Hornsea Project Four: Environmental Statement (ES)

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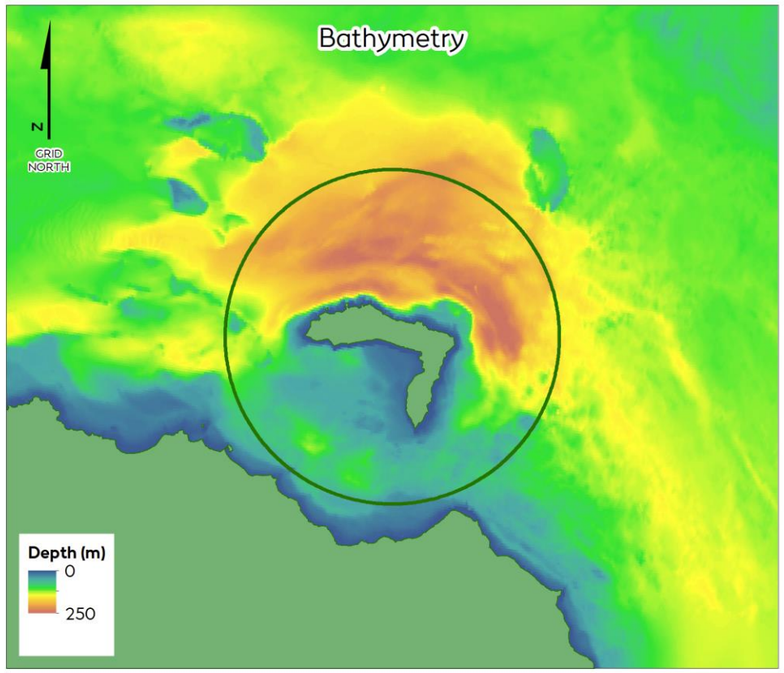
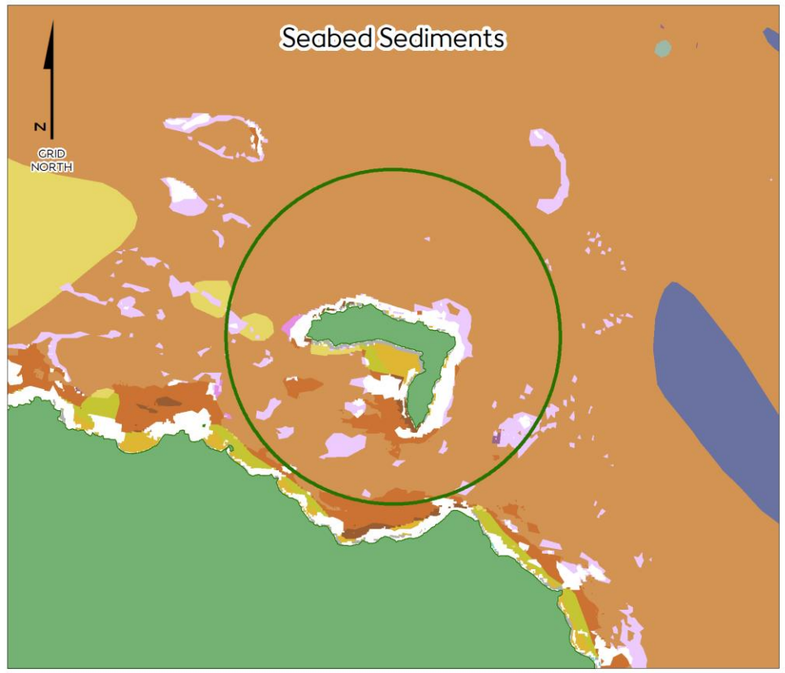
Table 12: Summary of baseline environment in relation to the Area of Search E1 (Rathlin Island) for resilience measure - fish habitat enhancement (seagrass).

Topic	Summary of Baseline Environment
Marine Geology, Oceanography and Physical Processes	The baseline environment for physical processes is illustrated in Figure 32. • Rathlin Island is surrounded by a wide range of rocky habitats. • Strong tidal streams prevail around most of the island and there is little silt, resulting in low turbidity. • The lower rock strata on which the island stands are cretaceous limestone laid down in beds 1-2 m thick. Basalt was laid over this in a series of lava flows and forms much of the island currently above sea level. The basalt / limestone junction often forms a shelf in the sublittoral. The limestone is patchily exposed in the sublittoral; where it is exposed it tends to weather forming fissures and caves (Goodwin et al. 2011).
Benthic and Intertidal Ecology	The baseline environment for benthic ecology is illustrated in Figure 33. • Rathlin island is designated as an SAC. • The immediate coastline is characterised by intertidal and submerged rock and biogenic reef. • Further offshore within the AoS, the seabed is dominated by coarse sediment, with patches of rock and biogenic reef. • There is a bed of *Zostera marina* seagrass located in Church Bay and lies around 6 m water depth on medium coarse sand. Surveys suggest that the seagrass is sparse (Goodwin et al. 2011).
Fish and Shellfish Ecology	The baseline environment for fish and shellfish ecology is illustrated in Figure 34. • The following fish species are known to inhabit the waters around Rathlin Island: a variety of rays, cod (*Gadus morhua*), haddock (*Melanogrammus aeglefinus*), whiting (*Merlangius merlangus*), ling (*Calluna vulgaris*), plaice (*Pleuronectes platessa*), common dab (*Limanda limanda*), red gurnard (*Chelidonichthys cuculus*) and conger eel (*Conger conger*). • Commercial kelp farms also operate in this AoS.
Marine Mammals	The baseline environment for marine mammals is illustrated in Figure 35. • While a range of marine mammals are known to inhabit the waters around both Britain and Ireland, the three considered to reliably be in the AoS are harbour porpoise (*Phocoena phocoena*), bottlenose dolphin (*Tursiops truncatus*) and minke whale (*Balaenoptera acutorostrata*) (Hammond et al. 2017). • It was observed in 1966 that there are only small numbers of grey seals around the Rathlin Island AoS (Lockley, 1966), and the up to date seal survey reports inidicate little to no grey seal presence in the area of Rathlin Island (SCOS, 2020). • The area betweemCarlingford Lough to the Copeland Islands (the Southeast of Northern Ireland) contains 80-85% of the total harbour seals observed in Northern Island (SCOS, 2020), therefore suggesting a low abundance/ density of organisms within the Rathlin Island AoS (SCOS, 2020).
Offshore and Intertidal Ornithology	The baseline environment for offshore and intertidal ornithology is illustrated in Figure 36. • Within the AoS there is a single SPA with offshore ornithology designated features, the Rathlin Island SPA. • This site is designated for razorbill (*Alca torda)*, peregrine falcon (*Falco peregrinus)*, kittiwake (*Rissa tridactyla)* and guillemot (*Uria aalge)* (JNCC, 2018). • During the summer months Rathlin's sea cliffs and sea stacks provide nesting sites for a variety of seabird species including guillemots (*Uria aalge*), razorbills and kittiwakes.
Commercial Fisheries	The baseline environment for commercial fisheries is illustrated in Figure 37.

Topic	Summary of Baseline Environment
	• Fishing for sea fish using demersal mobile gear is prohibited in the waters within the Rathlin Zone. The boundaries of the Rathlin Zone correspond to the seaward boundaries of the Rathlin Island SAC (DEFRA, 2016).
Shipping and Navigation	The baseline environment for shipping and navigation is illustrated in **Figure 38**. • The vessel density in the AoS varies from 1 to >200,000 route(s)/ 0.08 km^2/ year. While there are several common routes around the island, the only major route is the ferry route between Ballycastle and Rathlin Island which is where the maximum rate vessel traffic occurs (Marine Traffic, 2021).
Marine Archaeology	The baseline environment for marine archaeology is summarised below. • One of the most famous shipwrecks found in this AoS is that of the HMS Drake which can be found in Church Bay and is now protected via the Protection of Wrecks Act 1973 and a popular scuba destination (Wessex Archaeology, 2021).

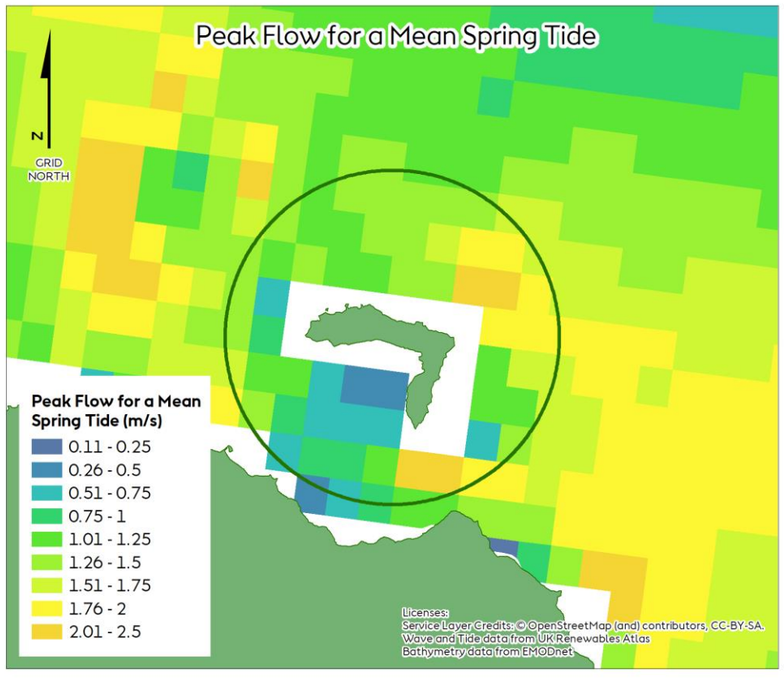


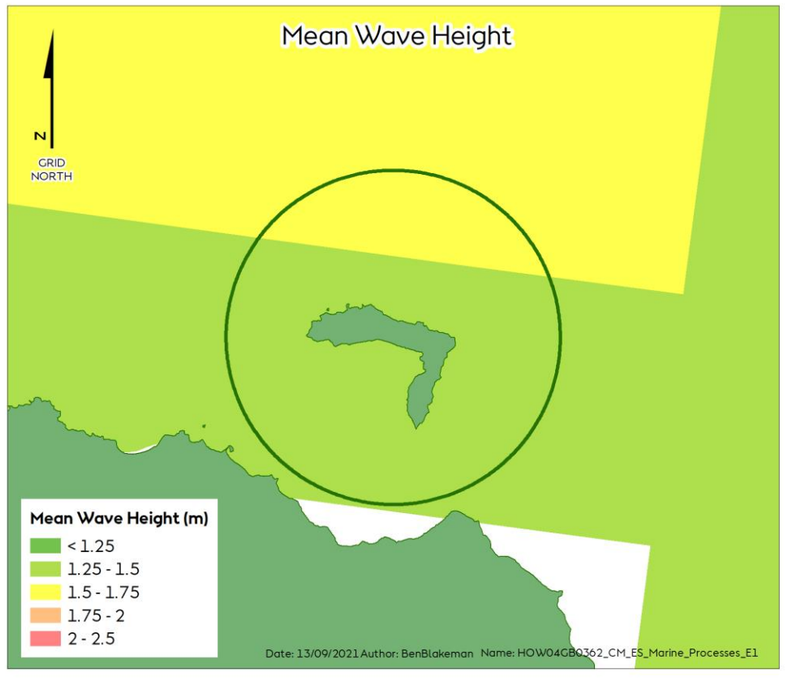


Hornsea Four
Compensation Measures
Areas of Search
Seagrass
E1: Rathlin Island, Northern Ireland
Marine Processes

Compensation Measures Areas of Search
Seagrass

EUNIS Habitats (UKSeaMap 2018)
- A4.12: Sponge communities on deep circalittoral rock
- A4.27: Faunal communities on deep moderate energy circalittoral rock
- A4.33: Faunal communities on deep low energy circalittoral rock
- A5.13: Infralittoral coarse sediment
- A5.14: Circalittoral coarse sediment
- A5.15: Deep circalittoral coarse sediment
- A5.23 or A5.24: Infralittoral fine sand or infralittoral muddy sand
- A5.25 or A5.26: Circalittoral fine sand or circalittoral muddy sand
- A5.27: Deep circalittoral sand
- A5.37: Deep circalittoral mud
- A5.43: Infralittoral mixed sediments
- A5.44: Circalittoral mixed sediments
- A5.45: Deep circalittoral mixed sediments
- No EUNIS habitat assigned





Coordinate system: ETRS 1989 UTM Zone 31N

0 5 10 Kilometres
0 2.5 5 Nautical Miles

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Compensation Measures
Marine Processes
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Figure 32: Resilience Measures Areas of Search Seagrass E1: Rathlin Island, Northern Ireland Physical Processes

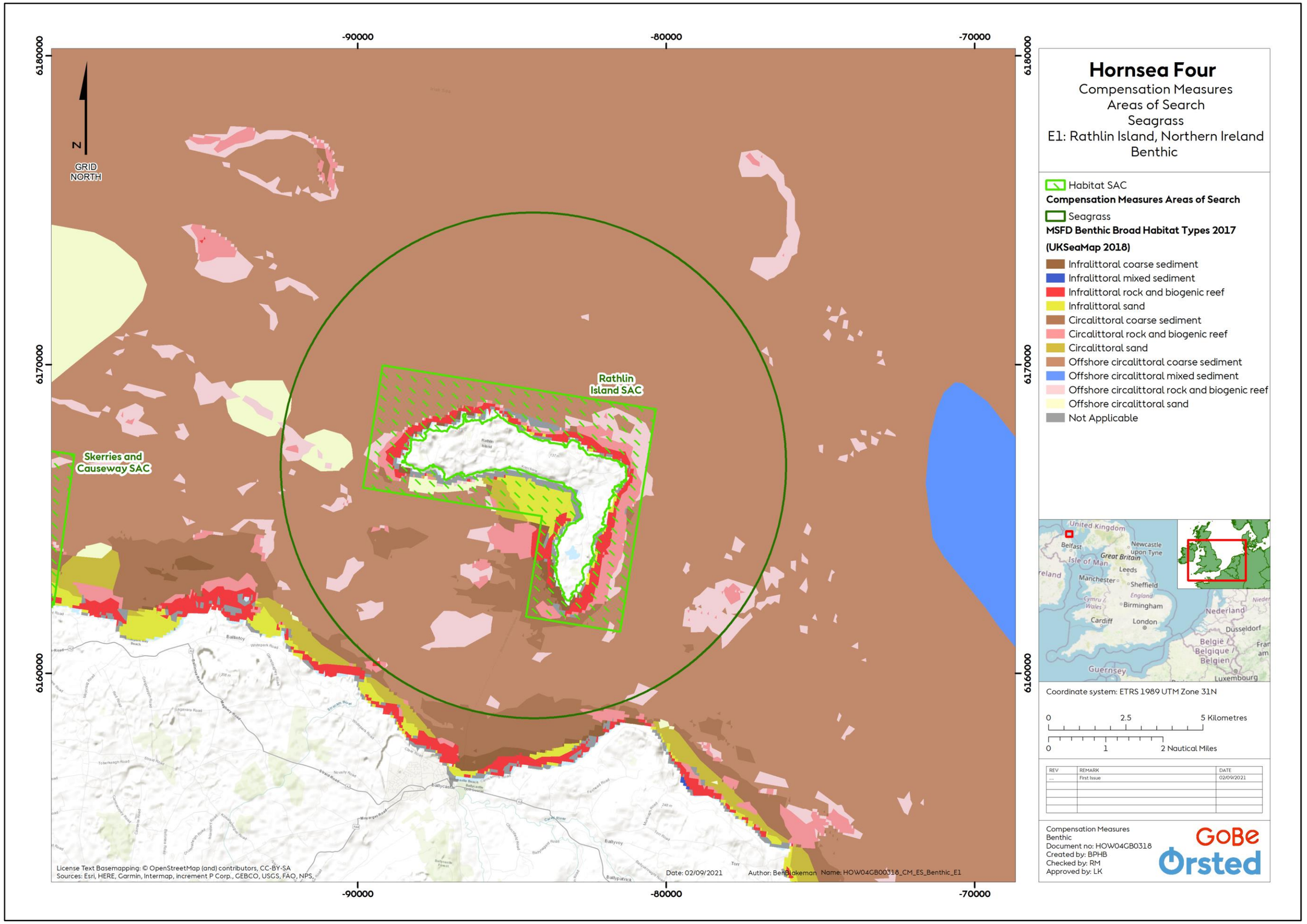


Figure 33: Resilience Measures Areas of Search Seagrass E1: Rathlin Island, Northern Ireland Benthic.

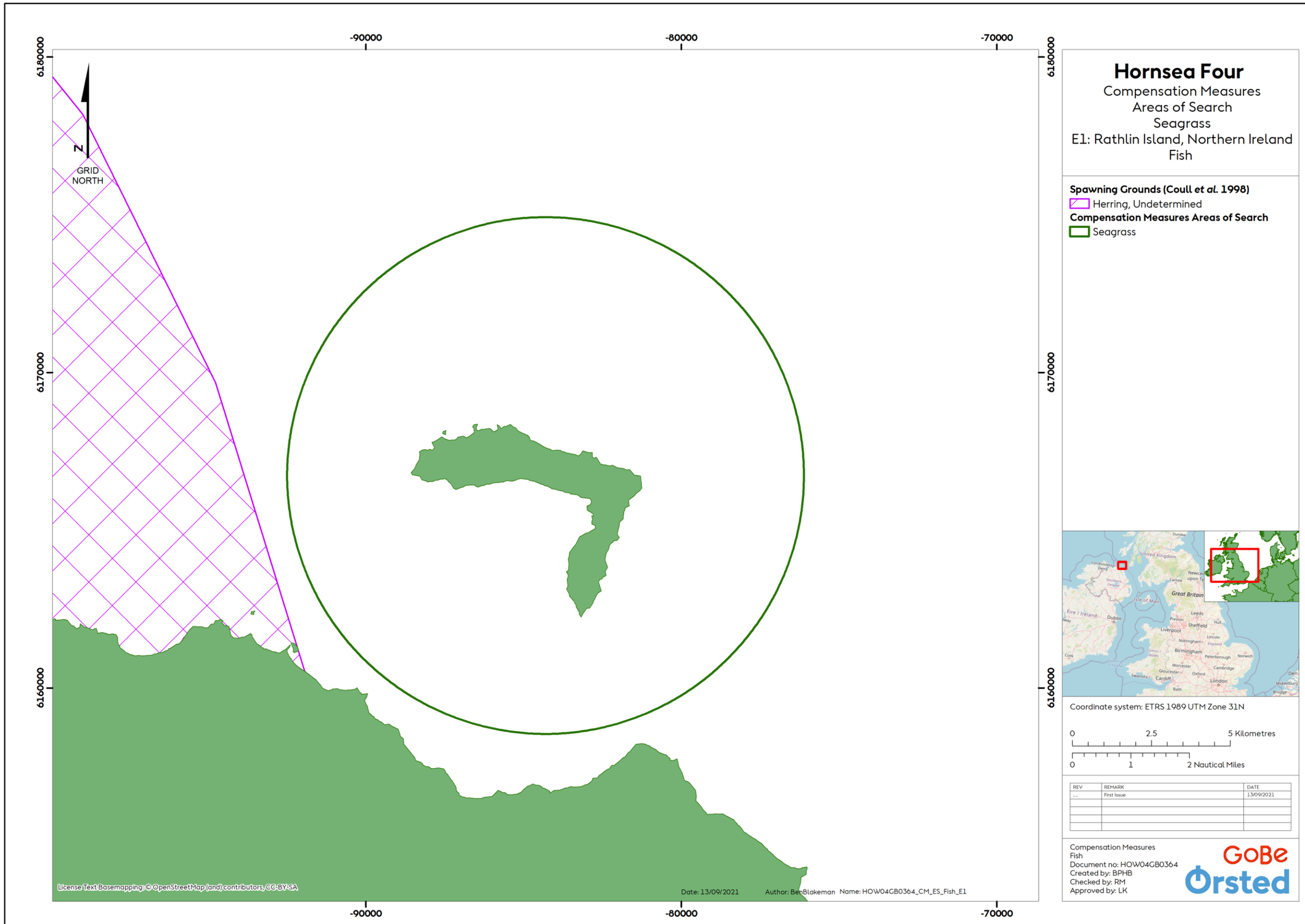
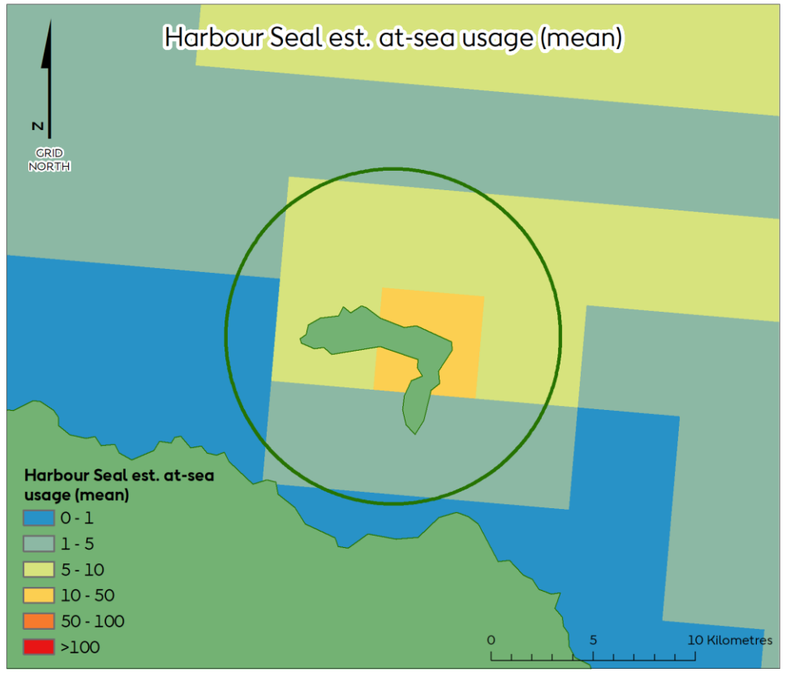
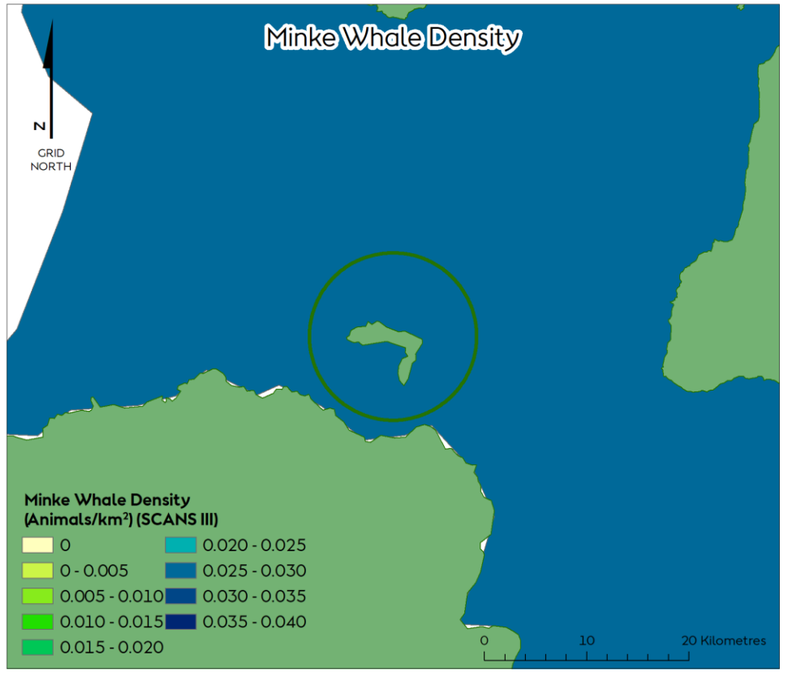
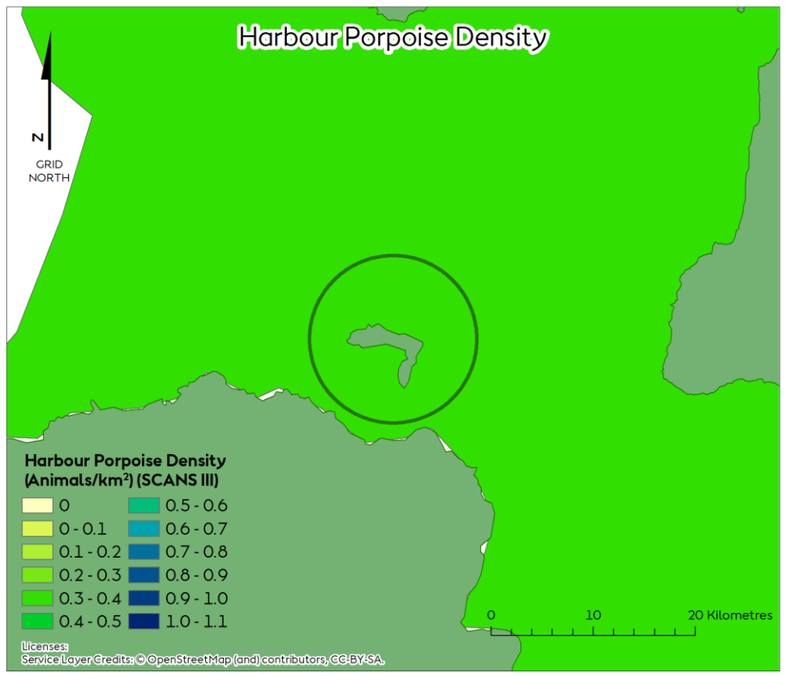
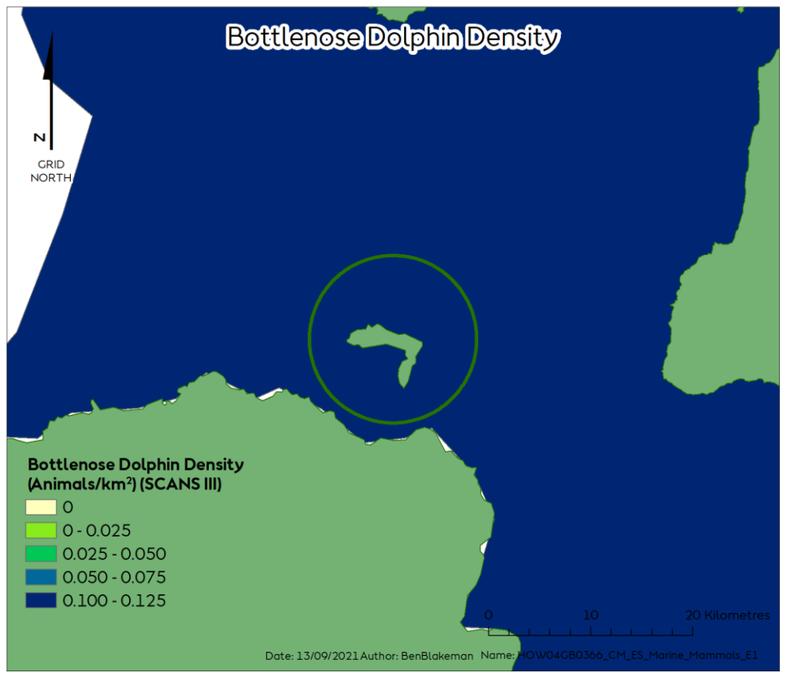


Figure 34: Resilience Measures Areas of Search Seagrass E1: Rathlin Island, Northern Ireland Fish and Shellfish.





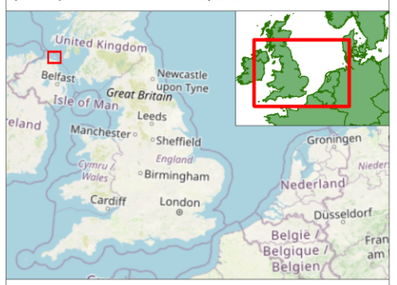




Hornsea Four
Compensation Measures
Areas of Search
Seagrass
E1: Rathlin Island, Northern Ireland
Marine Mammals

Compensation Measures Areas of Search
Seagrass

Estimated at-sea Distribution of Grey and Harbour Seals maps data from Sea Mammal Research Unit (SMRU) and Marine Scotland, 2017



Coordinate system: ETRS 1989 UTM Zone 31N

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Compensation Measures
Marine Mammals
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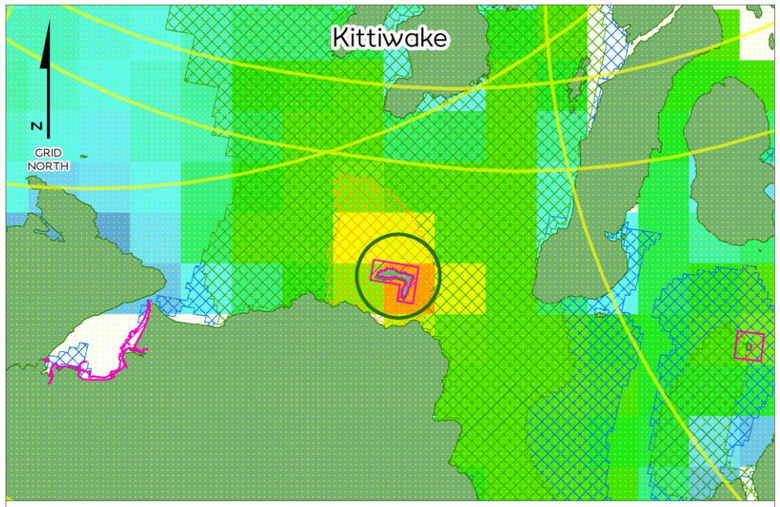
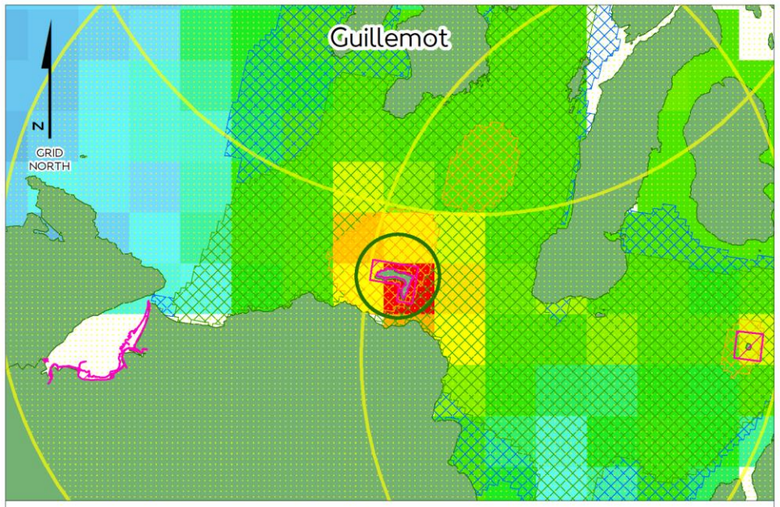
Figure 35: Resilience Measures Areas of Search Seagrass E1: Rathlin Island, Northern Ireland Marine Mammals.



Kittiwake Hotspots (Cleasby et al, 2020)
- Maximum Curvature
- Statistically Significant Getis-Ord hotspot
- Top 5% Getis-Ord hotspot
- Top 1% Getis-Ord hotspot

Kittiwake (Waggit et al., 2019) Density
High : 2.07
Low : 0

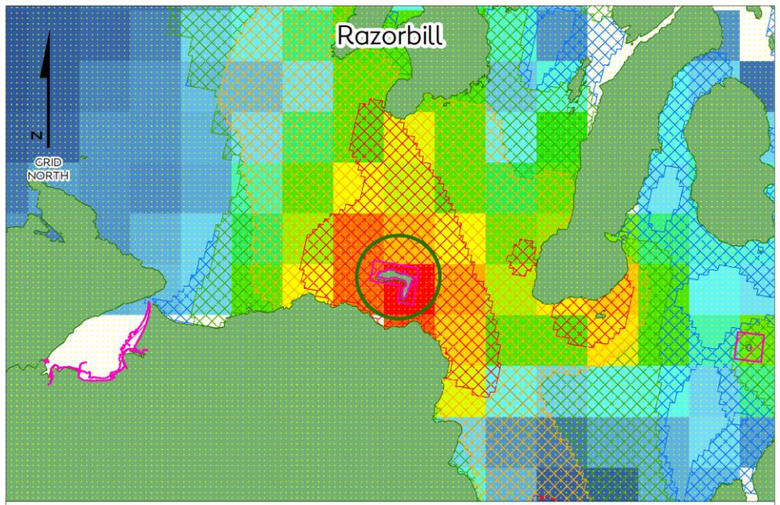
Hotspots identified at the UK-scale for Black-legged Kittiwakes using Getis-Ord hotspot analysis with a neighbourhood size of d = 10 km based on FPT analysis or Maximum Curvature. Getis-Ord hotspots defined as all cells with the top 1% of calculated Gi* scores; all cells within the top 5% of Gi* score; all cells in which Gi* scores were deemed statistically significant at the < 0.01 level.



Guillemot Hotspots (Cleasby et al, 2020)
- Maximum Curvature
- Statistically Significant Getis-Ord hotspot - d = 9km
- Top 5% Getis-Ord hotspot - d = 9km
- Top 1% Getis-Ord hotspot - d = 9km

Guillemot (Waggit et al., 2019) Density
High : 6.25
Low : 0

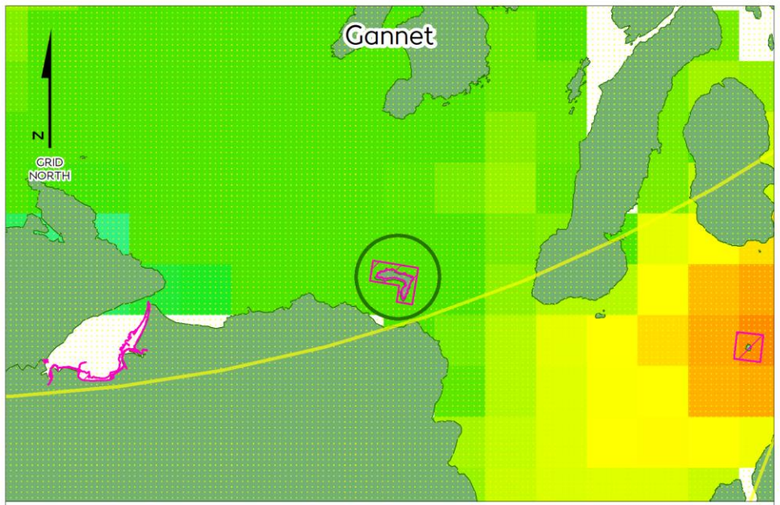
Hotspots identified at the UK-scale for Common Guillemots using Getis-Ord hotspot analysis with a neighbourhood size of d = 9 km based on FPT analysis or Maximum Curvature.



Razorbill Hotspots (Cleasby et al, 2020)
- Maximum Curvature
- Statistically Significant Getis-Ord hotspot - d = 7km
- Top 5% Getis-Ord hotspot - d = 7km
- Top 1% Getis-Ord hotspot - d = 7km

Razorbill (Waggit et al., 2019) Density
High : 3
Low : 0

Hotspots identified at the UK-scale for Razorbills using Getis-Ord hotspot analysis with a neighbourhood size of d = 7 km based on FPT analysis or Maximum Curvature.



Gannet (Waggit et al., 2019) Density
High : 1.65
Low : 0

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Date: 13/09/2021 Author: BenBlakeman Name: HOW04GB0368_CM_ES_Ornithology_E1

Hornsea Four

Compensation Measures
Areas of Search
Seagrass
E1: Rathlin Island, Northern Ireland
Ornithology

Special Protection Area (SPA) with Marine Components

Mean-Max Foraging Range (Woodward 2019)
- Common Guillemot - 73.2km Buffer
- Gannet - 315.2km Buffer
- Kittiwake - 156.1km Buffer
- Razorbill - 88.7km Buffer

Compensation Measures Areas of Search
- Seagrass

Waggitt et al 2019 densities data. Spatial variation in predicted densities (animals per km) of seabird species in July in the North-East Atlantic. Values are provided at 10km resolution.

Coordinate system: ETRS 1989 UTM Zone 31N

0 25 50 Kilometres
0 10 20 Nautical Miles

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Compensation Measures
Ornithology
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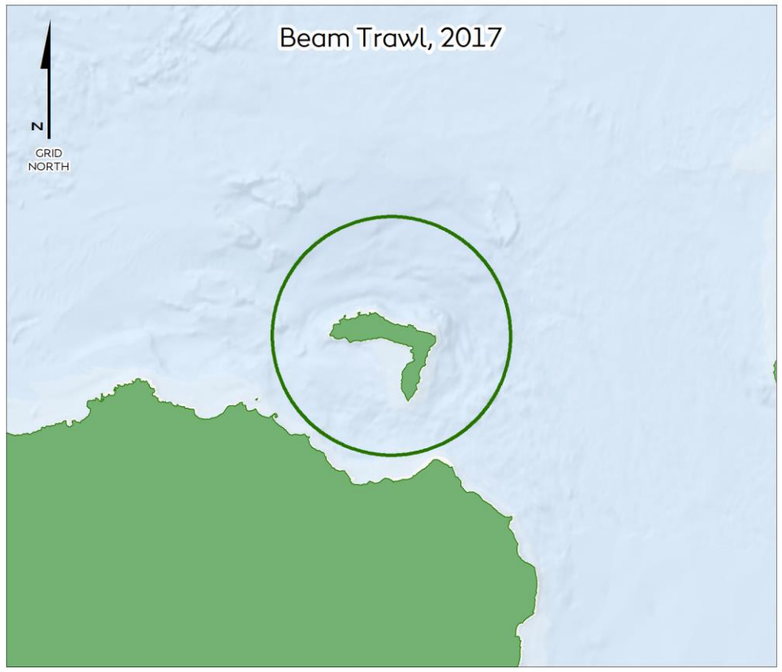
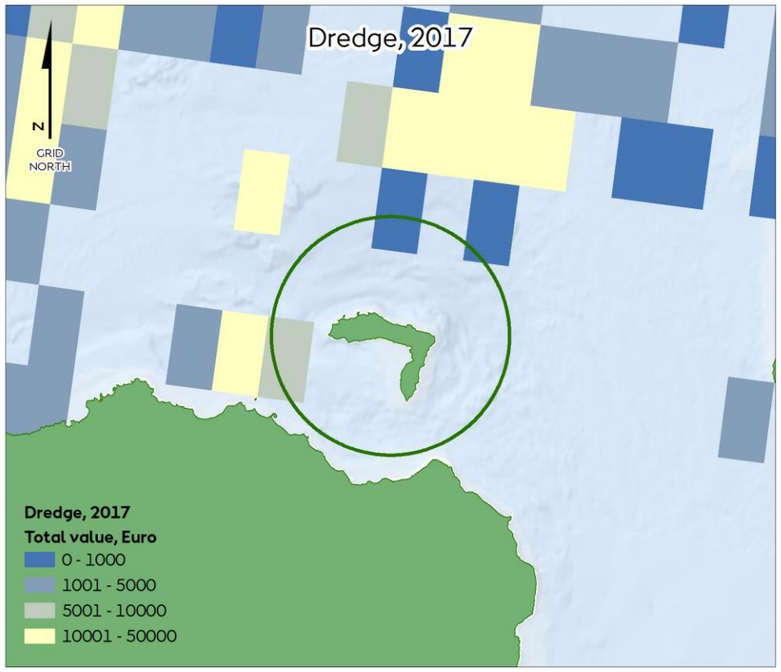
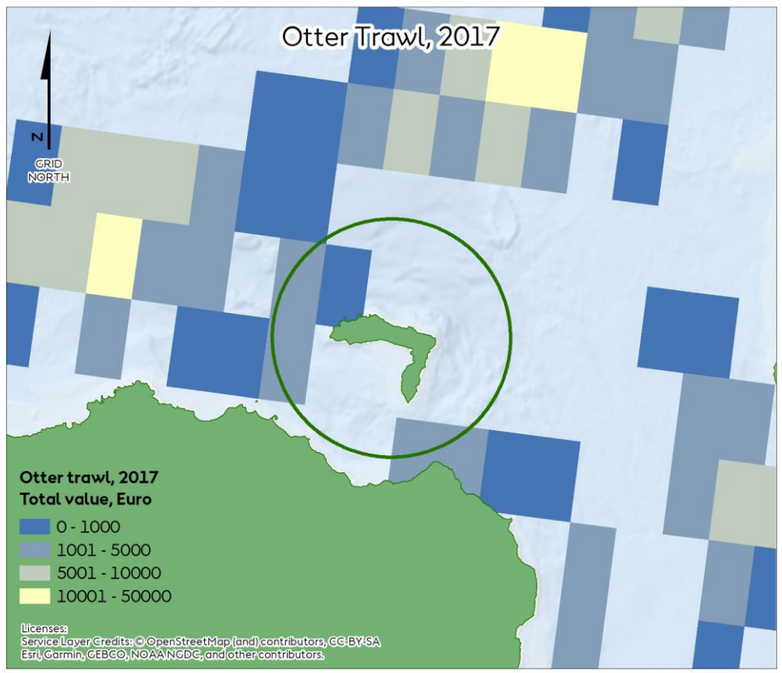
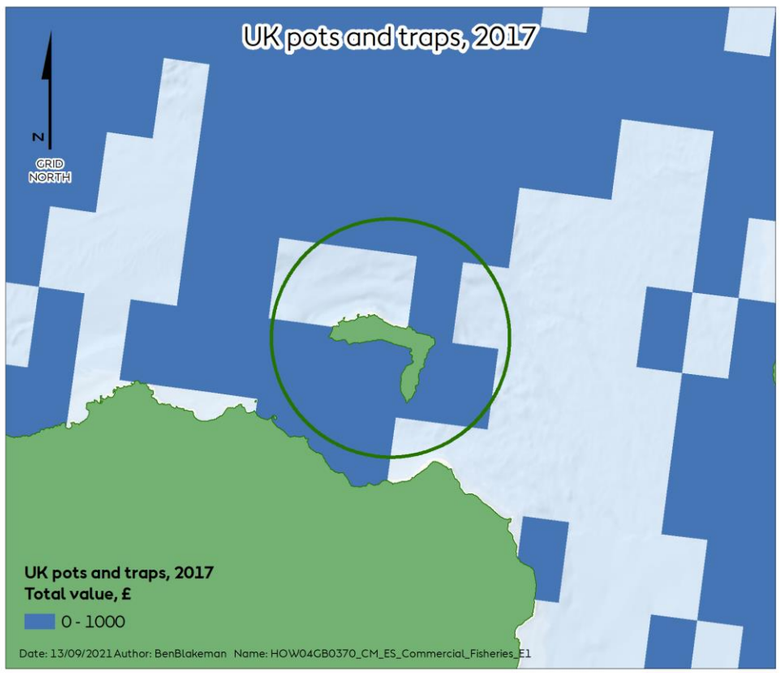
Figure 36: Resilience Measures Areas of Search Seagrass E1: Rathlin Island, Northern Ireland Ornithology.



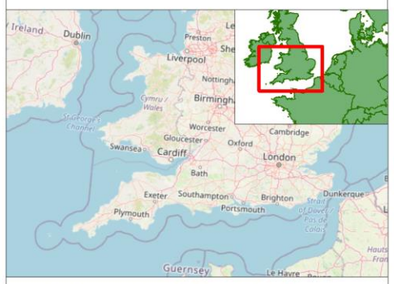






Hornsea Four
Compensation Measures
Areas of Search
Seagrass
E1: Rathlin Island, Northern Ireland
Commercial Fisheries

Compensation Measures Areas of Search
Seagrass



Coordinate system: ETRS 1989 UTM Zone 31N

0 5 10 Kilometres
0 2.5 5 Nautical Miles

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Compensation Measures
Commercial Fisheries
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Figure 37: Resilience Measures Areas of Search Seagrass E1: Rathlin Island, Northern Ireland Commercial Fisheries.

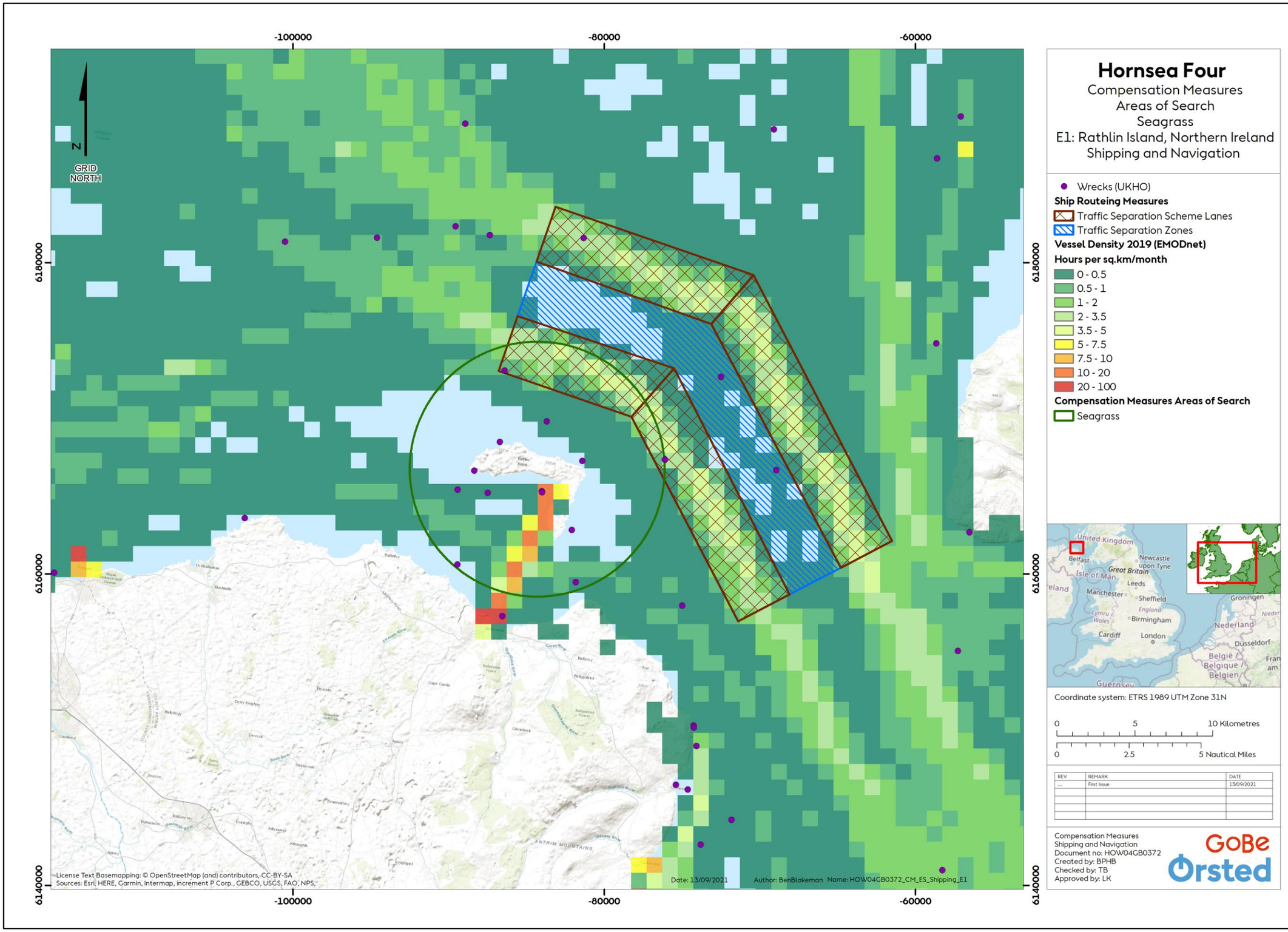
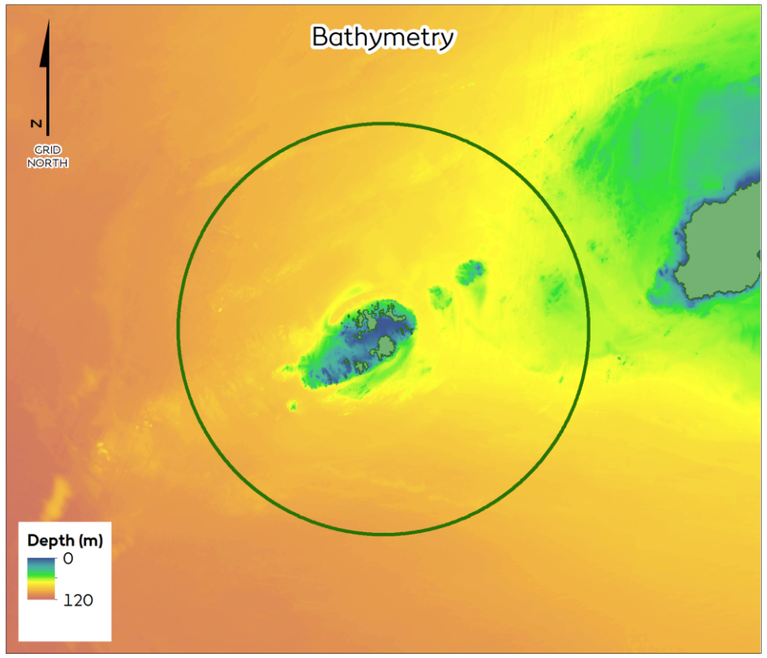


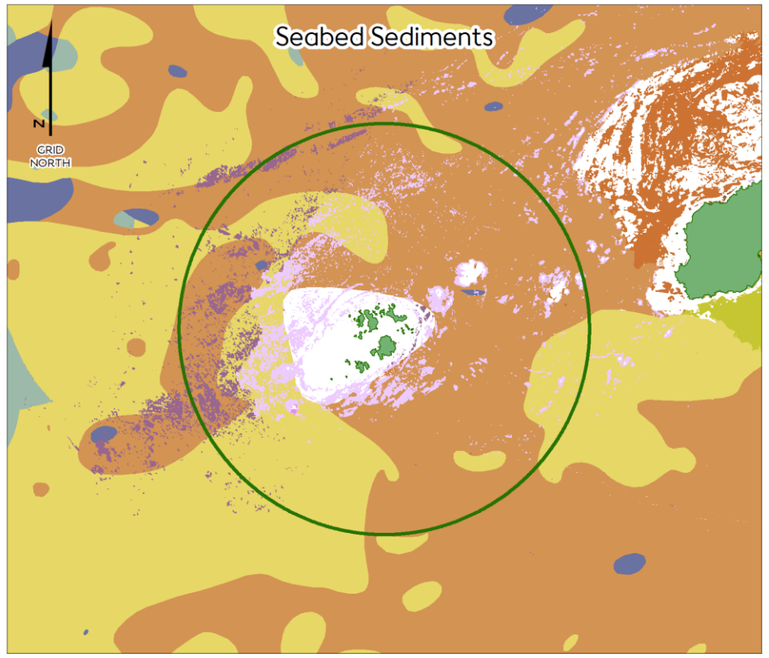
Figure 38: Resilience Measures Areas of Search Seagrass E1: Rathlin Island, Northern Ireland Shipping .

Table 13: Summary of baseline environment in relation to the Area of Search E2 (Isles of Scilly) for resilience measure - fish habitat enhancement (seagrass).

Topic	Summary of Baseline Environment
Marine Geology, Oceanography and Physical Processes	The baseline environment for physical processes is illustrated in Figure 39. • The Isles of Scilly represent the UK's largest group of tied islands, approximately 140 (Royal Haskoning, 2010), composed of an igneous, granite shoal (Evans, 1990) and characterised by sandy beaches of till and weathered granite (DECC, 2016a). • The water circulation is predominately controlled by the North Atlantic Circulation (DECC, 2016b), with a significant northerly coastal current present between the islands and Lundy Island (Pingree et al., 1999). In addition, there is a localised clockwise circulation around the Scilly Islands (Southward et al., 2005). • The mean spring tidal range for the AoS is between 4.01 and 5.00 m (ABPmer et al., 2011). Exposed to waves originating from the North Atlantic, the wave regime is dominated by westerly Atlantic swell waves (Royal Haskoning, 2011). The Isles of Scilly experience annual mean wave heights of 2.26 m to 2.5 m; seasonal variation occurs with wave heights of 1.26 m to 1.5 m and 3.01 m to 3.25 m shown for summer and winter, respectively (ABPmer et al., 2011).
Benthic and Intertidal Ecology	The baseline environment for benthic ecology is illustrated in Figure 40. • Seabed habitats: The Isles of Scilly are immediately surrounded by rock and biogenic reef, whilst the surrounding seabed is dominated by sand and coarse sediments, with patches of rock and biogenic reefs. • Designations: The Isles of Scilly are designated as an SAC, and there are numerous MCZs around the Isles of Scilly themselves. Also within the AoS is the South of the Isles of Scilly MCZ as well as a slight overlap with the Cape Bank MCZ in the north east of the AoS.
Fish and Shellfish Ecology	The baseline environment for fish and shellfish ecology is illustrated in Figure 41. • The Isles of Scilly is located as the Atlantic Ocean divides into the English Channel and the Celtic Sea. The mixing currents create oceanic fronts which are highly productive, forming a foundation of plankton which is the basis for a food chain that draws in species such as basking and blue sharks. This region is also one of the few places in the UK where the European crawfish or spiny lobster is still found and caught commercially. Some of the MCZs around Scilly have this species listed. There are two species of stalked jellyfish within the Isles of Scilly MCZ – *Haliclystus auricula* and *Lacernariopsis campanulata* (Isles of Scilly IFCA, 2021).
Marine Mammals	The baseline environment for marine mammals is illustrated in Figure 42 and Figure 43. • A range of marine mammals are known to inhabit the waters around the Isles of Scilly, including: harbour porpoise (*Phocoena phocoena*), bottlenose dolphin (*Tursiops truncatus*), common dolphin (*Delphinus delphis*), striped dolphin (*Stenella coeruleoalba*) and minke whale (*Balaenoptera acutorostrata*) (Hammond et al. 2017). • There are several seal haul outs identified as important in the AoS, including: Western Rocks, Eastern Isles and Norrad Rocks. At these three sites, a total of 359 grey seals were recorded (Leeney et al. 2010), indicating a significant presence within the AoS. The SCOS 2020 report does not identify this AoS as being of relevance to harbour seals (SCOSO, 2020).
Offshore and Intertidal Ornithology	The baseline environment for offshore and intertidal ornithology is illustrated in Figure 44.

Topic	Summary of Baseline Environment
	• Within the AoS there is a singe SPA with offshore ornithology designated features, the Isles of Scilly SPA. This site is designated for storm petrel (*Hydrobates pelagicus*), lesser black-backed gull (*Larus fuscus)*, great black-backed gull (*Larus marinus*), and shag (*Phalacrocorax aristotelis*) (JNCC, 2020a).
Commercial Fisheries	The baseline environment for commercial fisheries is illustrated in **Figure 45**. • The most important methods for fishermen are potting (for European lobsters (*Homarus gammarus*) and brown (edible) crabs (*Cancer pagurus*)), tangle nets (for spiny lobster *(Palinurus elephas*) and species such as monkfish (*Lophius*)), gill nets (for pollack (*Pollachius pollachius*) and grey mullet (*Mugil cephalus*)), and trammel nets (for bait to be used in lobster and crab pots). • Less frequently used methods include handlines and rods (pollack (*Pollachius pollachius*)),and light otter trawls (haddock (*Melanogrammus aeglefinus*), Dover sole (*Solea solea*), megrim (*Lepidorhombus whiffiagonis*), plaice (*Pleuronectes platessa*) and john dory (*Zeus faber*)). • Fishing is seasonal and primarily takes place between March and November (Isles of Scilly IFCA, 2021).
Shipping and Navigation	The baseline environment for shipping and navigation is illustrated in **Figure 46**. • The vessel density in the AoS varies from 1 to >200,000 route(s)/0.08 km^2/ year. • The water between the islands is covered in a network of routes with many vessels using them (<100,000 routes/0.08 km^2/ year). Around the outside of the islands however, the vessel traffic is reduced with numbers ranging from 1-5 routes/0.08 km^2/ year (Marine Traffic, 2021).
Marine Archaeology	The baseline environment for marine archaeology is described below. • The Isles of Scilly are fortunate in having one of the densest concentrations of archaeological sites in Britain and is reflected in the Isles of Scilly Museum collections. • Around the Isles there are the remains of a least 700 wrecks, many of national and international importance, which, with other submerged features, point to an astounding marine archaeological resource yet largely unrecorded (Isles of Scilly Museum, 2021).





Hornsea Four
Compensation Measures
Areas of Search
Seagrass
E2: Isles of Scilly
Marine Processes

Compensation Measures Areas of Search
- Seagrass

EUNIS Habitats (UKSeaMap 2018)
- A4.12: Sponge communities on deep circalittoral rock
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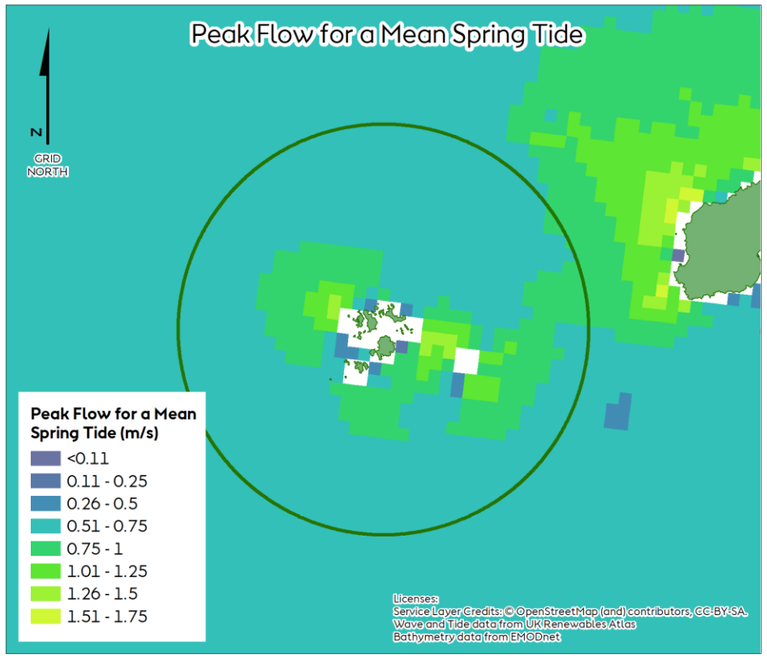
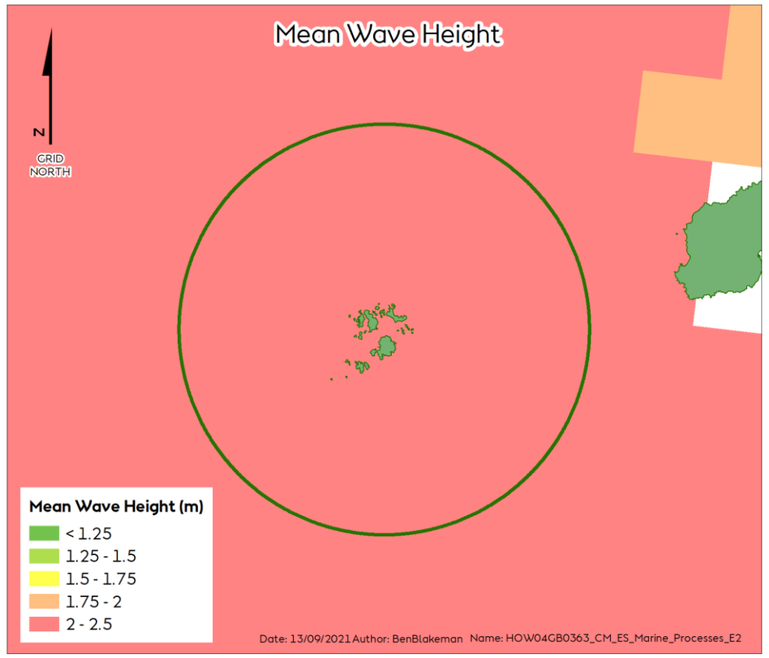
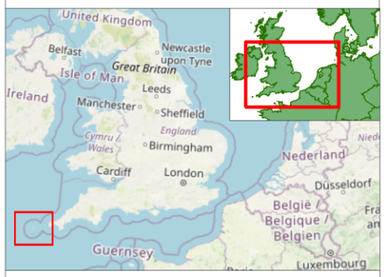
- A5.45: Deep circalittoral mixed sediments
- No EUNIS habitat assigned







Coordinate system: ETRS 1989 UTM Zone 31N

0 20 40 Kilometres
0 10 20 Nautical Miles

REV	REMARK	DATE
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Compensation Measures
Marine Processes
Document no: HOW04GB03206?
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Figure 39: Resilience Measures Areas of Search Seagrass E2: Isles of Scilly Physical Processes.

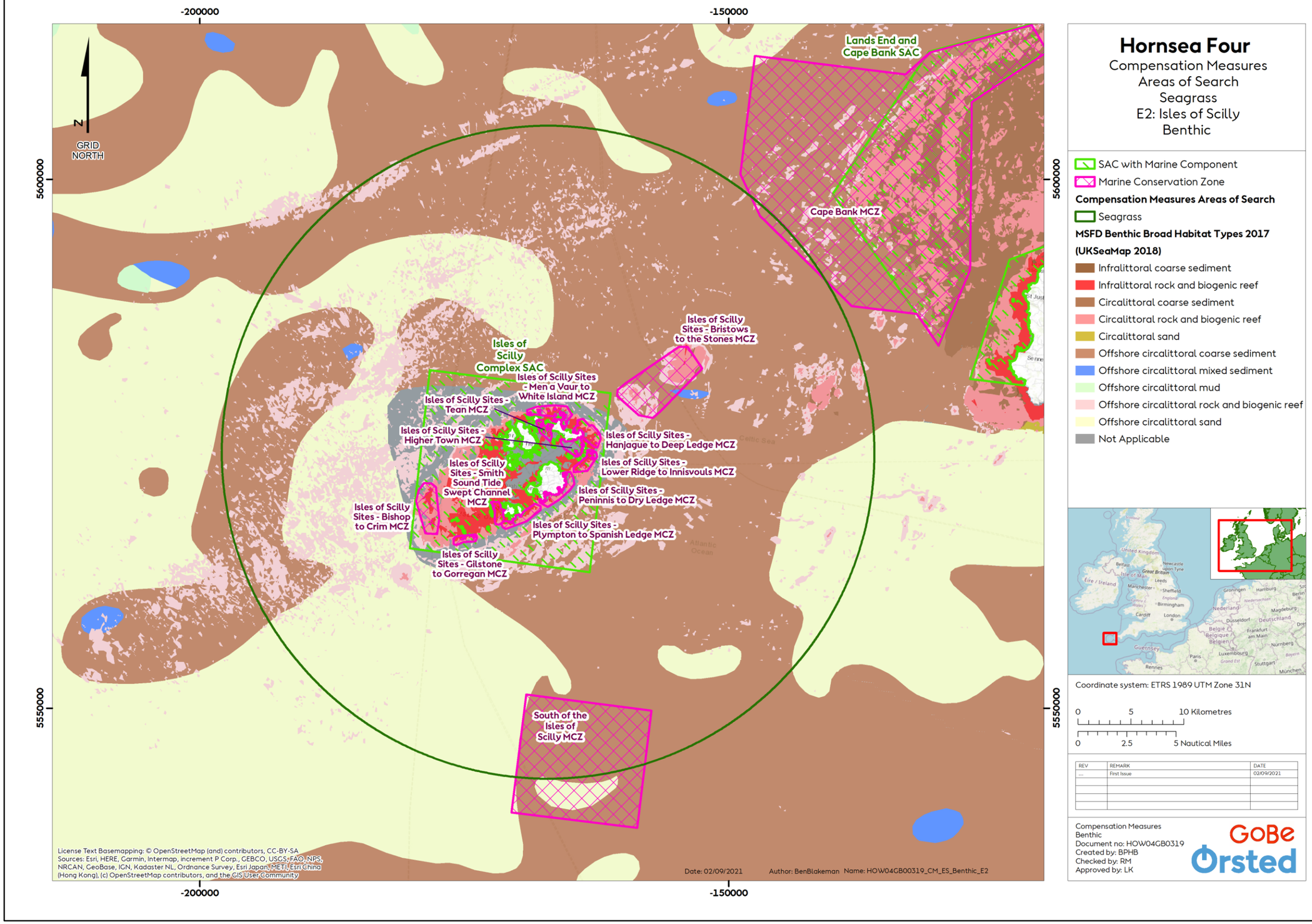


Figure 40: Resilience Measures Areas of Search Seagrass E2: Isles of Scilly Benthic.

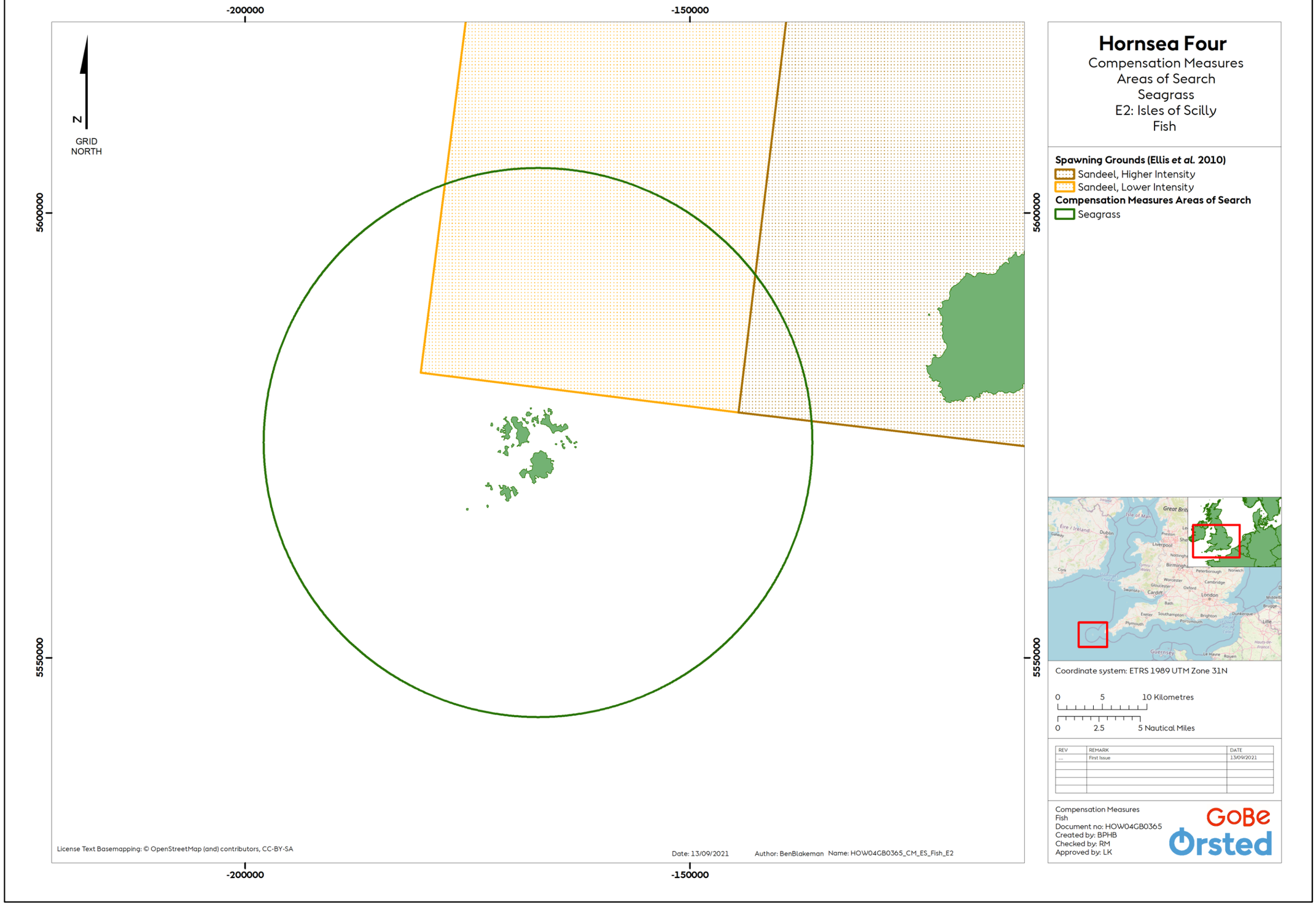
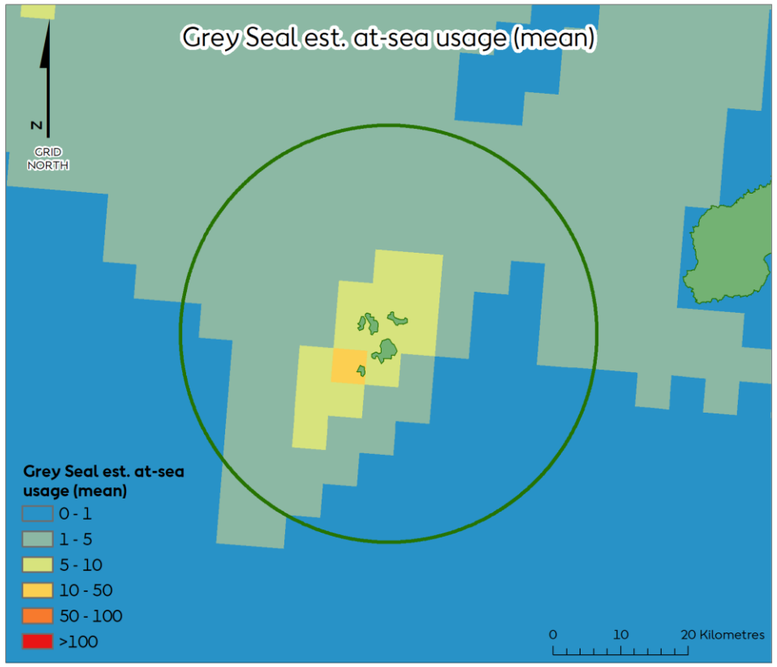
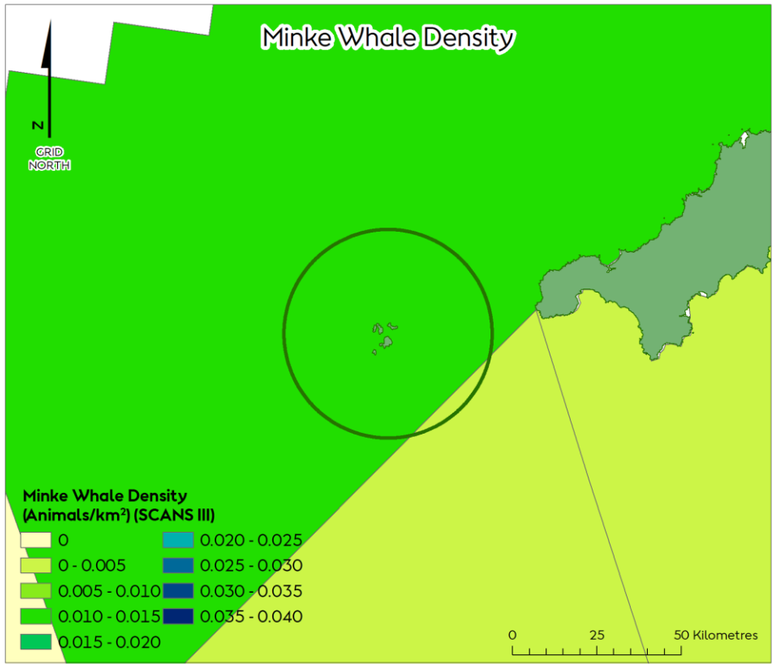
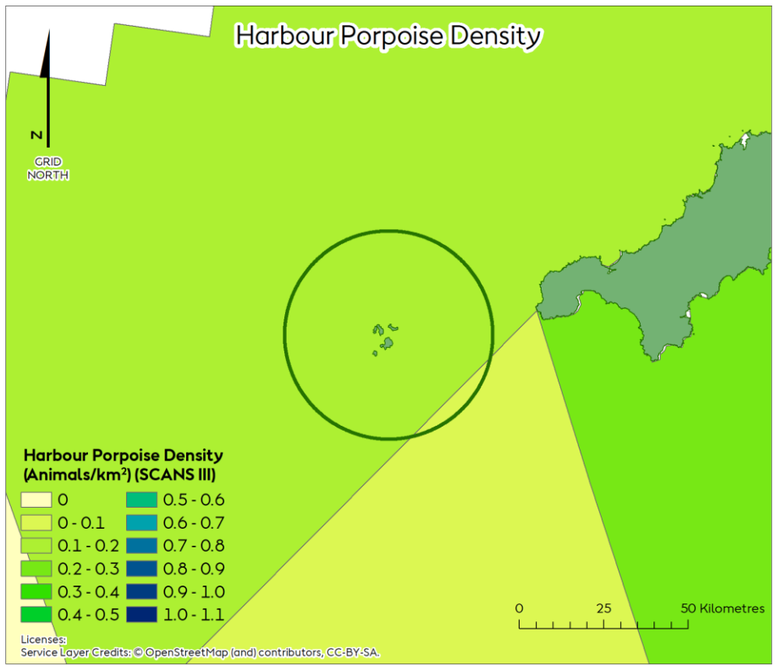
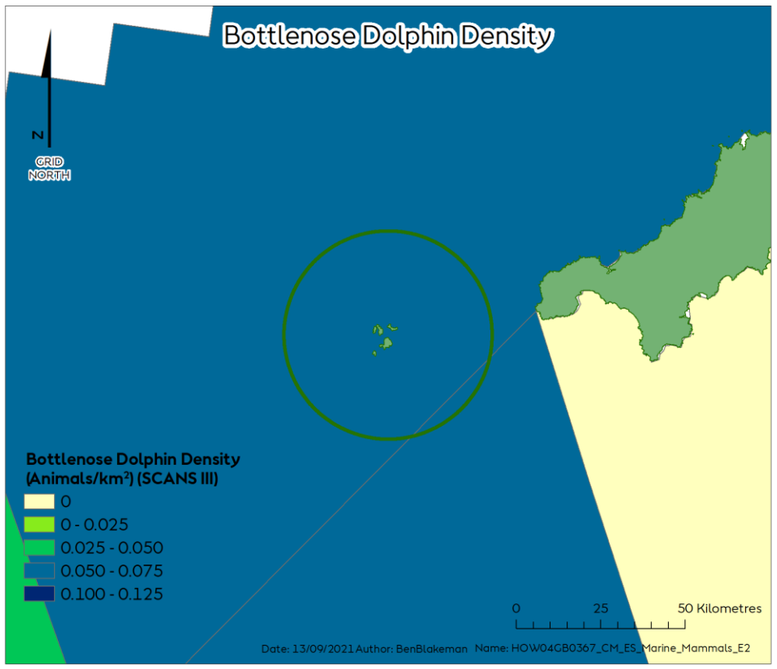


Figure 41: Resilience Measures Areas of Search Seagrass E2: Isles of Scilly Fish Ecology.









Hornsea Four
Compensation Measures
Areas of Search
Seagrass
E2: Isles of Scilly
Marine Mammals

Compensation Measures Areas of Search
Seagrass

Estimated at-sea Distribution of Grey and Harbour Seals maps data from Sea Mammal Research Unit (SMRU) and Marine Scotland, 2017

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Compensation Measures
Marine Mammals
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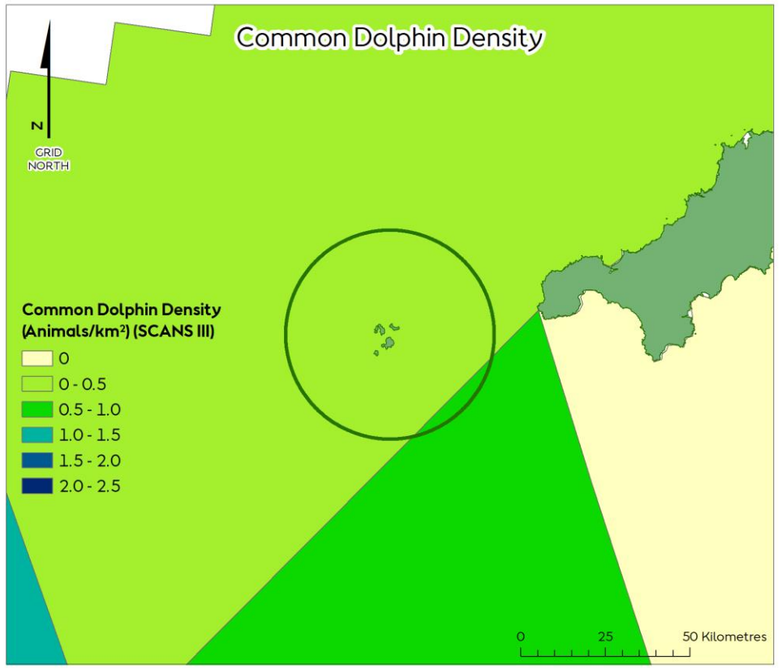
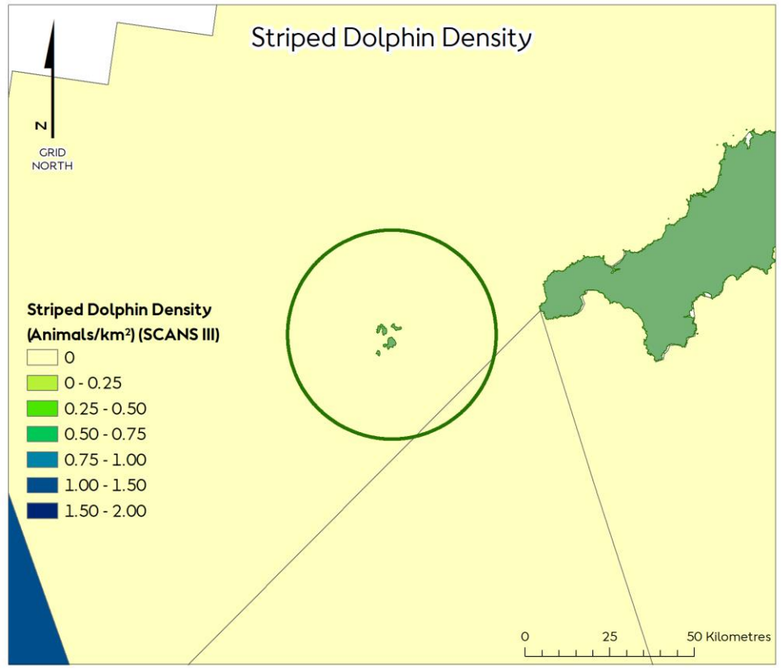
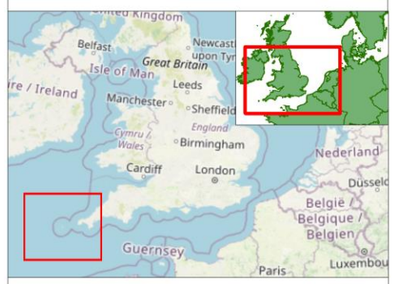
Figure 42: Resilience Measures Areas of Search Seagrass E2: Isles of Scilly Marine Mammal 1.





Hornsea Four
Compensation Measures
Areas of Search
Seagrass
E2: Isles of Scilly
Marine Mammals

Compensation Measures Areas of Search
Seagrass



Coordinate system: ETRS 1989 UTM Zone 31N

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Compensation Measures
Marine Mammals
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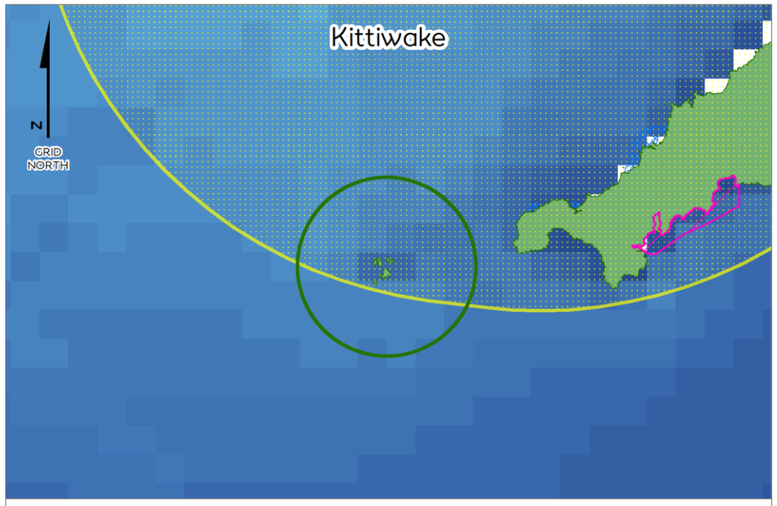
Date: 13/09/2021 Author: BenBlakeman Name: HOW04GB0376_CM_ES_Marine_Mammals_E2_2

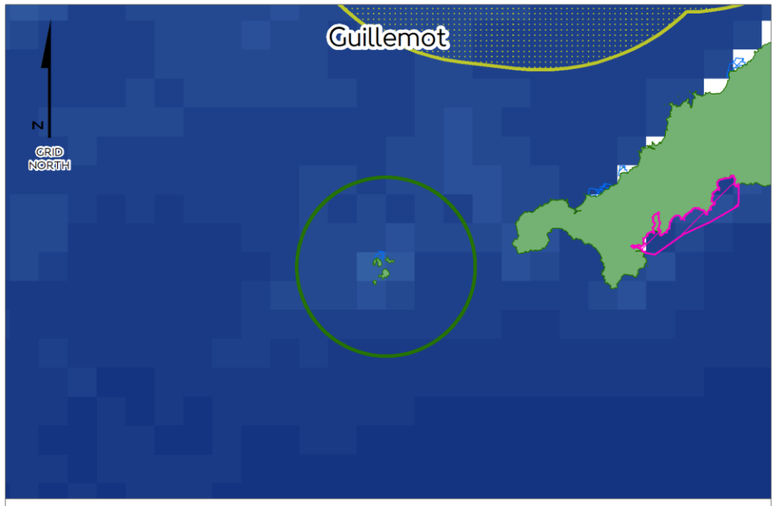
Figure 43: Resilience Measures Areas of Search Seagrass E2: Isles of Scilly Marine Mammal 2.



Kittiwake Hotspots (Cleasby et al, 2020)
- Maximum Curvature
- Statistically Significant Getis-Ord hotspot
- Top 5% Getis-Ord hotspot
- Top 1% Getis-Ord hotspot

Kittiwake (Waggit et al., 2019) Density
High : 2.07
Low : 0

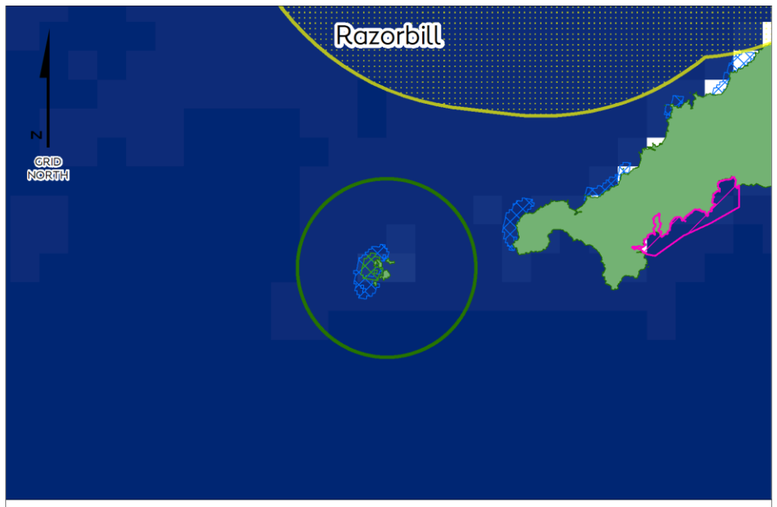
Hotspots identified at the UK-scale for Black-legged Kittiwakes using Getis-Ord hotspot analysis with a neighbourhood size of d = 10 km based on FPT analysis or Maximum Curvature. Getis-Ord hotspots defined as all cells with the top 1% of calculated Gi* scores; all cells within the top 5% of Gi* score; all cells in which Gi* scores were deemed statistically significant at the < 0.01 level.



Guillemot Hotspots (Cleasby et al, 2020)
- Maximum Curvature
- Statistically Significant Getis-Ord hotspot - d = 9km
- Top 5% Getis-Ord hotspot - d = 9km
- Top 1% Getis-Ord hotspot - d = 9km

Guillemot (Waggit et al., 2019) Density
High : 6.25
Low : 0

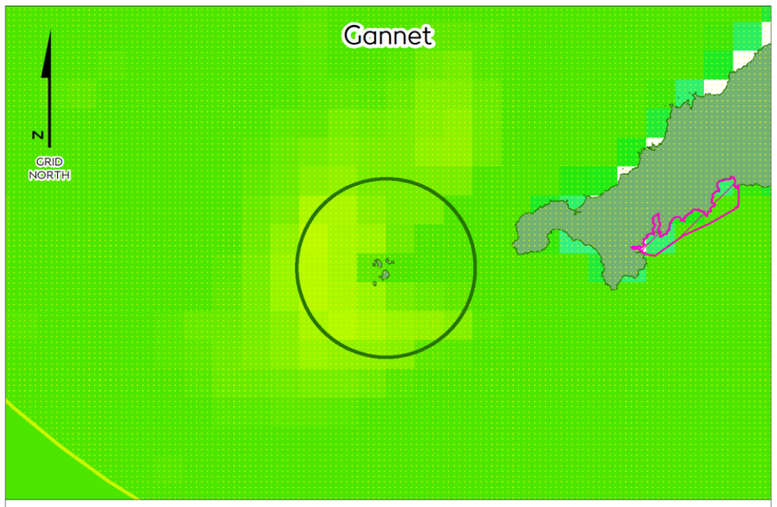
Hotspots identified at the UK-scale for Common Guillemots using Getis-Ord hotspot analysis with a neighbourhood size of d = 9 km based on FPT analysis or Maximum Curvature.



Razorbill Hotspots (Cleasby et al, 2020)
- Maximum Curvature
- Statistically Significant Getis-Ord hotspot - d = 7km
- Top 5% Getis-Ord hotspot - d = 7km
- Top 1% Getis-Ord hotspot - d = 7km

Razorbill (Waggit et al., 2019) Density
High : 3
Low : 0

Hotspots identified at the UK-scale for Razorbills using Getis-Ord hotspot analysis with a neighbourhood size of d = 7 km based on FPT analysis or Maximum Curvature.



Gannet (Waggit et al., 2019) Density
High : 1.65
Low : 0

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Date: 13/09/2021 Author: BenBlakeman Name: HOW04GB0369_CM_ES_Ornithology_E2

Hornsea Four

Compensation Measures
Areas of Search
Seagrass
E2: Isles of Scilly
Ornithology

Special Protection Area (SPA) with Marine Components

Mean-Max Foraging Range (Woodward 2019)
- Common Guillemot - 73.2km Buffer
- Gannet - 315.2km Buffer
- Kittiwake - 156.1km Buffer
- Razorbill - 88.7km Buffer

Compensation Measures Areas of Search
- Seagrass

Waggitt et al 2019 densities data. Spatial variation in predicted densities (animals per km) of seabird species in July in the North-East Atlantic. Values are provided at 10km resolution.

Coordinate system: ETRS 1989 UTM Zone 31N

0 25 50 Kilometres
0 10 20 Nautical Miles

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Compensation Measures
Ornithology
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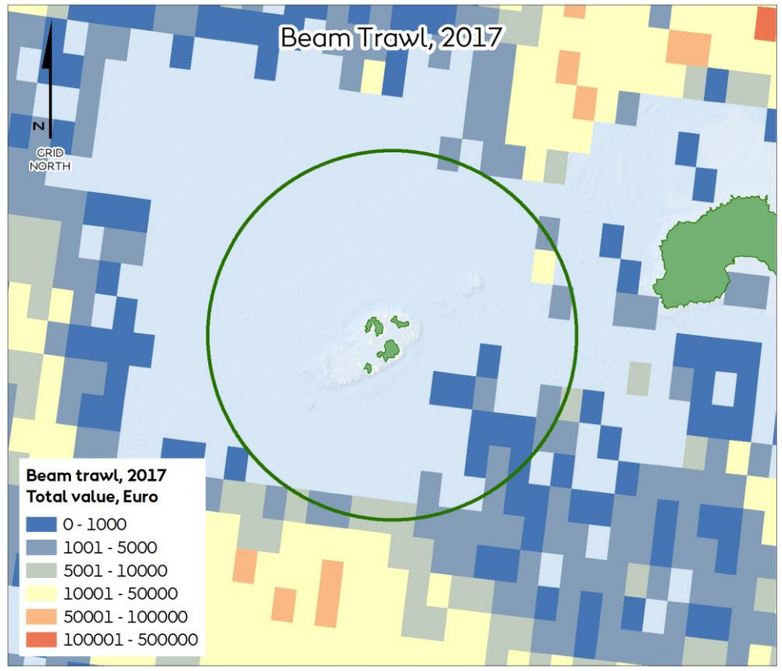
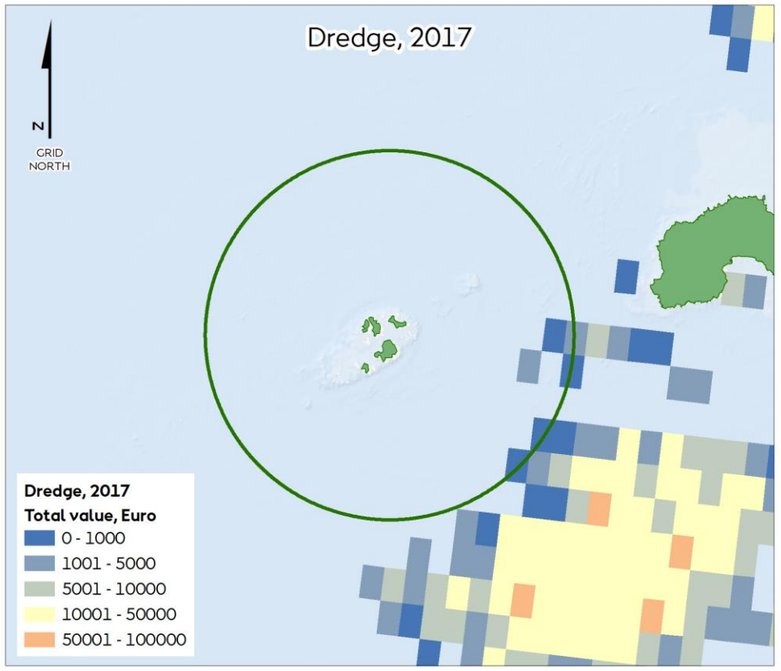
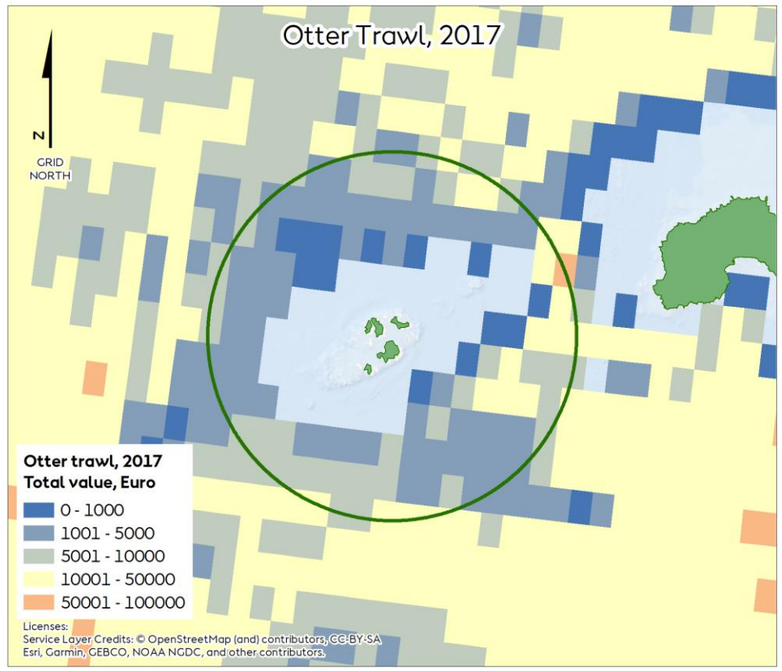
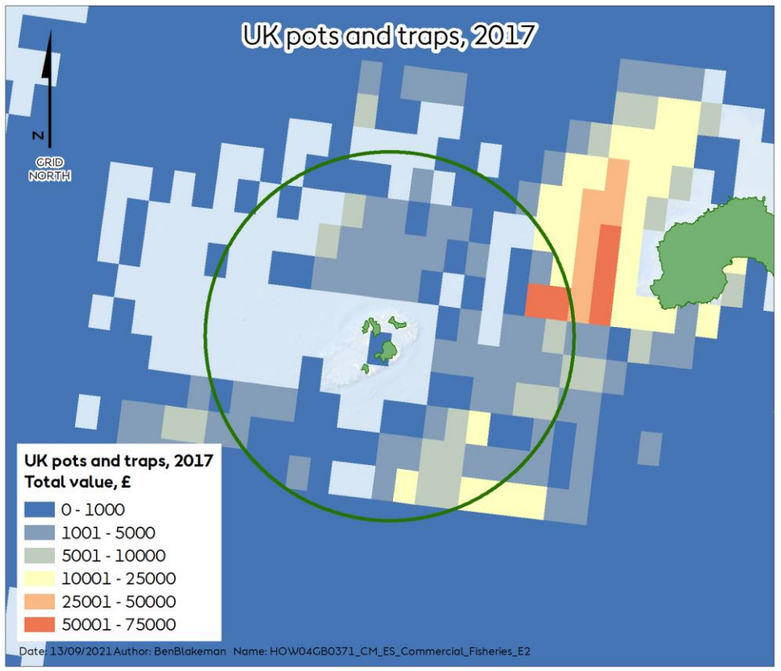
Figure 44: Resilience Measures Areas of Search Seagrass E2: Isles of Scilly Ornithology.



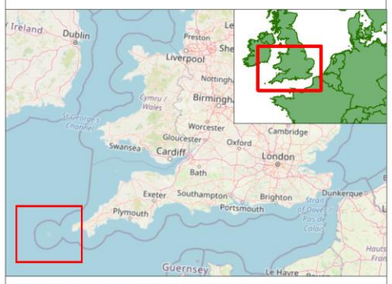






Hornsea Four
Compensation Measures
Areas of Search
Seagrass
E2: Isles of Scilly
Commercial Fisheries

Compensation Measures Areas of Search
Seagrass



Coordinate system: ETRS 1989 UTM Zone 31N

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0 10 20 Nautical Miles

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Compensation Measures
Commercial Fisheries
Document no: HOW04GB0371
Created by: BPHB
Checked by: TB
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Figure 45: Resilience Measures Areas of Search Seagrass E2: Isles of Scilly Commercial Fisheries.

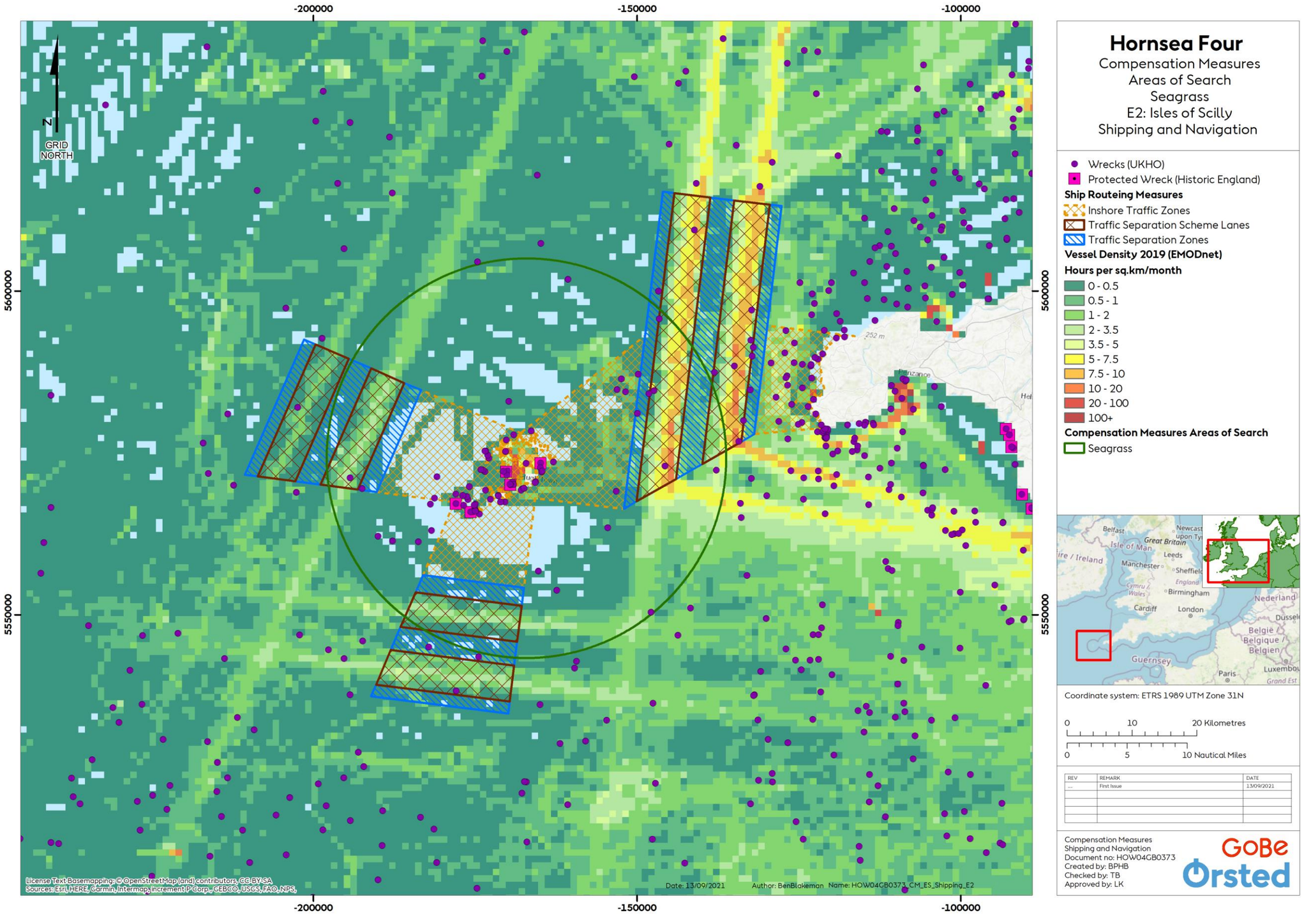
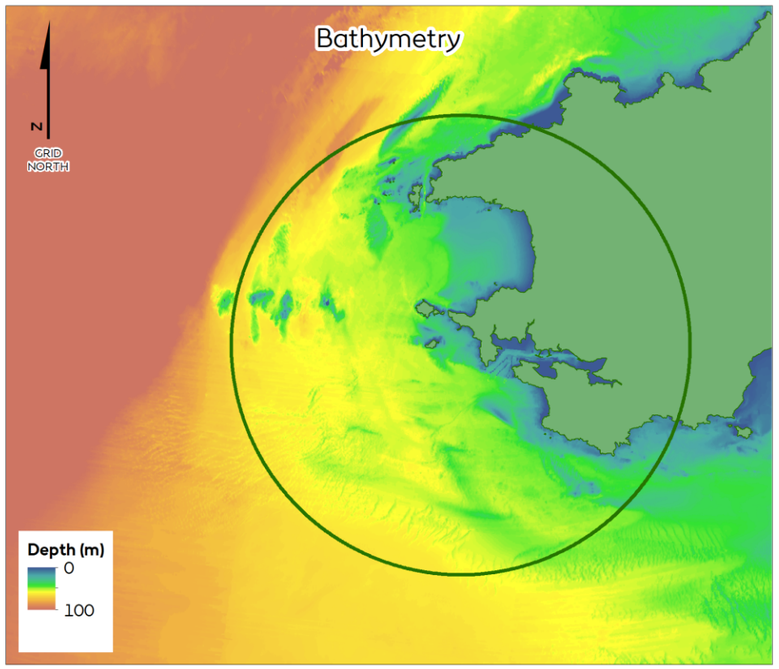


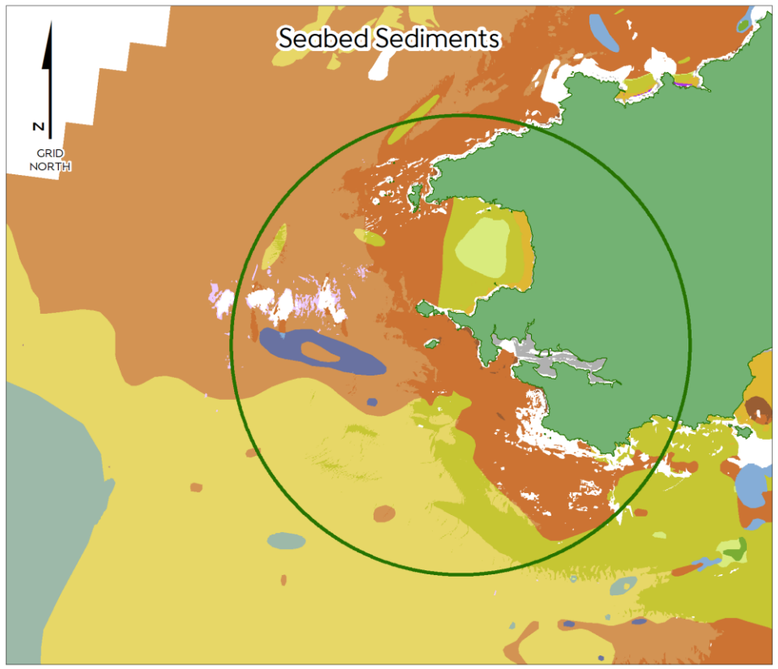
Figure 46: Resilience Measures Areas of Search Seagrass E2: Isles of Scilly Shipping.

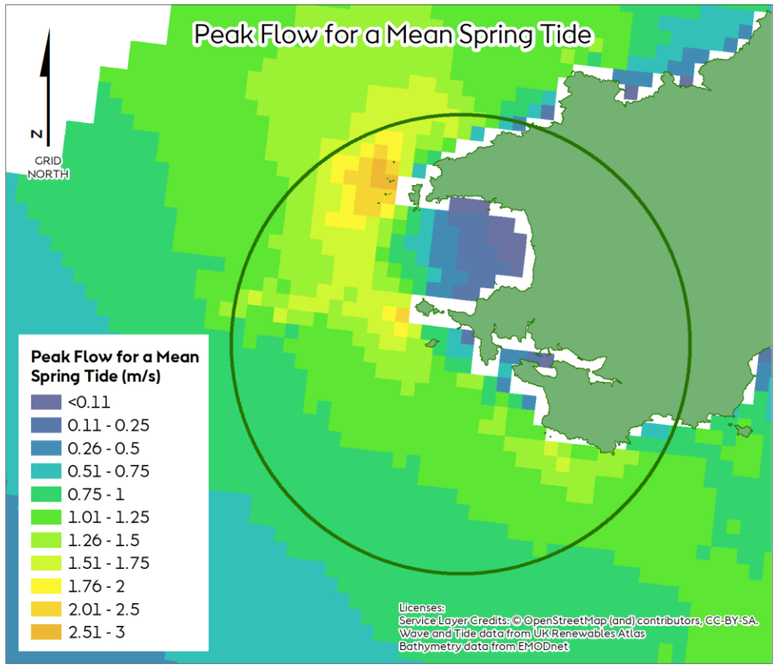
Table 14: Summary of baseline environment in relation to the Area of Search E3 (Celtic Sea) for resilience measure - fish habitat enhancement (seagrass).

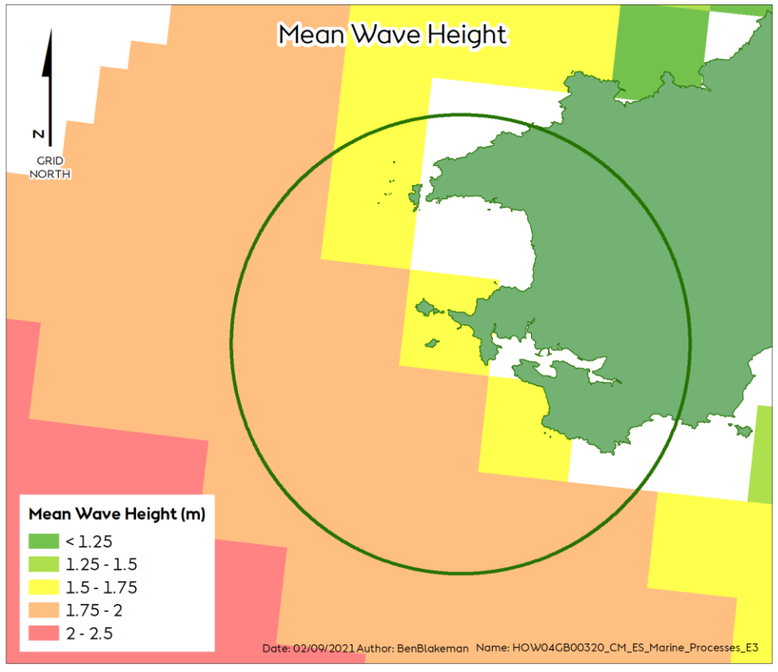
Topic	Summary of Baseline Environment
Marine Geology, Oceanography and Physical Processes	The baseline environment for physical processes is illustrated in **Figure 47**. • The AoS is shallow towards the coast, but sits of the edge of the continental shelf, which drops away sharply towards the west. • Seabed sediments are comprised of mixed coarse and sandy sediments.
Benthic and Intertidal Ecology	The baseline environment for benthic ecology is illustrated in **Figure 48**. • Seabed habitats in the AoS are mainly sands and mixed sediments, with some outcrops of rock and biogenic reef. • Numerous designated sites are present within the AoS, including the Pembrokeshire and West Wales Marine SACs, and the Skomer MCZ.
Fish and Shellfish Ecology	The baseline environment for fish and shellfish ecology is illustrated in **Figure 49**. • The AoS overlaps with spawning and nursery grounds for species including herring, cod, whiting, mackerel, cod, plaice, sole and sandeel (high intensity).
Marine Mammals	The baseline environment for marine mammals is illustrated in **Figure 50 and Figure 51**. • A range of marine mammals are known to be present in this AoS including: harbour porpoise (*Phocoena phocoena*), bottlenose dolphin (*Tursiops truncatus*), common dolphin (*Delphinus delphis*), striped dolphin (*Stenella coeruleoalba*), risso's dolphin (*Grampus griseus*) and minke whale (*Balaenoptera acutorostrata*) (Hammond et al. 2017). • There are two large grey seal colonies within the AoS (SCOS, 2020).
Offshore and Intertidal Ornithology	The baseline environment for offshore ornithology is illustrated in **Figure 52**. • Within the AoS there are two SPAs with offshore ornithology designated features, Skomer, Skokholm and the Seas off Pembrokeshire / Sgomer, Sgogwm a Moroedd Penfro SPA and the Grassholm SPA. The Skomer, Skokholm and the Seas off Pembrokeshire / Sgomer, Sgogwm a Moroedd Penfro SPA is designated for European storm petrel (*Hydrobates pelagicus*), red-billed chough (Pyrrhocorax pyrrhocorax), short-eared owl (*Asio flammeus*), manx shearwater (*Puffinus puffinus),* Atlantic puffin (*Fratercula arctica*), and lesser black-backed gull (*Larus fuscus*) (JNCC, 2017b). The Grassolm SPA is designated for gannet (*Morus bassanus*) (JNCC, 2015b). • As shown on **Figure 52**, there is an area of high gannet density in the west of the AoS.
Commercial Fisheries	The baseline environment for commercial fisheries is illustrated in **Figure 53**. • The Celtic Sea is a large area that includes ICES Divisions VIIg-h, the western parts of Divisions VIIe-f and the shelf waters in Divisions VIIj. • As shown on **Figure 53**, fishing effort is highest in the south and west of the AoS.
Shipping and Navigation	The baseline environment for shipping and navigation is illustrated in **Figure 54**. • The vessel density in the AoS varies from 1 to >222,000 route(s)/0.15 km^2/ year. • The Milford Haven Waterway holds the majority of the vessels, with the primary routes going from the settlements along the river, out through the mouth of the estuary and wither A) in a northwest direction directly across towards Ireland, or B) in a southwest direction to pass the southern tip of Cornwall and out into the English Chanel (Marine Traffic, 2021). • As shown on **Figure 54**, there is an area of avoidance for shipping in the west of the AoS and a traffic separation scheme immediately to the west of the AoS.

Topic	Summary of Baseline Environment
Marine Archaeology	The baseline environment for marine archaeology is described below. • Within the AoS, there are many different types of archaeological features including both ship and aircraft wrecks.









Hornsea Four

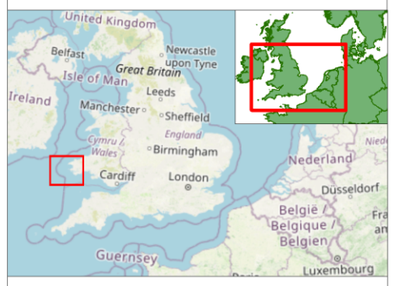
Compensation Measures
Areas of Search
Seagrass
E3: Celtic Sea, Wales
Marine Processes

Compensation Measures Areas of Search

Seagrass

EUNIS Habitats (UKSeaMap 2018)

- A4.27: Faunal communities on deep moderate energy circalittoral rock
- A4.33: Faunal communities on deep low energy circalittoral rock
- A5.13: Infralittoral coarse
- A5.14: Circalittoral coarse
- A5.15: Deep circalittoral coarse sediment
- A5.23 or A5.24: Infralittoral fine sand or infralittoral muddy sand
- A5.25 or A5.26: Circalittoral fine sand or circalittoral muddy sand
- A5.27: Deep circalittoral
- A5.33: Infralittoral sandy
- A5.35: Circalittoral sandy
- A5.36: Circalittoral fine
- A5.37: Deep circalittoral
- A5.43: Infralittoral mixed
- A5.44: Circalittoral mixed
- A5.45: Deep circalittoral mixed sediments
- No EUNIS habitat



Coordinate system: ETRS 1989 UTM Zone 31N

0 10 20 Kilometres

0 5 10 Nautical Miles

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Compensation Measures
Marine Processes
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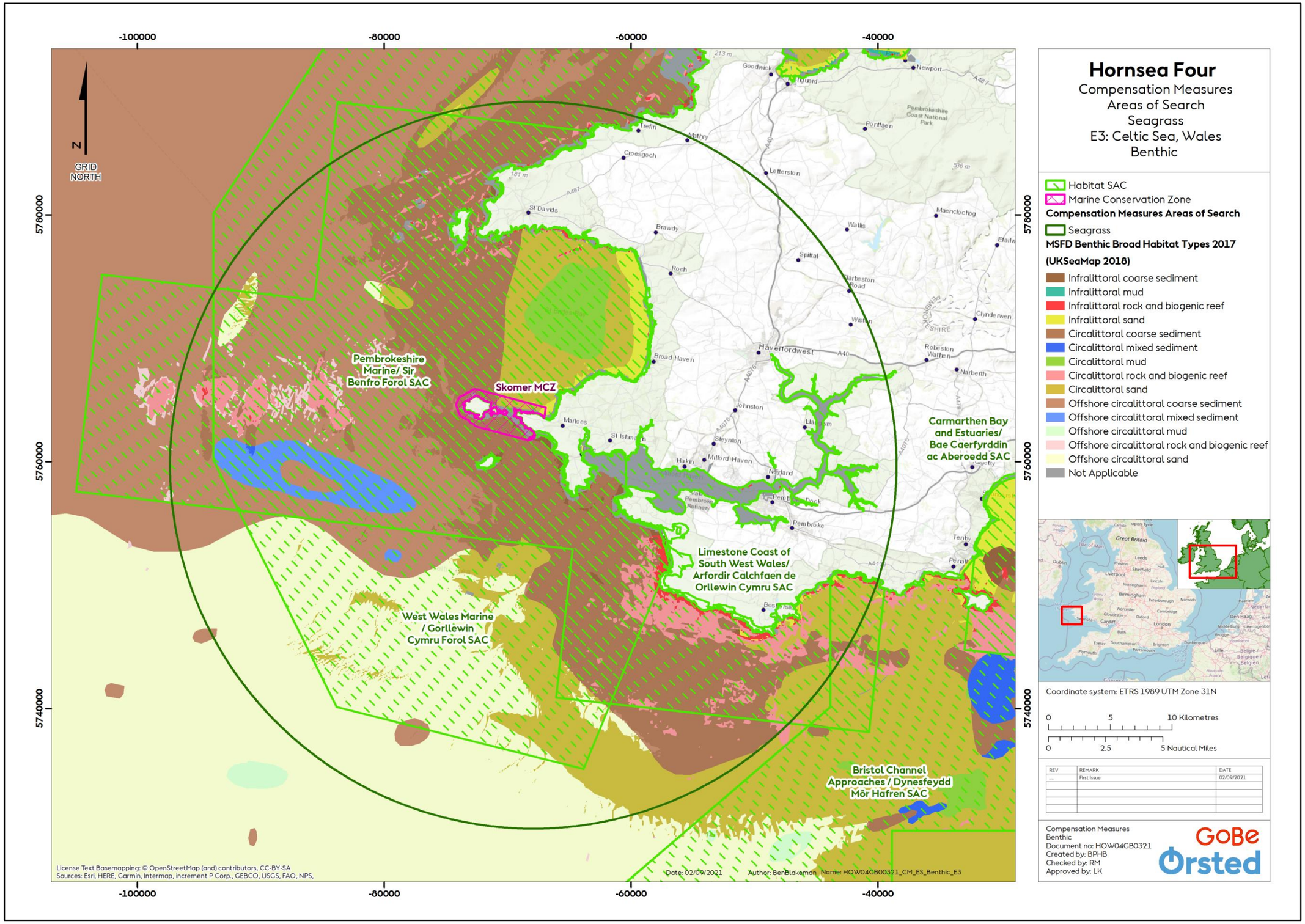
Figure 47: Resilience Measures Areas of Search Seagrass E3: Celtic Sea, Wales Marine Processes.



Hornsea Four

Compensation Measures
Areas of Search
Seagrass
E3: Celtic Sea, Wales
Benthic

- Habitat SAC
- Marine Conservation Zone

Compensation Measures Areas of Search

- Seagrass

MSFD Benthic Broad Habitat Types 2017 (UKSeaMap 2018)

- Infralittoral coarse sediment
- Infralittoral mud
- Infralittoral rock and biogenic reef
- Infralittoral sand
- Circalittoral coarse sediment
- Circalittoral mixed sediment
- Circalittoral mud
- Circalittoral rock and biogenic reef
- Circalittoral sand
- Offshore circalittoral coarse sediment
- Offshore circalittoral mixed sediment
- Offshore circalittoral mud
- Offshore circalittoral rock and biogenic reef
- Offshore circalittoral sand
- Not Applicable

Coordinate system: ETRS 1989 UTM Zone 31N

0 5 10 Kilometres

0 2.5 5 Nautical Miles

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—	First Issue	02/09/2021

Compensation Measures
Benthic
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Figure 48: Resilience Measures Areas of Search Seagrass E3: Celtic Sea, Wales Benthic.

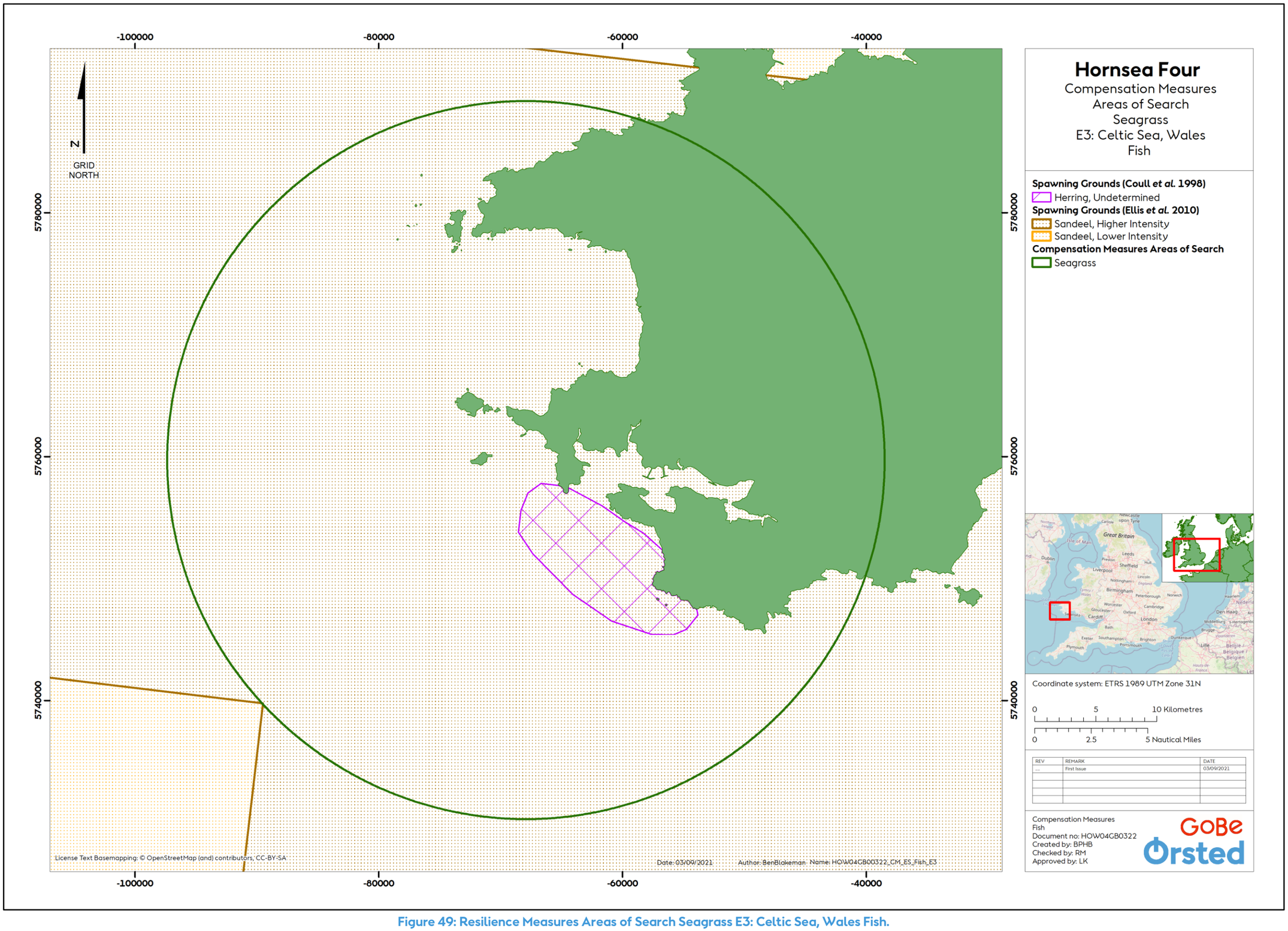
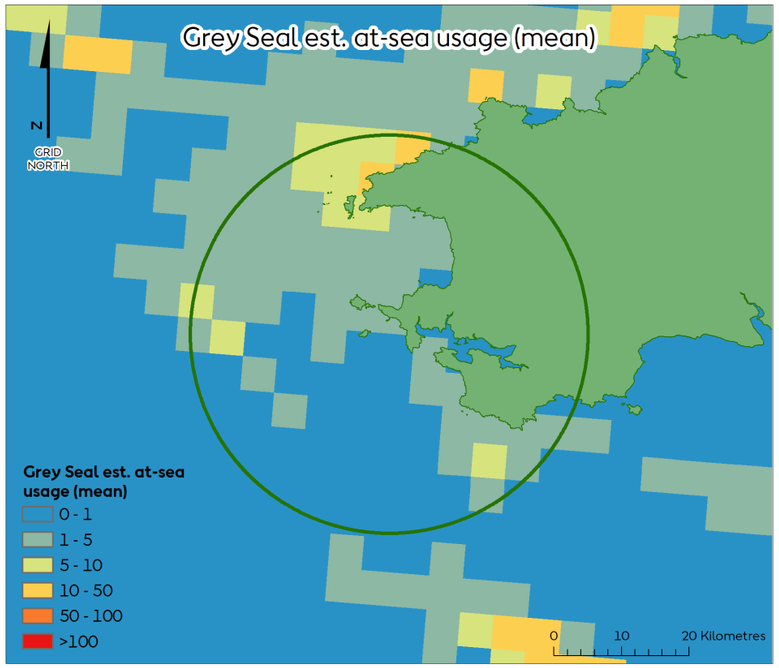
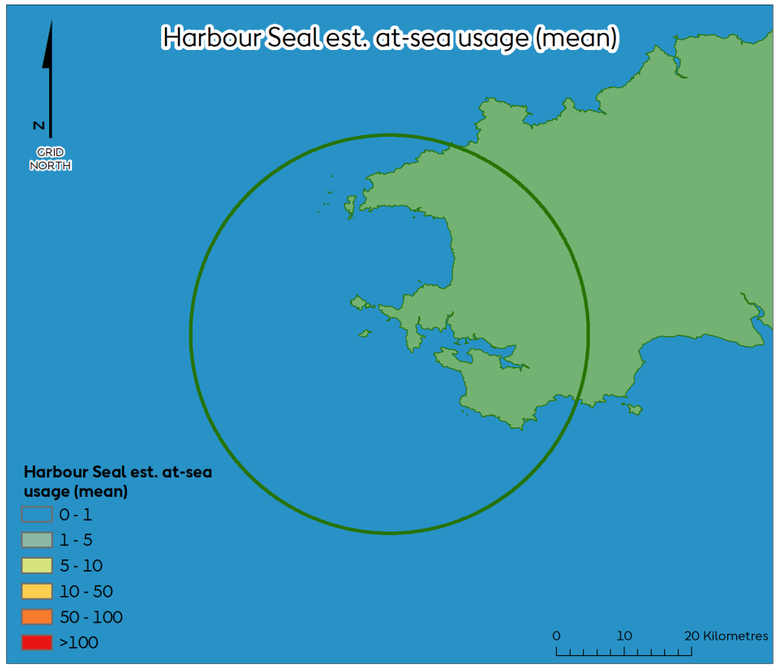
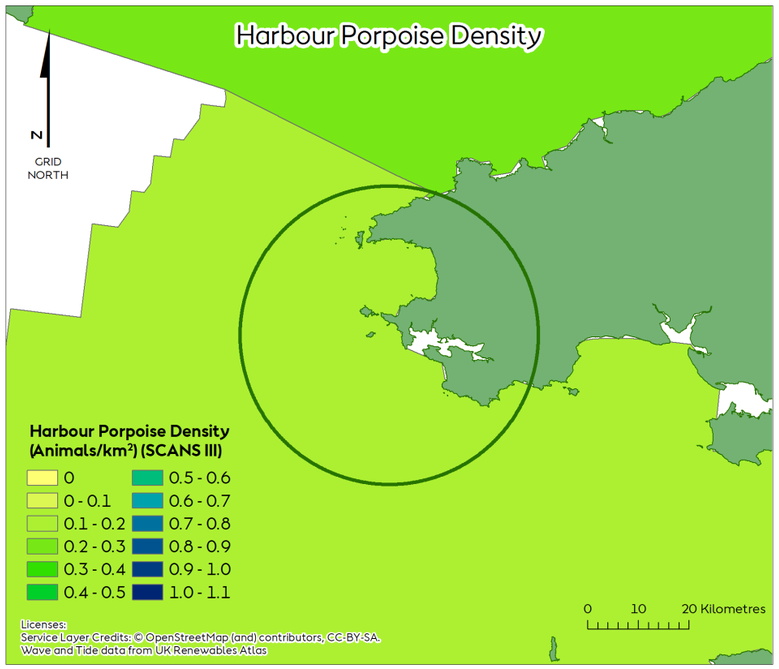
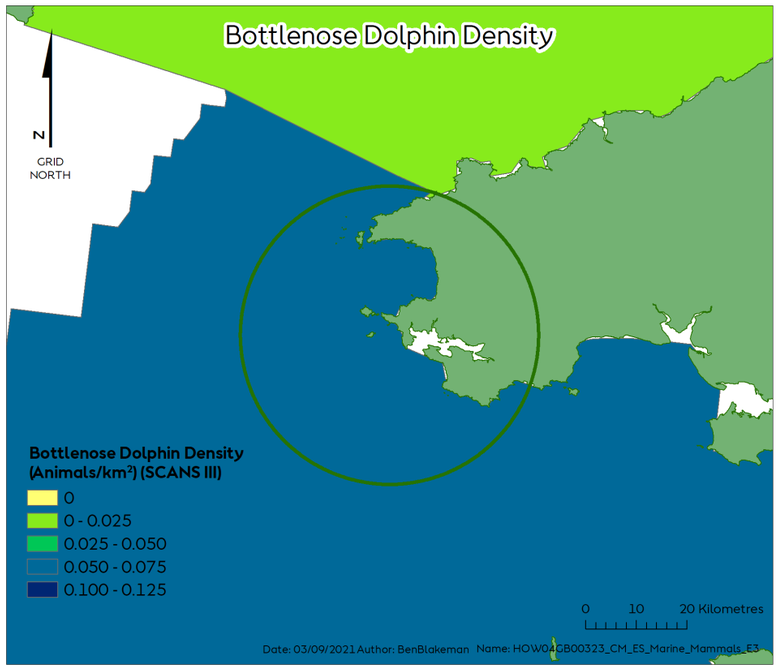


Figure 49: Resilience Measures Areas of Search Seagrass E3: Celtic Sea, Wales Fish.









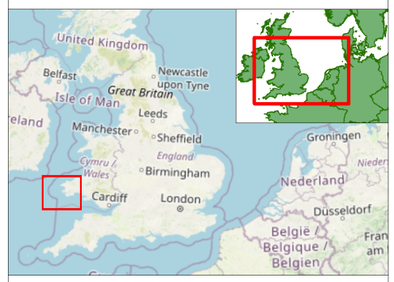
Hornsea Four

Compensation Measures
Areas of Search
Seagrass
E3: Celtic Sea, Wales
Marine Mammals

Compensation Measures Areas of Search

Seagrass

Estimated at-sea Distribution of Grey and Harbour Seals maps data from Sea Mammal Research Unit (SMRU) and Marine Scotland, 2017



Coordinate system: ETRS 1989 UTM Zone 31N

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Compensation Measures
Marine Mammals
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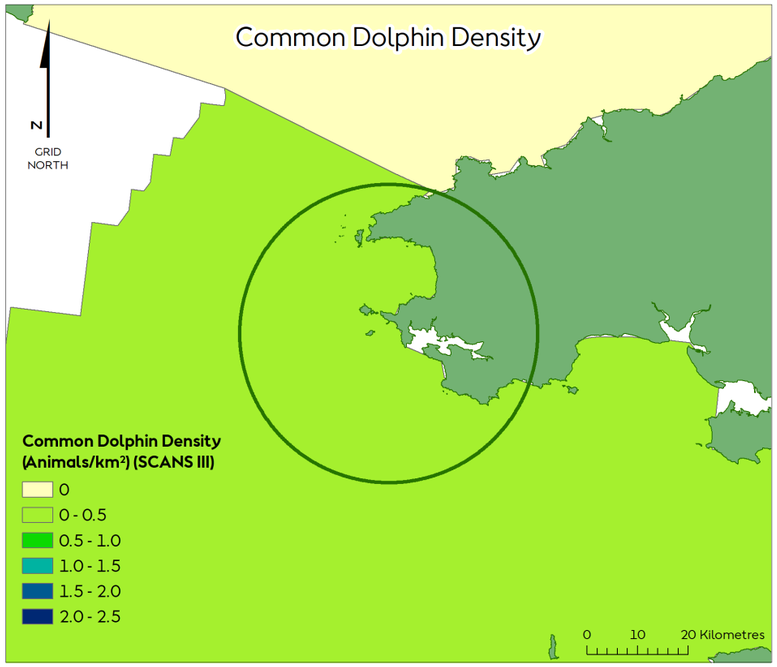
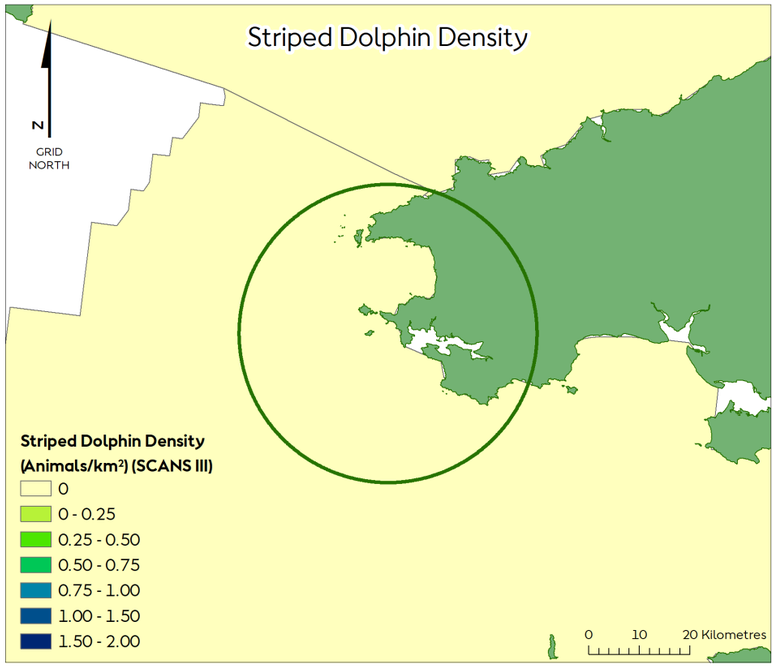
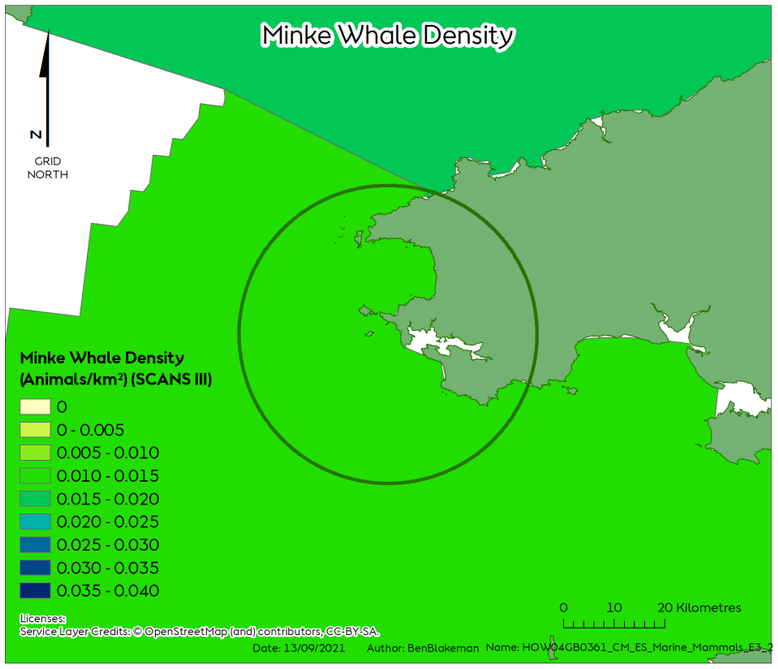
Figure 50: Compensation Measures Areas of Search Seagrass E3: Celtic Sea, Wales Marine Mammals 1.







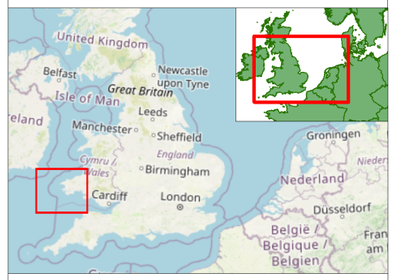
Hornsea Four

Compensation Measures
Areas of Search
Seagrass
E3: Celtic Sea, Wales
Marine Mammals

Compensation Measures Areas of Search

Seagrass

No data available for Risso's Dolphin density



Coordinate system: ETRS 1989 UTM Zone 31N

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Compensation Measures
Marine Mammals
Document no: HOW04GB0361
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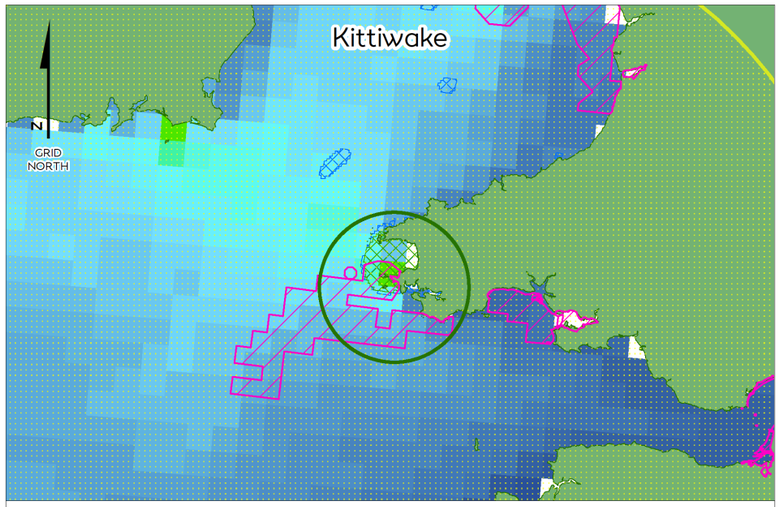
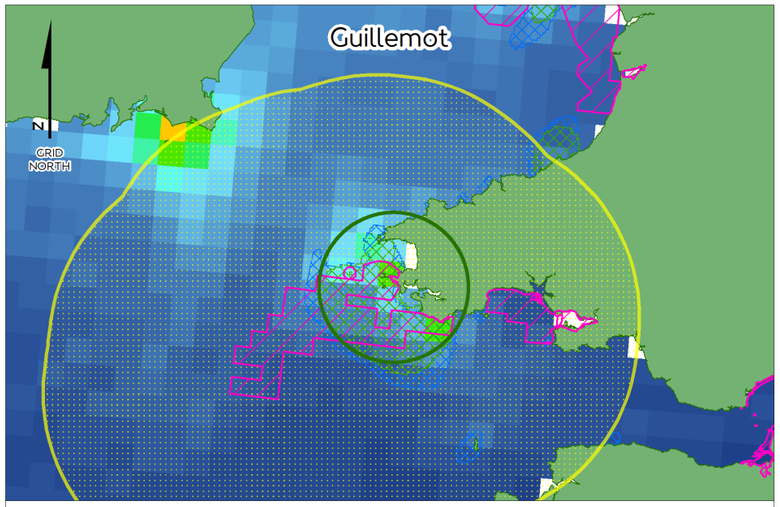
Figure 51: Compensation Measures Areas of Search Seagrass E3: Celtic Sea, Wales Marine Mammals 2.



Kittiwake Hotspots (Cleasby et al, 2020)
- Maximum Curvature
- Statistically Significant Getis-Ord hotspot
- Top 5% Getis-Ord hotspot
- Top 1% Getis-Ord hotspot

Kittiwake (Waggit et al., 2019) Density
High : 2.07
Low : 0

Hotspots identified at the UK-scale for Black-legged Kittiwakes using Getis-Ord hotspot analysis with a neighbourhood size of d = 10 km based on FPT analysis or Maximum Curvature. Getis-Ord hotspots defined as all cells with the top 1% of calculated Gi* scores; all cells within the top 5% of Gi* score; all cells in which Gi* scores were deemed statistically significant at the < 0.01 level.



Guillemot Hotspots (Cleasby et al, 2020)
- Maximum Curvature
- Statistically Significant Getis-Ord hotspot - d = 9km
- Top 5% Getis-Ord hotspot - d = 9km
- Top 1% Getis-Ord hotspot - d = 9km

Guillemot (Waggit et al., 2019) Density
High : 6.25
Low : 0

Hotspots identified at the UK-scale for Common Guillemots using Getis-Ord hotspot analysis with a neighbourhood size of d = 9 km based on FPT analysis or Maximum Curvature.

Hornsea Four

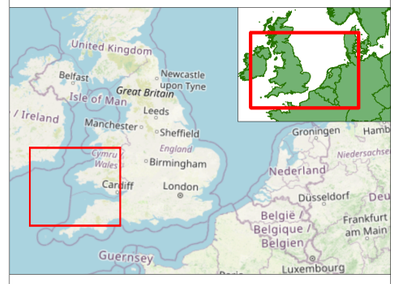
Compensation Measures
Areas of Search
Seagrass
E3: Celtic Sea, Wales
Ornithology

- Special Protection Area (SPA) with Marine Components

Mean-Max Foraging Range (Woodward 2019)
- Common Guillemot - 73.2km Buffer
- Gannet - 315.2km Buffer
- Kittiwake - 156.1km Buffer
- Razorbill - 88.7km Buffer

Compensation Measures Areas of Search
- Seagrass

Waggitt et al 2019 densities data. Spatial variation in predicted densities (animals per km) of seabird species in July in the North-East Atlantic. Values are provided at 10km resolution.



Coordinate system: ETRS 1989 UTM Zone 31N

0 50 100 Kilometres
0 25 50 Nautical Miles

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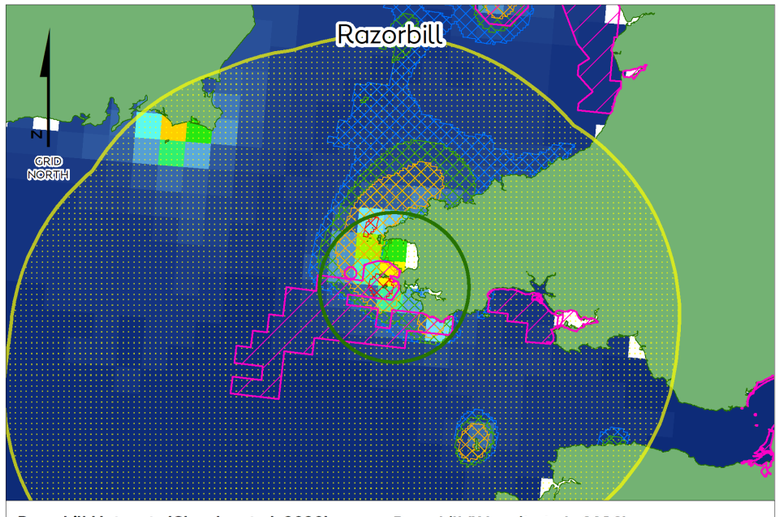
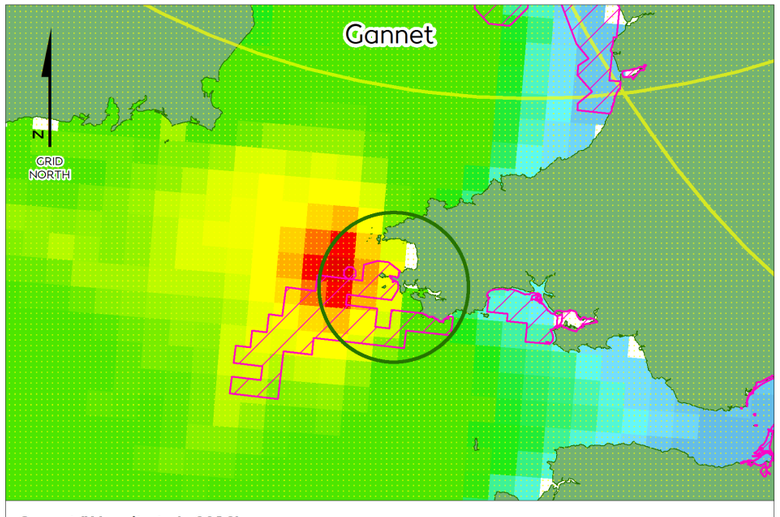


Razorbill Hotspots (Cleasby et al, 2020)
- Maximum Curvature
- Statistically Significant Getis-Ord hotspot - d = 7km
- Top 5% Getis-Ord hotspot - d = 7km
- Top 1% Getis-Ord hotspot - d = 7km

Razorbill (Waggit et al., 2019) Density
High : 3
Low : 0

Hotspots identified at the UK-scale for Razorbills using Getis-Ord hotspot analysis with a neighbourhood size of d = 7 km based on FPT analysis or Maximum Curvature.



Gannet (Waggit et al., 2019) Density
High : 1.65
Low : 0

Licenses:
Service Layer Credits: © OpenStreetMap (and) contributors, CC-BY-SA.

Date: 03/09/2021 Author: BenBlakeman Name: HOW04GB00324_CM_ES_Ornithology_E3

Compensation Measures
Ornithology
Document no: HOW04GB0324
Created by: BPHB
Checked by: TB
Approved by: LK

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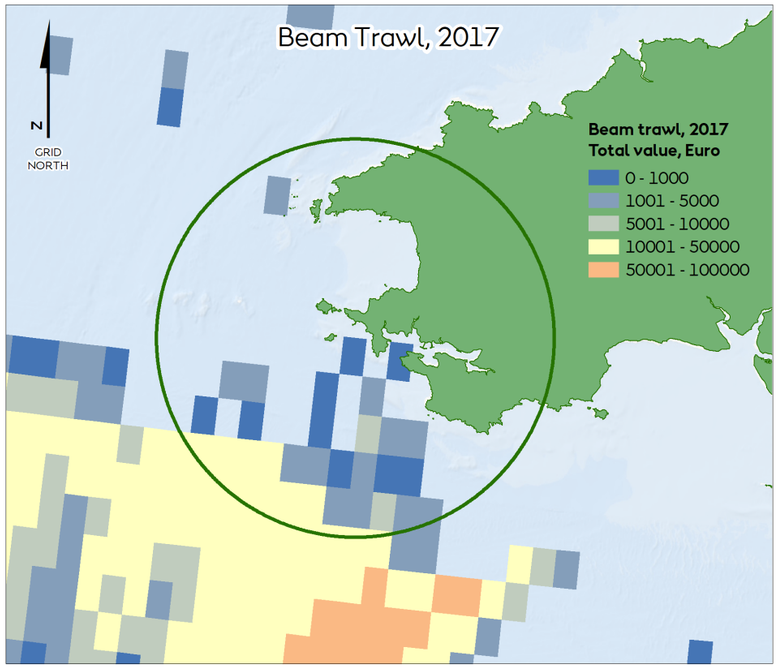
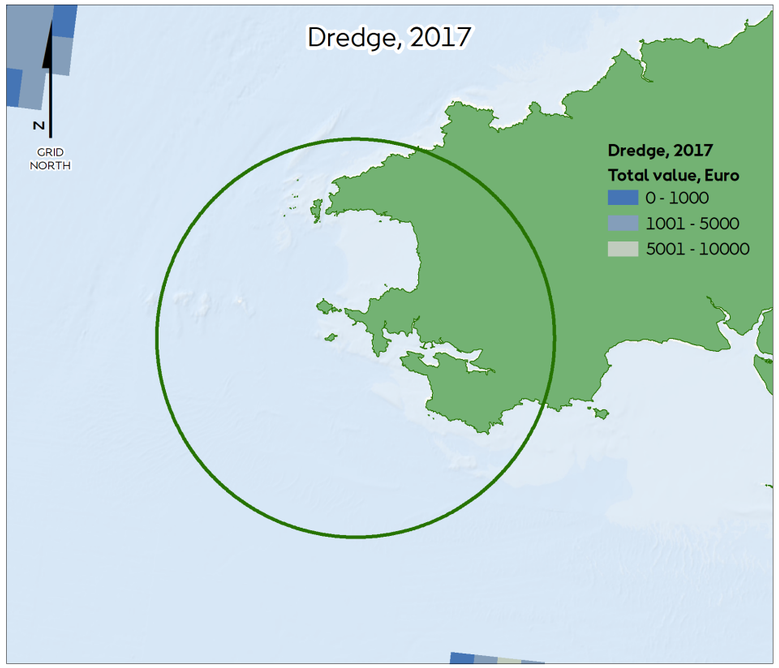
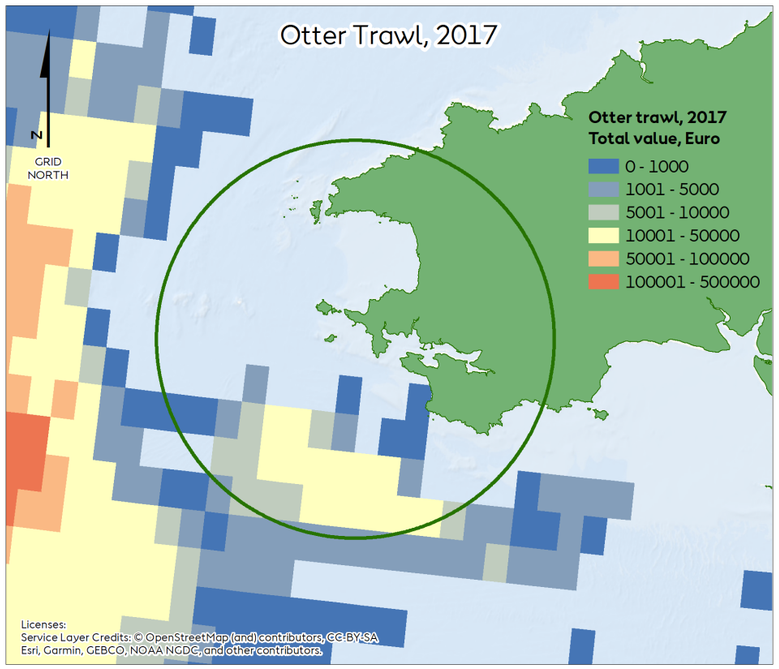
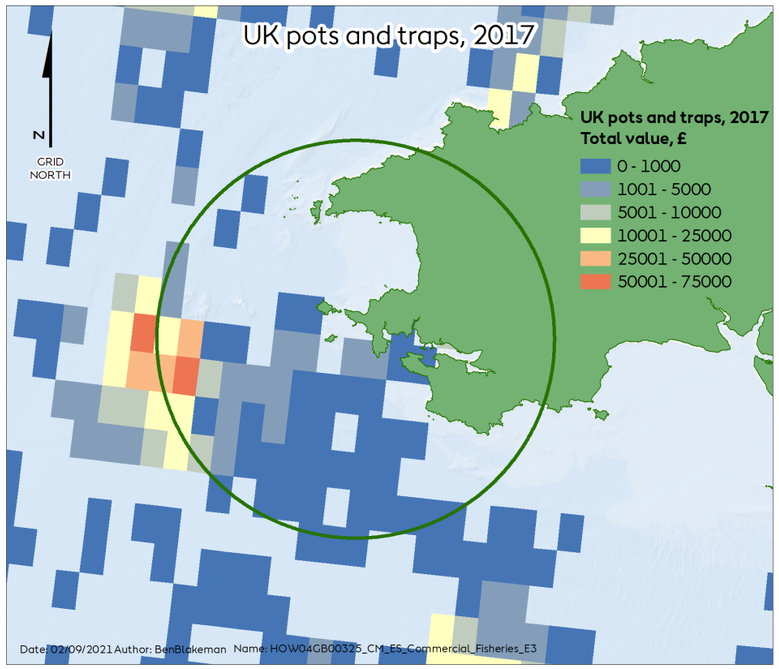
Figure 52: Resilience Measures Areas of Search Seagrass E3: Celtic Sea, Wales Ornithology.







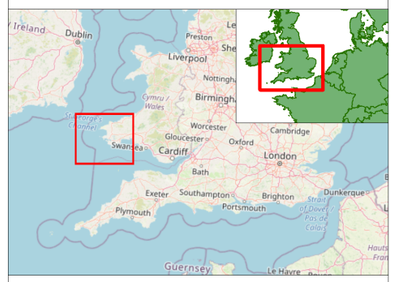


Hornsea Four

Compensation Measures
Areas of Search
Seagrass
E3: Celtic Sea, Wales
Commercial Fisheries

Compensation Measures Areas of Search

Seagrass



Coordinate system: ETRS 1989 UTM Zone 31N

0 20 40 Kilometres

0 10 20 Nautical Miles

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Compensation Measures
Commercial Fisheries
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Figure 53: Resilience Measures Areas of Search Seagrass E3: Celtic Sea, Wales Commercial Fisheries.

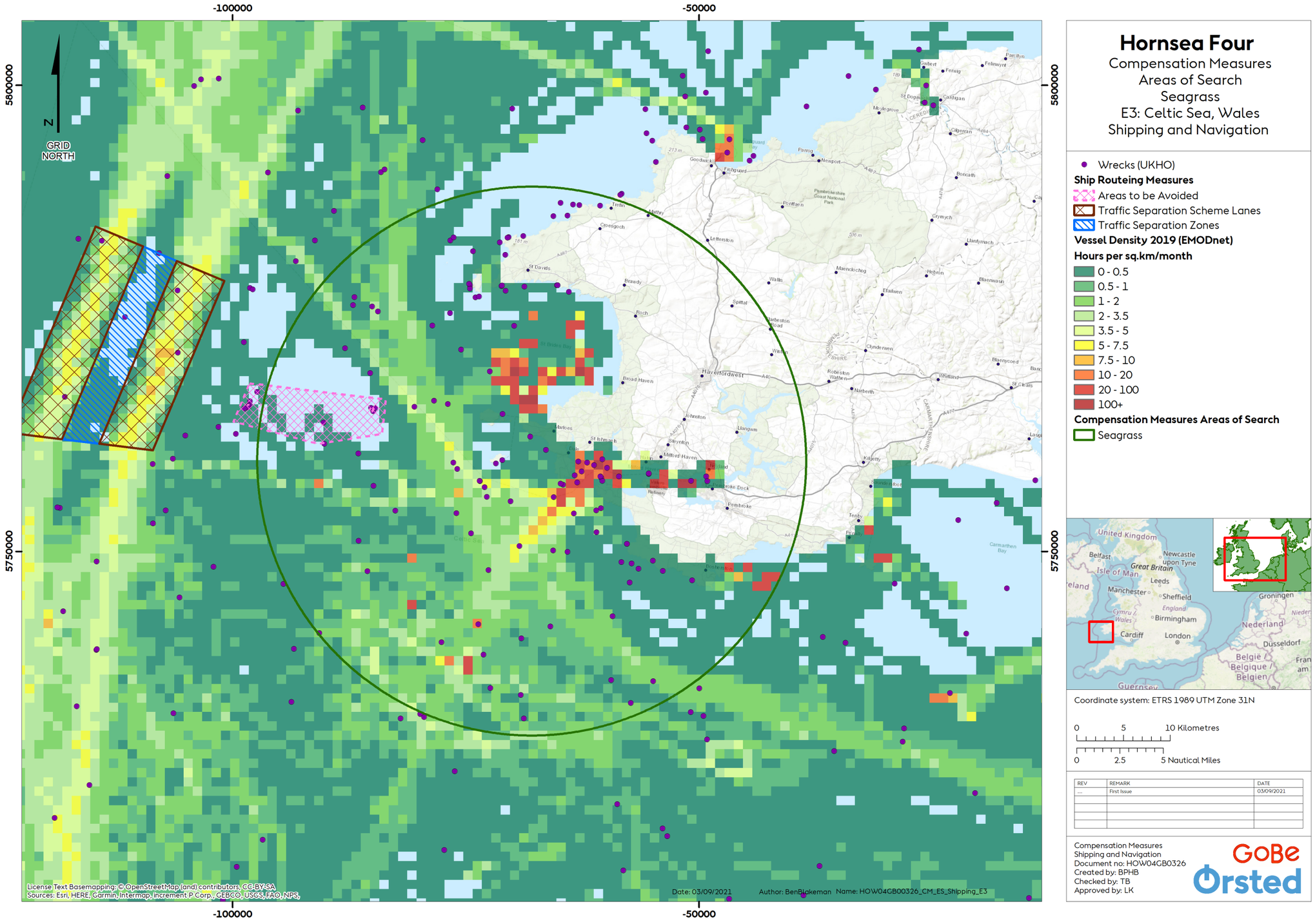
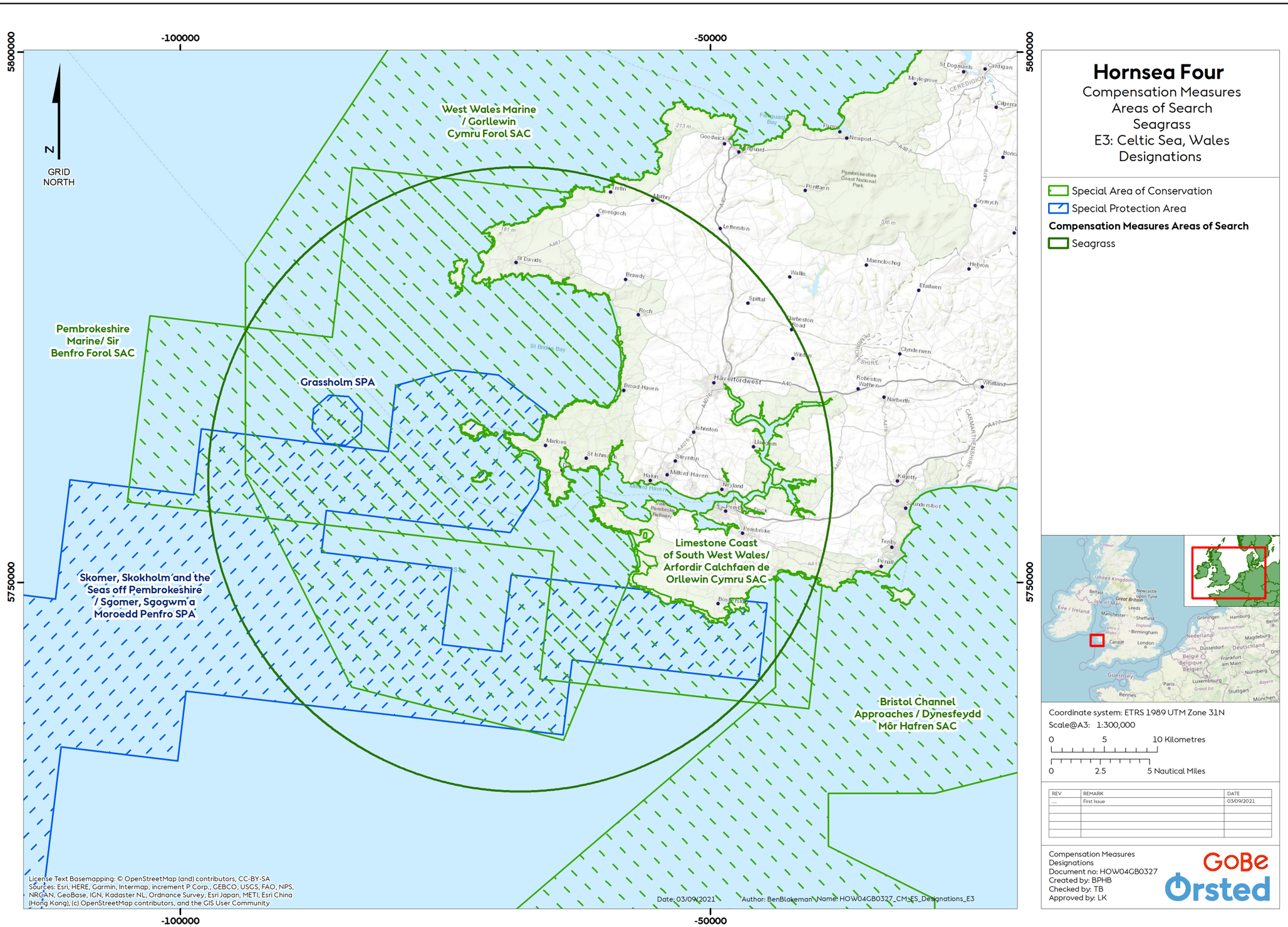


Figure 54: Resilience Measures Areas of Search Seagrass E3: Celtic Sea, Wales Shipping and Navigation.



Hornsea Four

Compensation Measures
Areas of Search
Seagrass
E3: Celtic Sea, Wales
Designations

- Special Area of Conservation
- Special Protection Area

Compensation Measures Areas of Search

- Seagrass

Coordinate system: ETRS 1989 UTM Zone 31N
Scale@A3: 1:300,000

0 5 10 Kilometres

0 2.5 5 Nautical Miles

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Compensation Measures
Designations
Document no: HOW04GB0327
Created by: BPHB
Checked by: TB
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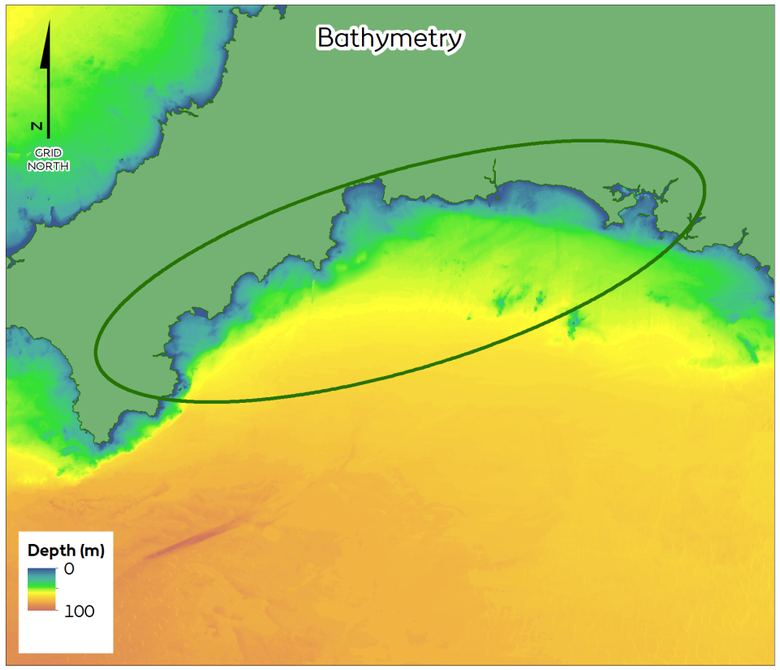
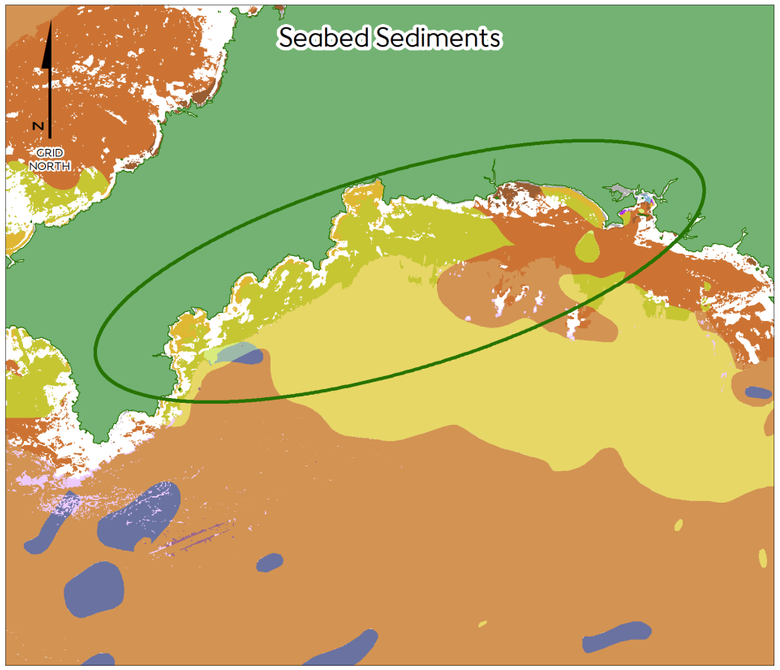
Figure 55: Resilience Measures Areas of Search Seagrass E3: Celtic Sea, Wales Designations.

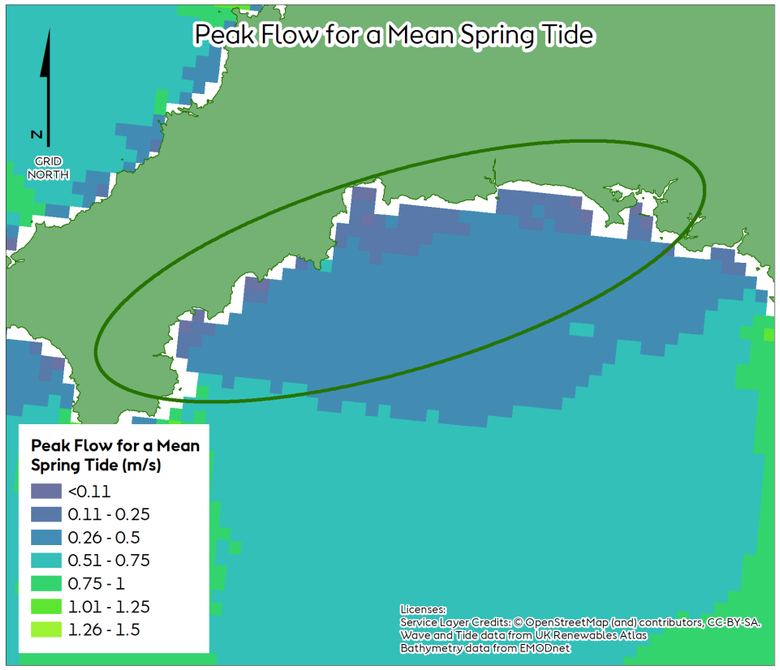
Table 15: Summary of baseline environment in relation to the Area of Search E4 (Plymouth Sound to Helford River) for resilience measure - fish habitat enhancement (seagrass).

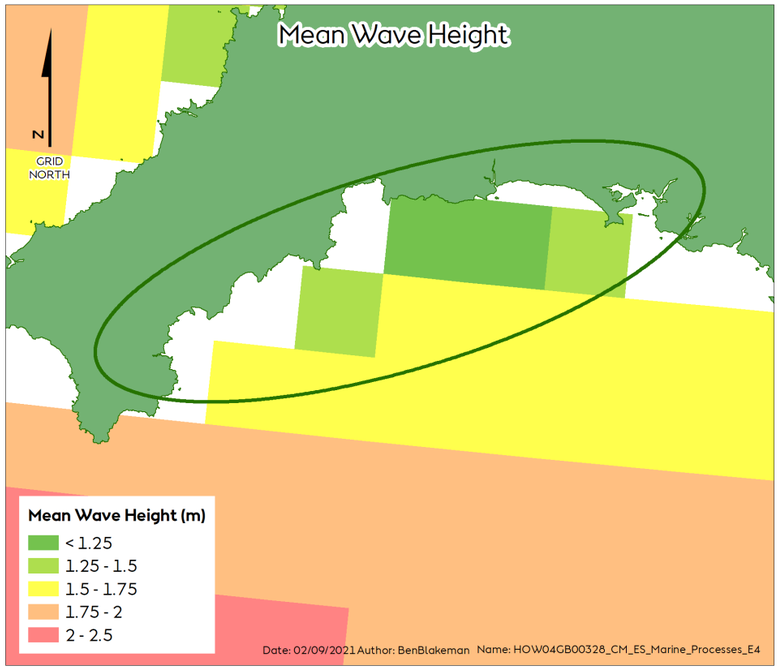
Topic	Summary of Baseline Environment
Marine Geology, Oceanography and Physical Processes	The baseline environment for physical processes is illustrated in **Figure 56**. • The AoS coastline is characterised by erosion resistant rock, absent of glacial deposits, with intermittent raised beaches and head deposits (Futurecoast, 2002). Seabed sediments are typically composed of sands and gravels, with localised areas of bedrock (Futurecoast, 2002). • The AoS is shallow towards the coast, becoming deeper in the south. • Seabed sediments are comprised of mixed coarse and sandy sediments. • Peak spring tidal currents are of the order of 0.26 to 0.5 m/s, with flows exceeding 1.0 m/s in localised areas, for example around headlands (Royal Haskoning, 2011; ABPmer et al., 2011). The mean spring tidal range for the AoS is between 4.01 and 5.00 m (ABPmer et al., 2011). Exposed to waves originating from the North Atlantic and English Channel, the wave regime is dominated by swell waves with a contribution also made by wind waves (DECC, 2016b; Halcrow, 2010; Royal Haskoning, 2011.
Benthic and Intertidal Ecology	The baseline environment for benthic ecology is illustrated in **Figure 57.** • Given the size of the AoS, a large species diversity is present and the abundances vary. Within the Helford Estuary, the lower shores show a high abundance of crustaceans, molluscs, sponges and sea squirts while the upper shores are dominated by limpets, barnacles and many common rockpool species. • The benthic environment in this region is characterised by a wide range of habitat types with deep circalittoral sand, circalittoral fine sand or circalittoral muddy sand, circalittoral coarse sediment, and deep circalittoral coarse sediment being the most common throughout the AoS (EMODnet, 2021). • Seabed habitats in the AoS are mainly sands and mixed sediments, with some outcrops of rock and biogenic reef. • Numerous designated sites are present within the AoS, including the Plymouth Sound and Estuaries SAC.
Fish and Shellfish Ecology	The baseline environment for fish and shellfish ecology is illustrated in **Figure 58**. • The AoS overlaps with spawning and nursery grounds for species including cod, whiting, mackerel, cod, plaice, sole and sandeel (high intensity). • The AoS also includes a herring spawning ground.
Marine Mammals	The baseline environment for marine mammals is illustrated in **Figure 59** (for the species where data are available). • The two identified cetacean species known to regularly occur in this AoS are harbour porpoise (*Phocoena phocoena*) and minke whale (*Balaenoptera acutorostrata*). Additionally there are many sightings of unidentified cetacean species which could potentially be common dolphin (*Delphinus delphis*) or striped dolphin (*Stenella coeruleoalba*) (Hammond et al. 2017). • There is one noted grey seal haul out within the Southern England area, on the Eastern side of Start Bay/ the South Hams (SCOS, 2020).
Offshore and Intertidal Ornithology	The baseline environment for offshore ornithology is illustrated in **Figure 60**. • Within the AoS there are two SPAs with offshore ornithology designated features, the Tamar Estuaries Complex SPA and the Falmouth Bay to St Austell Bay SPA. The Tamar Estuaries Complex SPA is designated for little egret (*Egretta garzetta*) and avocet (*Recurvirostra avosetta*) (JNCC, 2015e). The Falmouth Bay to St Austell Bay SPA is designated for black-throated loon (*Gavia arctica*), common loon (*Gavia immer*), and the horned grebe (*Podiceps auratus*) (JNCC, 2017a).

Topic	Summary of Baseline Environment
Commercial Fisheries	The baseline environment for commercial fisheries is illustrated in **Figure 61**. • Across the South Coast of England (region including the AoS), the Apparent Fishing Effort ranges from 0 to >1,000 hours/ 120 km^2 (Global Fishing Watch, 2021). This area contains spawning and nursery grounds for the following commercial species: Cod (*Gadus*), Whiting (*Merlangius merlangus*), Plaice (*Pleuronectes platessa*), Lemon Sole (*Microstomus kitt*), Sole (*Solea solea*) and Sandeel (*Ammodytes tobianus*). • This region also contains spawning grounds for Herring (*Clupea harengus*) and nursery areas for Mackerel (*Scomber*) (Cefas, 2021). • Fishing activity is focused on dradging and otter trawling. Potting ind trapping also occurs coastally.
Shipping and Navigation	The baseline environment for shipping and navigation is illustrated in **Figure 62**. • The vessel density in the AoS varies from 1 to >222,000 route(s)/0.15 km^2/ year. • The majority of vessels occur within Plymouth Sound and the Fal Estuary. Additionally there are a comparatively high number of vessels within the Fowey Estuary. Between the two ends of the AoS there are several small lanes for vessel traffic, ranging at around 5 routes/ 0.15 km^2/ year (Marine Traffic, 2021).
Marine Archaeology	The baseline environment for marine archaeology is illustrated in **Figure 62**. • Within the AoS, there are many different types of archaeological features including both ship and aircraft wrecks.









Hornsea Four

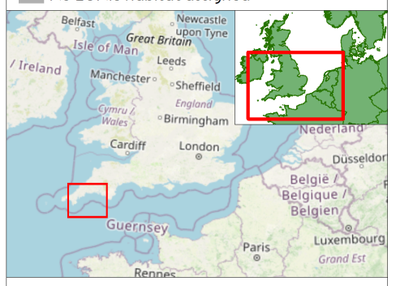
Compensation Measures
Areas of Search
Seagrass
E4: Plymouth Sound to Helford River, Cornwall
Marine Processes

Compensation Measures Areas of Search

Seagrass

EUNIS Habitats (UKSeaMap 2018)

- A4.12: Sponge communities on deep circalittoral rock
- A4.27: Faunal communities on deep moderate energy circalittoral rock
- A4.33: Faunal communities on deep low energy circalittoral rock
- A5.13: Infralittoral coarse sediment
- A5.14: Circalittoral coarse sediment
- A5.15: Deep circalittoral coarse sediment
- A5.23 or A5.24: Infralittoral fine sand or infralittoral muddy sand
- A5.25 or A5.26: Circalittoral fine sand or circalittoral muddy sand
- A5.27: Deep circalittoral sand
- A5.33: Infralittoral sandy mud
- A5.35: Circalittoral sandy mud
- A5.37: Deep circalittoral mud
- A5.43: Infralittoral mixed sediments
- A5.44: Circalittoral mixed sediments
- A5.45: Deep circalittoral mixed sediments
- No EUNIS habitat assigned



Coordinate system: ETRS 1989 UTM Zone 31N

0 20 40 Kilometres

0 10 20 Nautical Miles

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Compensation Measures
Marine Processes
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Approved by: LK

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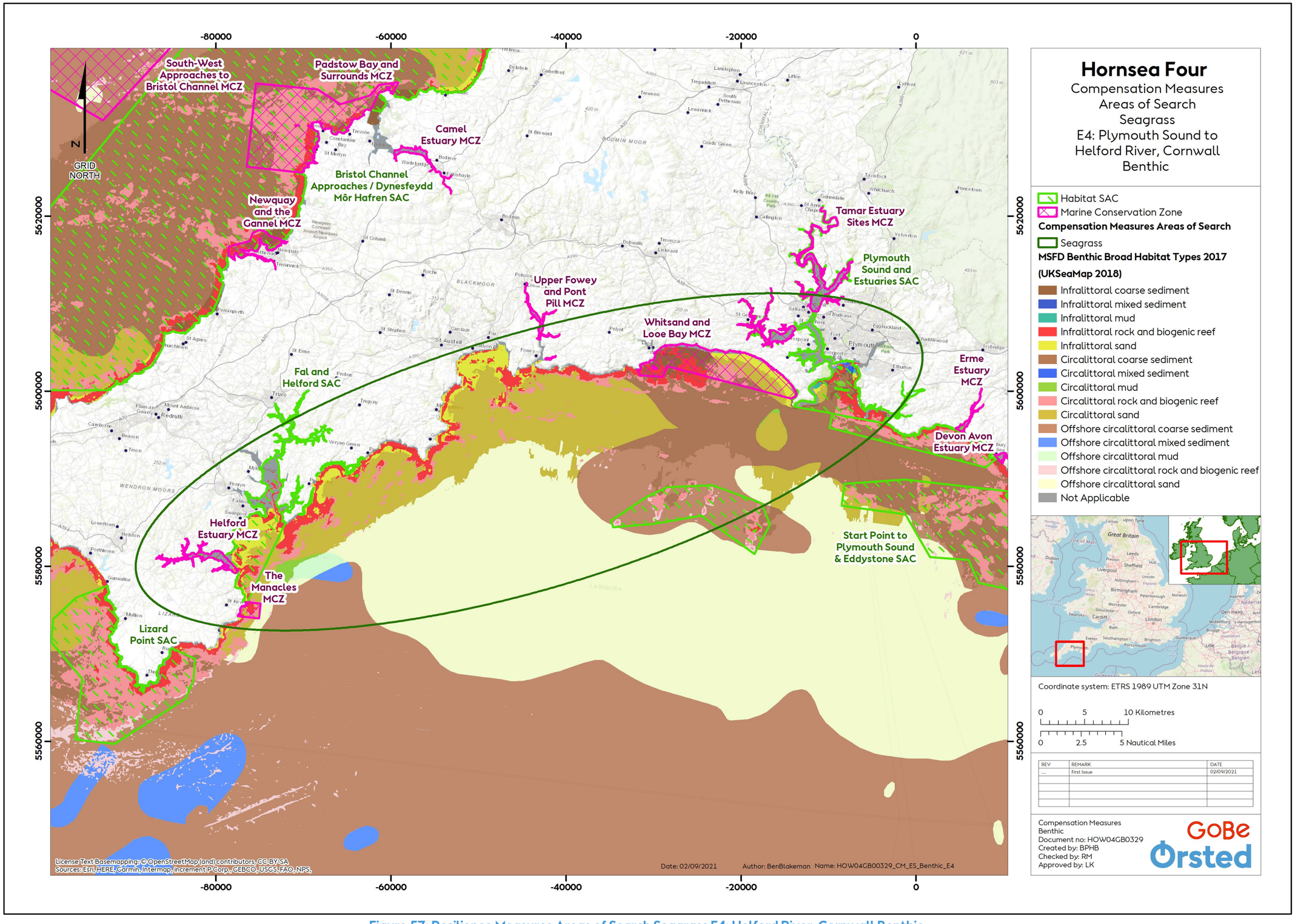
Figure 56: Resilience Measures Areas of Search Seagrass E4: Helford River, Cornwall Marine Processes.



Hornsea Four

Compensation Measures
Areas of Search
Seagrass
E4: Plymouth Sound to Helford River, Cornwall Benthic

Habitat SAC
Marine Conservation Zone

Compensation Measures Areas of Search

Seagrass

MSFD Benthic Broad Habitat Types 2017 (UKSeaMap 2018)

- Infralittoral coarse sediment
- Infralittoral mixed sediment
- Infralittoral mud
- Infralittoral rock and biogenic reef
- Infralittoral sand
- Circalittoral coarse sediment
- Circalittoral mixed sediment
- Circalittoral mud
- Circalittoral rock and biogenic reef
- Circalittoral sand
- Offshore circalittoral coarse sediment
- Offshore circalittoral mixed sediment
- Offshore circalittoral mud
- Offshore circalittoral rock and biogenic reef
- Offshore circalittoral sand
- Not Applicable

Coordinate system: ETRS 1989 UTM Zone 31N

0 5 10 Kilometres
0 2.5 5 Nautical Miles

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Compensation Measures
Benthic
Document no: HOW04GB0329
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Figure 57: Resilience Measures Areas of Search Seagrass E4: Helford River, Cornwall Benthic.

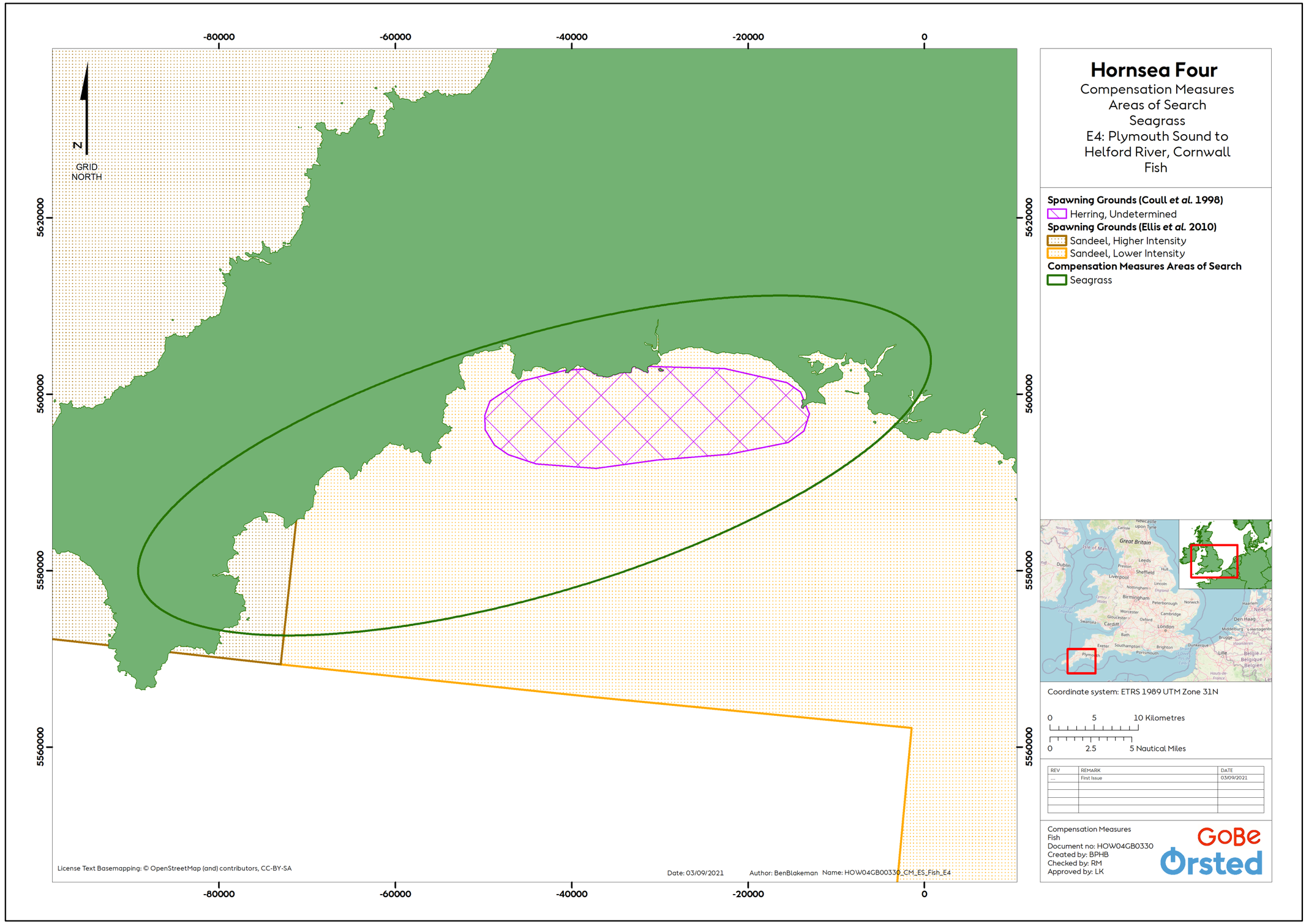
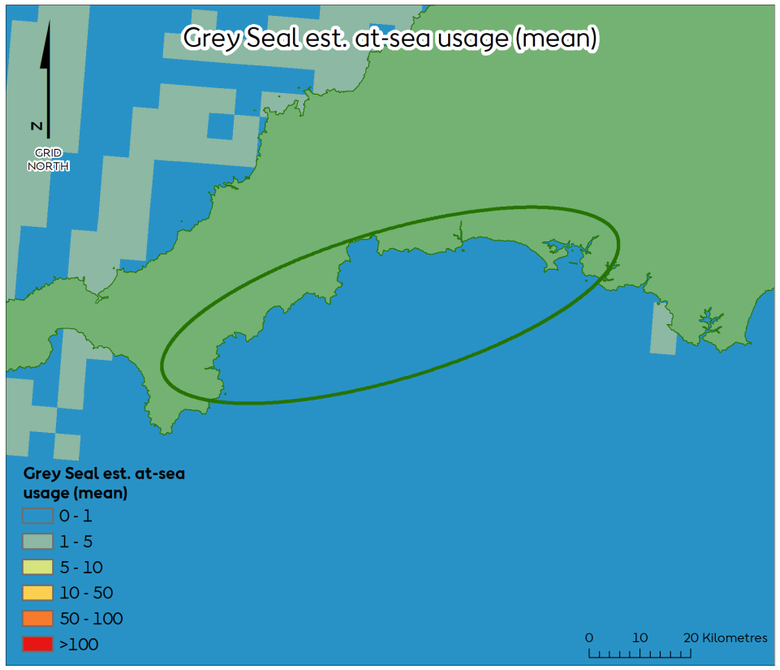
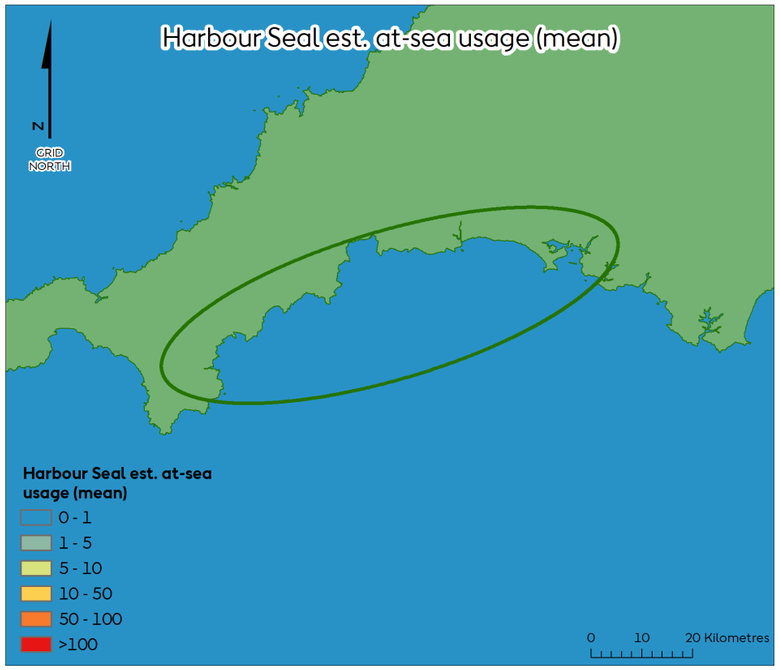
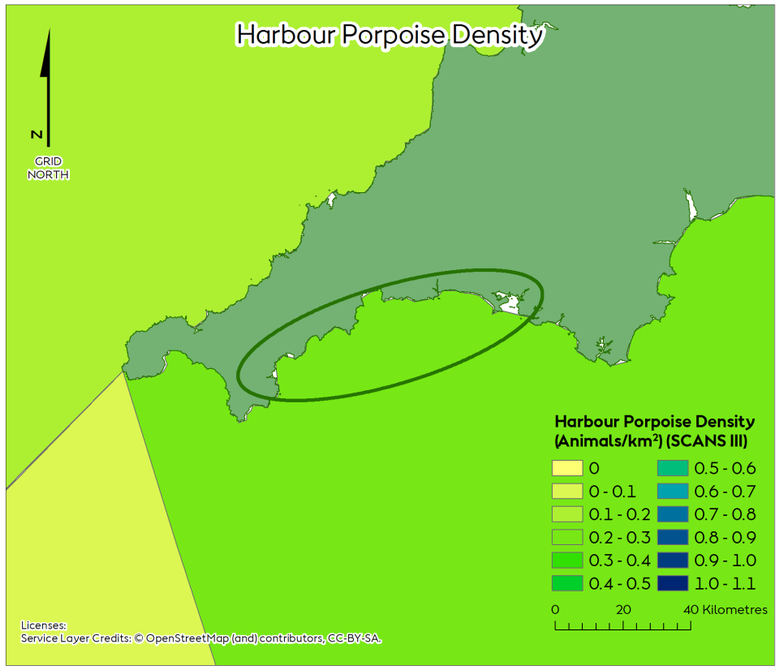
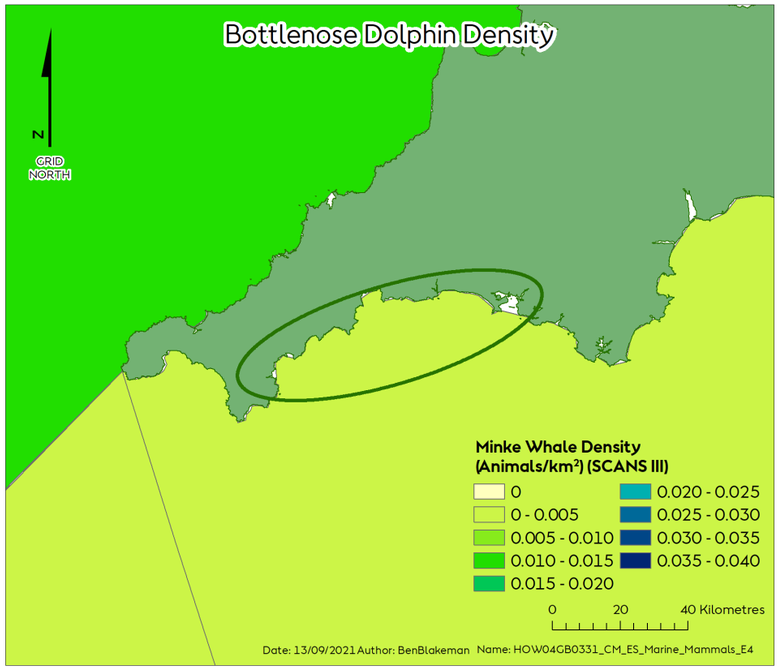


Figure 58: Resilience Measures Areas of Search Seagrass E4: Helford River, Cornwall Fish.









Hornsea Four

Compensation Measures
Areas of Search
Seagrass
E4: Plymouth Sound to Helford River, Cornwall
Marine Mammals

Compensation Measures Areas of Search

Seagrass

Estimated at-sea Distribution of Grey and Harbour Seals maps data from Sea Mammal Research Unit (SMRU) and Marine Scotland, 2017

Coordinate system: ETRS 1989 UTM Zone 31N

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Compensation Measures
Marine Mammals
Document no: HOW04GB0331
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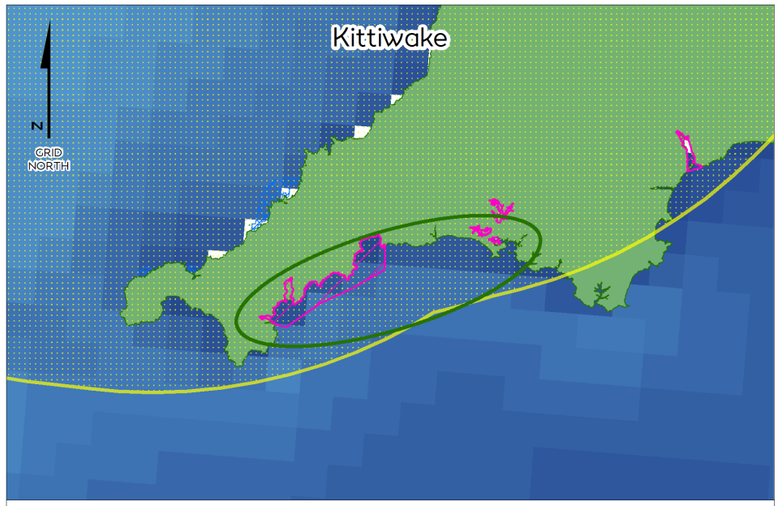
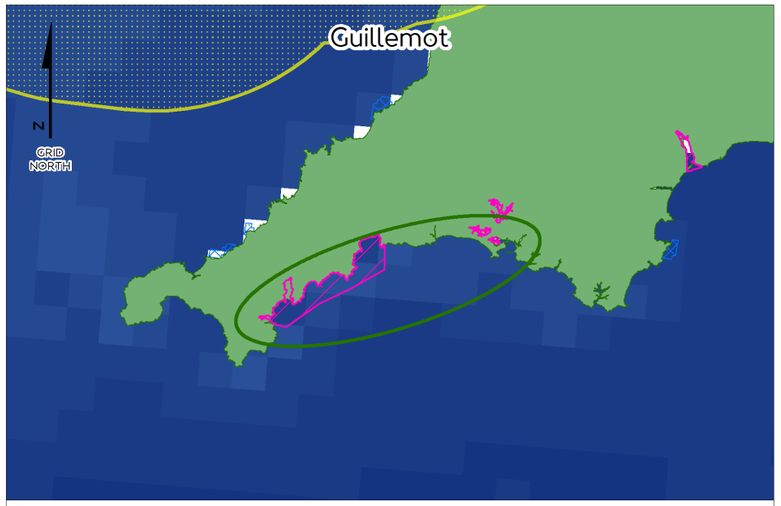
Figure 59: Resilience Measures Areas of Search Seagrass E4: Helford River, Cornwall Marine Mammals.



Kittiwake Hotspots (Cleasby et al, 2020)
- Maximum Curvature
- Statistically Significant Getis-Ord hotspot
- Top 5% Getis-Ord hotspot
- Top 1% Getis-Ord hotspot

Kittiwake (Waggit et al., 2019) Density
High : 2.07
Low : 0

Hotspots identified at the UK-scale for Black-legged Kittiwakes using Getis-Ord hotspot analysis with a neighbourhood size of d = 10 km based on FPT analysis or Maximum Curvature. Getis-Ord hotspots defined as all cells with the top 1% of calculated Gi* scores; all cells within the top 5% of Gi* score; all cells in which Gi* scores were deemed statistically significant at the < 0.01 level.



Guillemot Hotspots (Cleasby et al, 2020)
- Maximum Curvature
- Statistically Significant Getis-Ord hotspot - d = 9km
- Top 5% Getis-Ord hotspot - d = 9km
- Top 1% Getis-Ord hotspot - d = 9km

Guillemot (Waggit et al., 2019) Density
High : 6.25
Low : 0

Hotspots identified at the UK-scale for Common Guillemots using Getis-Ord hotspot analysis with a neighbourhood size of d = 9 km based on FPT analysis or Maximum Curvature.

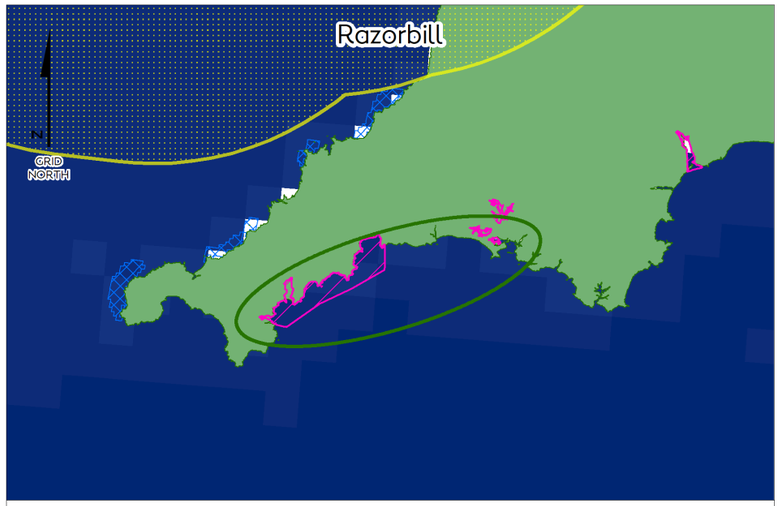
Hornsea Four

Compensation Measures
Areas of Search
Seagrass
E4: Plymouth Sound to Helford River, Cornwall
Ornithology

Special Protection Area (SPA) with Marine Components

Mean-Max Foraging Range (Woodward 2019)
- Common Guillemot - 73.2km Buffer
- Gannet - 315.2km Buffer
- Kittiwake - 156.1km Buffer
- Razorbill - 88.7km Buffer

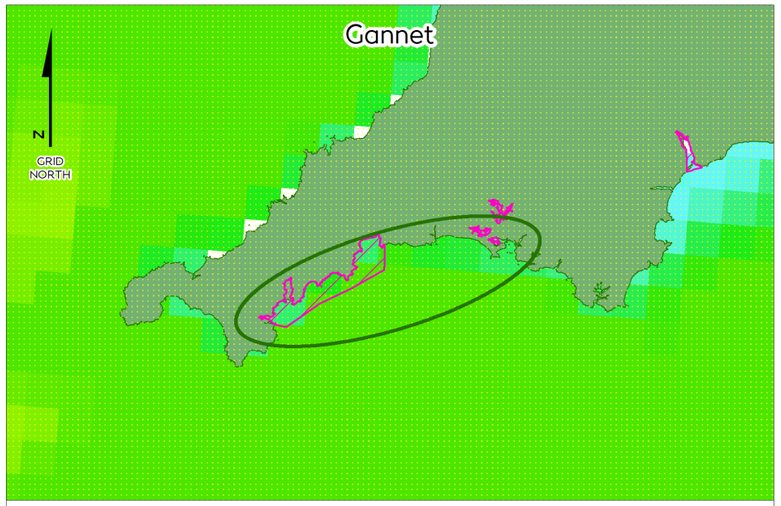
Compensation Measures Areas of Search
- Seagrass



Razorbill Hotspots (Cleasby et al, 2020)
- Maximum Curvature
- Statistically Significant Getis-Ord hotspot - d = 7km
- Top 5% Getis-Ord hotspot - d = 7km
- Top 1% Getis-Ord hotspot - d = 7km

Razorbill (Waggit et al., 2019) Density
High : 3
Low : 0

Hotspots identified at the UK-scale for Razorbills using Getis-Ord hotspot analysis with a neighbourhood size of d = 7 km based on FPT analysis or Maximum Curvature.



Gannet (Waggit et al., 2019) Density
High : 1.65
Low : 0

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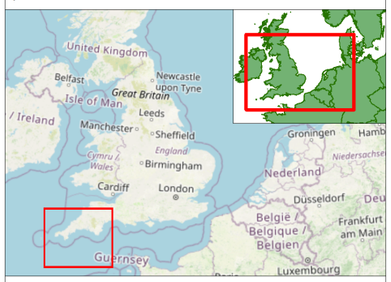
Date: 03/09/2021 Author: BenBlakeman Name: HOW04GB00332_CM_ES_Ornithology_E4

Waggitt et al 2019 densities data. Spatial variation in predicted densities (animals per km) of seabird species in July in the North-East Atlantic. Values are provided at 10km resolution.



Coordinate system: ETRS 1989 UTM Zone 31N

0 25 50 Kilometres
0 10 20 Nautical Miles

REV	REMARK	DATE
---	First Issue	03/09/2021

Compensation Measures
Ornithology
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Checked by: TB
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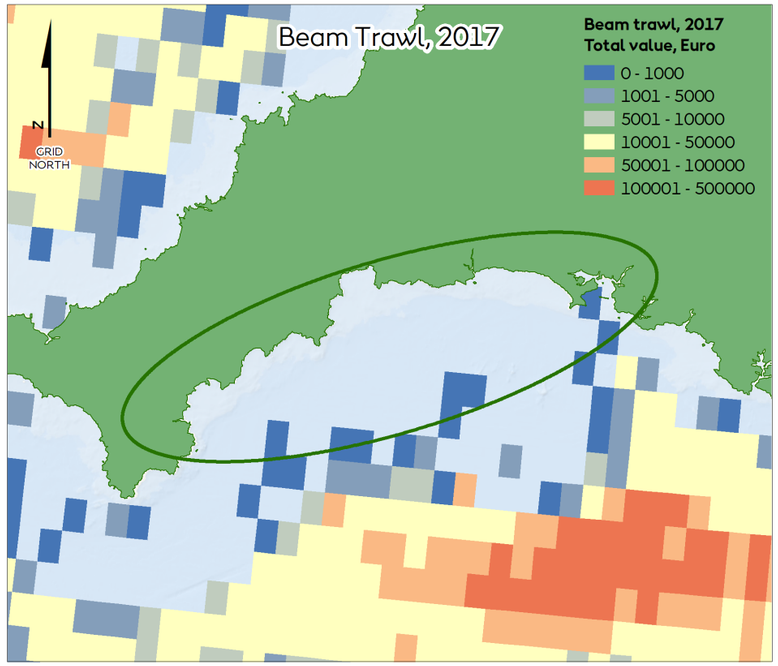
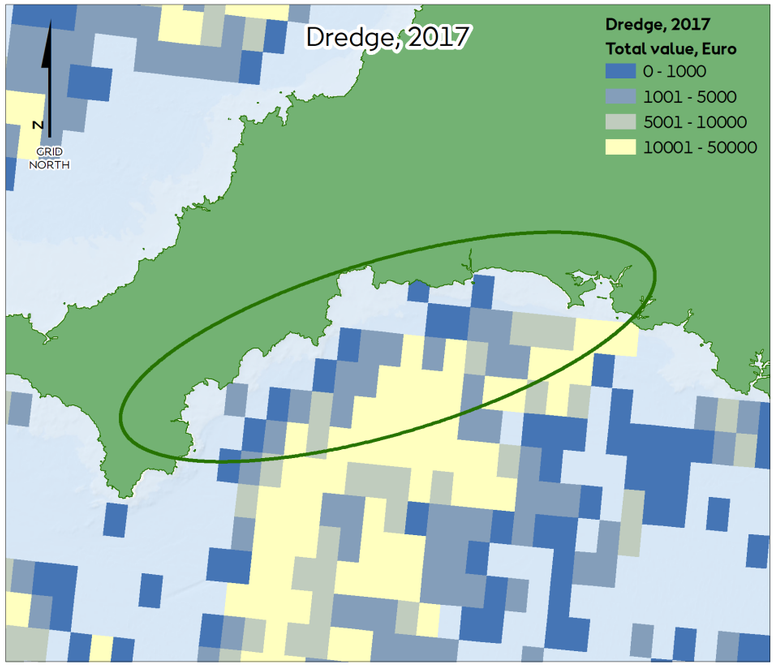
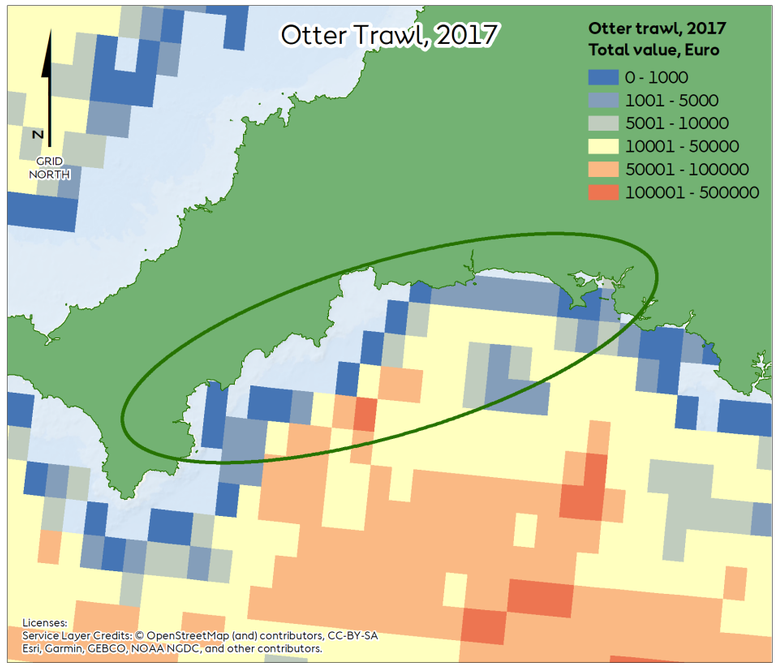
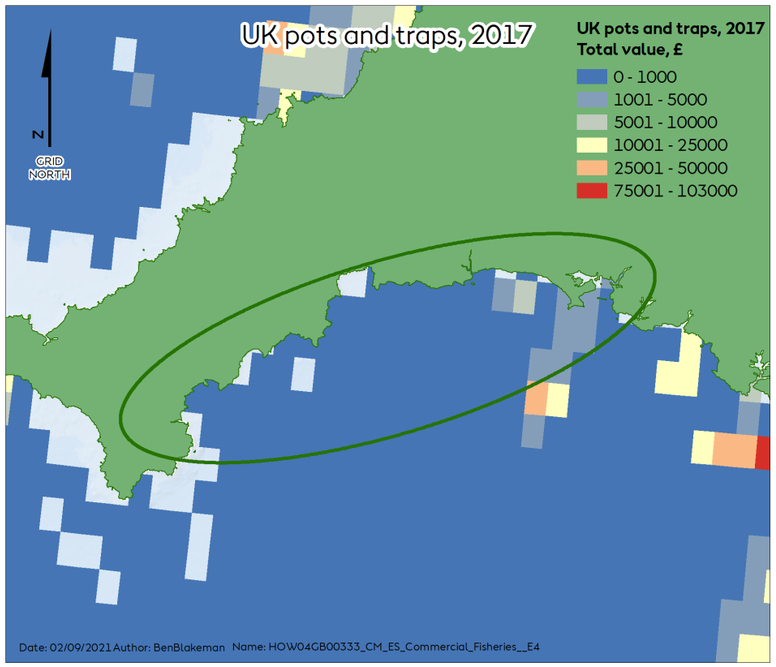
Figure 60: Resilience Measures Areas of Search Seagrass E4: Helford River, Cornwall Ornithology.



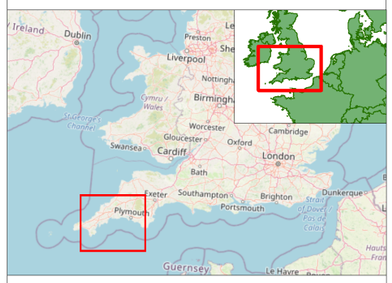






Hornsea Four
Compensation Measures
Areas of Search
Seagrass
E4: Plymouth Sound to
Helford River, Cornwall
Commercial Fisheries

Compensation Measures Areas of Search
Seagrass



Coordinate system: ETRS 1989 UTM Zone 31N

0 20 40 Kilometres
0 10 20 Nautical Miles

REV	REMARK	DATE
---	First Issue	02/09/2021

Compensation Measures
Commercial Fisheries
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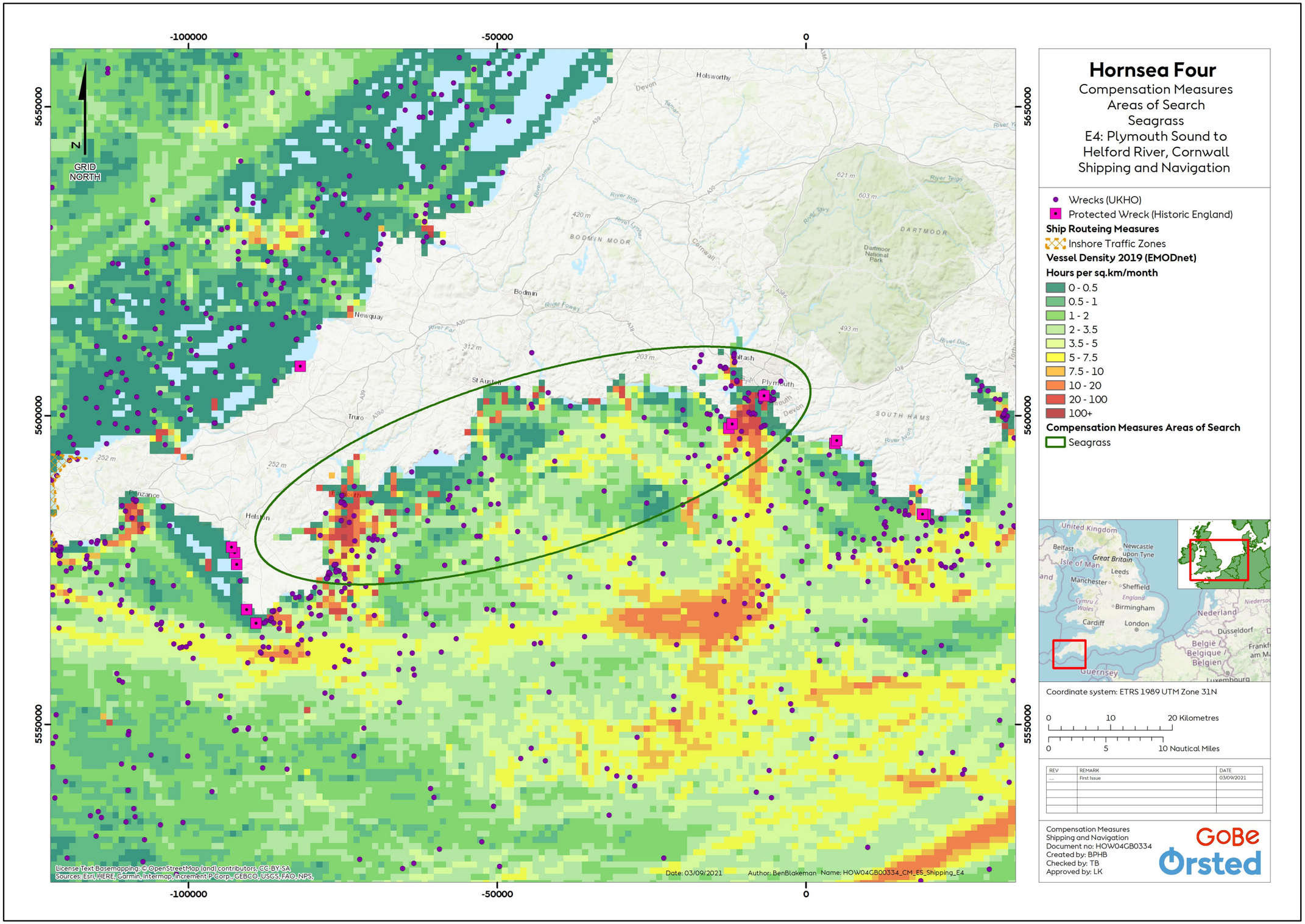
Figure 61: Resilience Measures Areas of Search Seagrass E4: Helford River, Cornwall Commercial Fisheries.



Hornsea Four

Compensation Measures
Areas of Search
Seagrass
E4: Plymouth Sound to Helford River, Cornwall
Shipping and Navigation

- Wrecks (UKHO)
- Protected Wreck (Historic England)

Ship Routeing Measures

- Inshore Traffic Zones

Vessel Density 2019 (EMODnet)

Hours per sq.km/month

- 0 - 0.5
- 0.5 - 1
- 1 - 2
- 2 - 3.5
- 3.5 - 5
- 5 - 7.5
- 7.5 - 10
- 10 - 20
- 20 - 100
- 100+

Compensation Measures Areas of Search

- Seagrass

Coordinate system: ETRS 1989 UTM Zone 31N

0 10 20 Kilometres

0 5 10 Nautical Miles

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Compensation Measures
Shipping and Navigation
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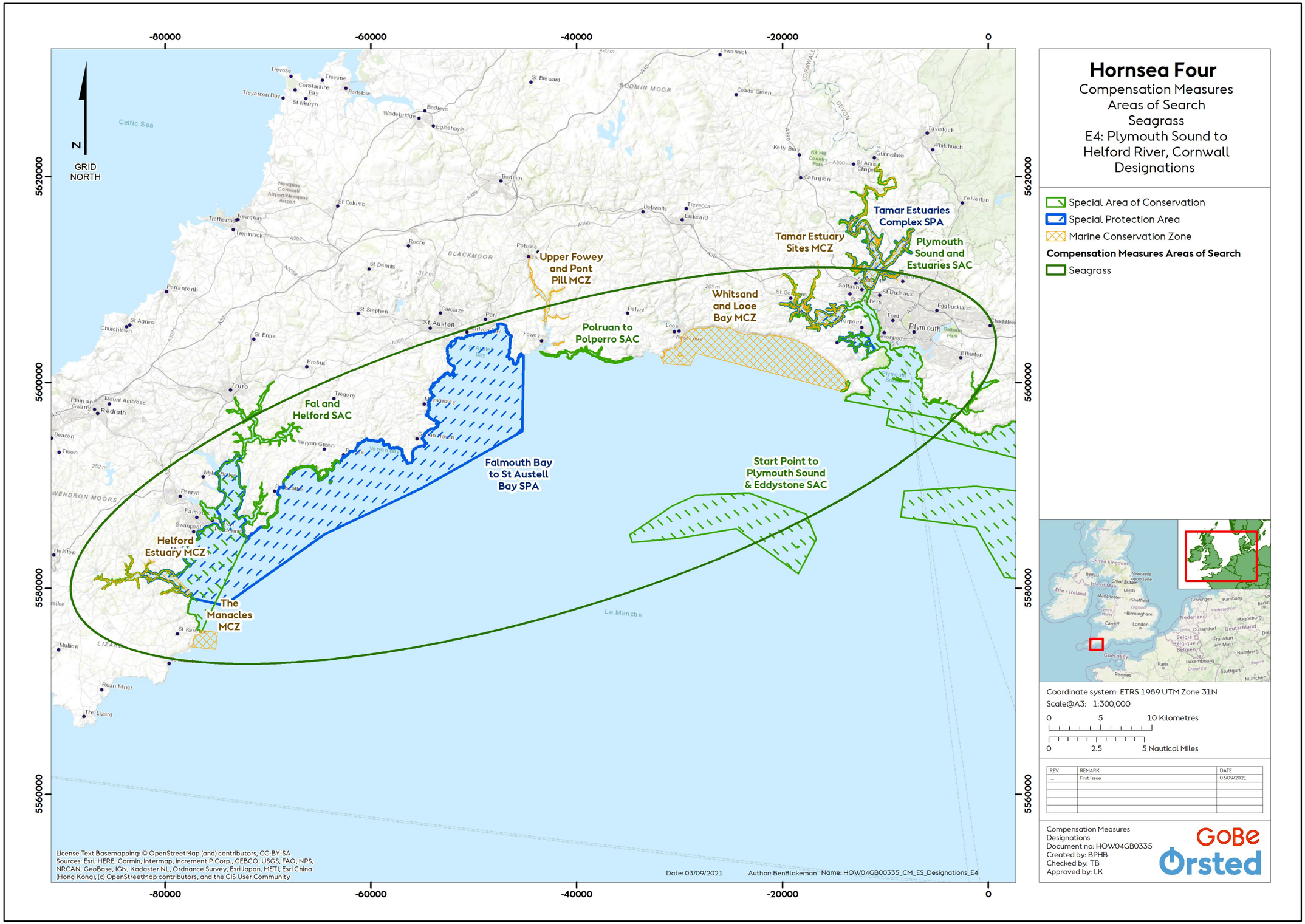
Figure 62: Resilience Measures Areas of Search Seagrass E4: Helford River, Cornwall Shipping and Navigation.



Hornsea Four

Compensation Measures
Areas of Search
Seagrass
E4: Plymouth Sound to Helford River, Cornwall
Designations

- Special Area of Conservation
- Special Protection Area
- Marine Conservation Zone

Compensation Measures Areas of Search

- Seagrass

Coordinate system: ETRS 1989 UTM Zone 31N
Scale@A3: 1:300,000

0 5 10 Kilometres

0 2.5 5 Nautical Miles

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....	First Issue	03/09/2021

Compensation Measures
Designations
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Figure 63: Resilience Measures Areas of Search Seagrass E4: Helford River, Cornwall Designations.