PUKFI Steering Group meeting

19th February 2020

Action 7 "Habitats"

PI's 2.4.1 – 2.4.3

1. **Habitat Modelling**
2. **Cameras**

PI’s 2.4.1, 2.4.2, 2.4.3 : Habitat outcome, management and information

Action 7: Spatial scale, intensity and impact of the fishery on habitats assessed and management measures developed where appropriate.

Aim:
Assess the habitats present in ICES areas VIId & VIIe and their impact to scallop dredging

1

- Calculating the Relative Benthic Status of the habitats using information on sensitive species present.
- Create maps showing habitat sensitivity that can be used to identify areas most at risk to dredging impacts

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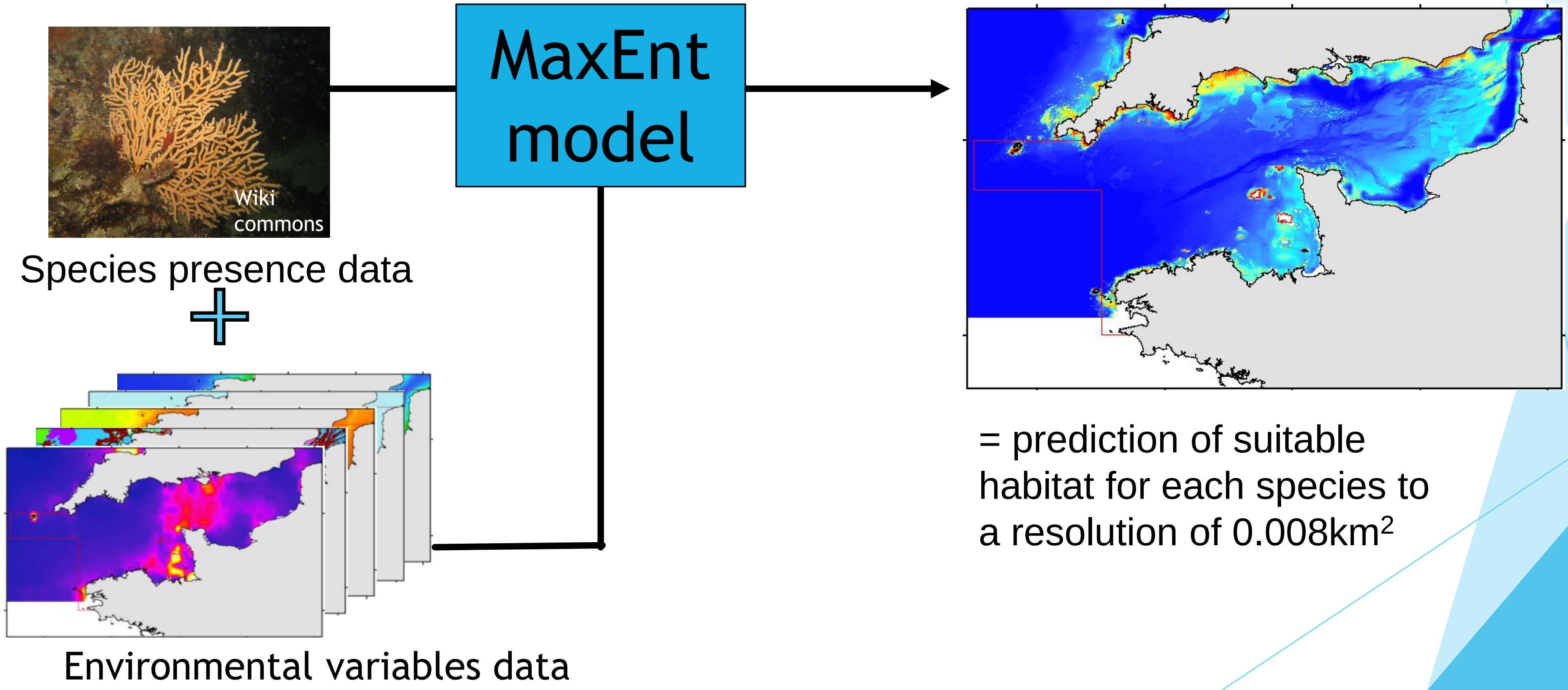
- Create maps showing habitat sensitivity that can be used to identify areas most at risk to dredging impacts

2

- Use a Benthic Impact Tool developed by Bangor University for assessing the habitats

Recap – Habitat Assessments

- **Habitat Suitability modelling (or Species Distribution Models (SDM's) – using MAXENT**
  - Based on the potential distribution of the species of interest
  - May not currently occur in predicted area but has the potential to recover or could have previously been found



= prediction of suitable habitat for each species to a resolution of $0.008km^2$

Habitat Assessments

- **Calculating the Relative Benthic Status of ICES areas VIId & VIIe**

$$\mathrm{RBS} = 1 - \frac{Fishing\ Effort\ (f) \times Depletion\ Rate(d)}{Recovery\ Rate\ (r)}$$

Habitat Assessments

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$$\text{RBS} = 1 - \frac{\boldsymbol{Fishing\ Effort\ (f) \times Depletion\ Rate (d)}}{\boldsymbol{Recovery\ Rate\ (r)}}$$

$f =$ **Fishing effort:** Spatial data where fishing takes place →

- Over lap of the Swept Area Ratio data (CEFAS – Action 8) & habitat suitability outputs where values > 0.5 within area of interest

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d = **Depletion Rate of scallop dredge** →

- Taken from Hiddink et al., 2017
  $d = 0.21$

Habitat Assessments

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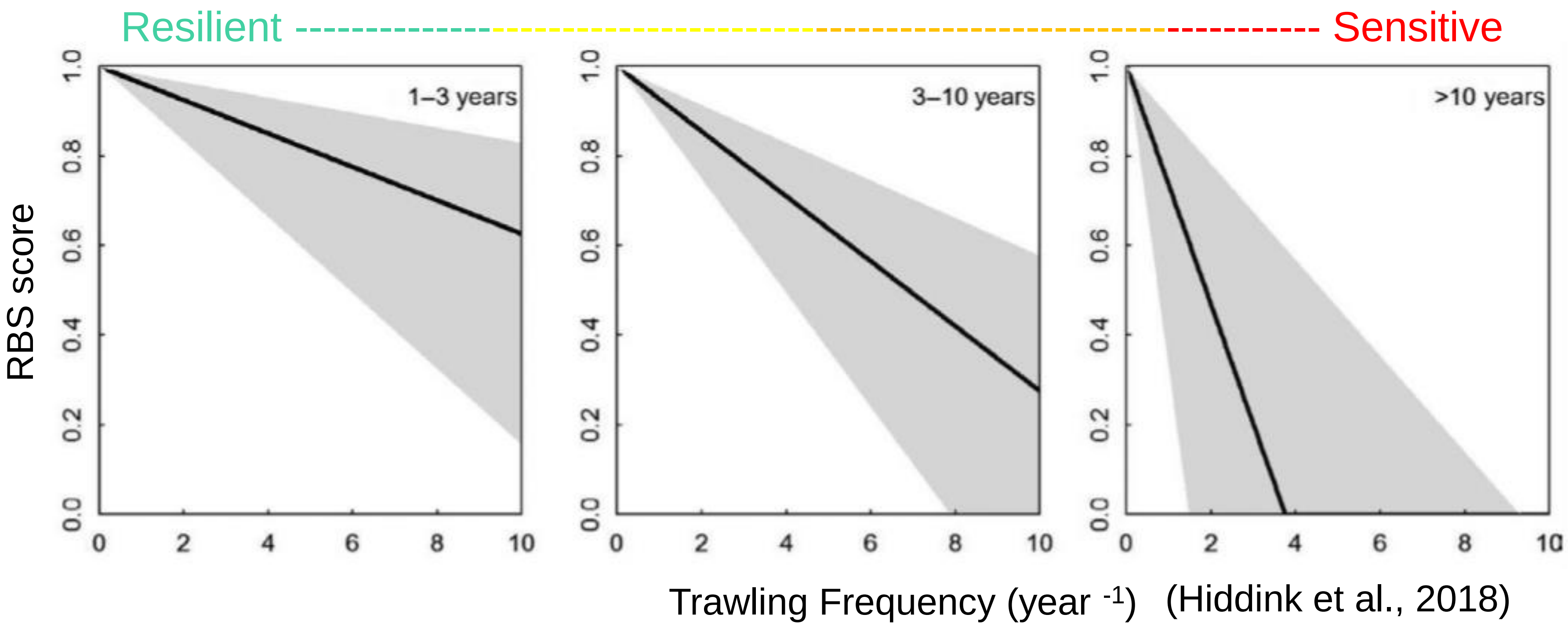
r = **Recovery rates** [calculated from species longevity] →

- $r = 5.31$ / [longevity of species (yrs^{-1})] (Hiddink et al., 2018)

Habitat Assessments

- **How longevity of an animal influences their response to trawling**



(Hiddink et al., 2018)

Habitat Assessments

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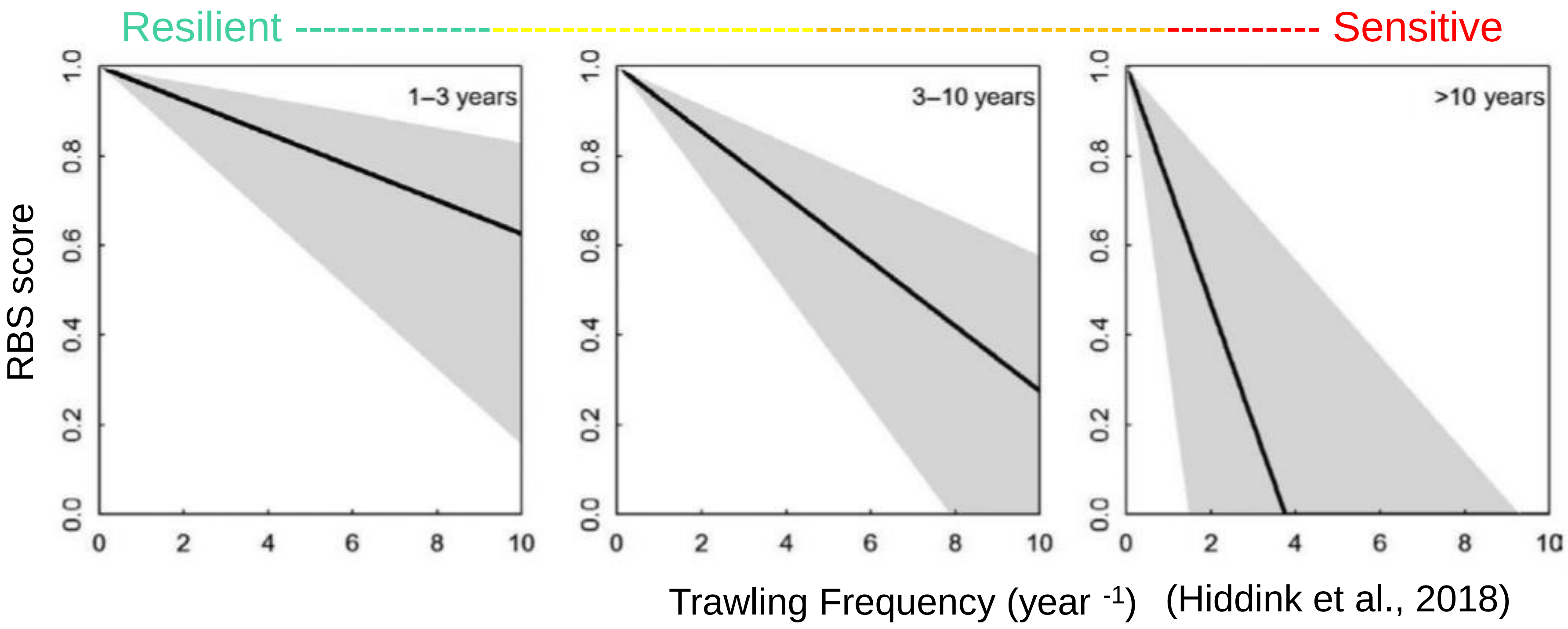

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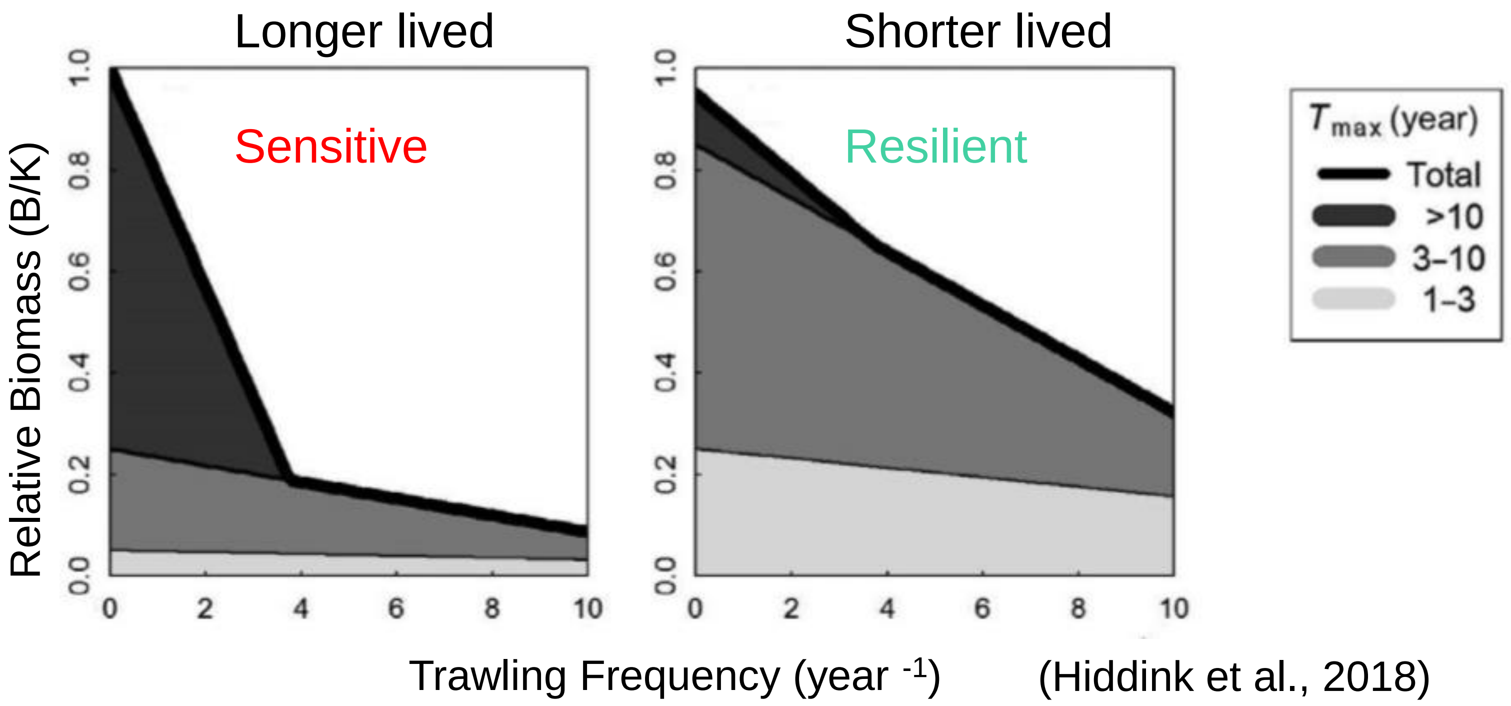


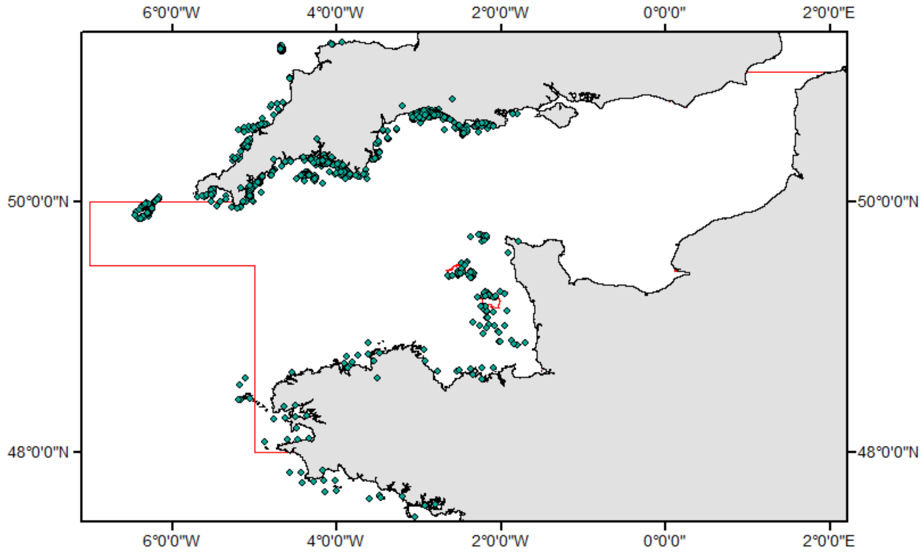
(Hiddink et al., 2018)

- As trawling frequency increases, there is a linear decline in the Relative Benthic Status
- Decline may depend on the longevity distribution within the benthic community

Recap – Habitat Assessments

- **Species distributions for sensitive species present in English Channel ICES areas VIId and VIIe**

data downloaded from the Global Biodiversity Information Facility GBIF (www.gbif.org)



Distribution of *Eunicella verrucosa* (sea fan), in the English Channel and surrounding area

Recap – Habitat Assessments

- **Species distributions for sensitive species present in English Channel ICES areas VIId and VIIe**
- **Longevity for each of the species of interest - used to define recovery (Hiddink et al., 2018)**

Species	Phylum	Longevity (years)
Alcyonidium_diaphanum	Bryozoa	10
Alcyonium_digitatum	Cnidaria	20
Alcyonium_glomeratum	Cnidaria	11
Amphianthus_dohrnii	Cnidaria	100
Arctica_islandica	Mollusca	507
Atrina_fragilis	Mollusca	20
Axinella_dissimilis	Porifera	150
Axinella_infundibuliformis	Porifera	150
Caryophyllia_inornate	Cnidaria	30
Caryophyllia_smithii	Cnidaria	20
Cerianthus_lloydii	Mollusca	20
Cliona_celata	Porifera	11
Eunicella_verrucosa	Mollusca	50
Flustra_foliacea	Bryozoa	10
Haliclona_grant_1835	Porifera	38
Homaxinella_subdola	Porifera	150
Leptopsammia_pruvoti	Cnidaria	25
Lithothamnion_corallioides	Rhodophyta	100
Modiolus_modiolus	Mollusca	100
Ostrea_edulis	Mollusca	10
Pentapora_fascialis	Cnidaria	10
Pentapora_foliacea	Cnidaria	10
Phymatolithon_calcareum	Rhodophyta	100
Sabellaria_spinulosa	Annelida	5
Suberites_carnosus	Porifera	15
Suberites_ficus	Porifera	15
Tethya_aurantium	Porifera	11
Tethya_citrina	Porifera	11
Zostera_marina	Tracheophyta	50

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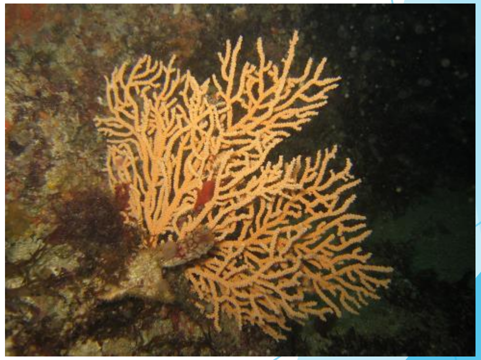

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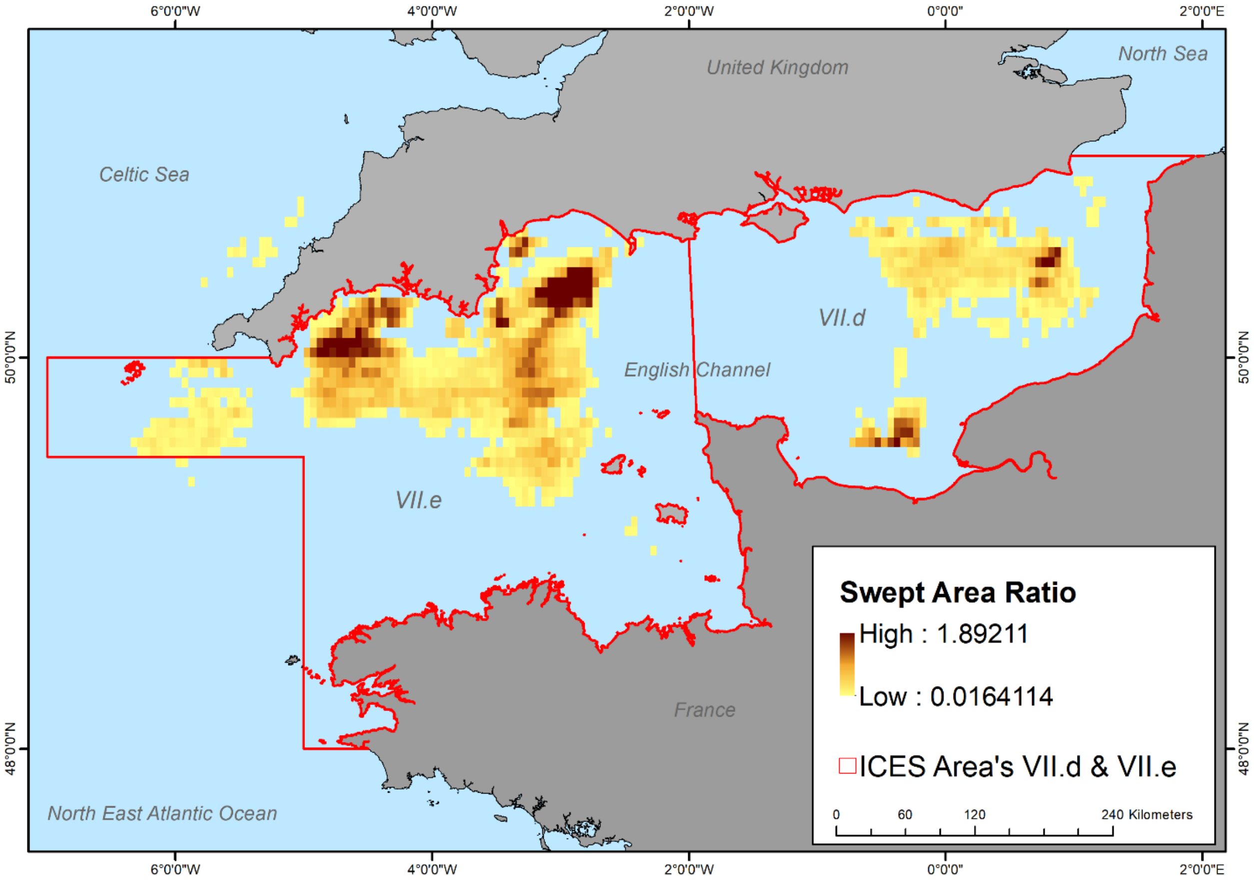
Habitat Assessments

- **Calculating the Relative Benthic Status of ICES areas VIId & VIIe**

- Swept Area Ratio



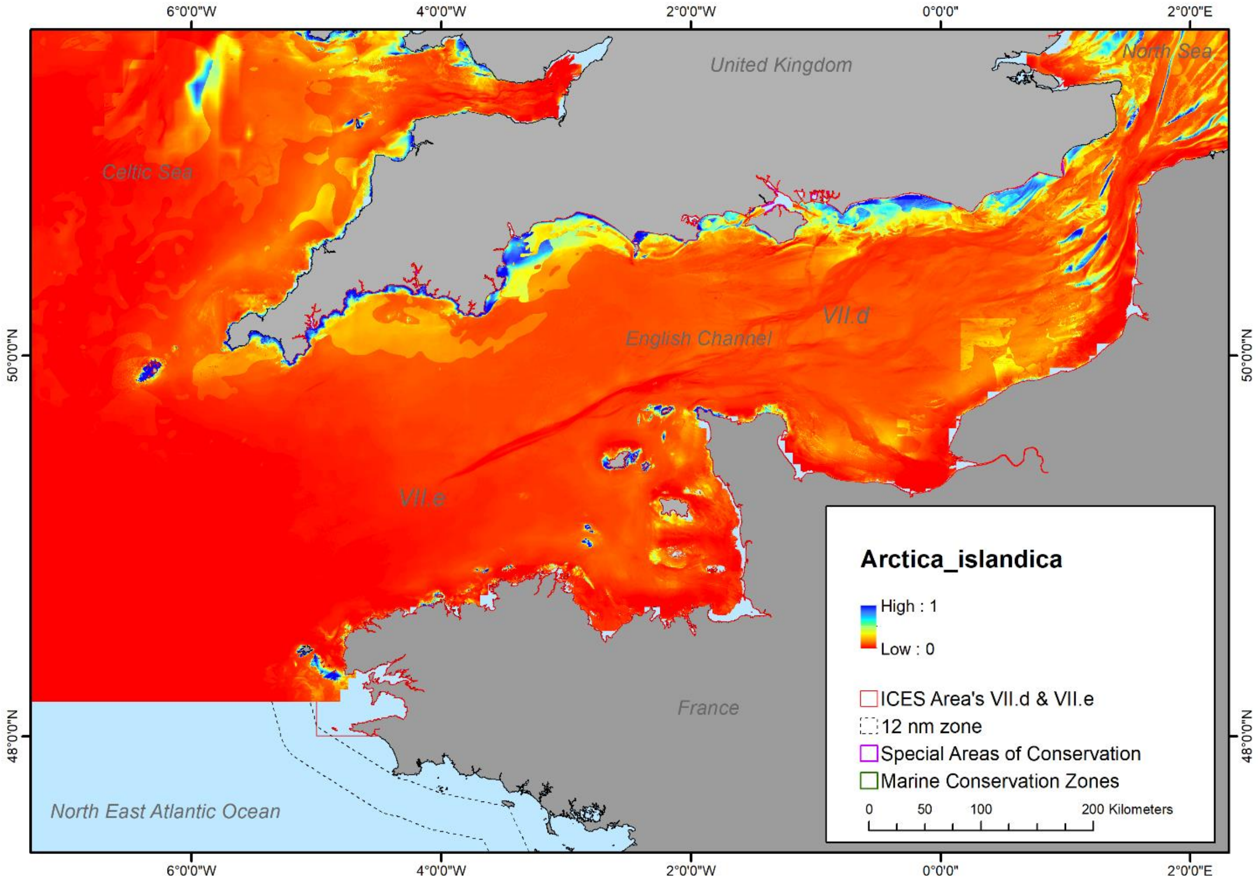
Mean SAR (year $^{-1}$) between 2012 – 2016

Habitat Assessments

- **Calculating the Relative Benthic Status of ICES areas VIId & VIIe**

- Swept Area Ratio

- MAXENT output



Habitat Suitability for *Arctica islandica* (longevity 507 years)

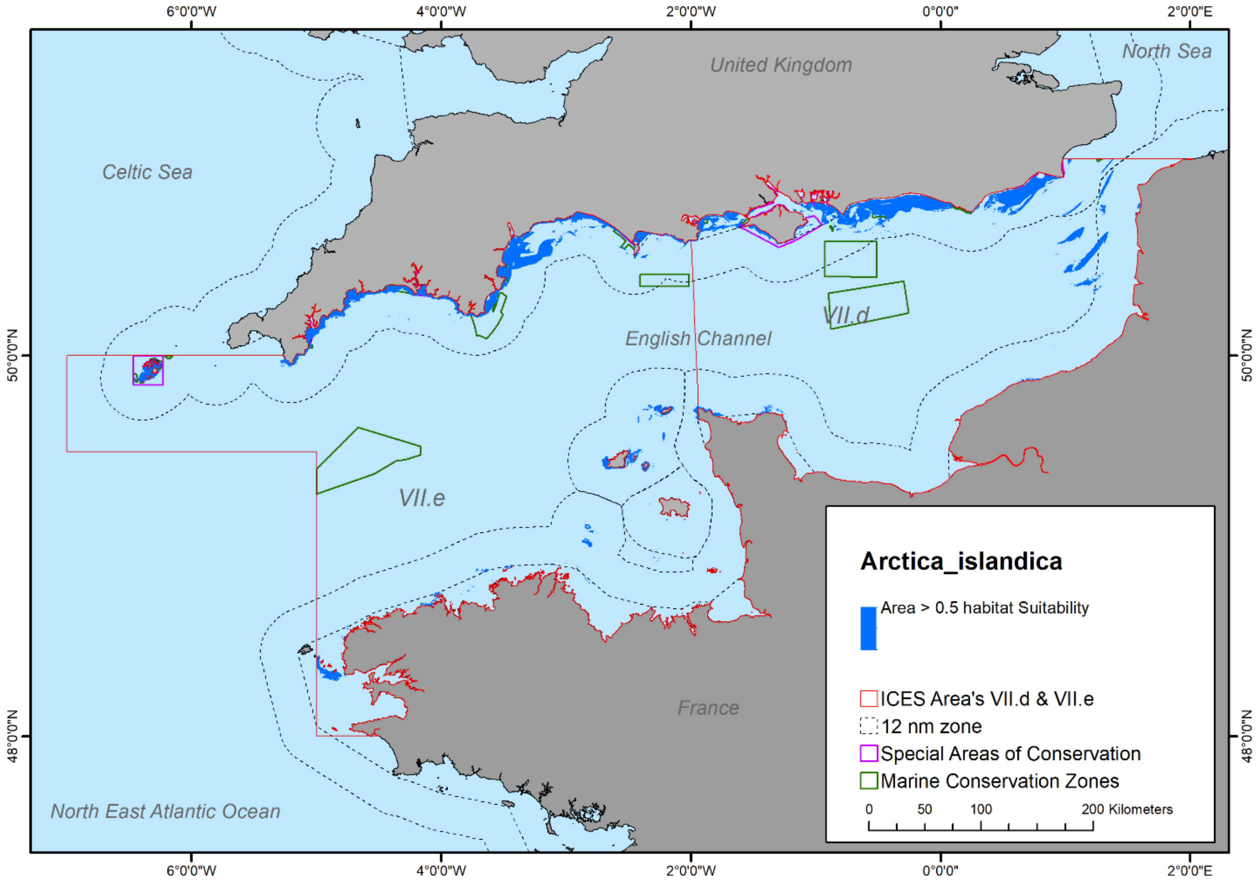
Habitat Assessments

- **Calculating the Relative Benthic Status of ICES areas VIId & VIIe**

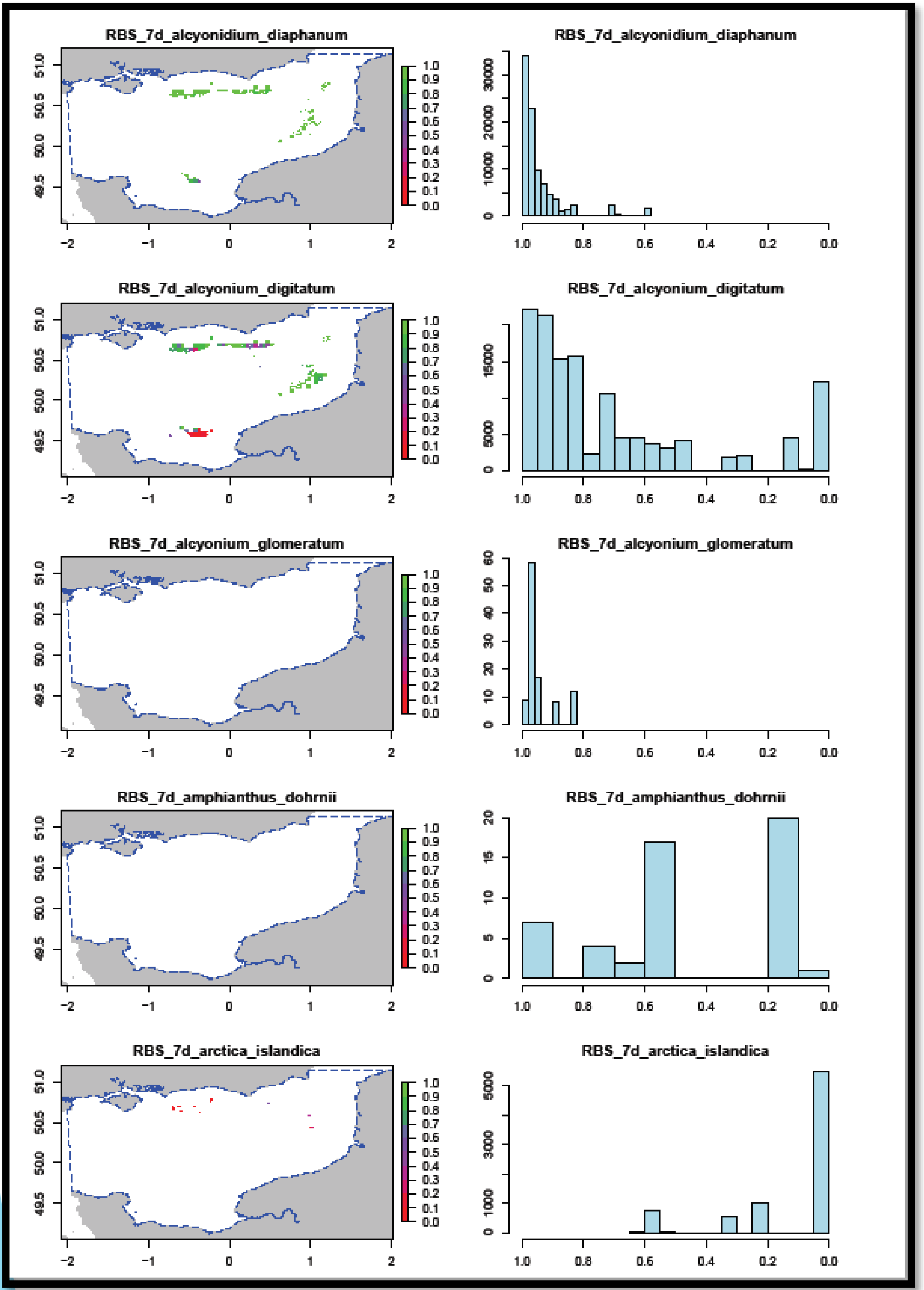
- Swept Area Ratio

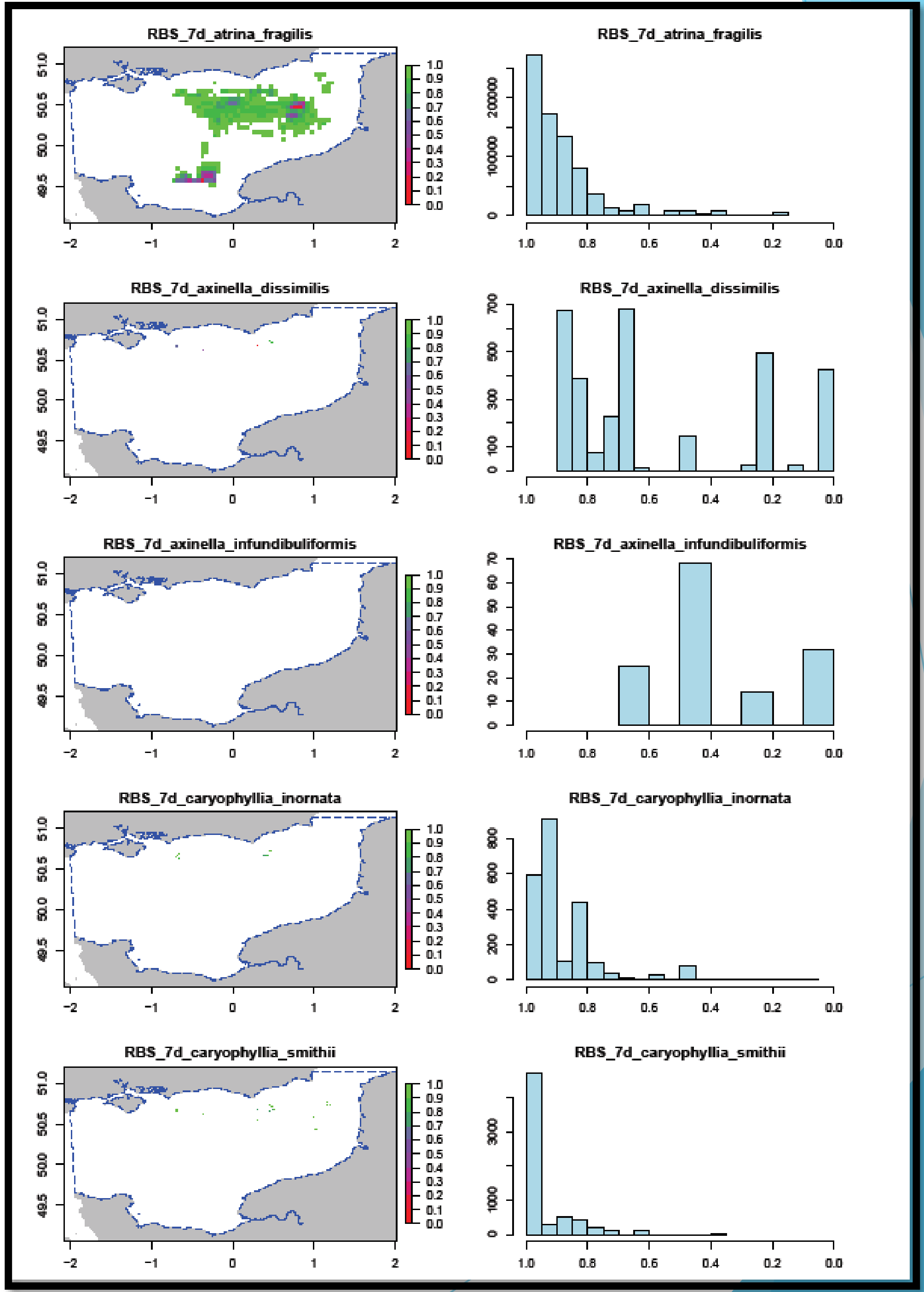
+

- Habitat Suitability great than 0.5



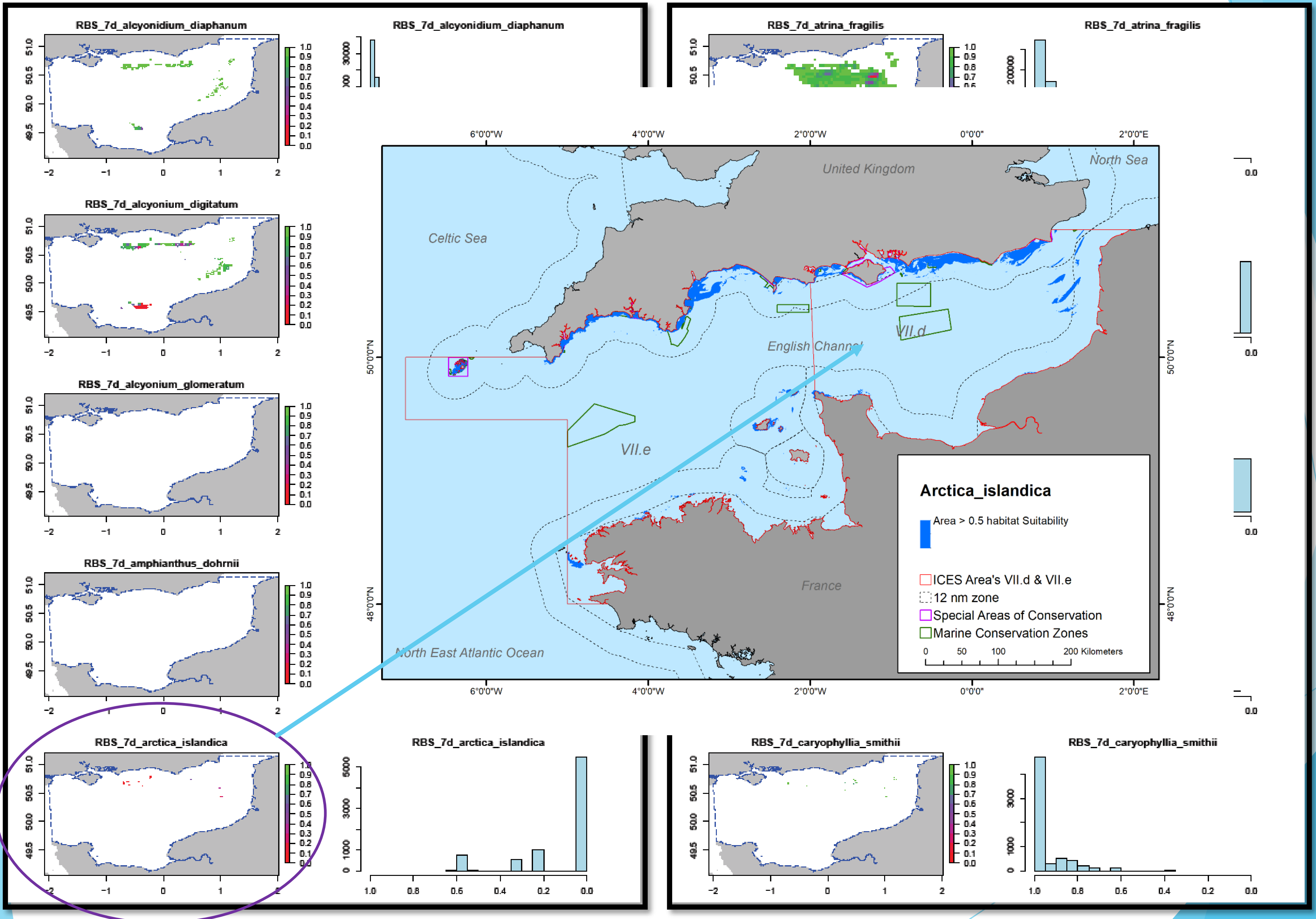
Habitat Suitability of > 0.5 for *Arctica islandica*





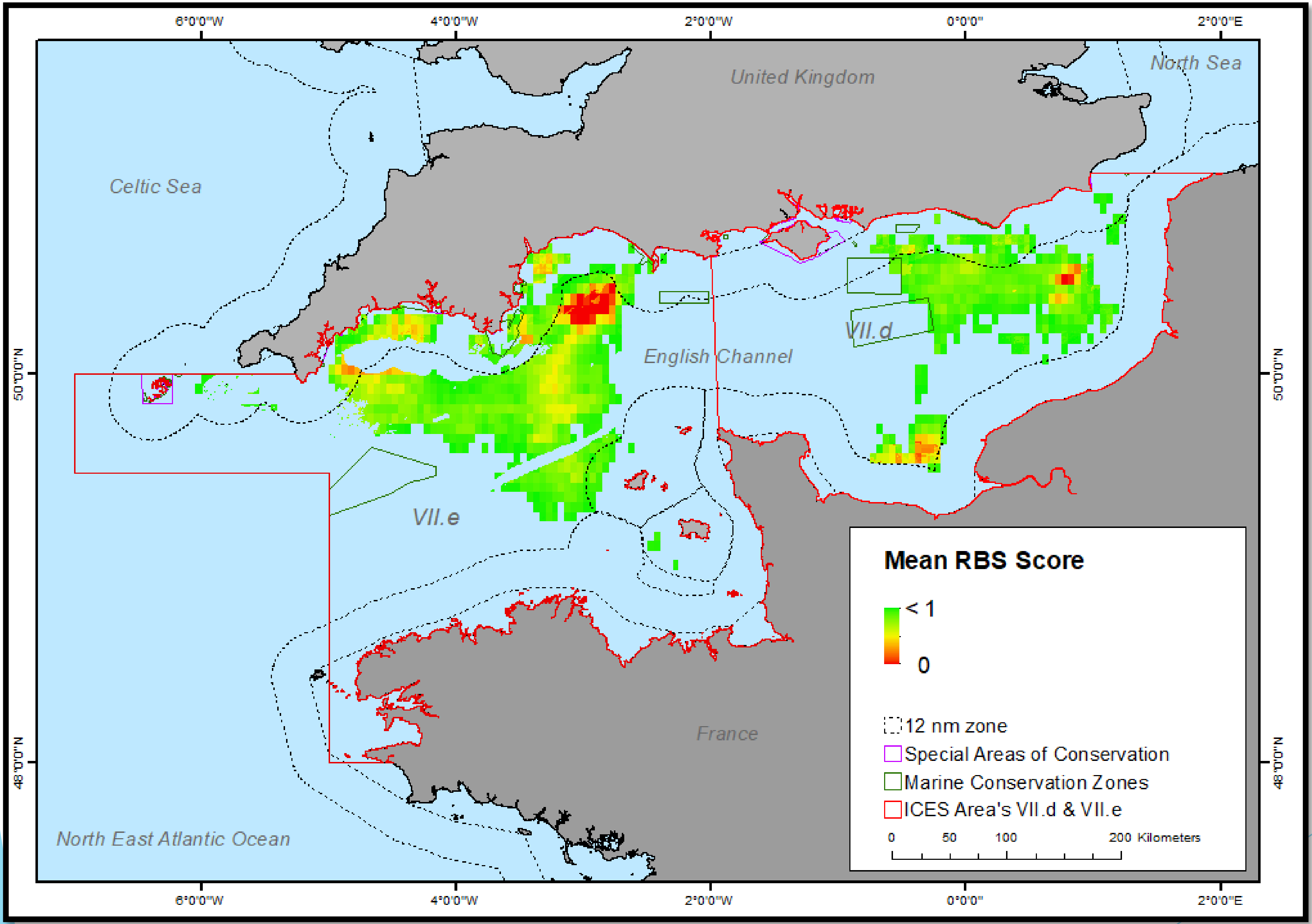
RBS

- Example RBS scores for each species
- ICES VIId shown
- RBS scores < 1



RBS

- Example RBS scores for each species
- ICES VIId
- RBS scores < 1
- Reduced area of impact
- Low score due to longevity



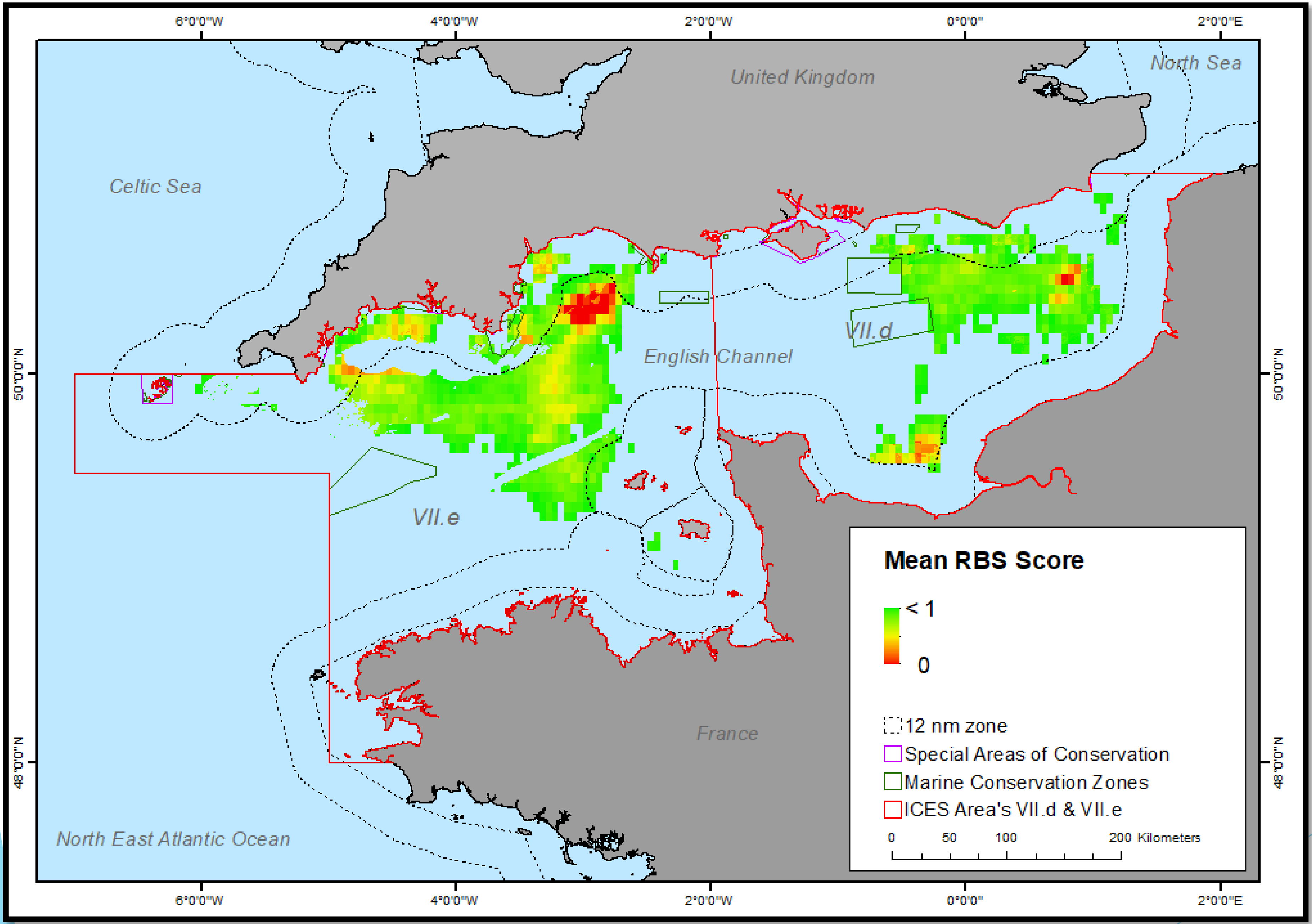
RBS

- mean RBS score for all species
- RBS score per grid cell (~0.008km^2)
- Proportion of biomass remaining relative to an un-impacted baseline

  RBS 1 = **No depletion**

  RBS 0 = **Complete depletion**

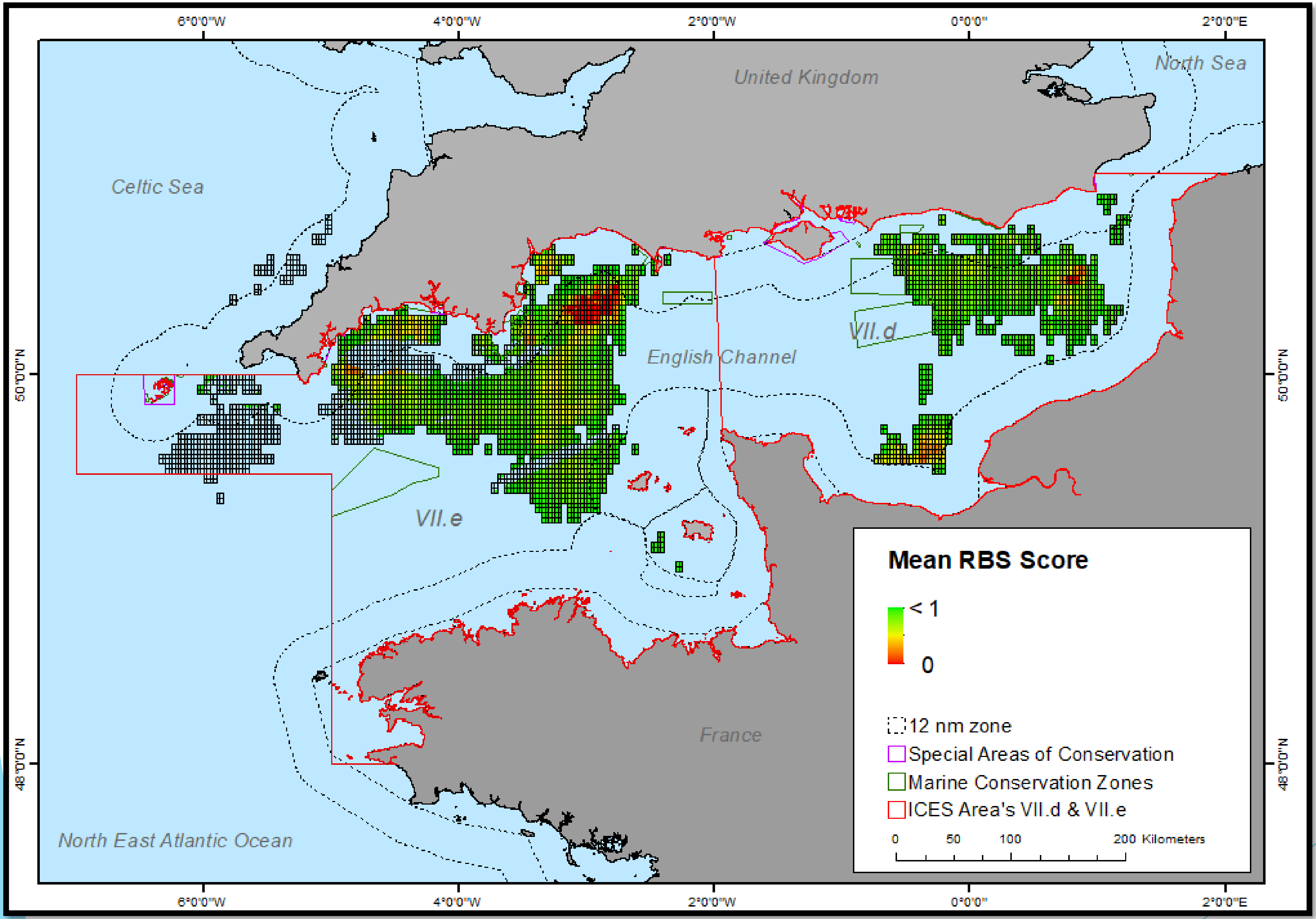
  RBS 0.6 = 60% of possible biomass remaining



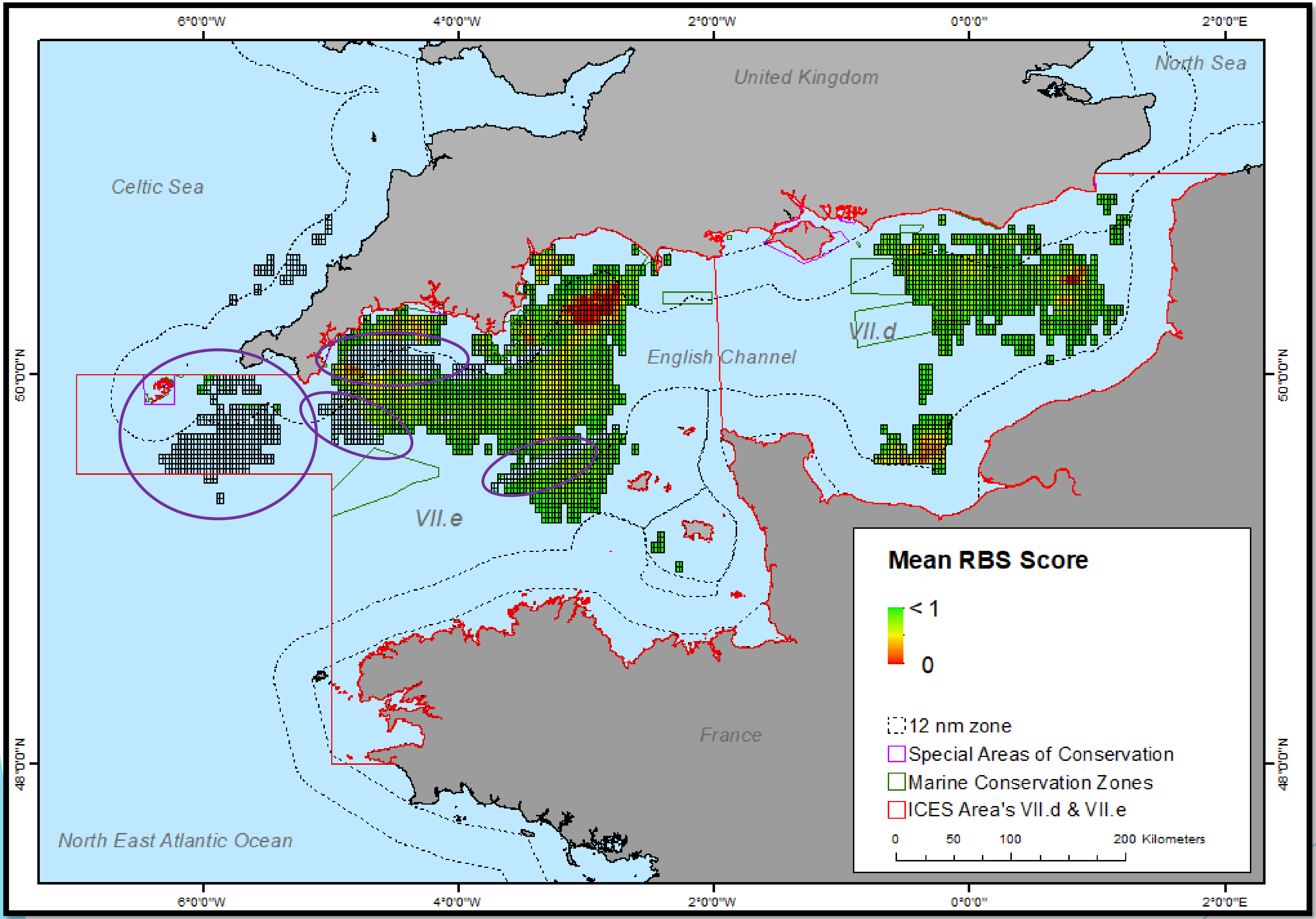
RBS

Worst Case Assessment

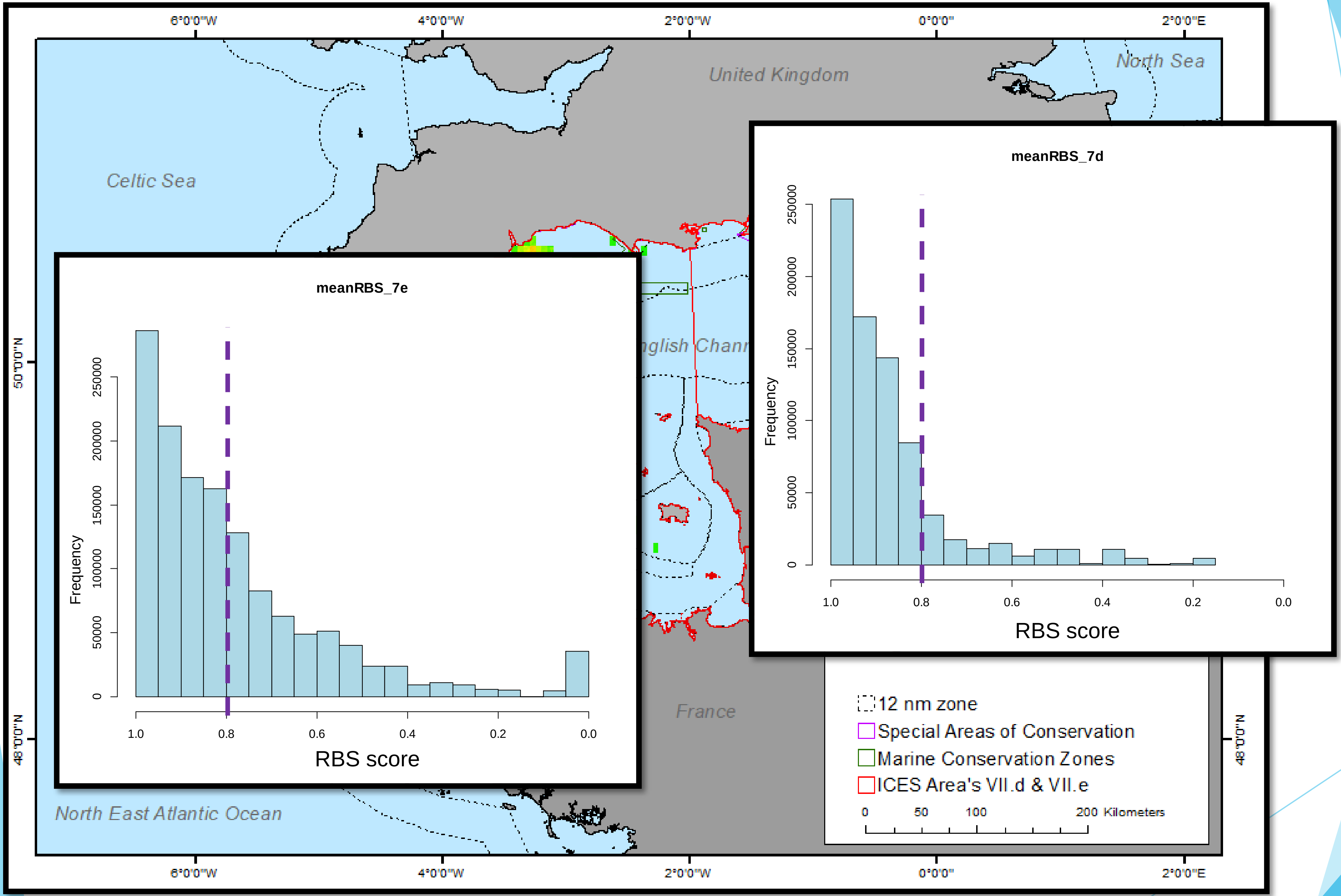
- Identifies areas where the highest impact of scallop fishing
- Based on habitat suitability of 0.5



- Overlap with fishing effort footprint



- Overlap with SAR footprint
- Few areas where dredging has zero impact



MSC fishery standards limits of 80%

- Question is how will habitats recover if the score is below 0.80

Habitat Assessments

- **Calculating the Relative Benthic Status of European Nature Information System (ENUIS) habitats within ICES areas VIId & VIIe**

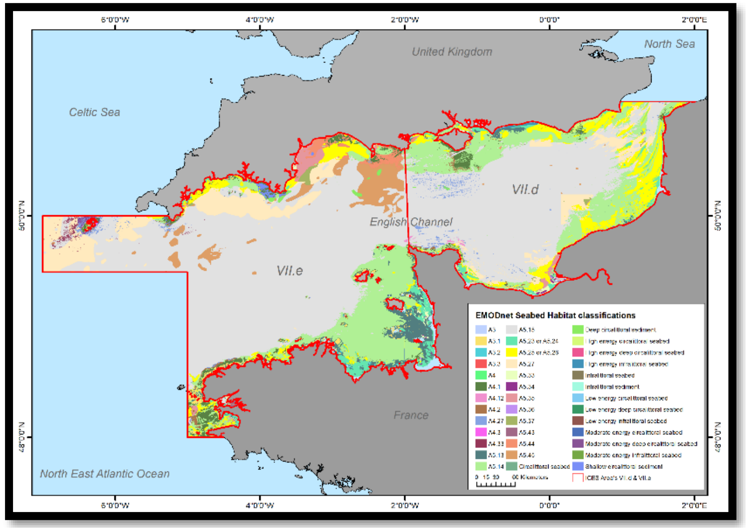
RBS score per grid cell for each species

Habitat Assessments

- **Calculating the Relative Benthic Status of European Nature Information System (ENUIS) habitats within ICES areas VIId & VIIe**

RBS score per grid cell for each species

+ Habitat map



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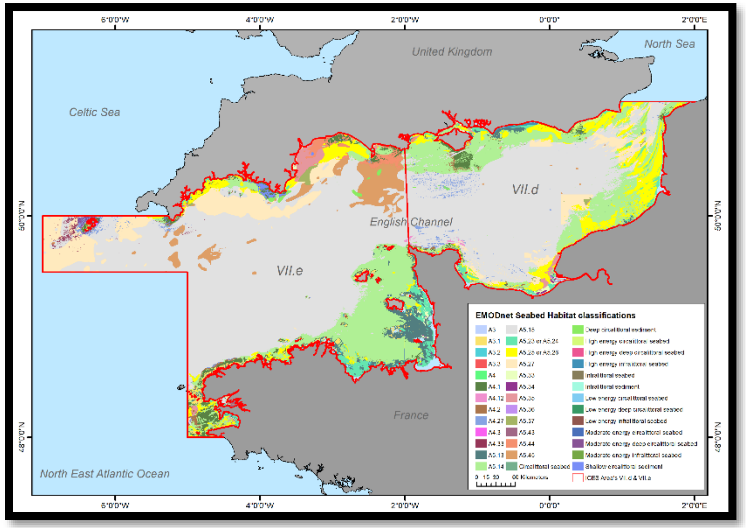

"..recognise habitat categories based on the following habitat characteristics: a. Substratum – sediment type (e.g., hard substrate) e. Geomorphology – seafloor topography (e.g., flat rocky terrace) f. Biota – characteristic floral and/or faunal group(s) (e.g., kelp-dominated seagrass bed and mixed epifauna, respectively)" – MSC

Habitat Assessments

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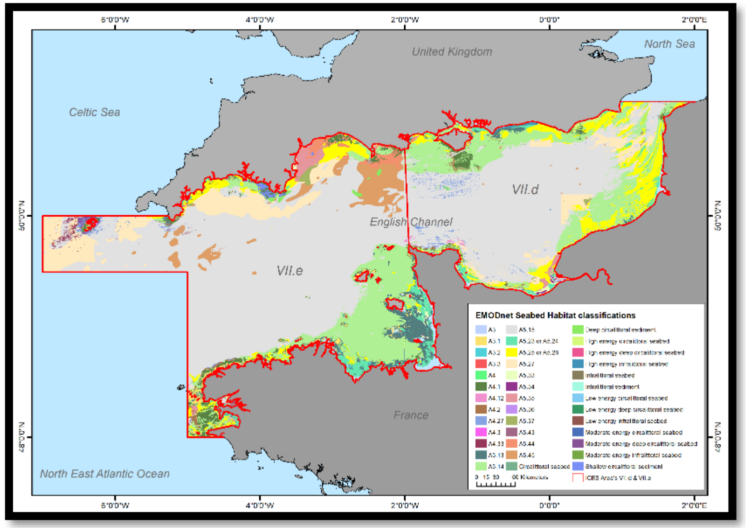

= mean RBS score per habitat for each species

Combined mean score per habitat

Habitat Type	Description	VIId	VIIe
A3	Infralittoral rock and other hard substrata	1	0.982
A3.1	Atlantic and Mediterranean high energy infralittoral rock	0.999	0.994
A3.2	Atlantic and Mediterranean moderate energy infralittoral rock	1	0.992
A3.3	Atlantic and Mediterranean low energy infralittoral rock	1	0.988
A4	Circalittoral rock and other hard substrata	1	0.977
A4.1	Atlantic and Mediterranean high energy circalittoral rock	0.986	0.986
A4.12	Sponge communities on deep circalittoral rock	0.875	0.876
A4.2	Atlantic and Mediterranean moderate energy circalittoral rock	0.972	0.966
A4.27	Faunal communities on deep moderate energy circalittoral rock	0.871	0.901
A4.3	Faunal communities on deep low energy circalittoral rock	1	0.992
A4.33	Sublittoral sediment	NA	0.998
A5.13	Infralittoral coarse sediment	0.996	0.989
A5.14	Circalittoral coarse sediment	0.955	0.985
A5.15	Deep circalittoral coarse sediment	0.845	**0.740**
A5.23 or A5.24	Infralittoral fine sand / Infralittoral muddy sand	0.996	0.985
A5.25 or A5.26	Circalittoral fine sand / Circalittoral muddy sand	0.993	0.974
A5.27	Deep circalittoral sand	0.983	0.924
A5.33	Infralittoral sandy mud	1	0.991
A5.34	Infralittoral fine mud	1	1
A5.35	Circalittoral sandy mud	0.999	0.899
A5.36	Circalittoral fine mud	1	1
A5.37	Deep circalittoral mud	0.974	0.951
A5.43	Infralittoral mixed sediments	1	0.996
A5.44	Circalittoral mixed sediments	0.984	0.920
A5.45	Deep circalittoral mixed sediments	0.876	0.969
Others	Circalittoral seabed	1	0.964
	Deep circalittoral sediment	0.902	0.830
	High energy circalittoral seabed	0.999	0.998
	High energy deep circalittoral seabed	NA	1
	High energy infralittoral seabed	0.997	0.997
	Infralittoral seabed	1	0.984
	Infralittoral sediment	1	0.996
	Low energy circalittoral seabed	1	0.995
	Low energy deep circalittoral seabed	NA	1
	Low energy infralittoral seabed	NA	1
	Moderate energy circalittoral seabed	0.999	1
	Moderate energy deep circalittoral seabed	0.944	1
	Moderate energy infralittoral seabed	1	0.996
	Shallow circalittoral sediment	0.976	0.938

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A4	Circalittoral rock and other hard substrata	1	0.977
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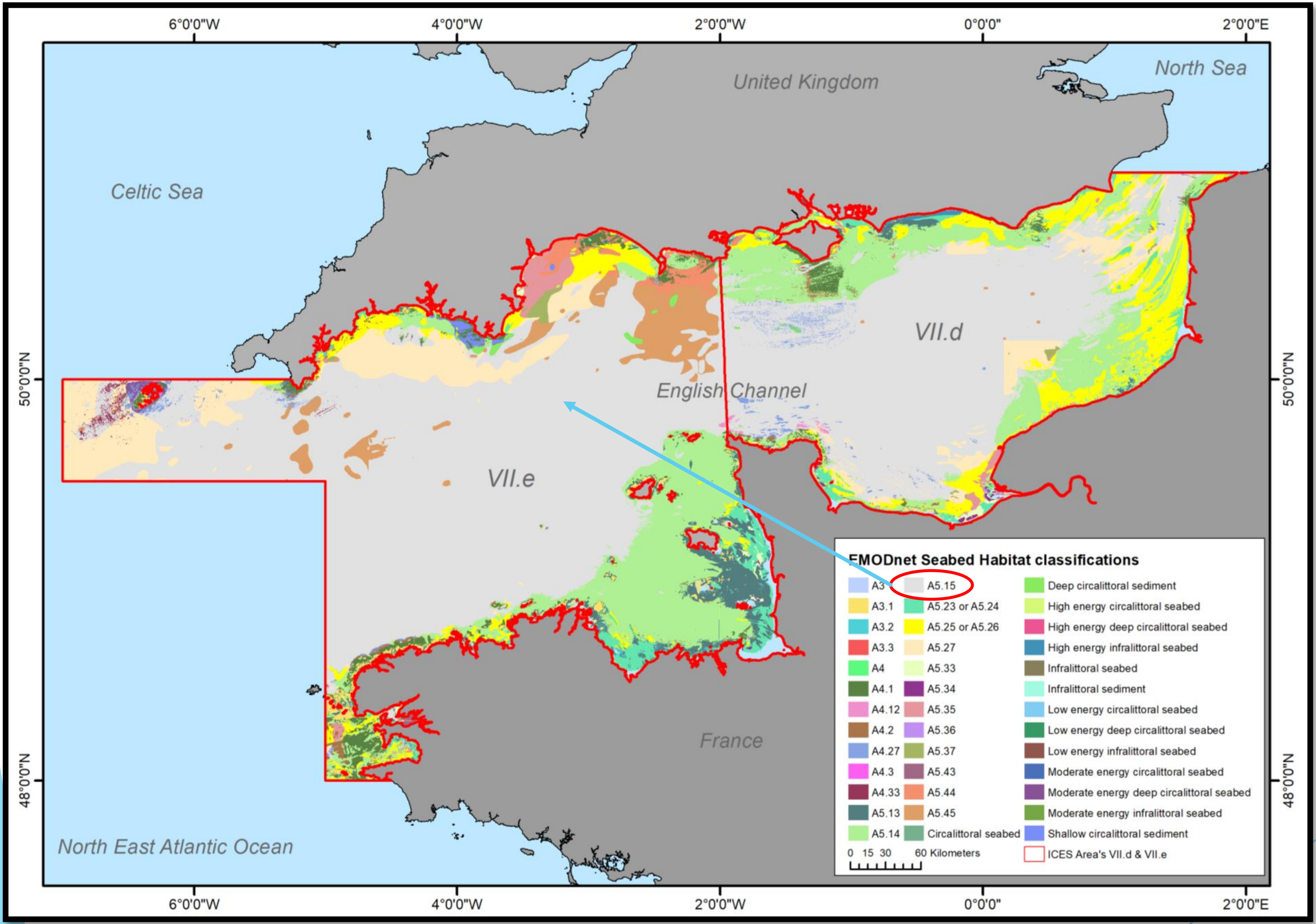
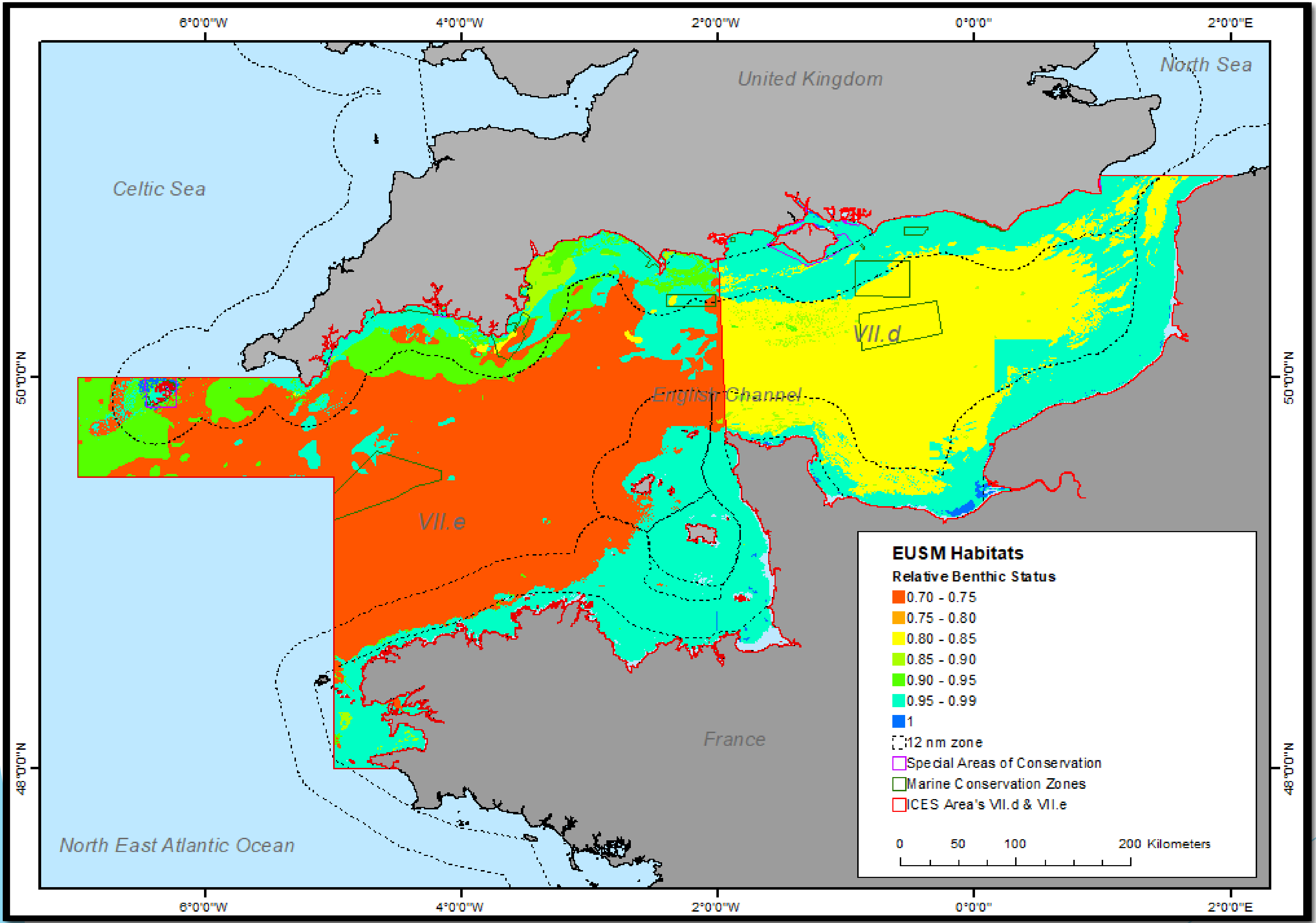
	Infralittoral sediment	1	0.996
	Low energy circalittoral seabed	1	0.995
	Low energy deep circalittoral seabed	NA	1
	Low energy infralittoral seabed	NA	1
	Moderate energy circalittoral seabed	0.999	1
	Moderate energy deep circalittoral seabed	0.944	1
	Moderate energy infralittoral seabed	1	0.996
	Shallow circalittoral sediment	0.976	0.938

- Only one habitat scores < 0.80 across both ICES areas VIId and VIIe



6°0'0"W
4°0'0"W
2°0'0"W
0°0'0"
2°0'0"E
50°0'0"N
48°0'0"N
United Kingdom
North Sea
Celtic Sea
English Channel
VII.d
VII.e
France
North East Atlantic Ocean
EMODnet Seabed Habitat classifications
A3
A3.1
A3.2
A3.3
A4
A4.1
A4.12
A4.2
A4.27
A4.3
A4.33
A5.13
A5.14
A5.15
A5.23 or A5.24
A5.25 or A5.26
A5.27
A5.33
A5.34
A5.35
A5.36
A5.37
A5.43
A5.44
A5.45
Circalittoral seabed
Deep circalittoral sediment
High energy circalittoral seabed
High energy deep circalittoral seabed
High energy infralittoral seabed
Infralittoral seabed
Infralittoral sediment
Low energy circalittoral seabed
Low energy deep circalittoral seabed
Low energy infralittoral seabed
Moderate energy circalittoral seabed
Moderate energy deep circalittoral seabed
Moderate energy infralittoral seabed
Shallow circalittoral sediment
ICES Area's VII.d & VII.e
0 15 30 60 Kilometers


6°0'0"W
4°0'0"W
2°0'0"W
0°0'0"
2°0'0"E
50°0'0"N
48°0'0"N
United Kingdom
North Sea
Celtic Sea
VII.d
English Channel
VII.e
France
North East Atlantic Ocean
EUSM Habitats
Relative Benthic Status
0.70 - 0.75
0.75 - 0.80
0.80 - 0.85
0.85 - 0.90
0.90 - 0.95
0.95 - 0.99
1
12 nm zone
Special Areas of Conservation
Marine Conservation Zones
ICES Area's VII.d & VII.e
0
50
100
200 Kilometers

Habitat Assessments

- **Calculating the Relative Benthic Status of European Nature Information System (ENUIS) habitats within ICES areas VIId & VIIe**

Expected, by MSC fisheries standard definition, “highly likely” to pass certification process as all but 1 habitats are already > 0.80

Table SA9: Probability required at different scoring guideposts. The language of probability in PI 2.4.1 and 2.5.1 is reversed, but holds the same probability expectation as for PI 2.2.1

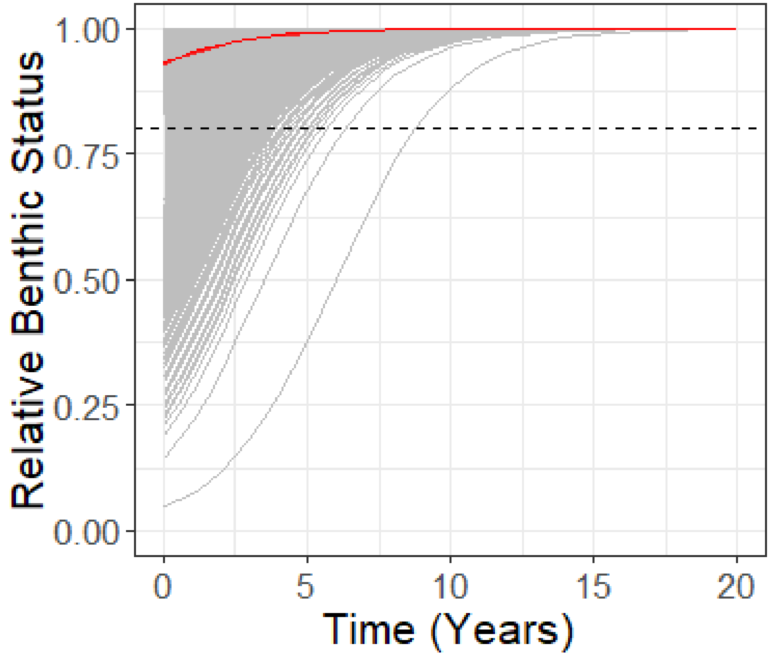
Performance indicator	SG60 probability requirement	SG80 probability requirement	SG100 probability requirement
PI 1.1.1	Likely = > 70th %ile	Highly likely = > 80th %ile	High degree of certainty = > 95th %ile
PI 2.1.1	Likely = > 70th %ile	Highly likely = > 80th %ile	High degree of certainty = > 90th %ile
PI 2.2.1	Likely = > 60th %ile	Highly likely = > 70th %ile	High degree of certainty = > 80th %ile
PI 2.3.1	Likely = > 70th %ile	Highly likely = > 80th %ile	High degree of certainty = > 90th %ile
PI 2.4.1	Unlikely = < 40th %ile	Highly unlikely = < 30th %ile	Evidence of highly unlikely = < 20th %ile
PI 2.5.1	Unlikely = < 40th %ile	Highly unlikely = < 30th %ile	Evidence of highly unlikely = < 20th %ile

Habitat Assessments

- **Calculating the Relative Benthic Status of European Nature Information System (ENUIS) habitats within ICES areas VIId & VIIe**

Expected, by MSC fisheries standard definition, “highly likely” to pass certification process as all but 1 habitats are already > 0.80

Recovery calculations for all habitats to be calculated



Example of the recovery rate of habitat with a high RBS score to recover to 0.80 (dotted line).

Habitat Assessments

- **Calculating the Relative Benthic Status using the Benthic Impact tool developed by Bangor University**
- **All habitat RBS scores = 1**
- **Recommended MSC score = SG100 for all habitats.**

Habitat Assessments

- **Calculating the Relative Benthic Status using the Benthic Impact tool developed by Bangor University**

- **All habitat RBS scores = 1**

- **Recommended MSC score = SG100 for all habitats.**

- **Factors effecting results:**

- Spatial resolution of grid cells 1° X 1° (tool unable to handle higher resolution)

- Depletion rates of 0.14 as opposed to 0.21

- Recovery rates of 0.42 as opposed to 5.31

Pro's :

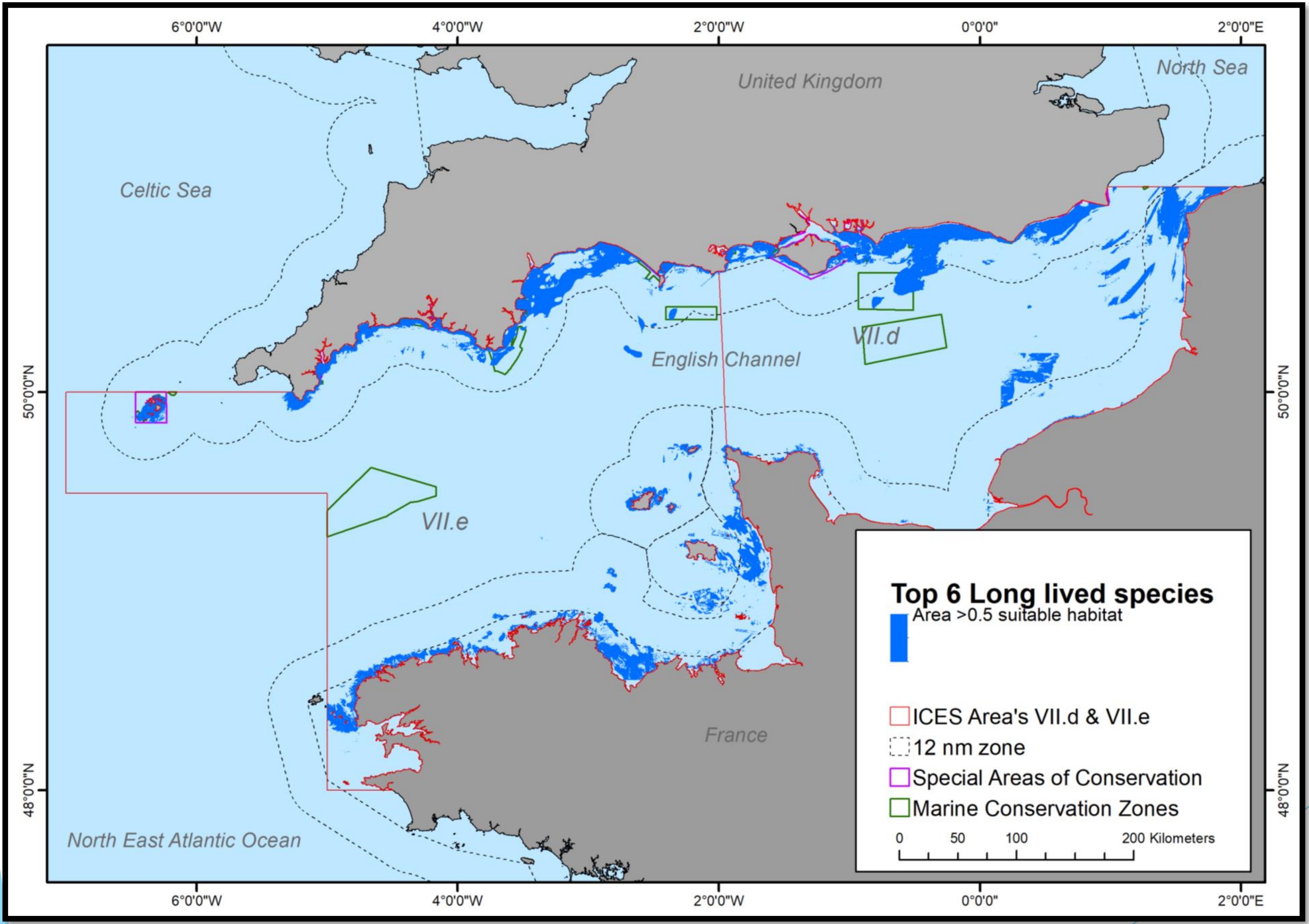
- Takes a whole community approach
- good way of dealing with uncertainty. E.g. species distributions and longevity

Con's:

- Tool uses the outcomes of a global meta-analysis – not unique

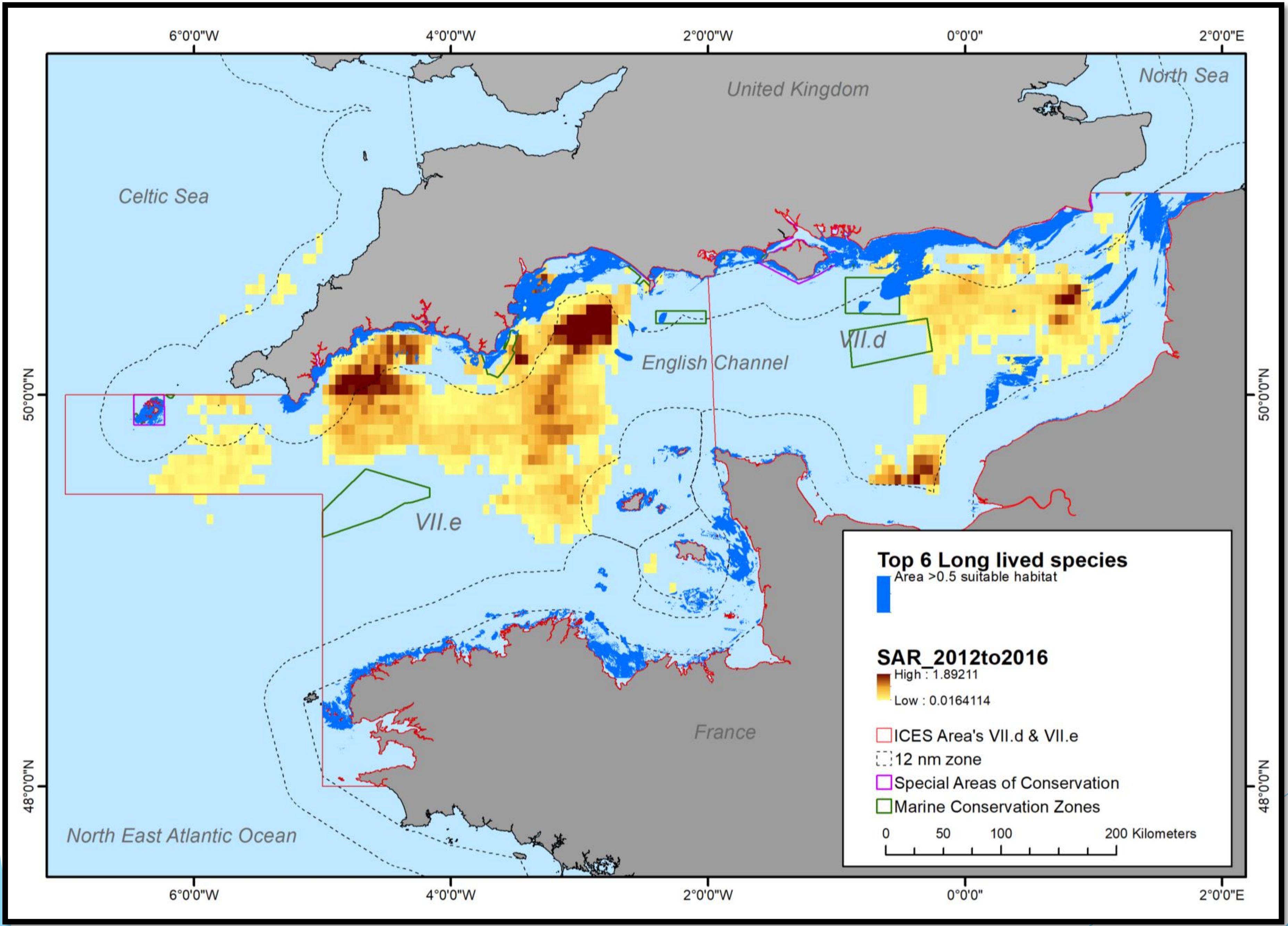
Habitats Management Strategy (PI 2.4.2)

- # Recommendations:
  - Move fishing effort away from areas where there are sensitive (longer lived) species

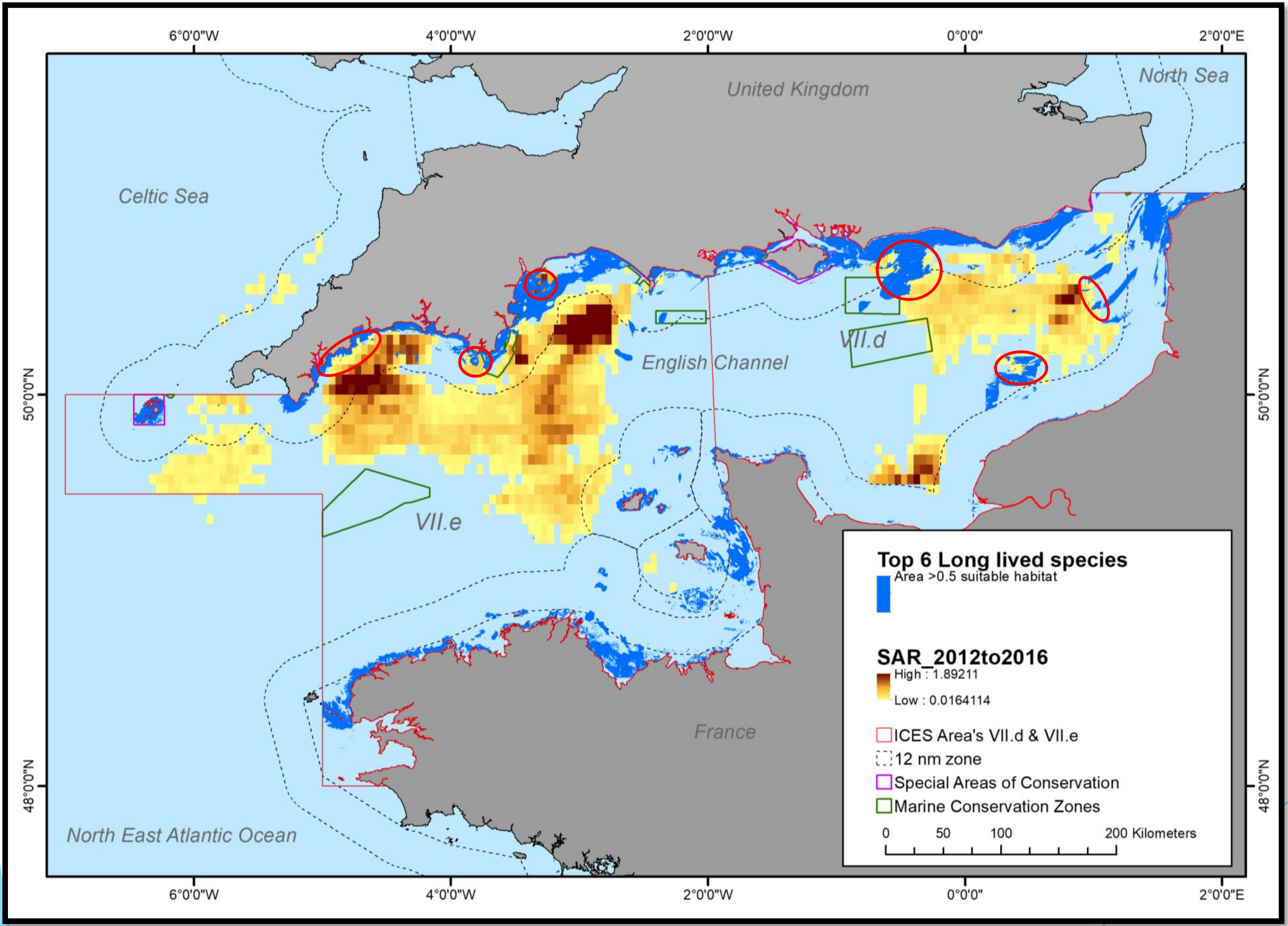


- Footprint of the potential distribution of the top 6 longest lived species

- Habitat Suitability > 0.5



- Footprint of the potential distribution of the top 6 longest lived species
- Habitat Suitability > 0.5
- Overlap with Fishing Effort



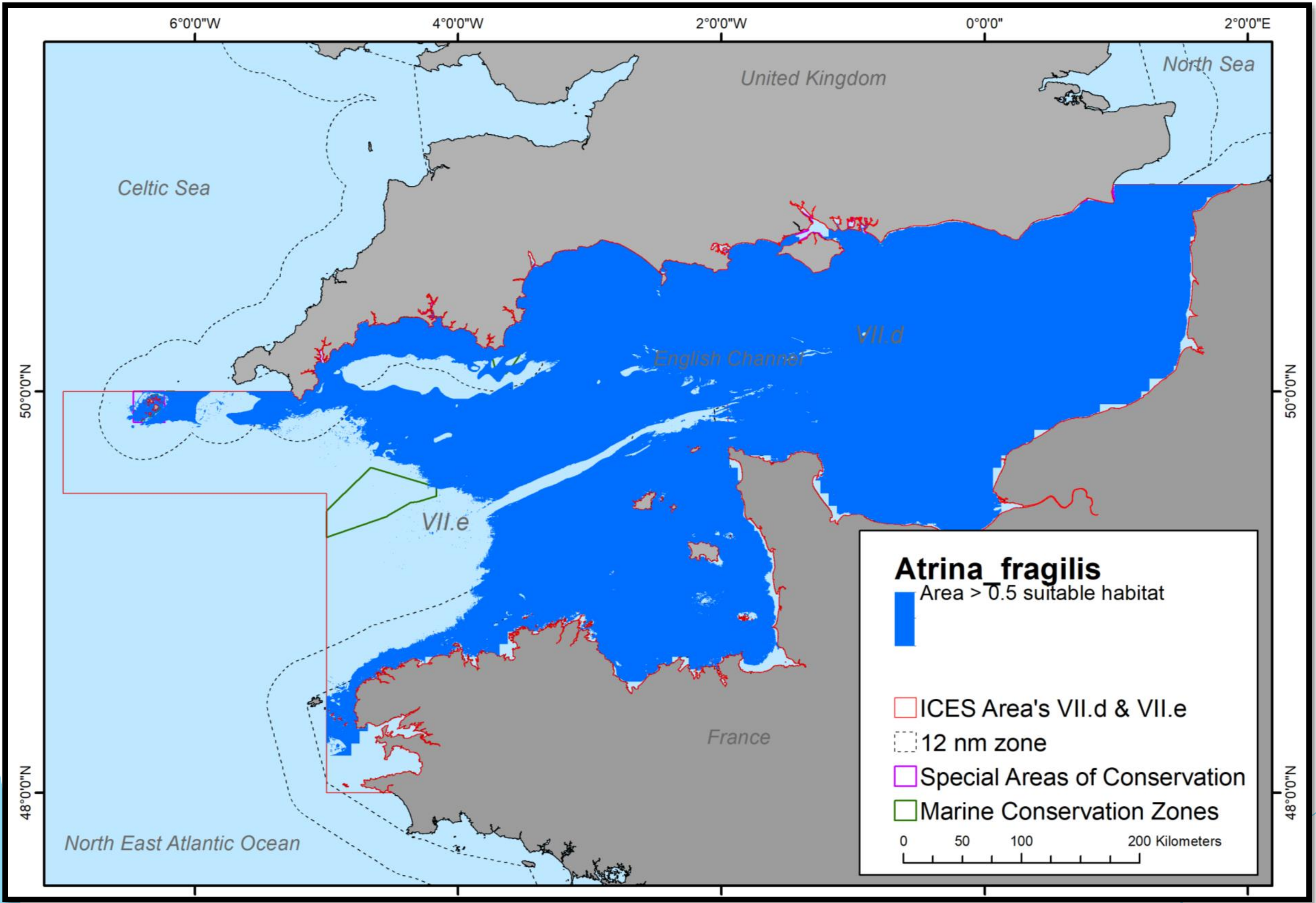
- Footprint of the potential distribution of the top 6 longest lived species

- Habitat Suitability > 0.5

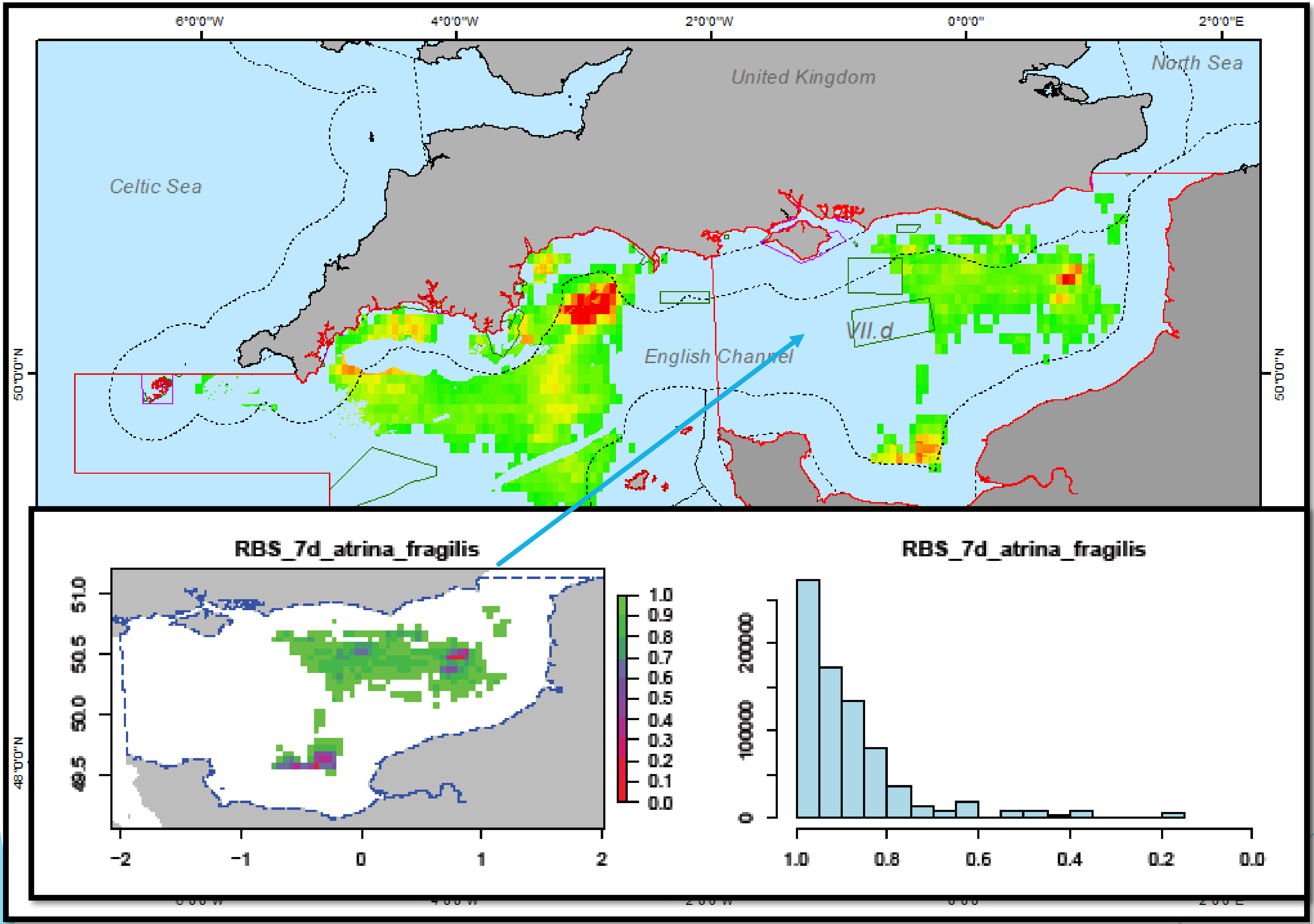
- Overlap with Fishing Effort

Habitats Management Strategy (PI 2.4.2)

- **Recommendations:**
  - Move fishing effort away from areas where there are sensitive (longer lived) species
  - Difficult for species with wide ranging distributions
    e.g. *Atrina fragilis* (fan mussel)



- Overall score influenced by species with potentially high distribution
  e.g. *Atrina fragilis*
  (20 years longevity)



- Overall score influenced by species with potentially high distribution
  e.g. *Atrina fragilis*
  (20 years longevity)

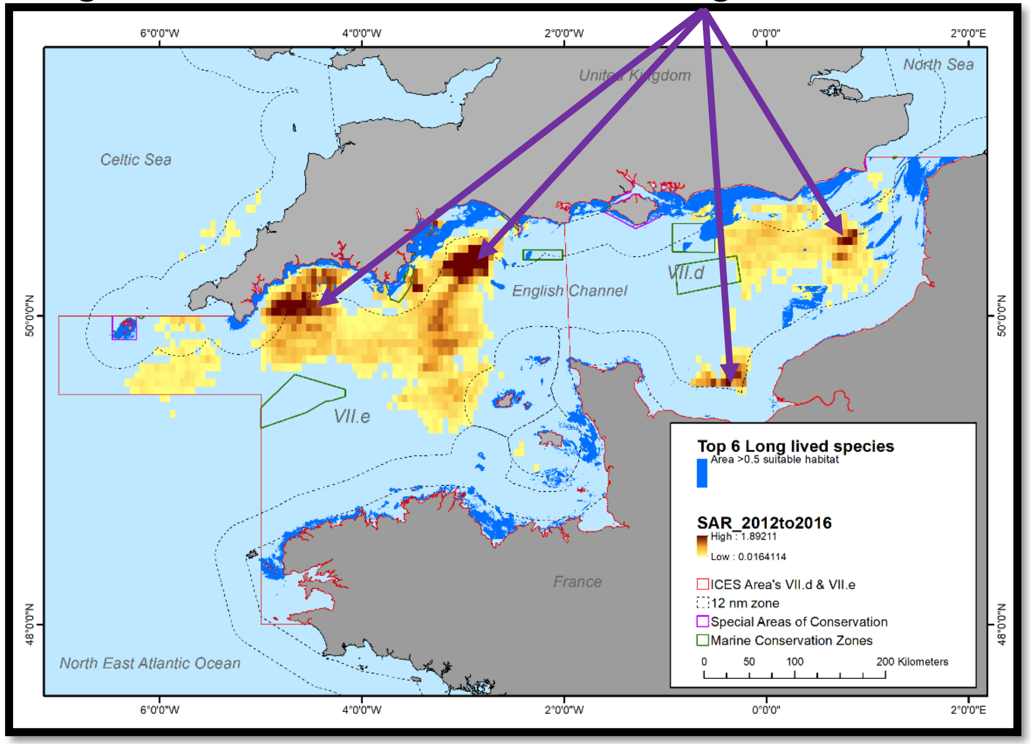
Habitats Management Strategy (PI 2.4.2)

- **Recommendations:**

  - Move fishing effort away from areas where there are sensitive (longer lived) species

  - RBS score heavily influenced by species with wide ranging distributions
    e.g. *Atrina fragilis* (fan mussel)

  - Reduce fishing effort in areas that have a high SAR score



Summary:

- Two habitat assessment methods – Both expected to pass the MSC certification process
- By definition, that habitats within ICES VIId & VIIe do not appear to be suffering too much from impact of scallop dredging
- Identified localised areas at high risk to the impact of scallop dredging
- Some species suffering more than other due to their potential distribution

Assessment limitations:

- **These are only models, only as good as the data which goes into it**
- **Longevity information not readily available for all marine invertebrate species**

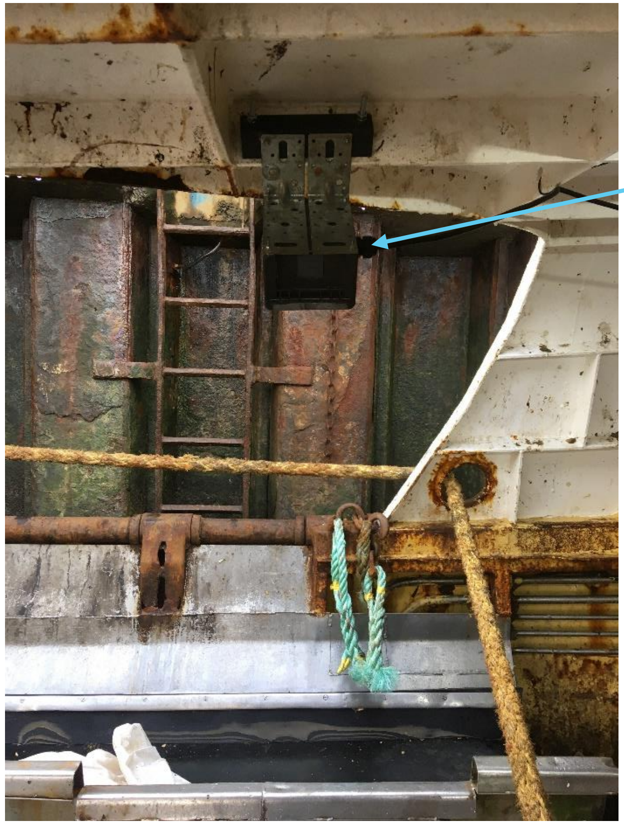
Camera deployment

Aim

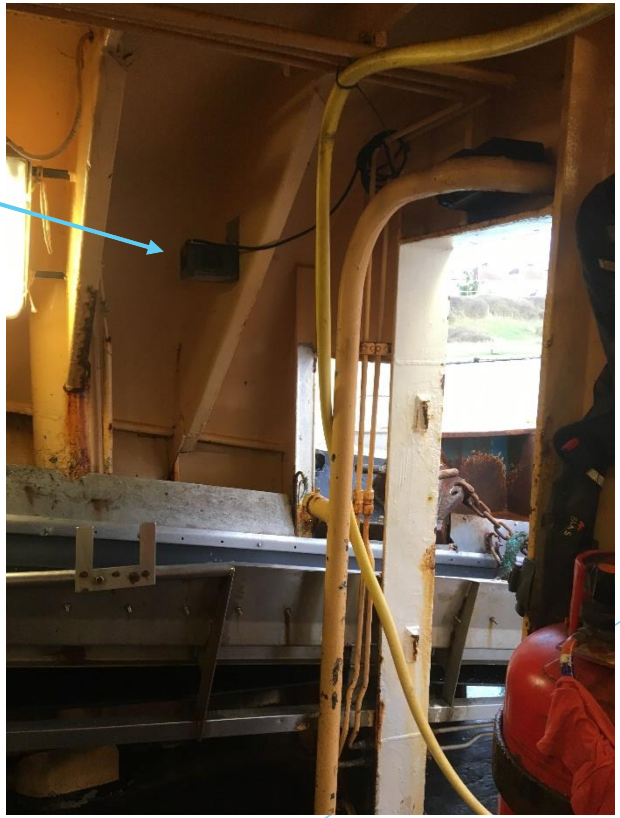
- Record the bycatch of sensitive benthic species and how dredging interacts with sensitive benthic species

Update:

- Memorandum of Understanding agreed with Industry
- Two cameras deployed – MFV Danielle & MFV Honeybourne III
- Data not yet received from fishermen



Cameras



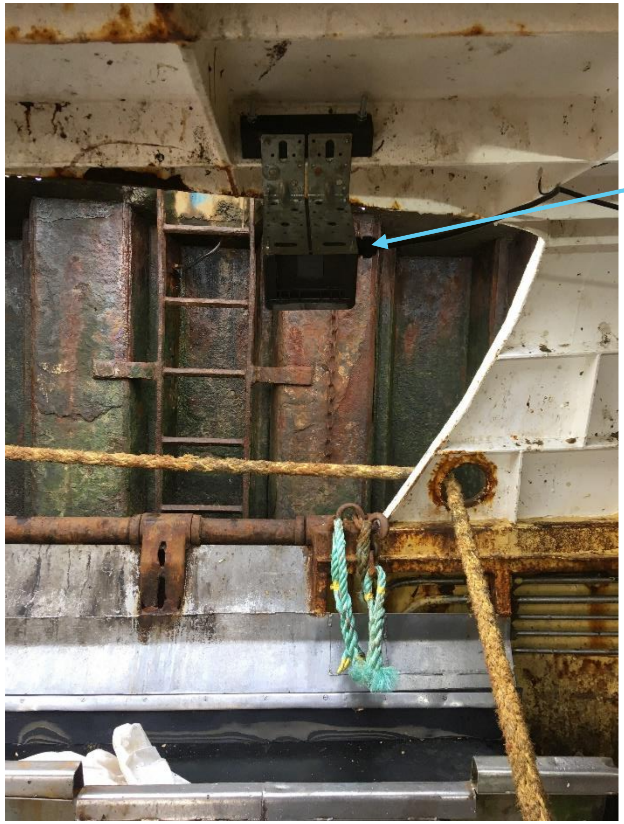
Camera deployment

Aim

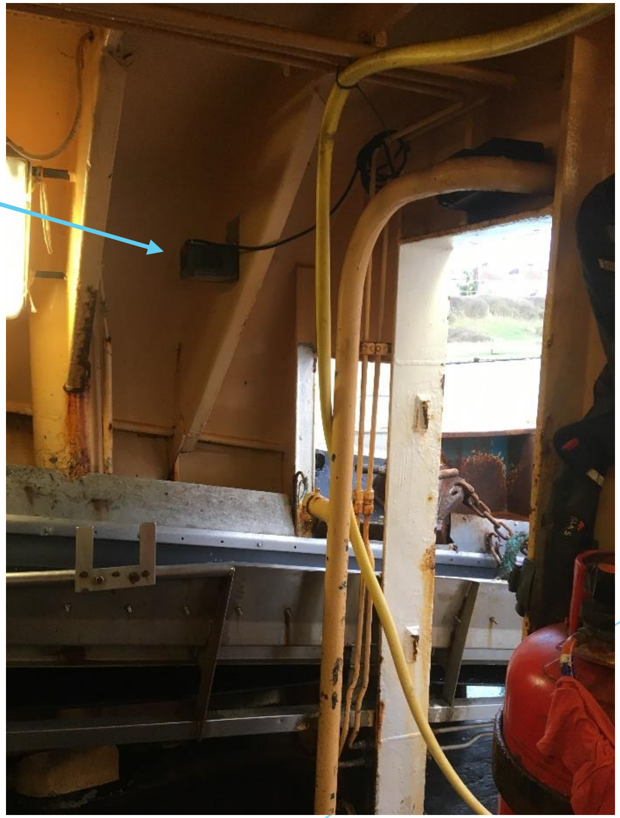
- Record the bycatch of sensitive benthic species and how dredging interacts with sensitive benthic species

Timeline:

- **Collect data from fishermen – early March**
- **Process video as early as possible to include findings in final report**



Cameras



Thank you

Questions?