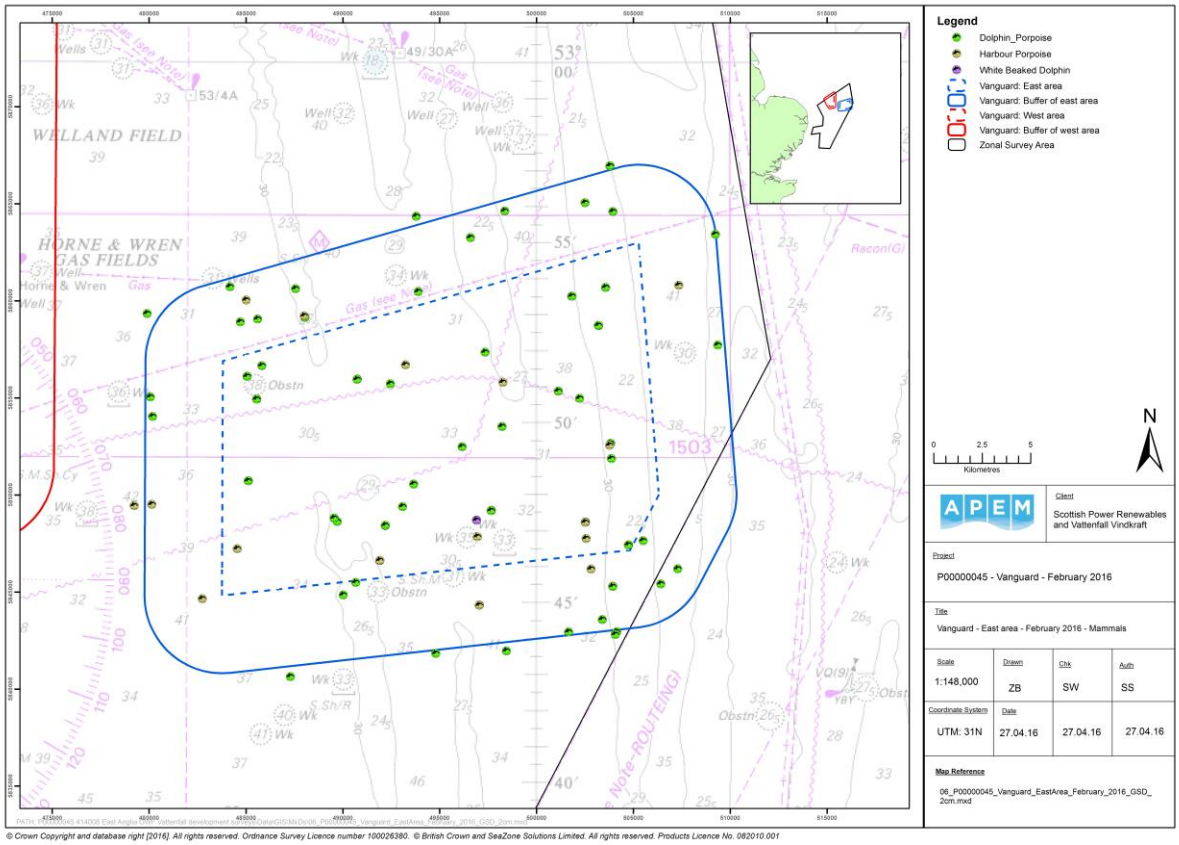
12.1.6.4 December 2015



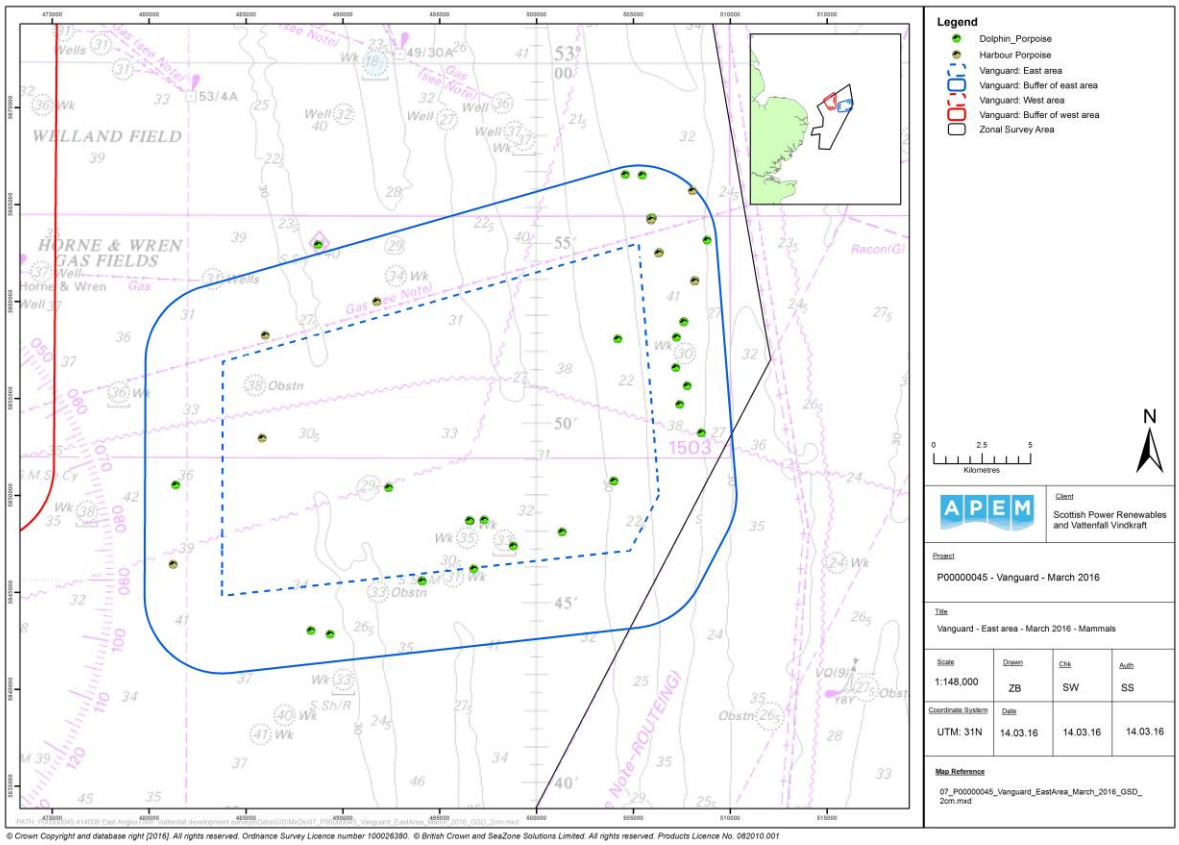
12.1.6.5 January 2016



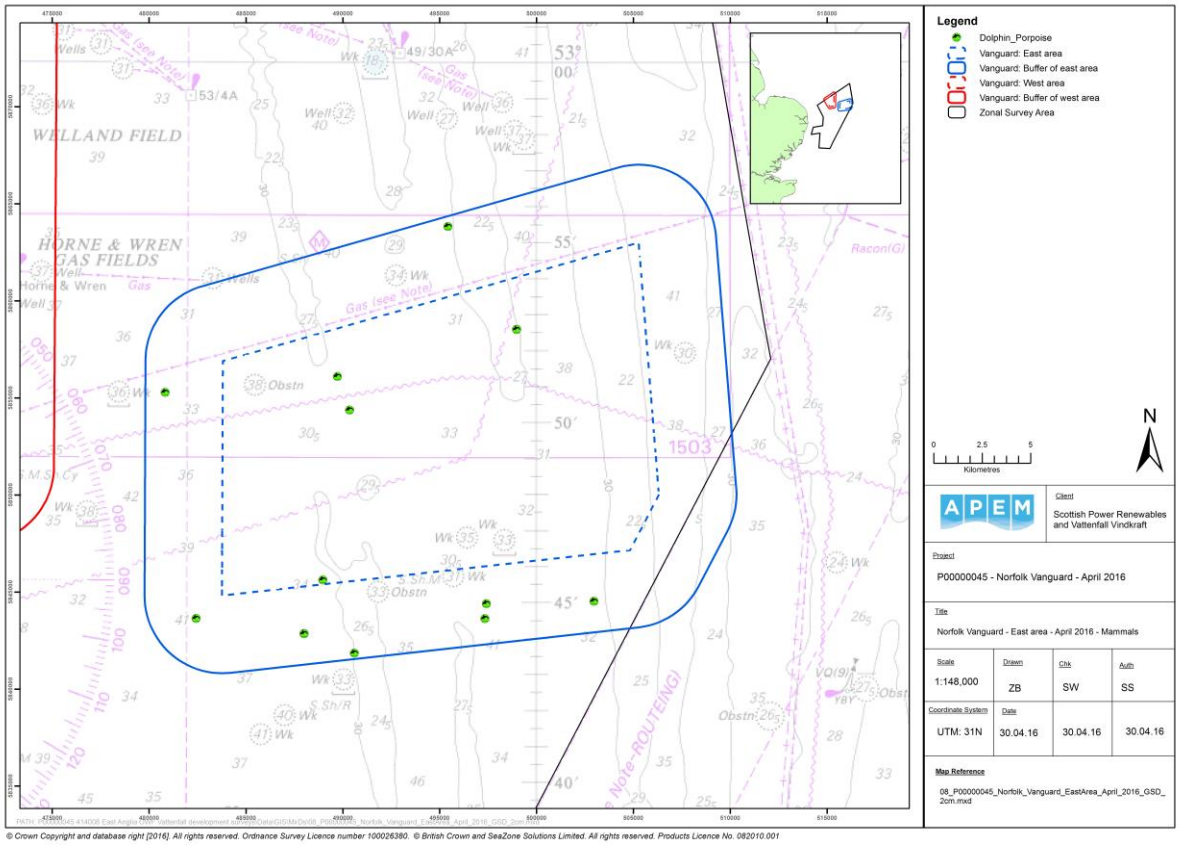
12.1.6.6 February 2016



12.1.6.7 March 2016

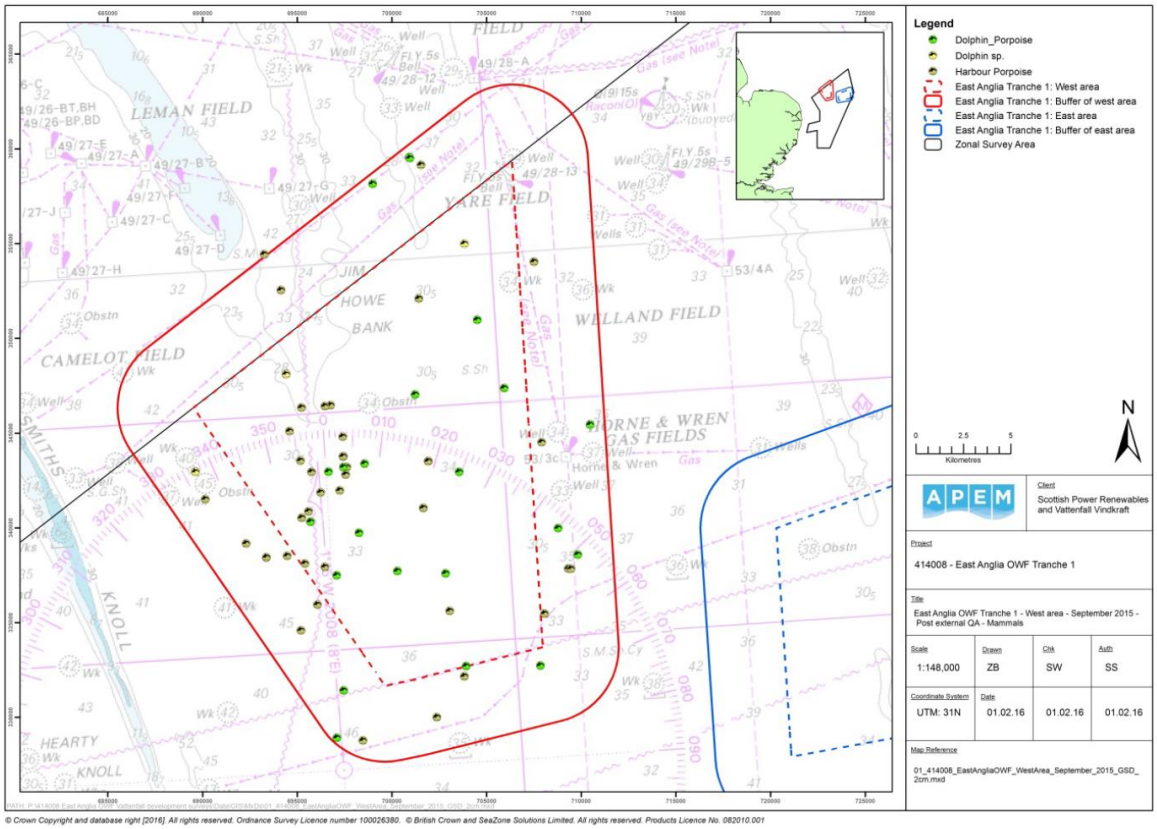


12.1.6.8 April 2016

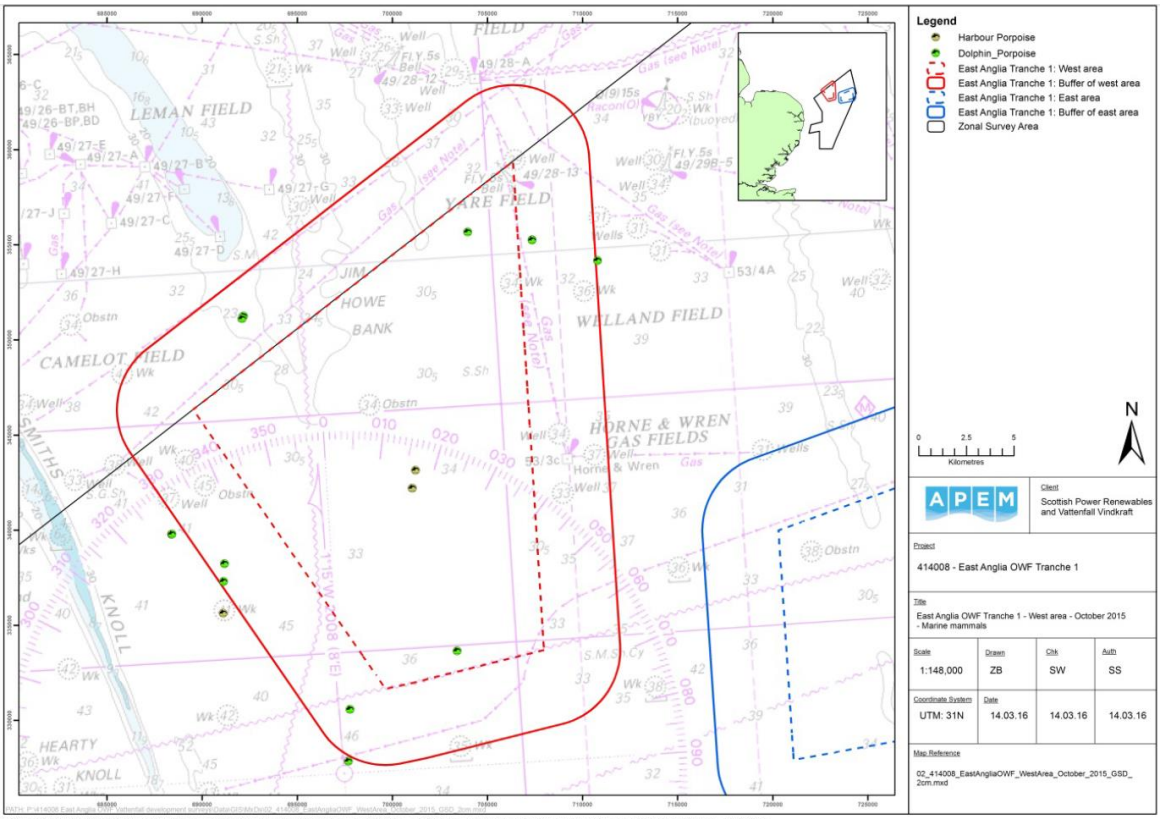


12.1.7 Norfolk Vanguard West

12.1.7.1 September 2015



12.1.7.2 October 2015



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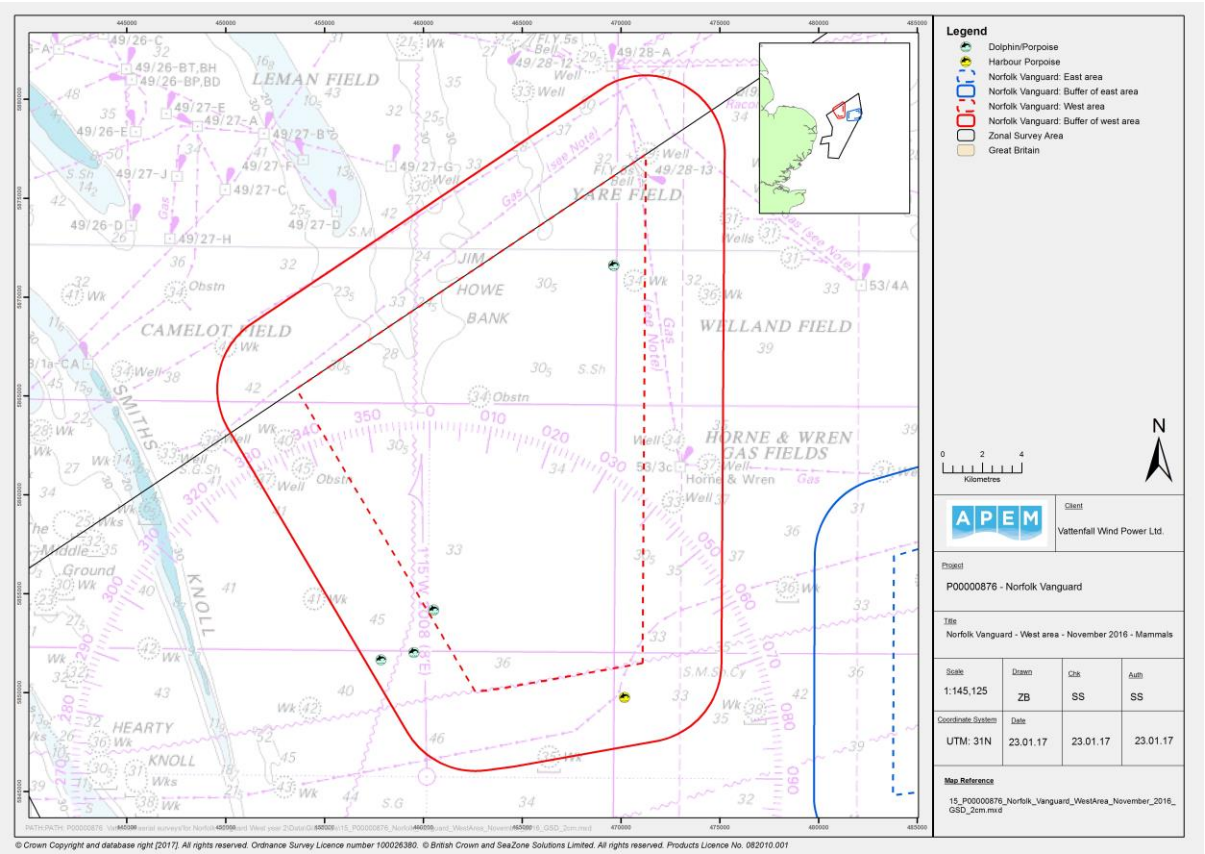
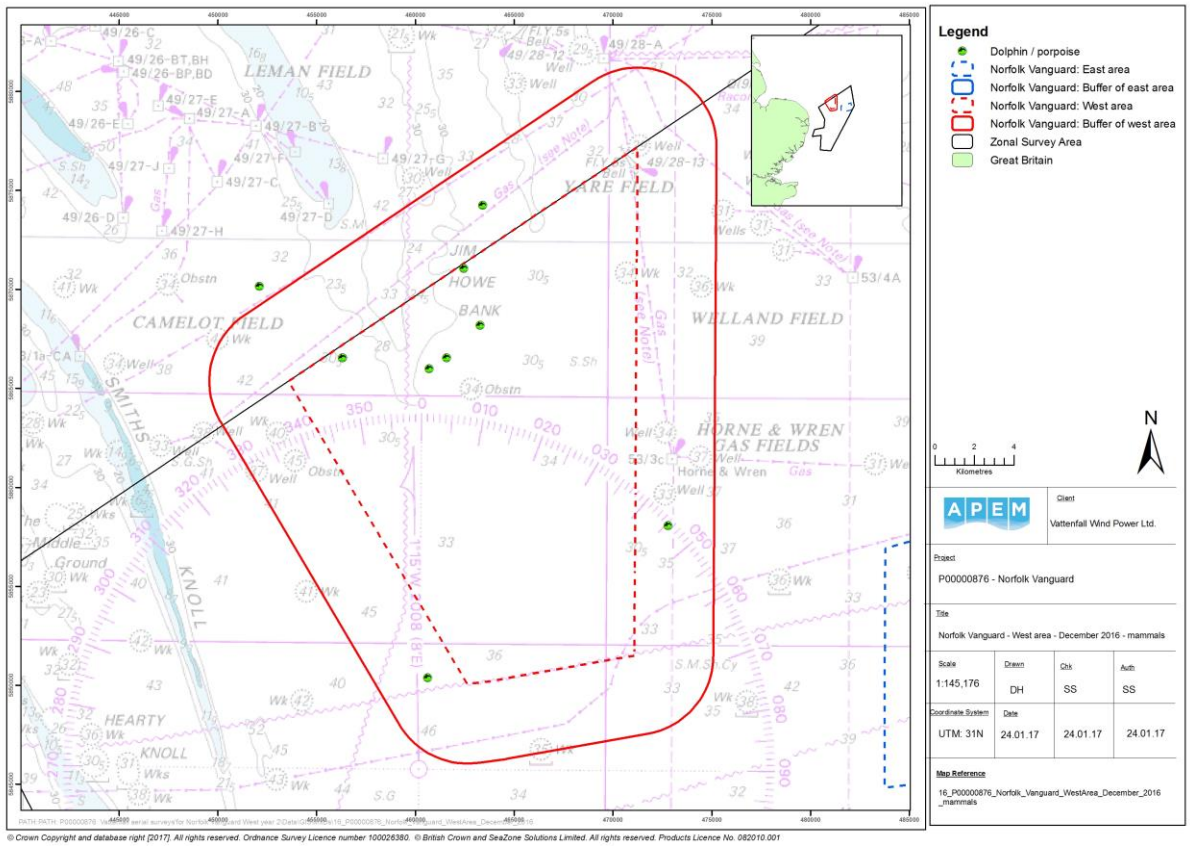
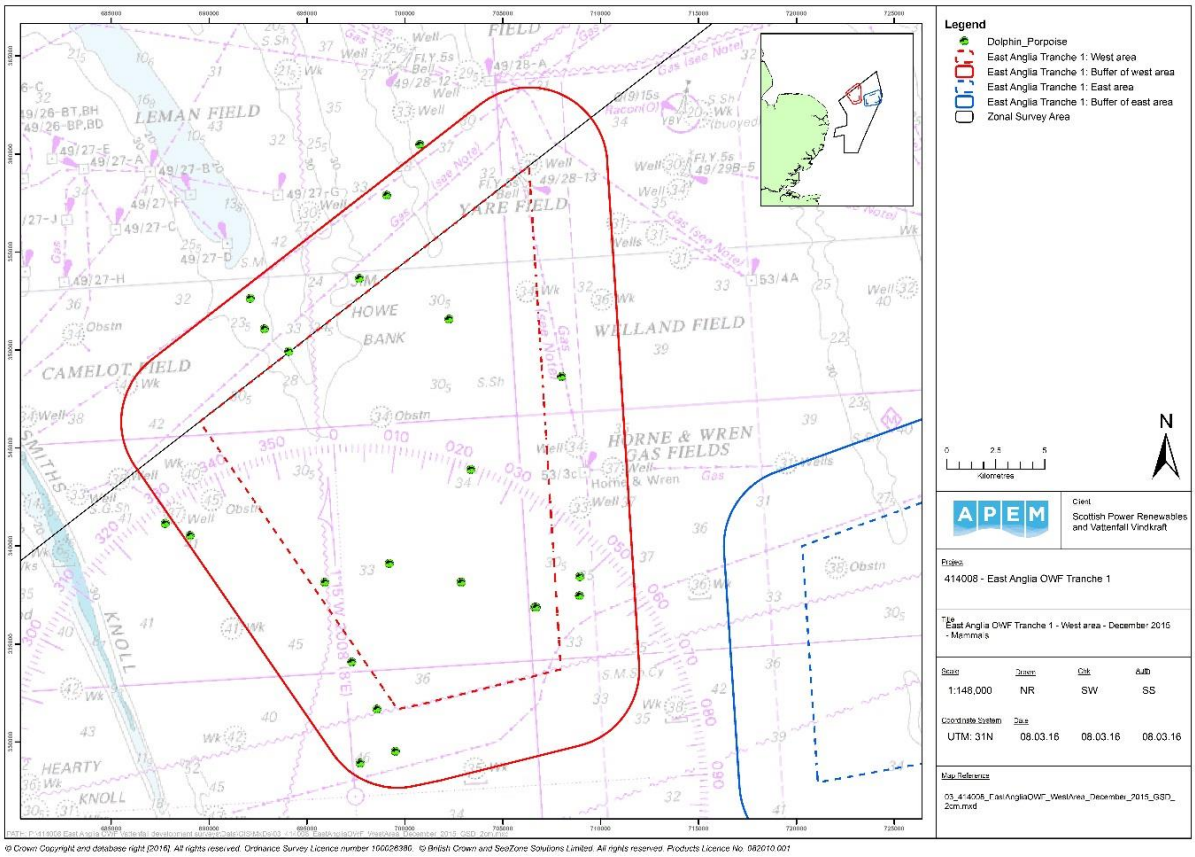


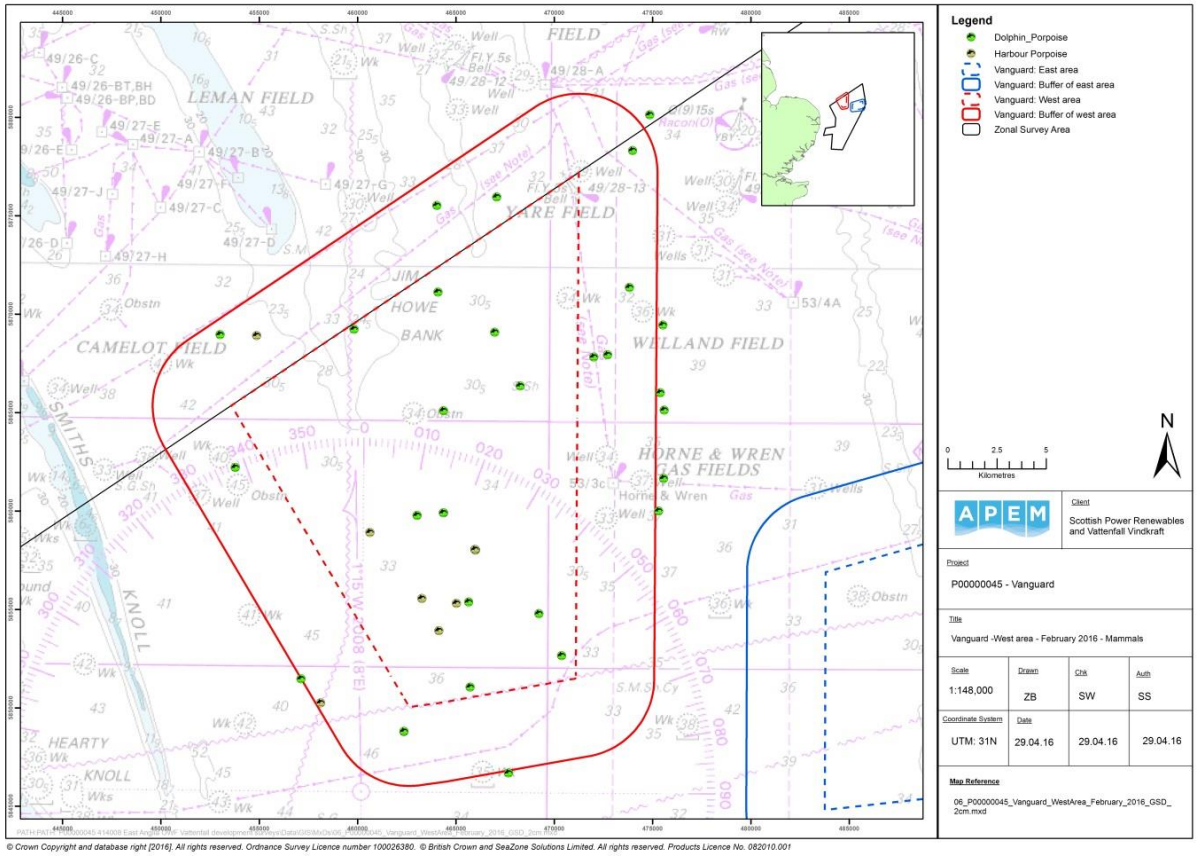
12.1.7.4 December 2015



12.1.7.5 January 2016



12.1.7.6 February 2016



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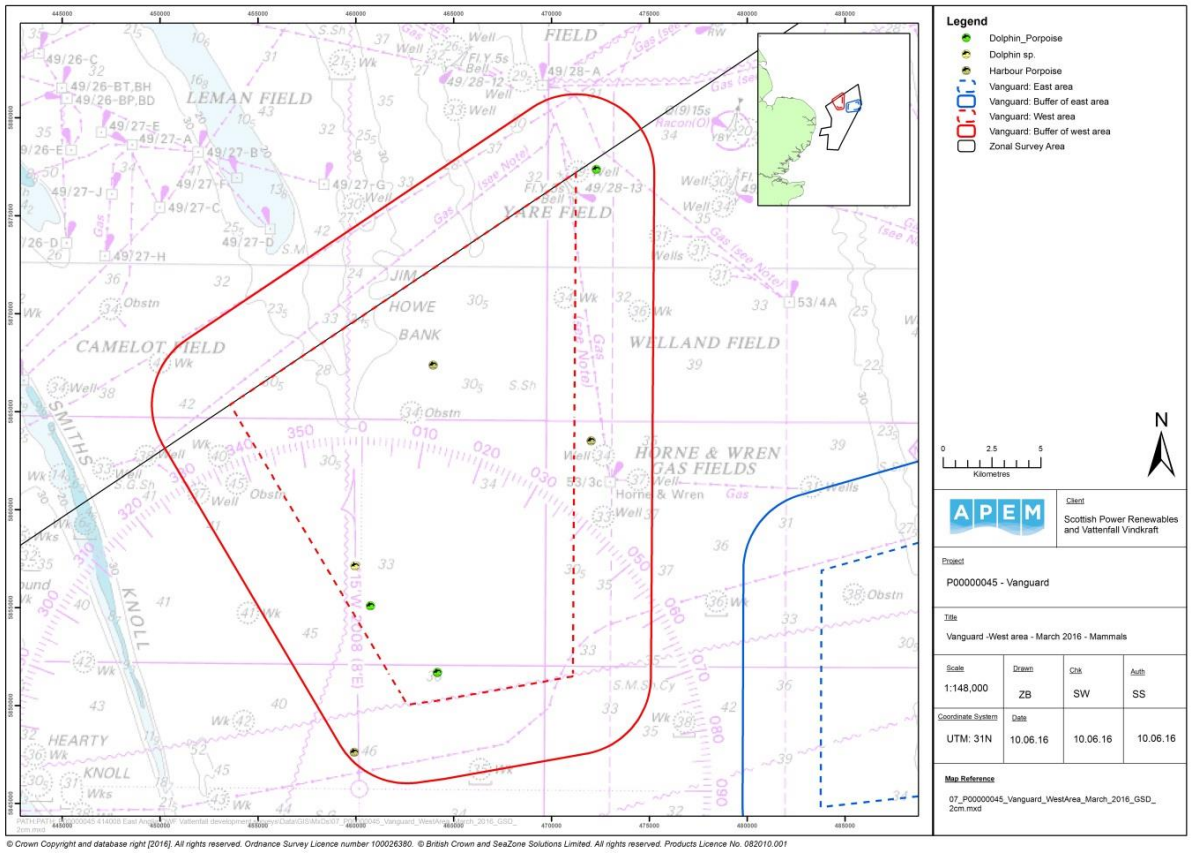
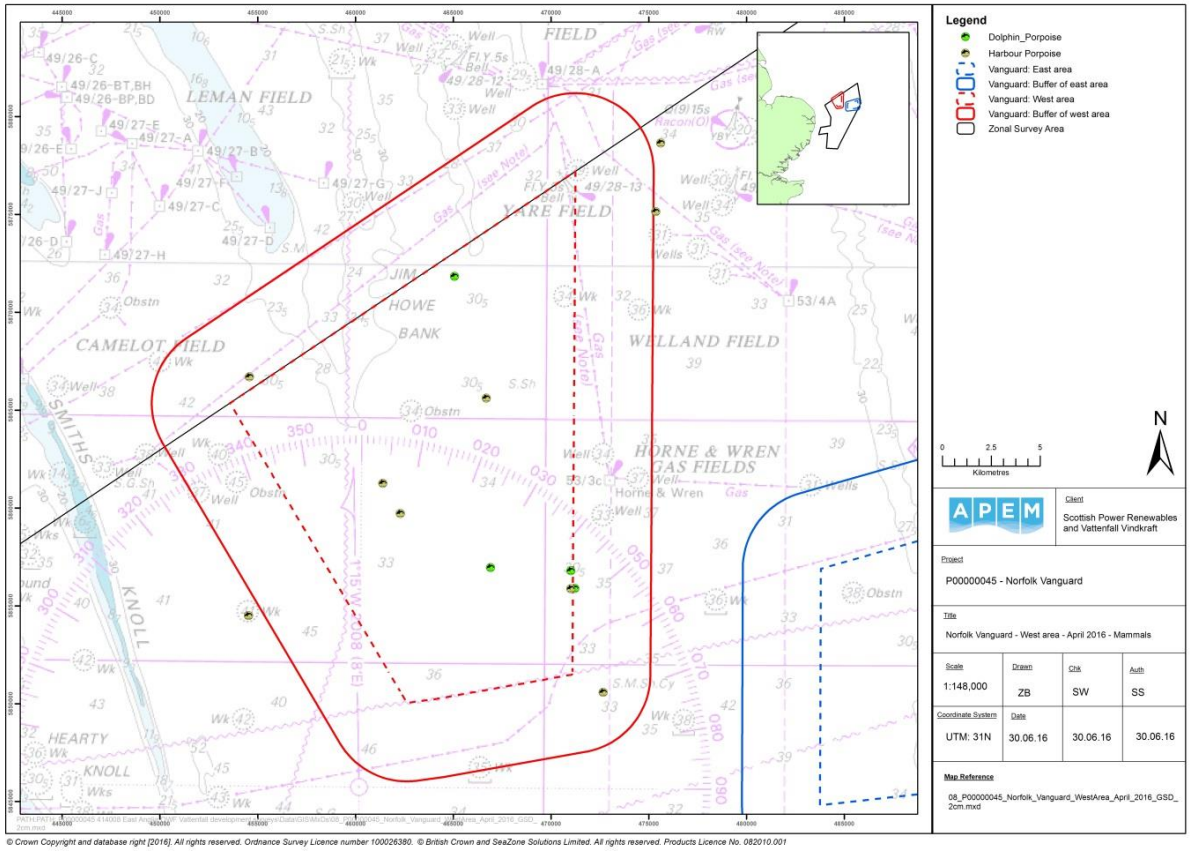
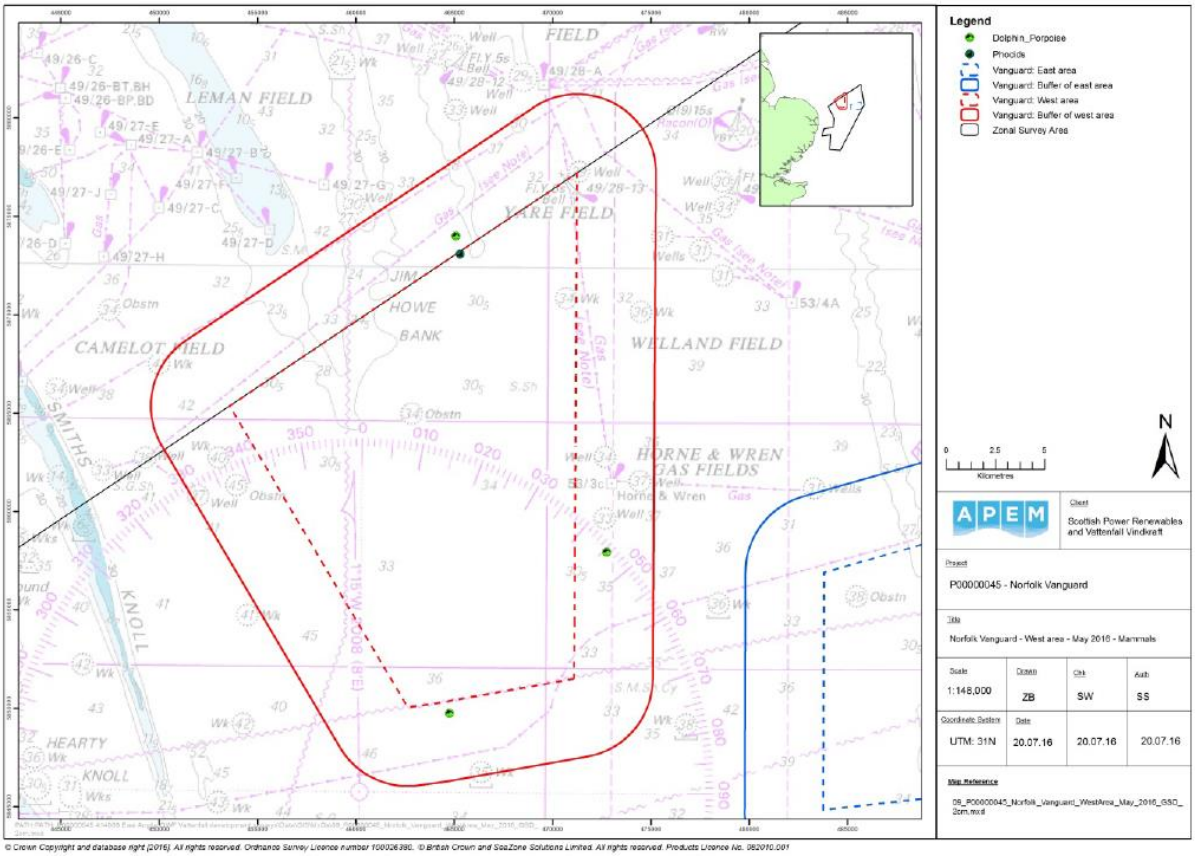


12.1.7.8 April 2016



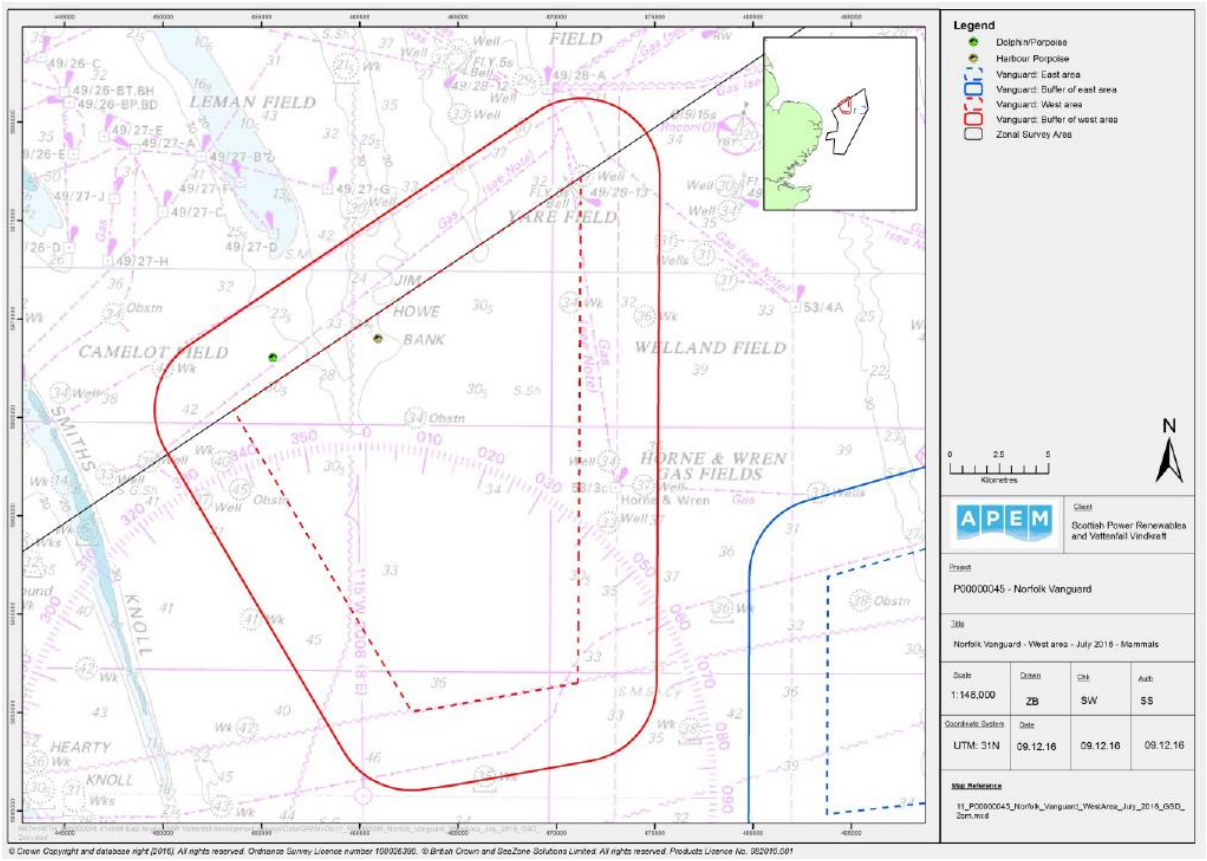
12.1.7.9 May 2016



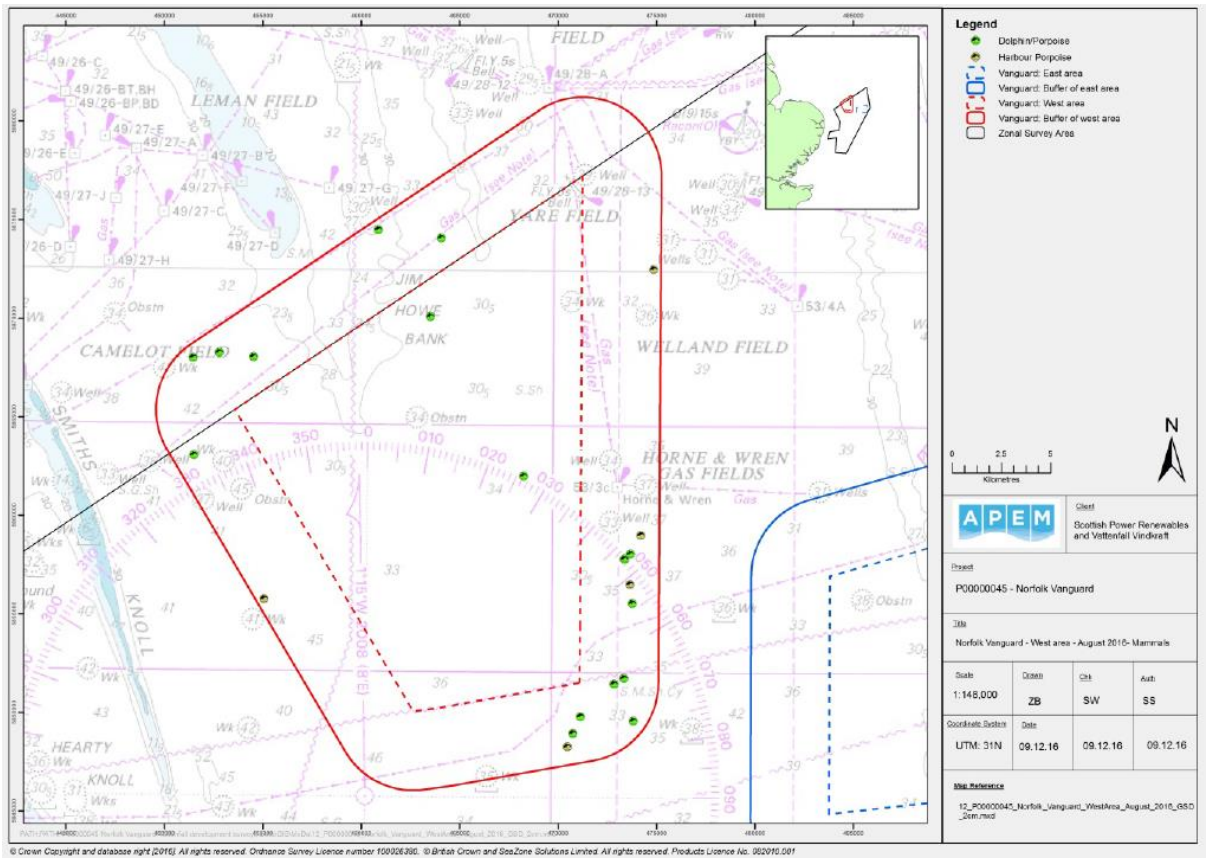
12.1.7.10 June 2016

53. No marine mammals were recorded during the survey

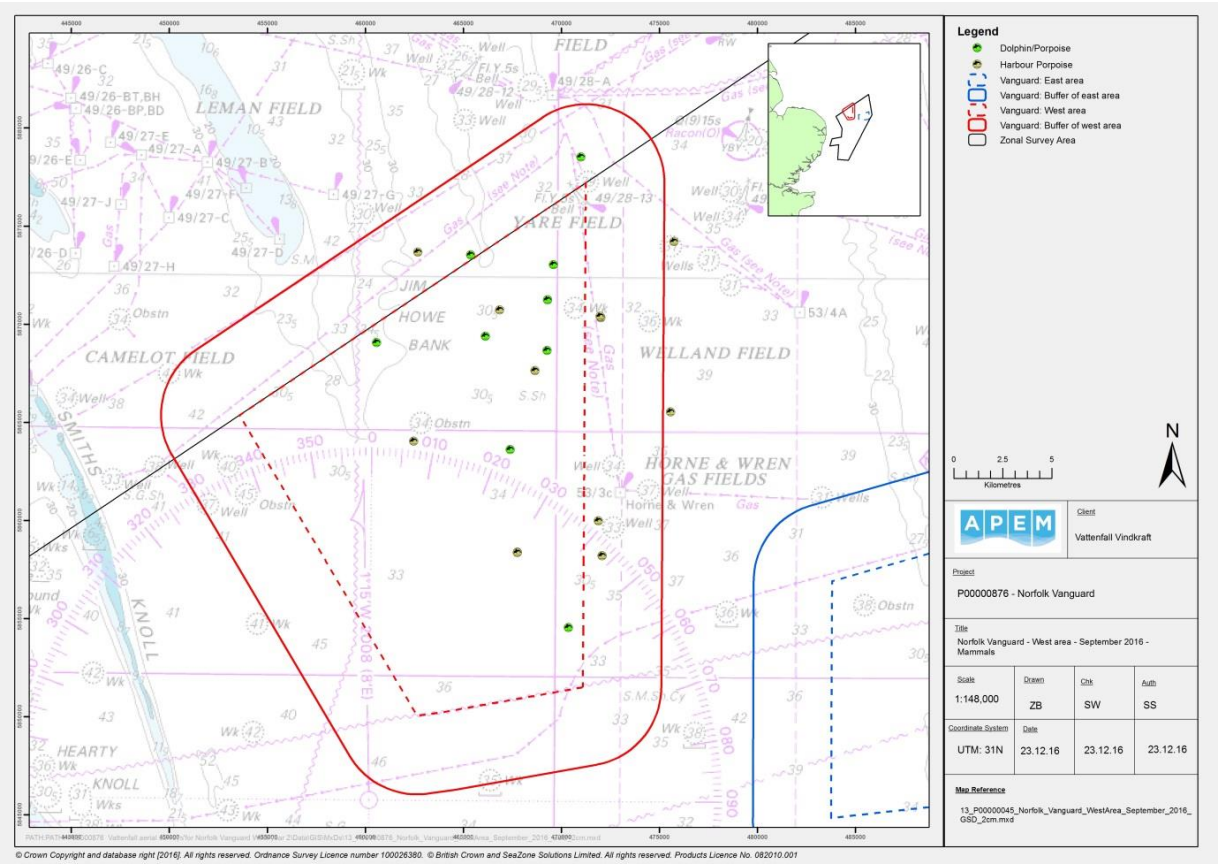
12.1.7.11 July 2016



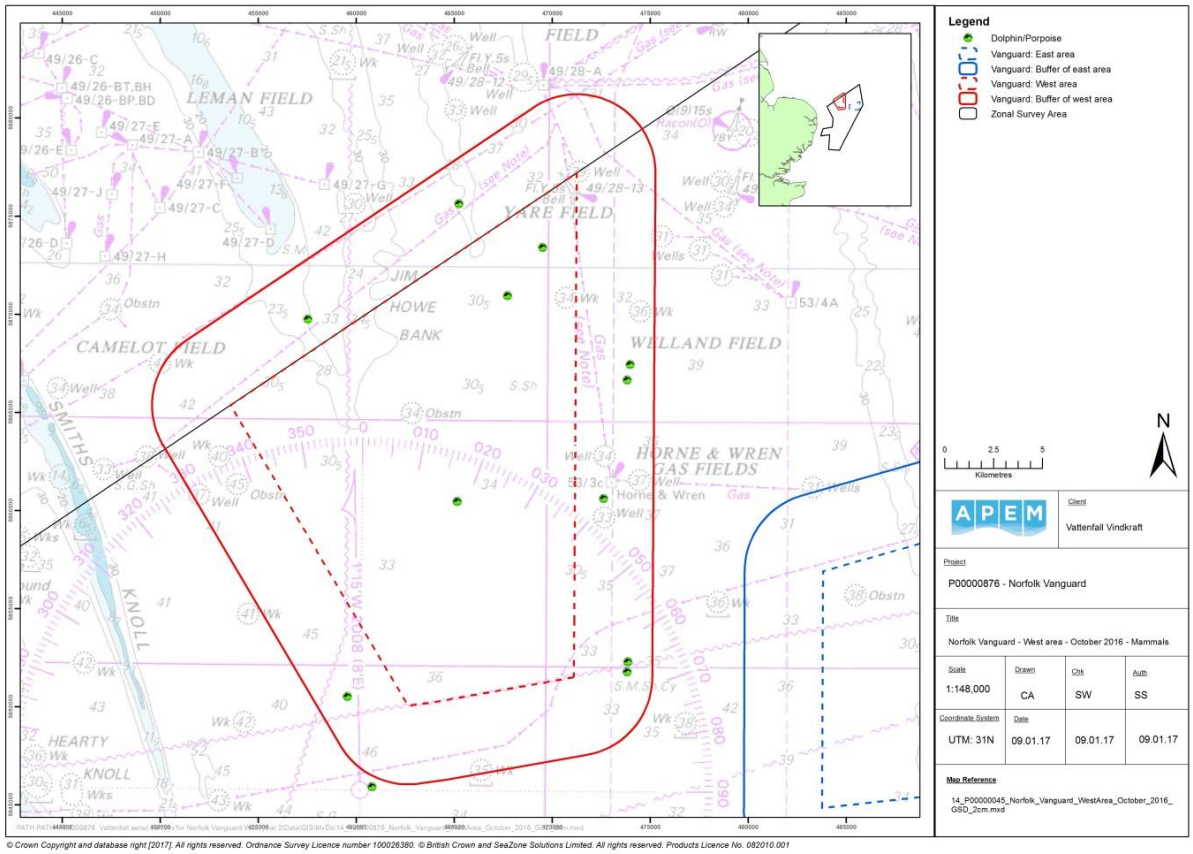
12.1.7.12 August 2016



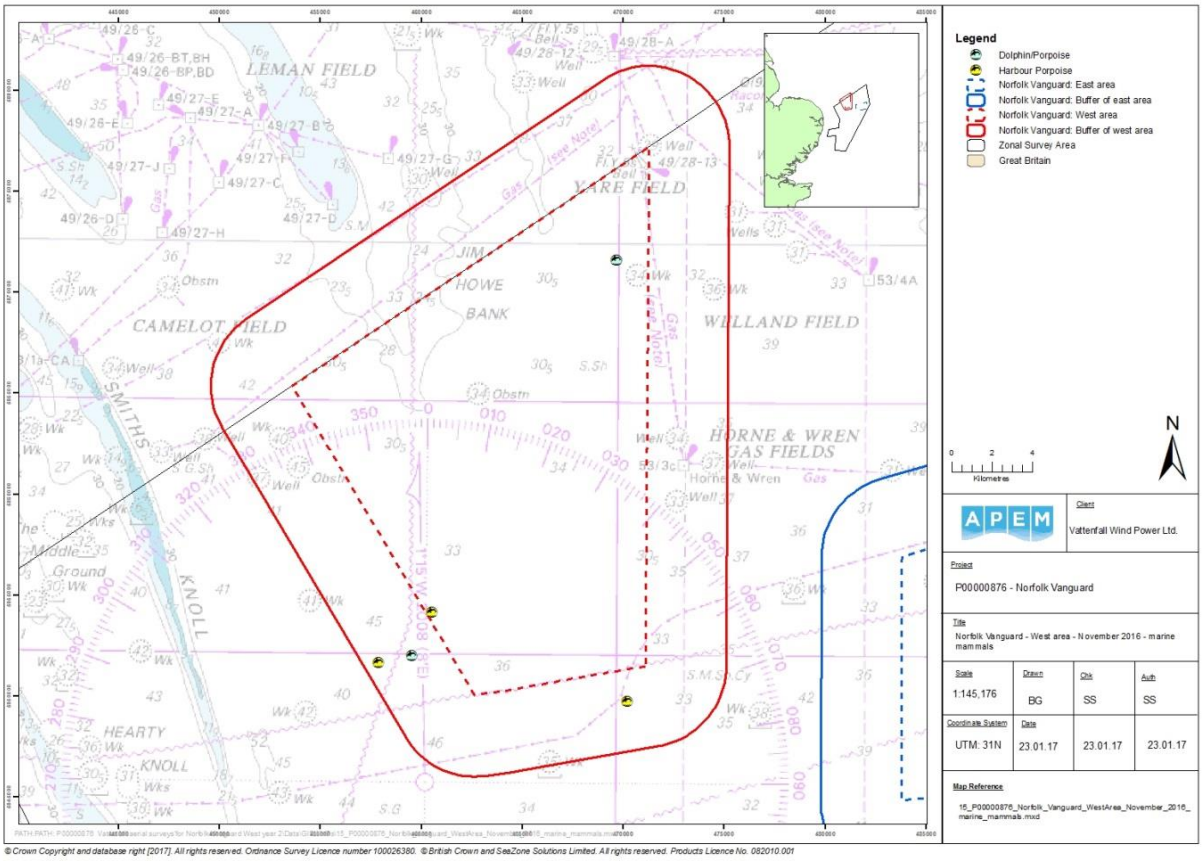
12.1.7.13 September 2016



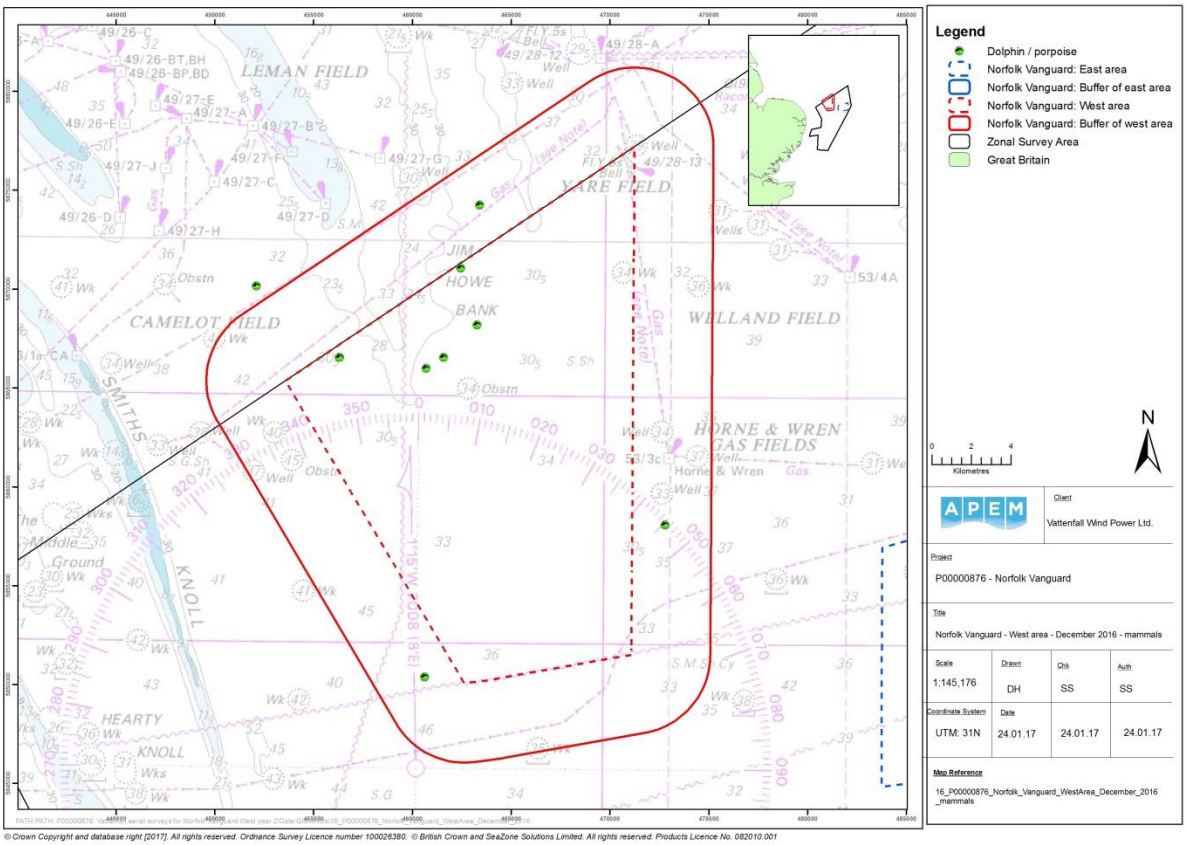
12.1.7.14 October 2016



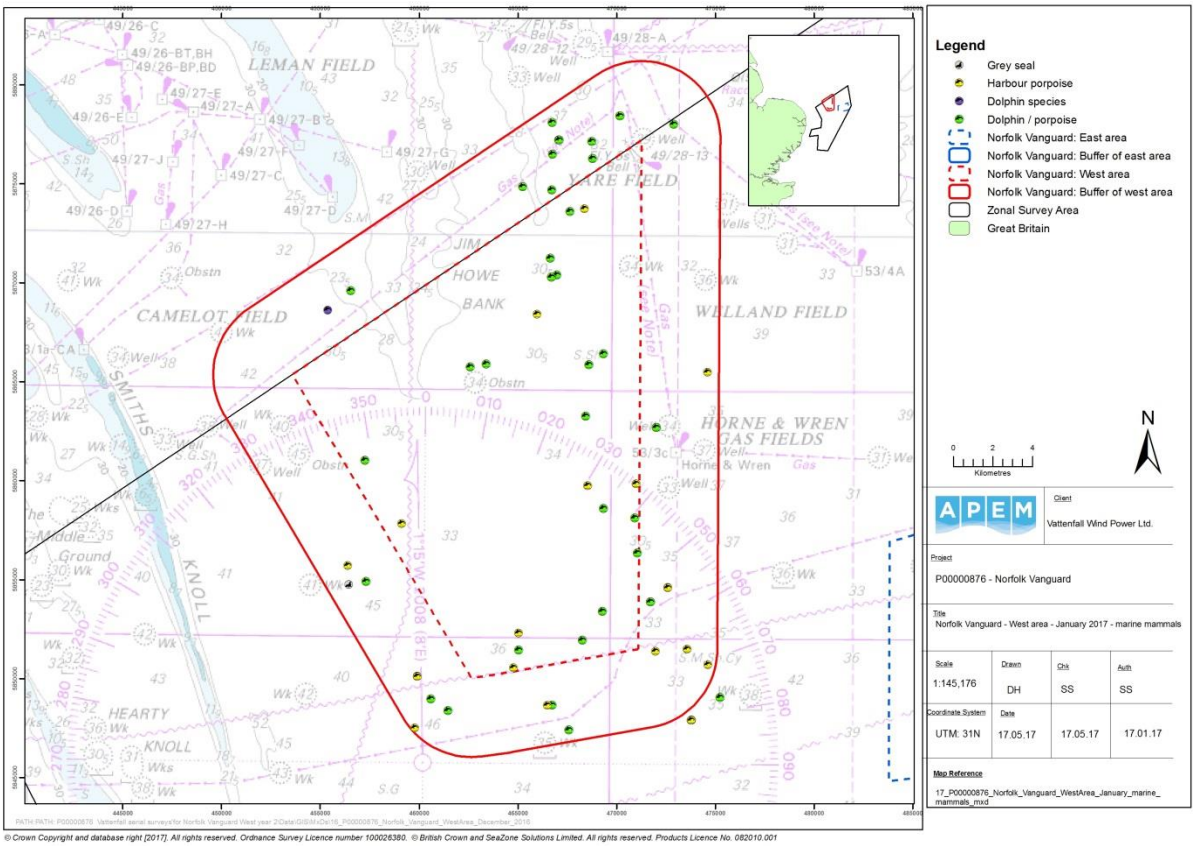
12.1.7.15 November 2016



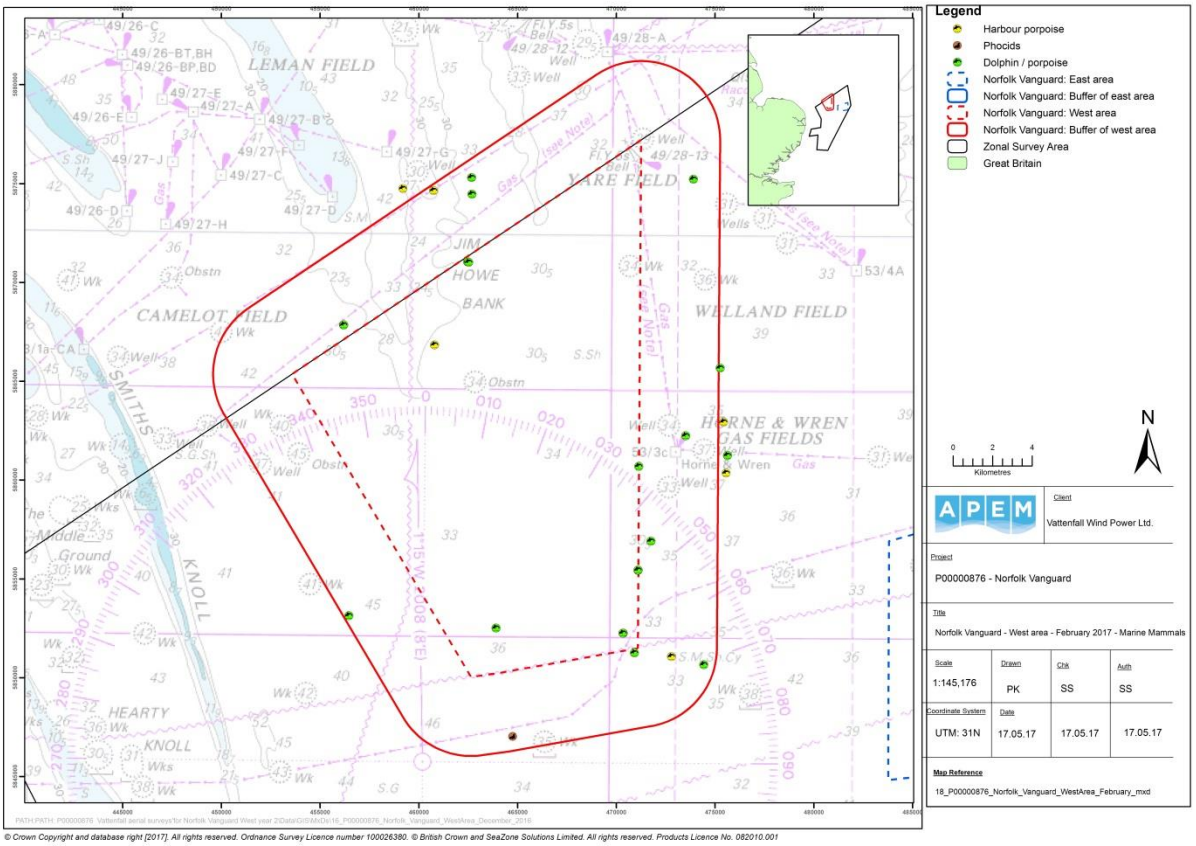
12.1.7.16 December 2016



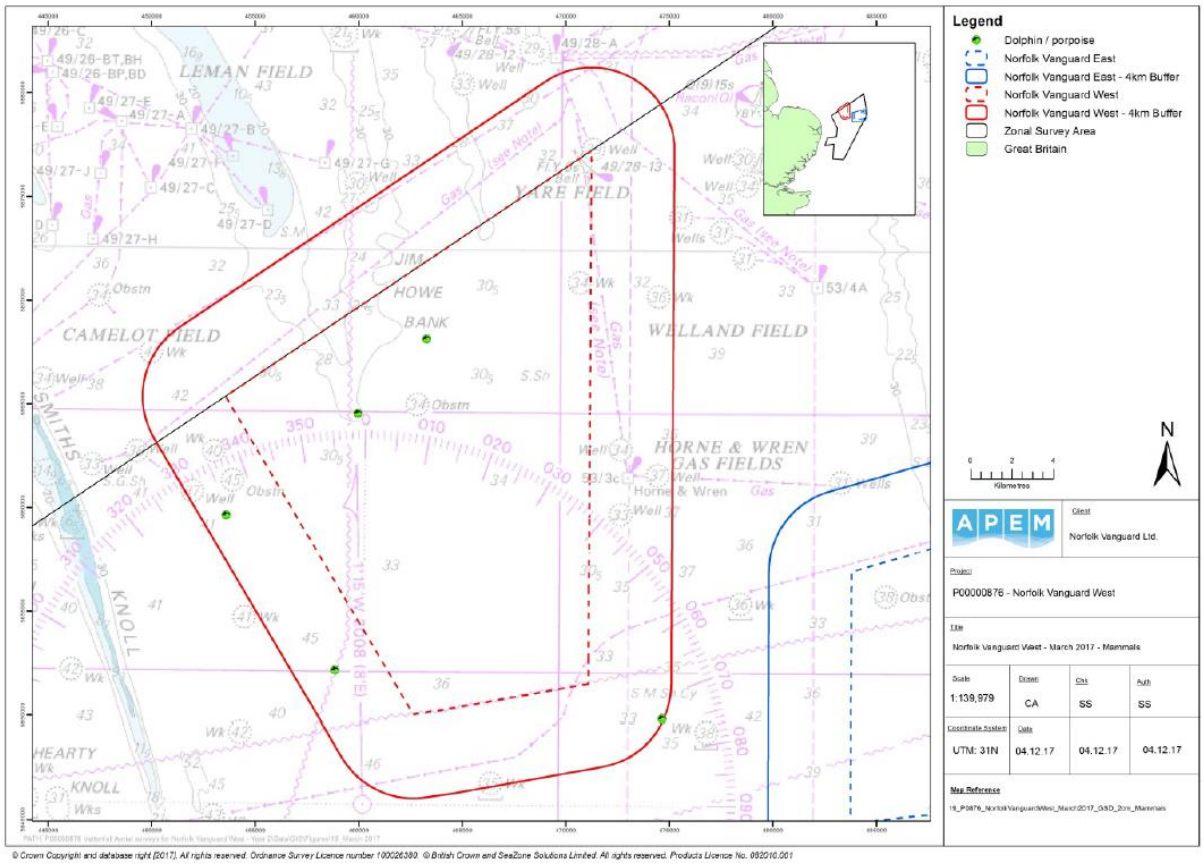
12.1.7.17 January 2017



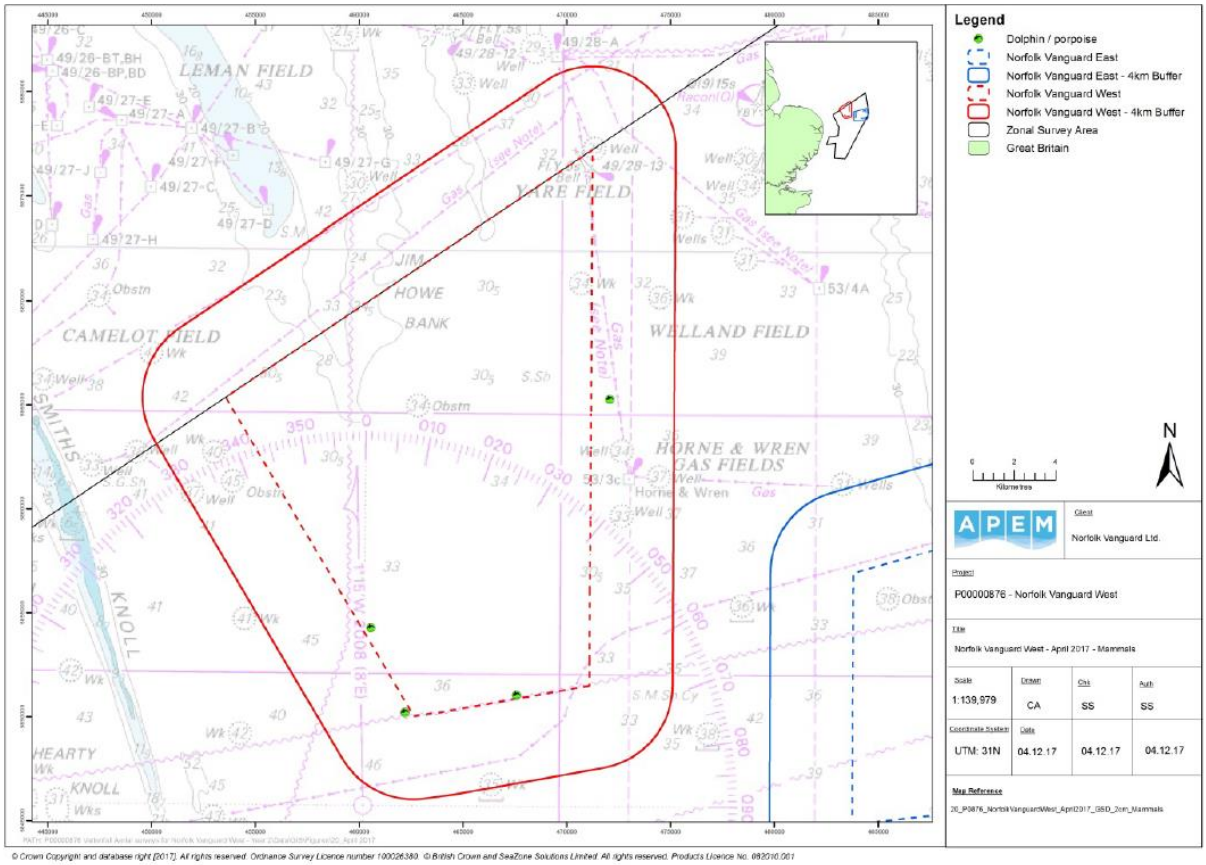
12.1.7.18 February 2017



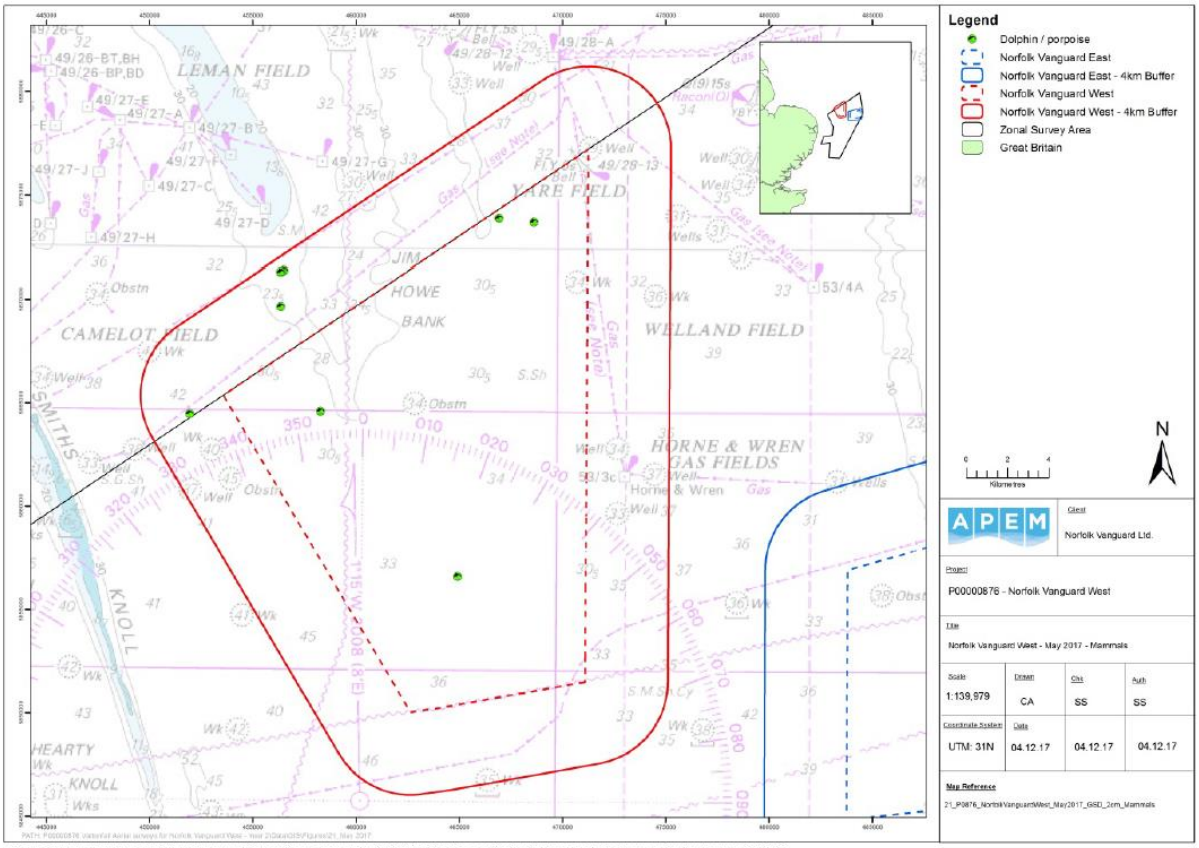
12.1.7.19 March 2017



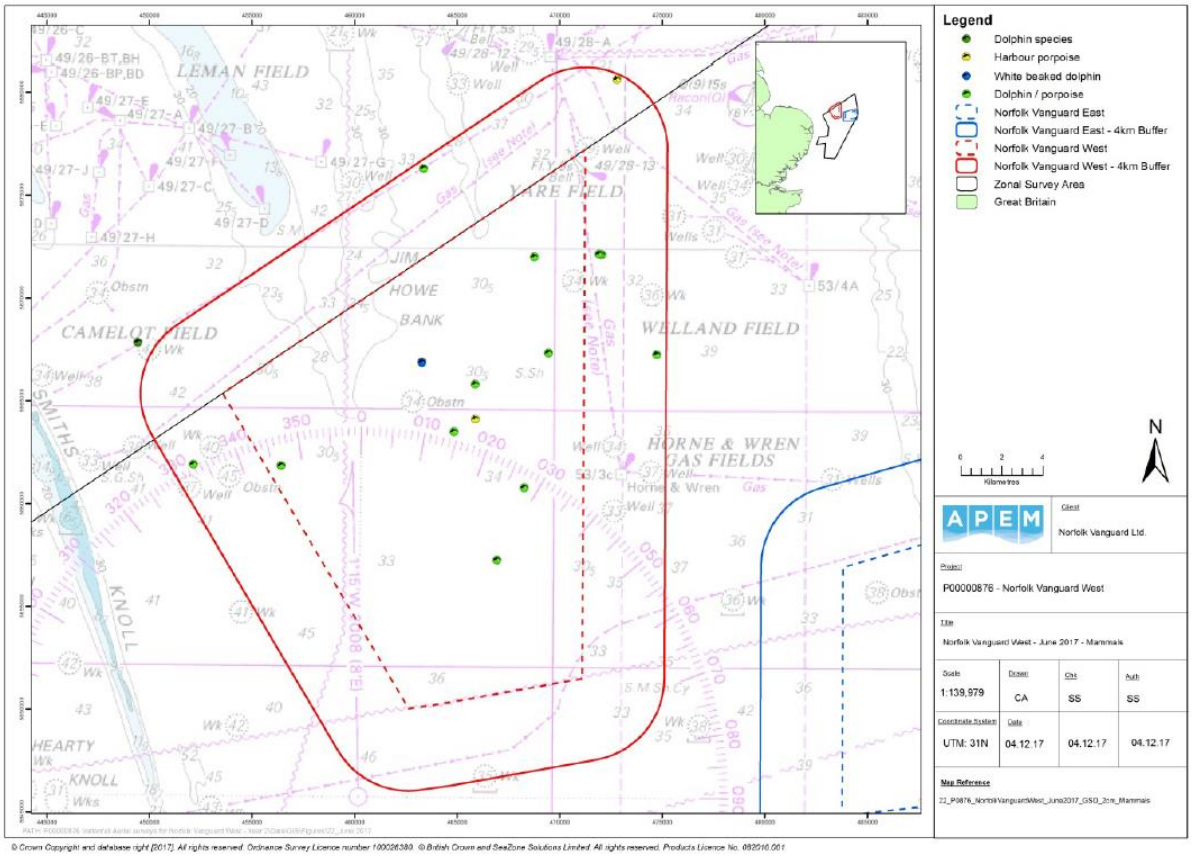
12.1.7.20 April 2017



12.1.7.21 May 2017



12.1.7.22 June 2017



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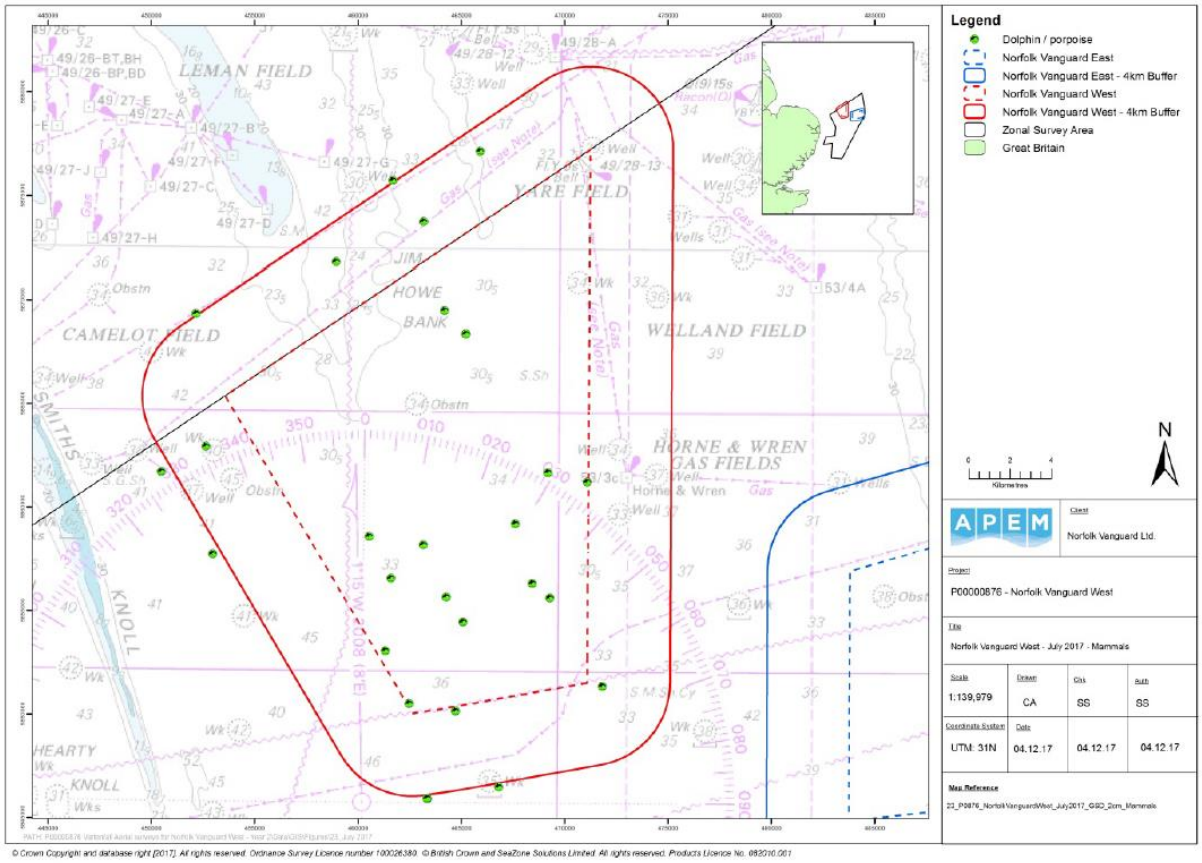

12.1.7.24 August 2017