



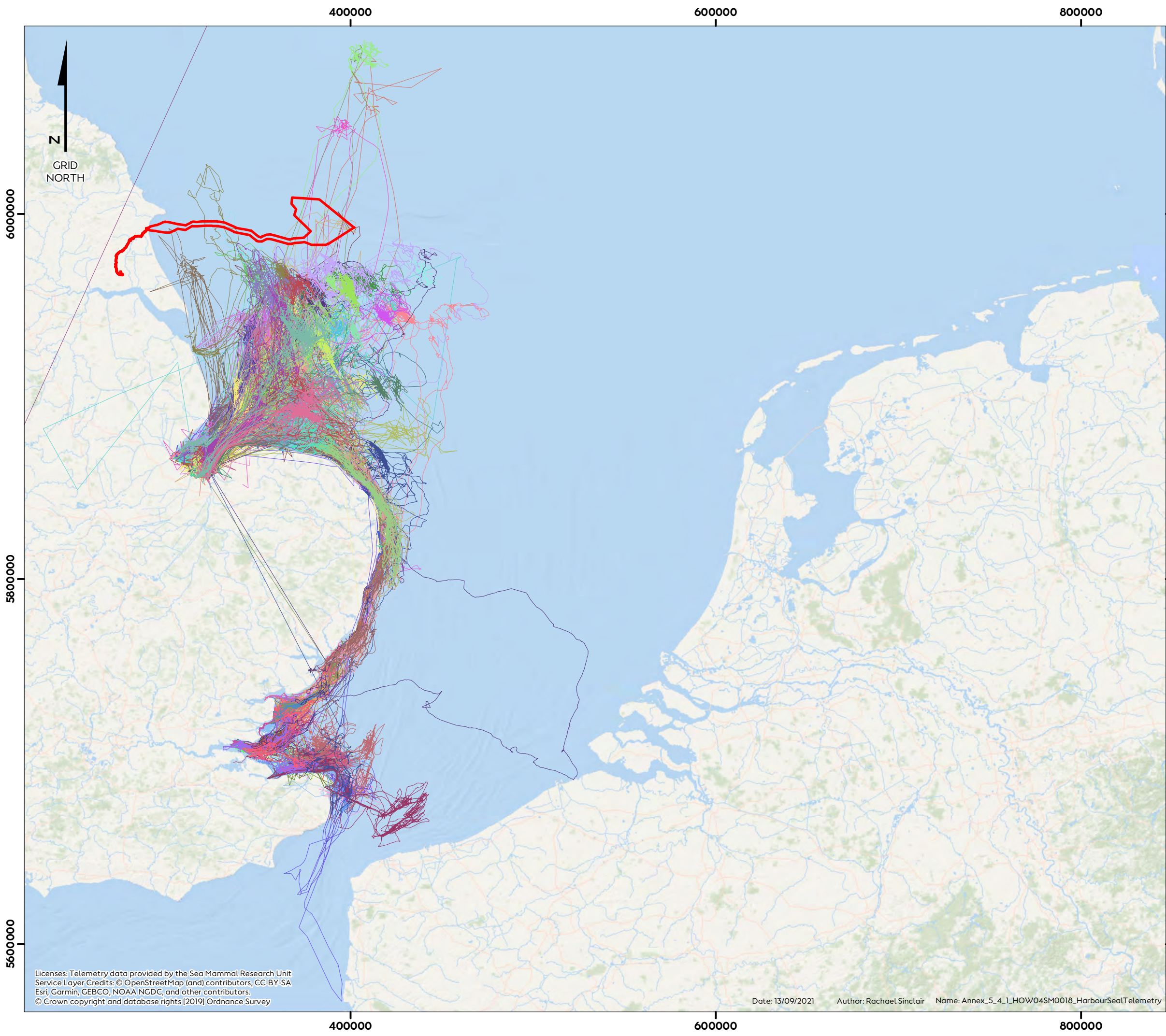
Hornsea Project Four: Environmental Statement (ES)

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Version B



Hornsea Four

Figure 35

Harbour Seal Telemetry Data

- Order Limits
- Harbour Seals Tagged in the Southeast England Seal MU (n=86)**
- Each colour represents a different seal



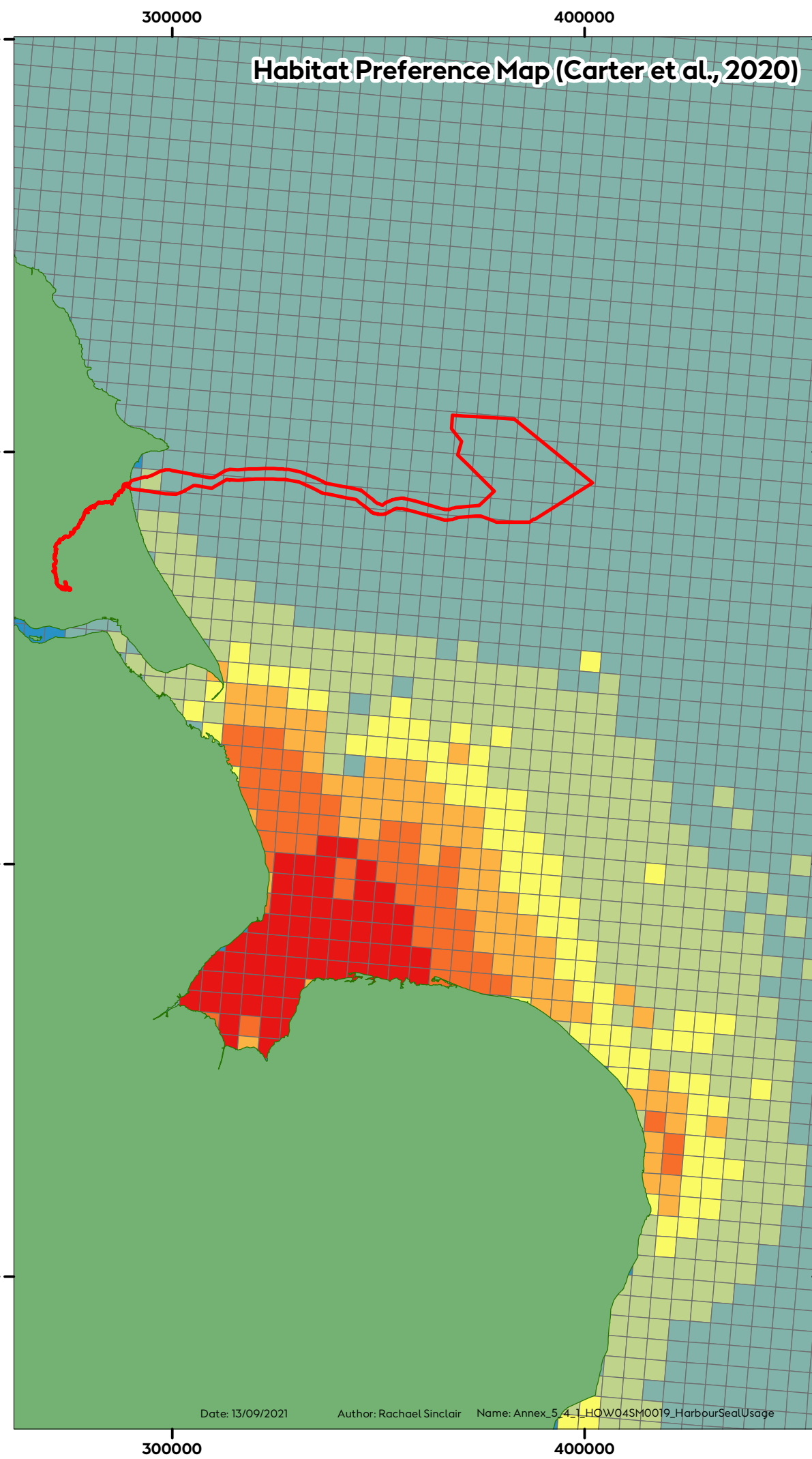
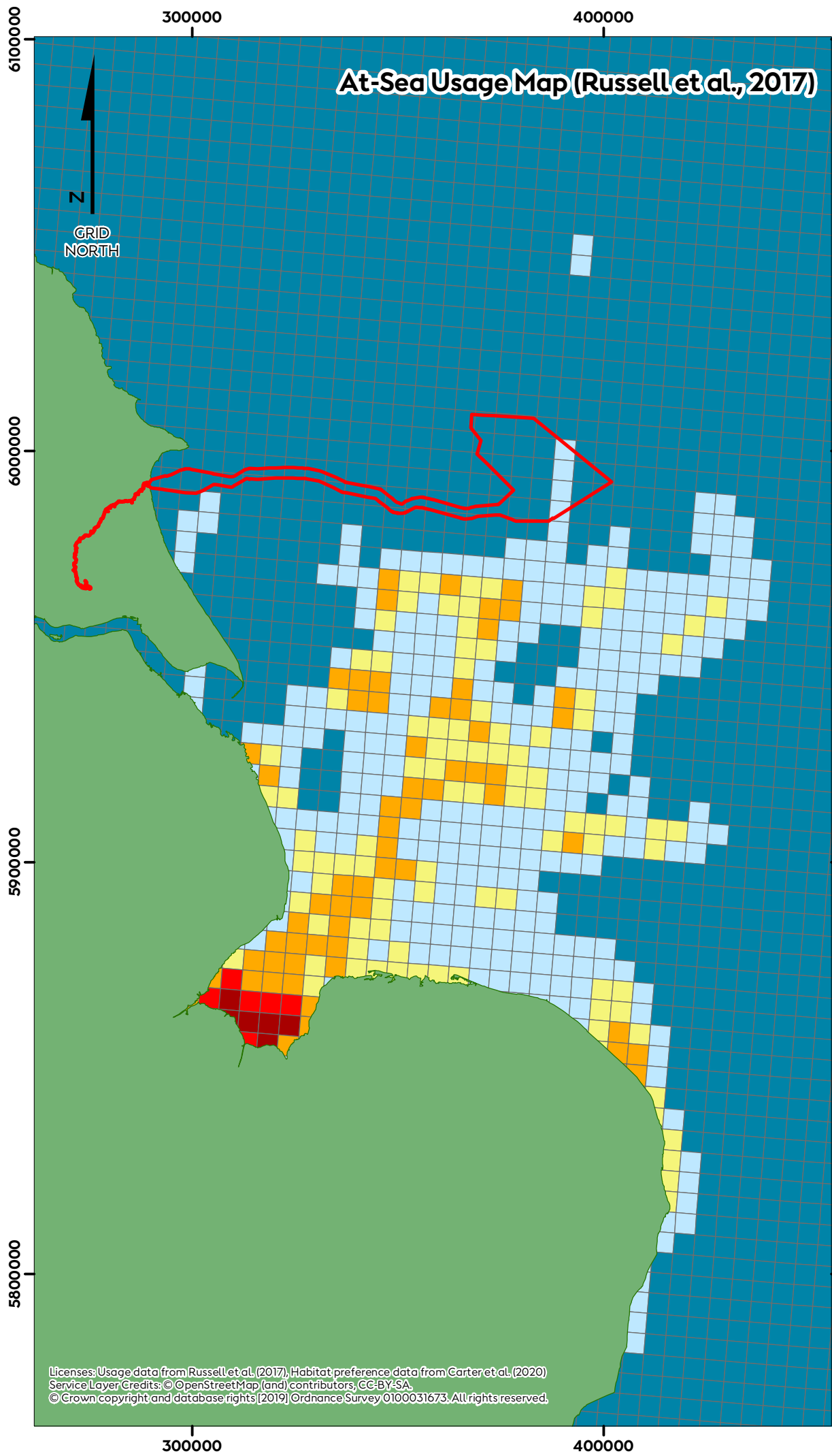
Coordinate system: ETRS 1989 UTM Zone 31N
 Scale@A3: 1:2,000,000

0 20 40 80 Kilometres

0 20 40 Nautical Miles

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Hornsea Four

Figure 36

Harbour Seal At-Sea Distribution

Order Limits

Harbour Seal At-Sea Usage (#/5x5km cell)

- 0<1
- 1<5
- 5<10
- 10<50
- 50<100
- >100

Habitat Preference: % British Isles At-Sea Population (per 25km²)

- 0.00
- 0.00 - 0.001
- 0.001 - 0.005
- 0.005 - 0.01
- 0.01 - 0.025
- 0.025 - 0.05
- >0.05

Coordinate system: ETRS 1989 UTM Zone 31N
 Scale@A3: 1:1,250,000

0 15 30 60 Kilometres
 0 15 30 Nautical Miles

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Harbour Seal At-Sea Distribution
 Document no: HOW04SM0019
 Created by: RRS
 Checked by: BPHB
 Approved by: LK

7.4 Hornsea Four site-specific aerial surveys

7.4.1.1 Only one harbour seal was sighted during the 24 months of site-specific aerial surveys, however, given the extreme difficulty of identifying seals at sea to species level in digital aerial surveys, this is unsurprising and does not mean that harbour seals were absent from the survey area. Across the 24 months of site-specific aerial surveys there were a total of 58 unidentified seal species sighted, an unknown proportion of which will have been harbour seals.

7.5 Connectivity with European Union (EU) sites

7.5.1.1 In general, harbour seals are not as wide ranging as grey seals, and tend to forage within 40-50 km from their haul-out sites (SCOS 2018). Telemetry studies have shown very little overlap between harbour seals tagged at Danish or French haul-out sites and UK waters (Brosseur et al. 2012, Brosseur and Kirkwood 2015, Vincent et al. 2017). There is evidence of connectivity between Danish waters and the Greater Thames Estuary area, however the telemetry tracks do not extend as far north as the Hornsea Four ([Figure 37](#)). Therefore, it is not expected that harbour seals from Danish or French sites will be significantly impacted by Hornsea Four and will not be included as part of the reference population that project alone impacts are assessed against.

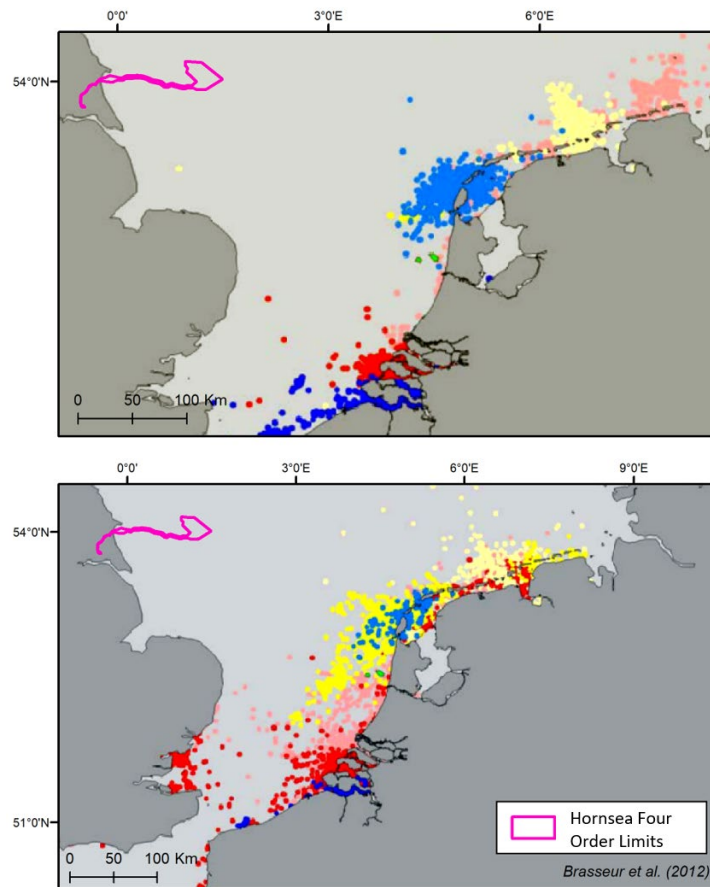


Figure 37: Location data from harbour seals tagged in the Dutch coastal area between 1997 and 2007. Top = winter observations (38 seals), bottom = summer observations (51 seals). Seal locations are coloured in accordance with tagging site: Red: Eastern Scheldt; Pink: Maasvlakte; Bright Yellow: Texel; Light yellow: Rottum; Blue: Northern Texel; Dark blue: Western Scheldt. Obtained from Brasseur et al. (2012). Overlain is the approximate location of Hornsea Four.

7.6 Harbour seal summary

7.6.1.1 All data sources examined indicated little overlap between Hornsea Four and areas of harbour seal use. However, due to the proximity of the Hornsea Four array area in relation to The Wash SAC this species will be included in the quantitative impact assessment to determine any potential impacts of Hornsea Four. The most appropriate harbour seal reference population against which to assess impacts is the estimated population size of the southeast England MU using the scaled August haul-out count data. The best source of estimated density data is the habitat preference map which will be used in the impact assessment to determine the number of animals potentially impacted by Hornsea Four.

8 Grey seal baseline

- 8.1.1.1 The grey seal is the larger of the two seal species found in the UK with adult males weighing 230-310 kg, adult females weighing 150-200 kg, and living for 20-30 years. Grey seals are generalist feeders and consume several different species including sandeels (the predominant prey species), gadoids and flatfish. They are wider ranging than harbour seals and regularly travel over 100 km between haul-out sites with foraging trips lasting up to 30 days. Most foraging occurs within 100 km of a haul-out site, although telemetry data have shown that they can feed up to several hundred kilometres offshore (SCOS 2018, 2021). Recent analysis of telemetry data has shown that grey seals tagged in the UK travelled a maximum of 448 km from a haul-out site (Carter et al. 2020). Grey seals breed in autumn and have a clockwise cline in birth date around the UK, with pupping in east England occurring between early November and mid-December. Grey seals give birth to a single white-coat pup which remains on land to suckle, through weaning and remains on land for up to three weeks after weaning before going to sea for the first time.
- 8.1.1.2 The UK supports approximately 38% of the world's breeding grey seals and approximately 88% of these are found in breeding colonies in Scotland. The North Sea grey seal population is steadily increasing by approximately 3% per year and overall, the UK grey seal population has Favourable Conservation Status (JNCC 2019c). The most recent UK wide population estimate (based on pup counts obtained in 2016) is 149,700 age 1+ grey seals at the start of the 2019 breeding season (95% CI: 120,000 – 174,900) (SCOS 2021).

8.2 Management Area

- 8.2.1.1 Hornsea Four is located within the Southeast England MU, however, given knowledge of the wide-ranging behaviour of grey seals (SCOS (2018), (SCOS 2021), and the degree of connectivity between the Hornsea Zone with haul-outs in the Northeast England MU (see below), the Southeast England MU alone is not an appropriate reference population against which to assess impacts. Therefore, there are three main ways to determine the size of the appropriate grey seal reference population ([Table 12](#)). One approach is to use the whole North Sea population estimate obtained from pup production estimates. SCOS (2021) presents an estimated grey seal population size for the North Sea at the beginning of the breeding season in 2019 of 46,500 grey seals (95% CI: 35,800 – 61,600). This population estimate is derived from the 2018 pup production counts which were input into a population dynamics model and projected forwards to the start of the 2019 breeding season. The second approach is to use the estimated pup production in 2016 (10,350) and resulting population estimate for 2019 for England only (28,400), and the third approach is to use the August haul-out counts and scale to account for the proportion of animals at sea at the time of the survey (see [Section 8.3](#) for details).
- 8.2.1.2 The population size estimates for each SMA derived from pup production counts are biased towards the distribution of grey seals at breeding colonies at the time of pupping. Therefore, they may not be representative of distributions and abundances within SMAs at other times of the year. Since the August haul-out count does not contain this bias (this does not coincide with the grey seal moult or pupping periods and so grey seals are not driven to aggregate at particular locations), the August counts could be considered to be more representative of grey seal distribution and abundance within SMAs throughout the year. In addition, these data are incorporated into the at-sea usage maps and so it makes sense to use the abundance and corresponding distribution data derived from the same sources. Therefore,

the reference population against which grey seal assessments will be made will be the East England SMA August haul-out counts from 2017 of 45,894 grey seals ([Table 12](#)).

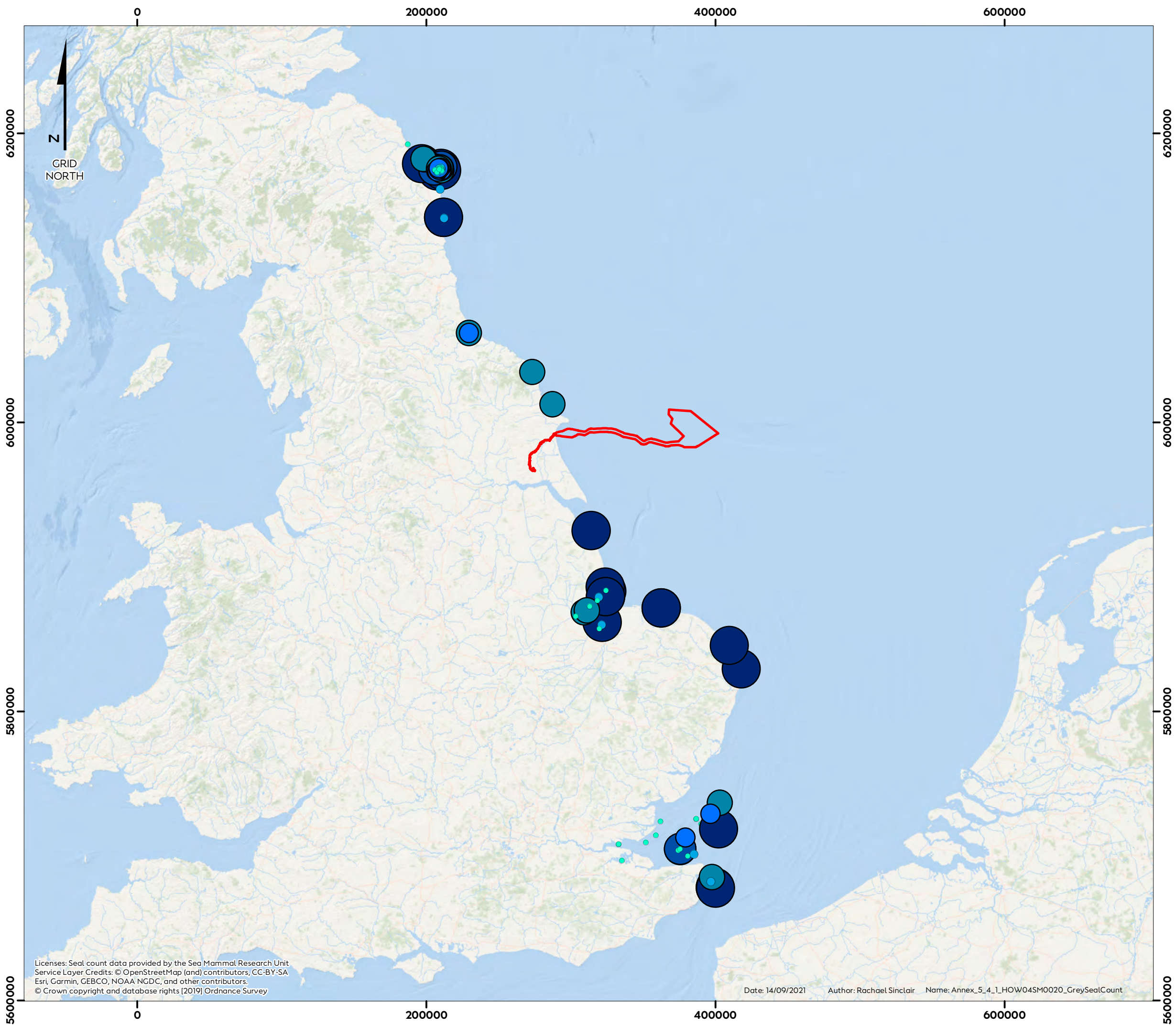
Table 12: Grey seal population estimates using various data sources.

Data source	Method	Limitations	Population estimate
North Sea pup production estimated pop size for 2016	Pup counts are modelled to obtain the estimated age 1+ population size the following year	Biased towards the distribution at breeding colonies	46,500 (95% CI: 35,800 –61,600)
England pup production 2016	Scaler from the UK pup production estimates to estimate the population size	at the time of pupping	28,400
East England MU August haul-out counts 2016-19	Scaled to account for the proportion of animals at sea at the time of the survey	More representative of year-round distribution	63,464 (95% CI: 53,035 - 79,000)

8.3 August haul-out counts

8.3.1.1 The most recent August haul-out counts for the Southeast England MU are from 2019. The haul-out count from 2016-2019 for the combined Southeast and Northeast England MUs was 15,168 grey seals, with counts being highest at Donna Nook (SE England) and Northumberland (NE England). Telemetry data has shown that, during the foraging season (including the August count period), 23.9% (95% CI: 19.2 - 28.6) of the total grey seal population is hauled-out (Russell et al. 2016). This can be used to scale the haul-out counts to obtain the total population size. Therefore the haul-out count of 15,168 grey seals in the SE and NE England MUs combined results in an estimated total population size of 63,464 grey seals (95% CI: 53,035 - 79,000).

8.3.1.2 The closest grey seal August haul-out location to Hornsea Four is Filey Brigg (approx. 21 km swimming distance north from the offshore ECC) where 41 grey seals were counted in August 2016 ([Figure 38](#)). The next closest grey seal haul-out site is Donna Nook (approx. 65 km south from the offshore ECC) where 5,265 grey seals were counted in the 2019 August haul-out survey.

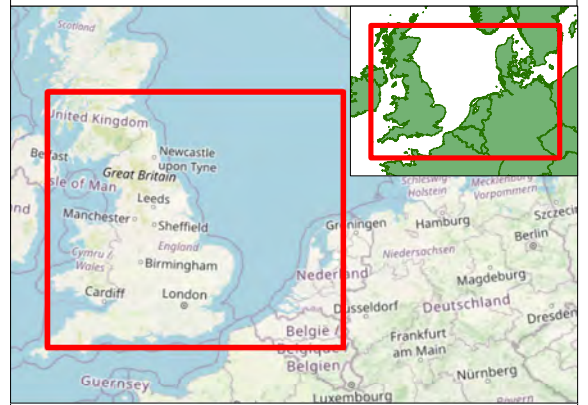


Hornsea Four
 Figure 38
 Grey Seal Haul-out Counts
 in the East England MUUs (2016-19)

Order Limits

Grey Seal Count

- 1-5
- 6-10
- 11-15
- 16-50
- 51-100
- >100



Coordinate system: ETRS 1989 UTM Zone 31N
 Scale@A3: 1:2,500,000

0 25 50 100 Kilometres

0 30 60 Nautical Miles

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8.4 Pupping counts

8.4.1.1 There are three grey seal breeding colonies in the Southeast England SMA: Donna Nook, Blakeney Point and Horsey, and one breeding colony in the Northeast England MU: the Farne Islands. All four of these breeding colonies in the East England MUs show an increasing trend in pup production over time (Figure 39). The total pup production estimate for 2018 across these four areas was 9,884 pups (note, data for the Farne Islands was not available for 2019).

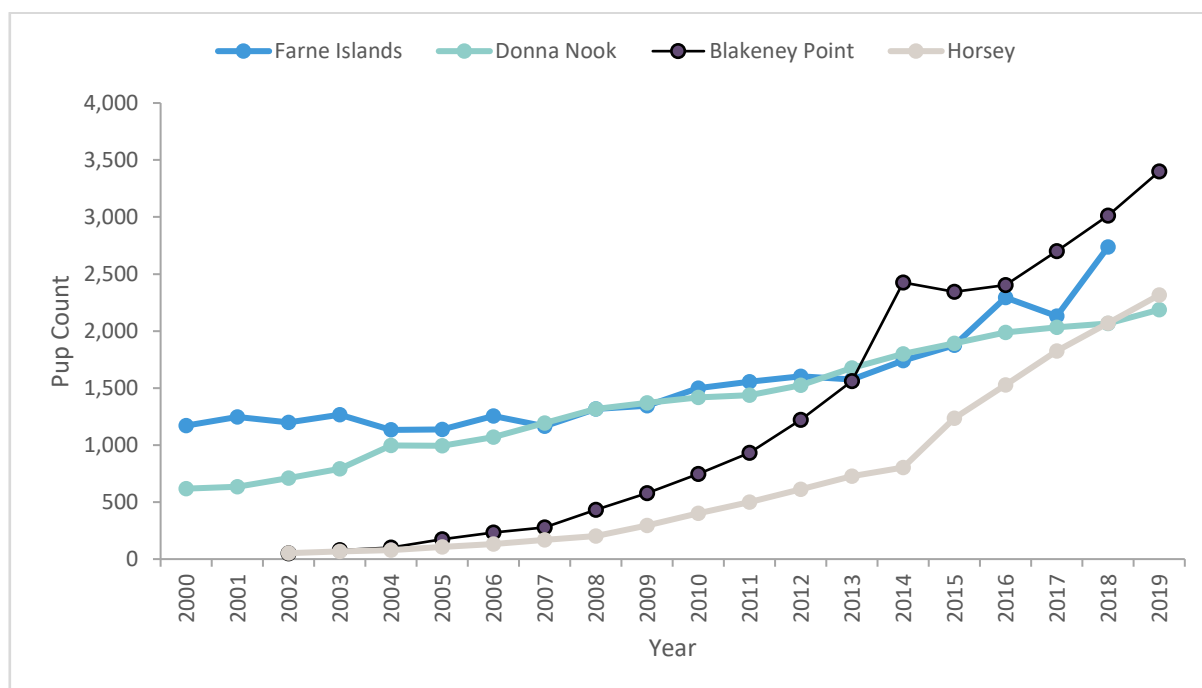


Figure 39: Annual pup count at the four grey seal breeding colonies in the East England MUs.

8.5 Telemetry data

8.5.1.1 The telemetry dataset for grey seals tagged in the Southeast and Northeast England SMAs consists of 70 animals tagged between 1988 and 2015:

- 2 animals tagged at Donna Nook between 1988 and 1989;
- 24 animals tagged at the Farnes between 1991 and 1997;
- 4 animals tagged at the Farnes in 2000;
- 10 animals tagged at Donna Nook in 2005;
- 10 animals tagged at the Farnes in 2008; and
- 20 animals tagged at Donna Nook and Blakeney in 2015.

8.5.1.2 The grey seal telemetry data indicate a small amount of overlap with the Hornsea Four array area (Figure 41). Of the 70 grey seals tagged in the Southeast and Northeast England SMAs, only 11 recorded GPS locations within the Hornsea Four array area. There are, however, a large number of telemetry tracks that pass through the offshore ECC area, where grey seals appear to transit between haul-out sites in the Wash and areas offshore where there are concentrations of telemetry tracks which are potentially foraging locations.

One such concentration in telemetry tracks is located adjacent to the northwest tip of the Hornsea Four array area which is potentially a grey seal foraging location.

- 8.5.1.3 The telemetry data indicated connectivity between the Hornsea Four array area and two grey seal SACs: the Humber Estuary SAC (Southeast England SMA) and the Berwickshire and North Northumberland Coast SAC (Northeast England SMA).

8.6 At-sea density

- 8.6.1.1 For comparative reasons, both the older seal at-sea usage maps (Russell et al. 2017) and the new seal habitat preference maps (Carter et al. 2020) are discussed here. However it should be noted that the new habitat preference maps are considered to be the better data source for estimates of at-sea densities since they a) use more recent data, b) use better quality data, and c) remove the null usage assumptions.
- 8.6.1.2 Both maps predict grey seals to be present around the UK, with patches of higher density in Orkney, Northumberland, the Humber estuary and in parts of the Hebrides ([Figure 40](#) – please note the different scales used in the two maps).
- 8.6.1.3 The old at-sea usage map predicted a hotspot in density extending out of the Humber Estuary and to the northwest of the Hornsea Four array area ([Figure 42 left](#)), with comparatively low numbers within the array area itself. By comparison, the new seal habitat preference map predicts higher levels of usage around the entrance to the Humber Estuary but does not predict a high density hotspot to the northwest of the array area ([Figure 42 right](#)). Using the old at-sea usage map, the highest densities within the Hornsea Four array area are estimated to be along the western edge, where the highest density cell contains an estimated 12.5 grey seals (0.5 seals/km²), and within the offshore ECC, there is an average density of 0.37 seals/km². Using the new habitat preference map, the highest densities within the Hornsea Four array area are estimated to be at the south, where the density reaches 0.66 seals/km², and within the offshore ECC the highest density is 1.17 seals/km².

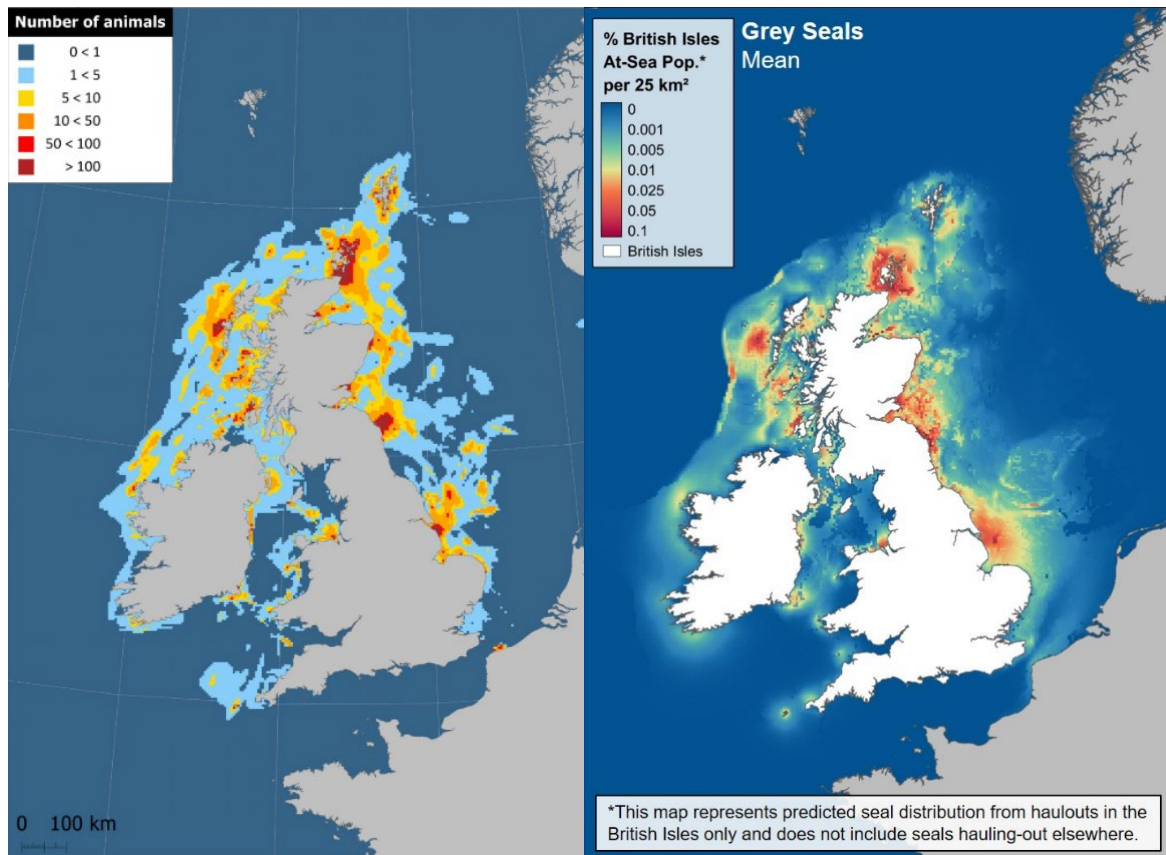
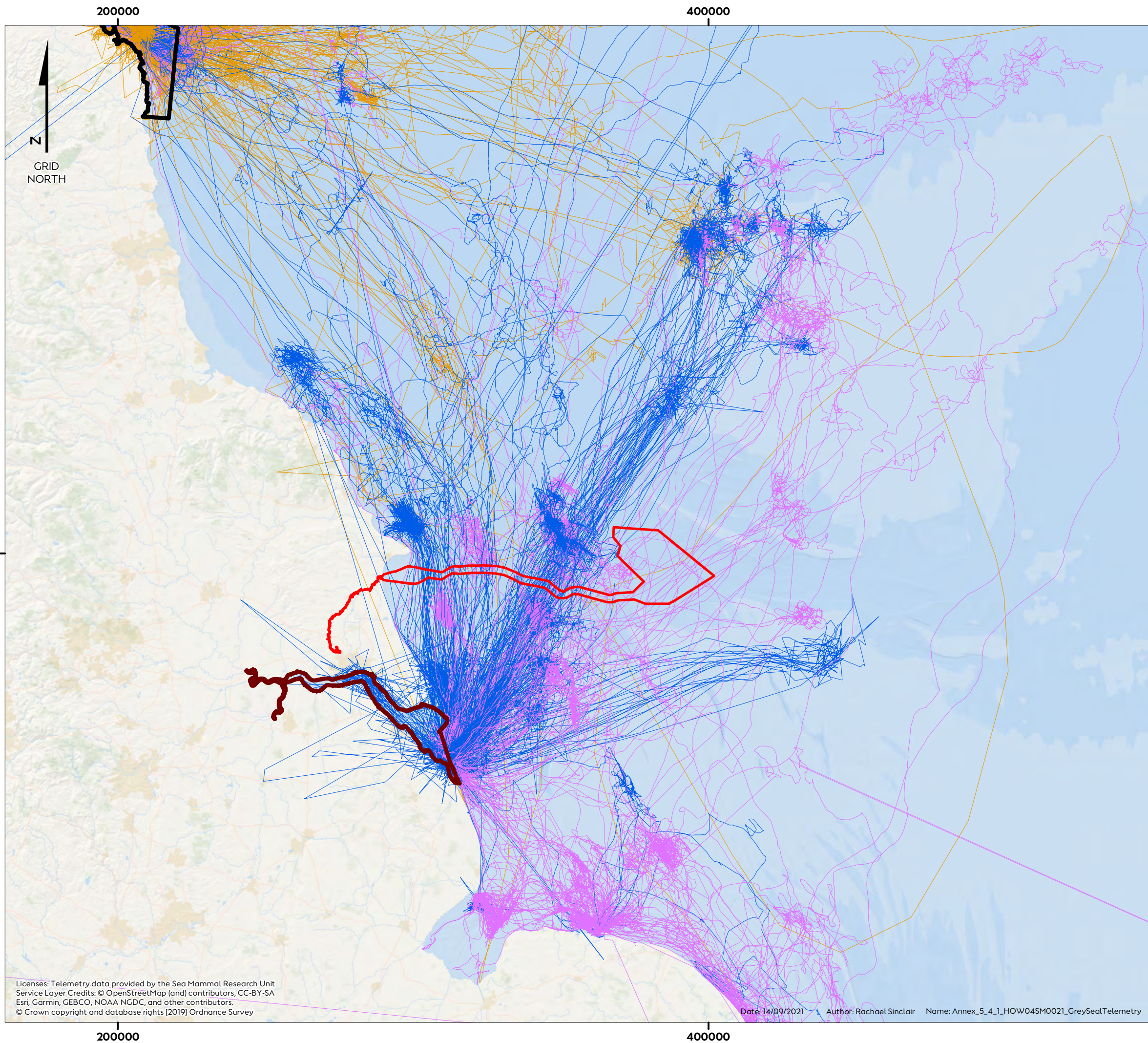


Figure 40: Grey seal at-sea distributions. Left = Mean at-sea usage from Russell et al. (2017). Right = Updated mean at-sea population from Carter et al. (2020) (note difference in scale, Russell et al. 2017 is number of seals per grid cell, Carter et al. 2020 is % of British Isles at-sea population per grid cell).

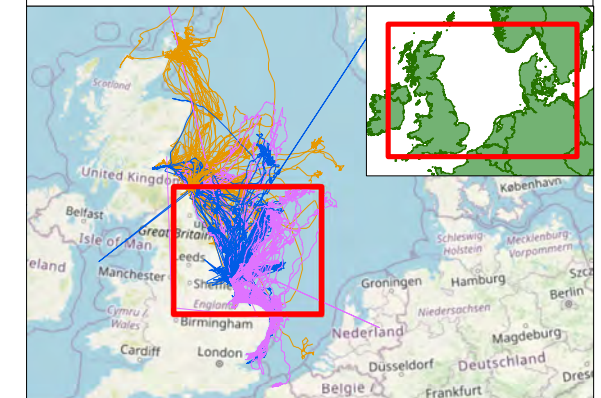


Hornsea Four

Figure 41

Grey Seal Telemetry Data

- Order Limits
 - Berwickshire and North Northumberland Coast SAC
 - Humber Estuary SAC
- Grey Seal Telemetry Tracks**
- Blakeney
 - Donna Nook
 - Farnes



Coordinate system: ETRS 1989 UTM Zone 31N

Scale@A3: 1:1,250,000

0 15 30 60 Kilometres

0 15 30 Nautical Miles

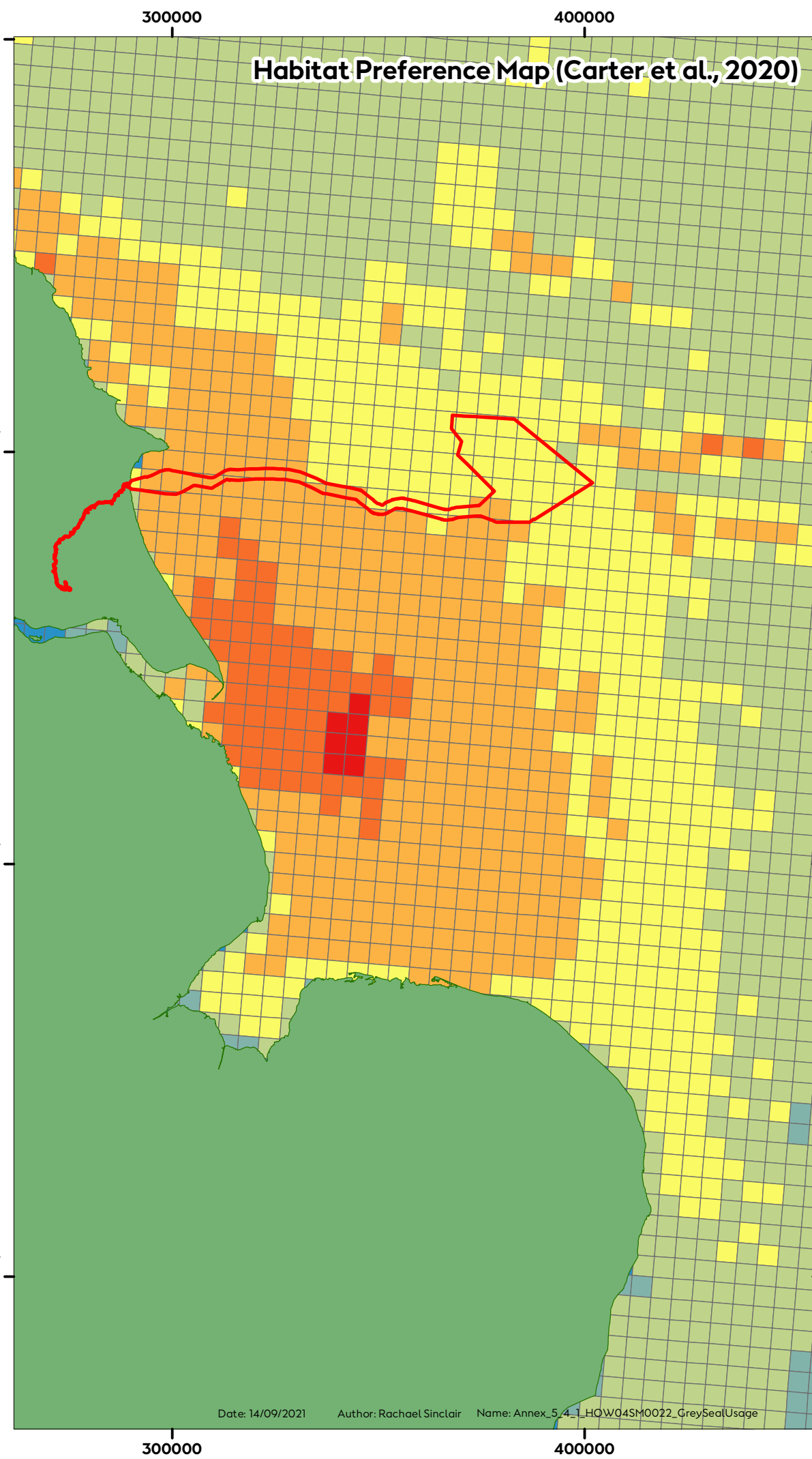
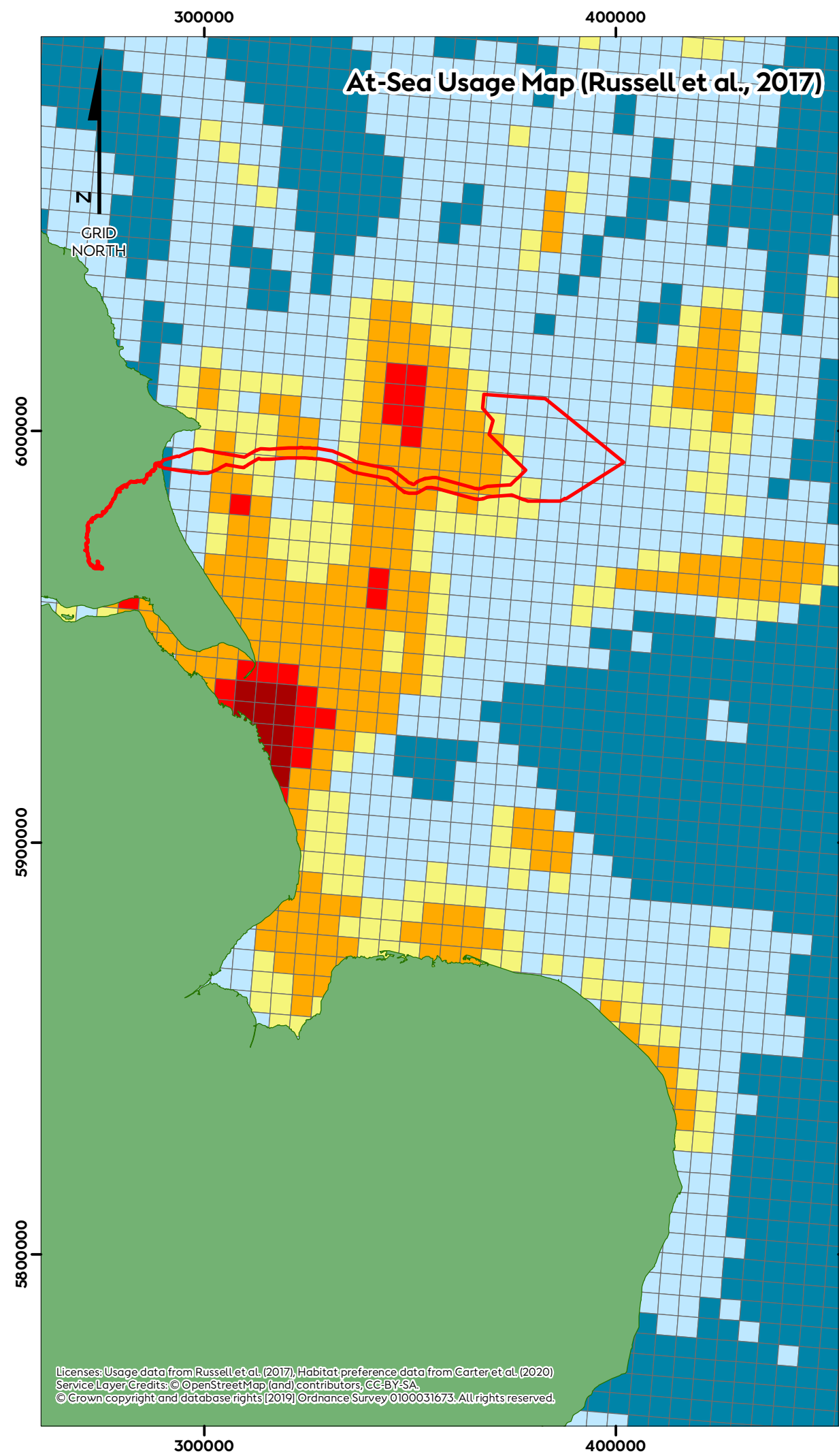
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Date: 14/09/2021 Author: Rachael Sinclair Name: Annex_5_4_1_HOW04SM0021_GreySealTelemetry

Grey Seal Telemetry
 Document no: HOW04SM0021
 Created by: RRS
 Checked by: BPHB
 Approved by: LK





Hornsea Four
Figure 42
Grey Seal At-Sea Distribution

Order Limits

Grey Seal At-Sea Usage (#/5x5km cell)

- 0<1
- 1<5
- 5<10
- 10<50
- 50<100
- >100

Habitat Preference: % British Isles At-Sea Population (per 25km²)

- 0.00
- 0.00 - 0.001
- 0.001 - 0.005
- 0.005 - 0.01
- 0.01 - 0.025
- 0.025 - 0.05
- >0.05



Coordinate system: ETRS 1989 UTM Zone 31N
Scale@A3: 1:1,250,000

0 15 30 60 Kilometres

0 15 30 Nautical Miles

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8.7 Hornsea Four site-specific aerial surveys

8.7.1.1 A total of 45 grey seals were sighted during the 24 months of site-specific aerial surveys, however, given the extreme difficulty of identifying seals at sea to species level in digital aerial surveys, this will not represent the total number of grey seals present in the survey area during the survey period. Across the 24 months of surveys there were a total of 58 unidentified seal species sighted, an unknown proportion of which will have been grey seals (Figure 43). The aerial survey data do, however, confirm that seals are present in the survey area year-round, though in relatively low numbers.

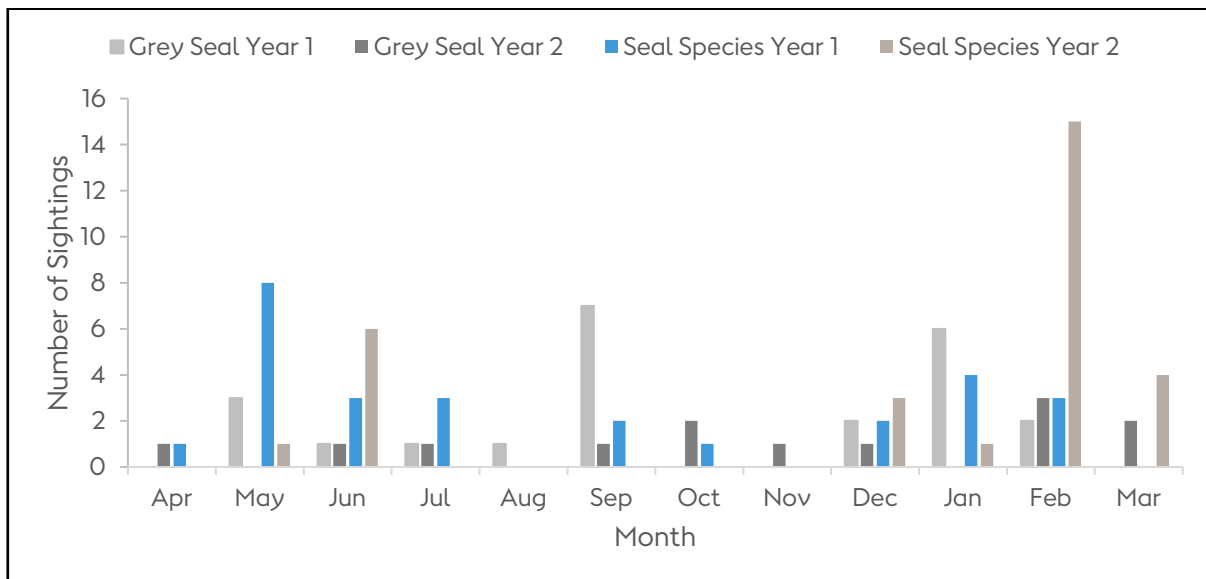


Figure 43: Monthly sightings counts for grey seals and seals of unknown species within the Hornsea Four site-specific aerial survey area between April 2016 and March 2018.

8.8 Connectivity with EU sites

8.8.1.1 Telemetry studies of grey seals tagged in Danish and French waters (Brasseur et al. 2015, Brasseur and Kirkwood 2015, Vincent et al. 2017, Aarts et al. 2018) have shown that some grey seal individuals can travel considerable distances and have telemetry tracks that extend around several parts of the UK. For example, along the east coast of the UK, grey seals tagged at Dutch and French haul-outs recorded location data at the Wash, the Humber Estuary and as far north as the Firth of Forth (Figure 44, Figure 45 and Figure 46). It is therefore possible that grey seals from Dutch and French haul-out sites have the potential to be impacted by activities associated with Hornsea Four.

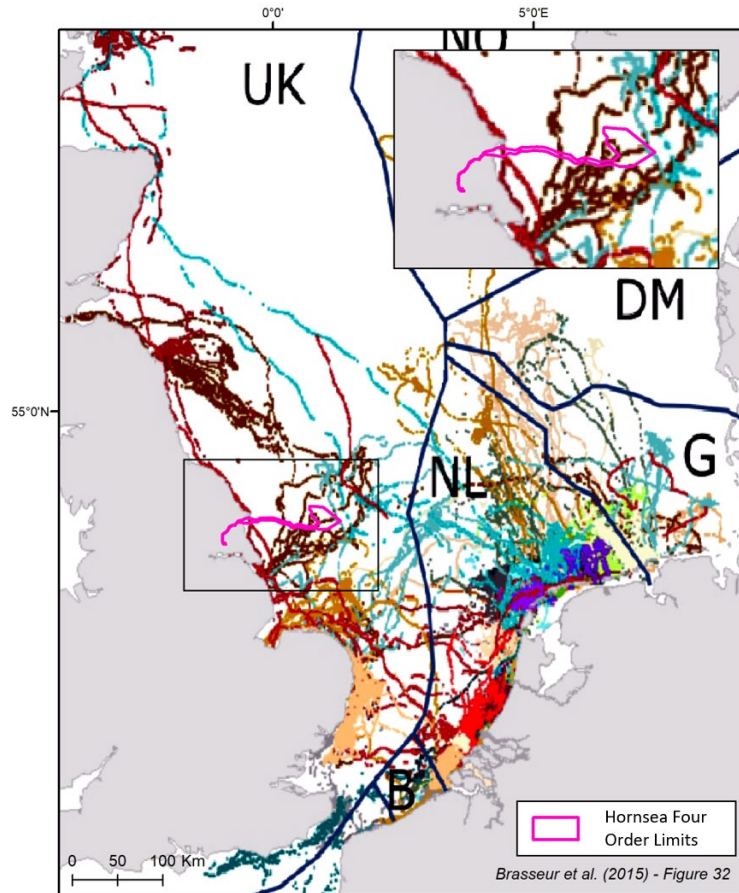


Figure 44: Locations of grey seals tracked from sites in the Netherlands up to 2014 - colours indicate individual seals (n = 75). Boundaries of national Exclusive Economic Zones in the North Sea are indicated. Obtained from Brasseur et al. (2015). Overlain is the approximate location of Hornsea Four.

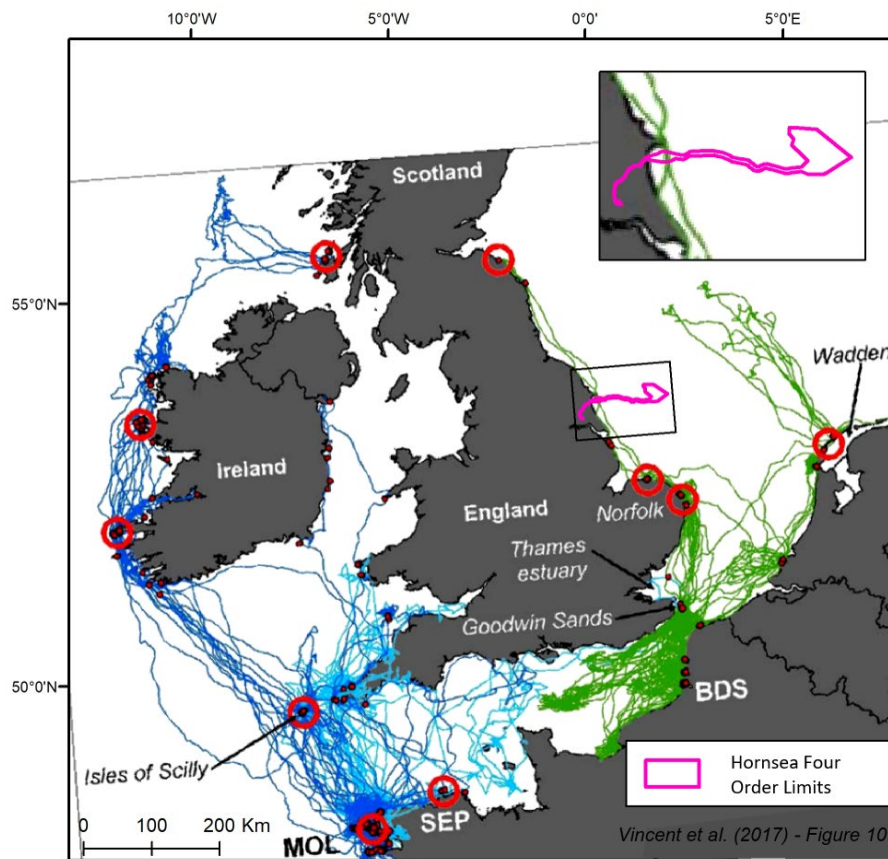


Figure 45: Grey seal telemetry tracks from Molene archipelago (MOL) (15 seals tagged between 1999 and 2003, light blue, and 19 tagged between 2010 to 2013, dark blue) and the baie de Somme (BDS) (11 seals tagged in 2012, green). SEP = Sept Iles archipelago. Red dots indicate haul-out locations of the seals. Thick, red circles indicate breeding locations. Obtained from Vincent et al. (2017). Overlain is the approximate location of Hornsea Four.

Hornsea 4

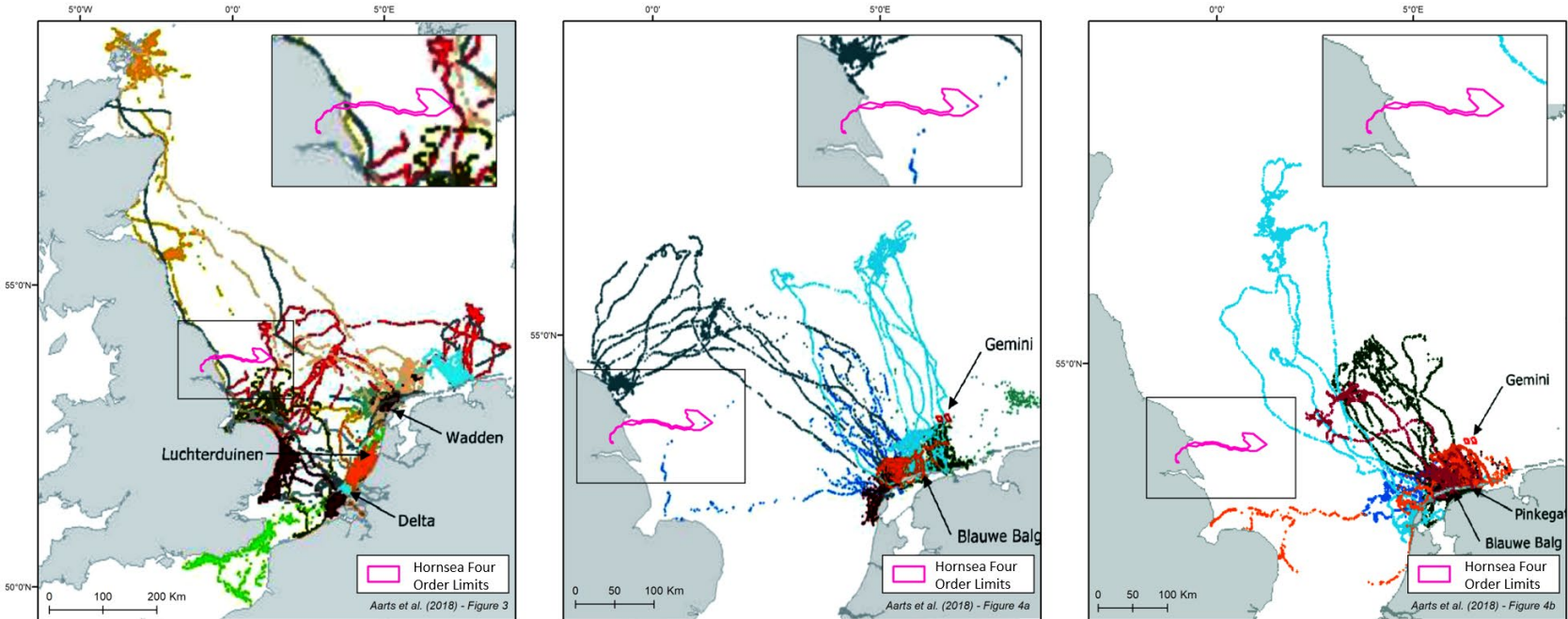


Figure 46: Locations recorded for tagged grey seals a) 20 seals tagged at the Wadden Sea and the Delta region in April 2014, b) 7 seals tagged at Blauwe Bay in April 2014 and c) 9 seals tagged at Pinkegat and Blauwe Bay in September 2015. Different colours are different seals. Obtained from Aarts et al. (2018). Overlain is the approximate location of Hornsea Four.

8.9 Grey seal summary

8.9.1.1 All data sources examined indicated some overlap between Hornsea Four and areas of grey seal use. Due to the connectivity between the Hornsea Four area and two grey seal SACs, this species will require a full and quantitative impact assessment to determine any potential impacts of Hornsea Four. The most appropriate grey seal reference population against which to assess impacts is the estimated population size of the northeast and southeast England MUs combined using the scaled August haul-out count data. This is likely to be more representative of the number of grey seals in these MUs year-round and outside of the breeding season. The best source of estimated density data is the at-sea usage map which will be used in the impact assessment to determine the number of animals potentially impacted by Hornsea Four.

9 Conclusion

9.1.1.1 The key species identified for impact assessment are harbour porpoise, minke whale, white-beaked dolphin, bottlenose dolphin, grey seal, and harbour seal.

9.1.1.2 Site-specific surveys suggested that the area may be important for harbour porpoise, with higher average densities here than in the rest of the reference population MU (North Sea). This is reflected by a number of other data sets describing harbour porpoise abundance and distribution of harbour porpoise in the North Sea. The Hornsea Four array area is located within the Southern North Sea SAC designated for harbour porpoise.

9.1.1.3 The densities proposed for use in the impact assessment are based on the best available data, with consideration given to the most up to date information together with the necessary precaution applied where there is uncertainty (i.e. where density estimates vary considerably between data sources, a range of estimates will be presented in the impact assessment, with the focus being on more recently collected data sets) ([Table 13](#)). None of the site-specific surveys extend far enough from Hornsea Four to provide reliable density estimates for the likely entire potential behavioural impact zones for the noise impact assessment, and as such, broader scale density estimates from SCANS III will be incorporated into the assessment for cetacean species comparison.

Table 13: Marine mammal reference populations and densities to be taken forward for impact assessment for Hornsea Four.

Species	Density estimate to be used in impact assessment	Source of density estimate	Reference population	Abundance of reference population
Harbour porpoise	Grid cell specific density (average across array area is 1.6 porpoise/km ²)	Modelled surface density estimates from the boat-based acoustic surveys of former Hornsea Zone plus a 10 km buffer	North Sea MU	345,373 (246,526 – 495,752)
	1.74 porpoise/km ²	Hornsea Four aerial surveys – average across 24 months		
	0.888 porpoise/km ²	SCANS-III Block O – to be used where impacts extend beyond the Hornsea Four aerial survey or former Hornsea Zone survey areas.		
Minke whale	Grid cell specific density (average across array area is 0.009 whales/km ²)	Modelled surface density estimates from the boat-based visual surveys of former Hornsea Zone plus a 10 km buffer	Celtic and Greater North Sea MU	20,118 (14,061 – 28,786)
	0.010 whales/km ²	SCANS-III Block O - to be used where impacts extend beyond the former Hornsea Zone survey area.		
White-beaked dolphin	Grid cell specific density (average across array area is 0.02 dolphins/km ²)	Modelled surface density estimates from the boat-based visual surveys of former Hornsea Zone plus a 10 km buffer	Celtic and Greater North Sea MU	43,951 (28,439 – 67,924)
	0.002 dolphins/km ²	SCANS-III Block O - to be used where impacts extend beyond the former Hornsea Zone survey area.		
Bottlenose dolphin	0.003 dolphins/km ²	Assuming a uniform density within the Greater North Sea MU	Greater North Sea & Coastal East Scotland MU	2,211
Harbour seal	Grid cell specific density	Seal habitat preference map	Southeast England MU	5,211 (4,264 – 6,948)
Grey seal	Grid cell specific density	Seal habitat preference map	Southeast & Northeast England MUs	63,464 (53,035 - 79,000)

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