

# Method for creating version 3 of the UK Composite Map of Annex I Sandbanks slightly covered by seawater all of the time

## 1 Introduction

### 1.1 Requirement

Sandbanks slightly covered by seawater all of the time (hereafter referred to as Sandbanks) are listed for protection under Annex I of the Habitats Directive (92/43/EEC<sup>1</sup>). This means that the UK has an obligation to provide protection for this habitat through the establishment and management of Special Areas of Conservation (SACs). To aid this process, the Joint Nature Conservation Committee (JNCC) maintains a composite data product showing the extent of all Annex I Sandbanks in UK. This is carried out in collaboration with all of the Country Nature Conservation Bodies<sup>2</sup> (CNCBs) and is updated at least once per six-yearly reporting period (required under Article 17 of the directive).

Version 1 of the product was published in 2012 (Ellwood, 2014). The dataset was created using a standardised method (extending Klein, 2006) for detecting and delineating Sandbanks where the data allowed, in addition to compiling Sandbanks delineated by the CNCBs.

The 2016 update (version 2) (Duncan, 2016) incorporated new evidence that had since been collected by JNCC and the CNCBs on the presence of Sandbanks and Sandbank communities, providing a basis to update the product where new data is available, and updated the confidence of previously delineated Sandbanks with a transparent confidence assessment method that is compatible with other Annex I products maintained by JNCC.

In addition, version 1 of this product involved the delineation of Sandbanks as defined by the 2007 Interpretation Manual of European Union Habitats (see section 1.2). Several UK inshore SACs were designated before these revised guidelines and Ellwood (2014) noted in the documentation for version 1 that further work should be undertaken to represent these inshore banks as designated. This recommendation was incorporated into the 2016 (version 2) update.

The 2019 update (version 3) has incorporated new data from JNCC and the CNCBs on the latest available evidence supporting the presence of Sandbanks and their associated communities, in addition to updating the confidence of said evidence according to the same method used in version 2.

### 1.2 Definition

The Interpretation Manual of European Union Habitats – EUR25 (CEC, 2003; also see Appendix) includes the following in its interpretation of “Sandbanks which are slightly covered by sea water all the time”:

---

<sup>1</sup> <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:31992L0043>

<sup>2</sup> Department of Agriculture, Environment and Rural Affairs (Northern Ireland) (DAERA), Natural England (NE), Natural Resources Wales (NRW) and Scottish Natural Heritage (SNH).

- Permanently submerged
- Top of bank is generally in < 20 m of water depth
- Composed mainly of sandy sediment
- May be non-vegetated or vegetated with *Zostera marina* (sea grass) and/or free living species of the *Corallinaceae* family (maerl)

The Interpretation Manual of European Union Habitats – EUR27 (CEC, 2007) subsequently added that a Sandbank is:

- Predominantly surrounded by deeper water.

The definition subsequently remained unchanged within The Interpretation Manual of European Union Habitats – EUR28 (CEC, 2013); also see Appendix.

The 2013 interpretation also refers to the presence of associated biological communities in its description of Sandbank feature:

- “Banks where sandy sediments occur in a layer over hard substrata are classed as Sandbanks if the associated biota are dependent on the sand rather than on the underlying hard substrata”
- “Sandbanks can, however, extend beneath 20 m below chart datum. It can, therefore, be appropriate to include in designations such areas where they are part of the feature and host its biological assemblages.”

### 1.3 Context

Topographically, Annex I Sandbanks can be formed as:

- 1) Sandy mounds; or
- 2) Tidal sandbanks that are either:
  - Open shelf ridge sandbanks;
  - Estuary mouth sandbanks; or
  - Headland associated banks.

The definition of “sandy sediments” follows that described in Appendix II of Marine Natura 2000 Project Group paper MN2KPG19\_7\_Sandbanks by Ridgeway and Johnston (2008). Sand is defined as sediment particles between 2 and 0.0625 mm in diameter and sandy sediment must be composed of less than 30 % gravel and have more sand than mud. Using the terminology of Folk (1954), this includes: “Gravel, sand and silt”, “Gravelly, muddy sand” [gmS], “Gravelly sand” [gS], “Muddy sand” [mS], “Sand” [S], “Slightly gravelly, muddy sand” [(g)mS] and “Slightly gravelly sand” [(g)S] (Figure 1).

This differs from the narrower JNCC and CNCB’s typical interpretation of “sandy sediments” in relation to the EUNIS habitat “A5.2 Sublittoral sand” (Figure 1).

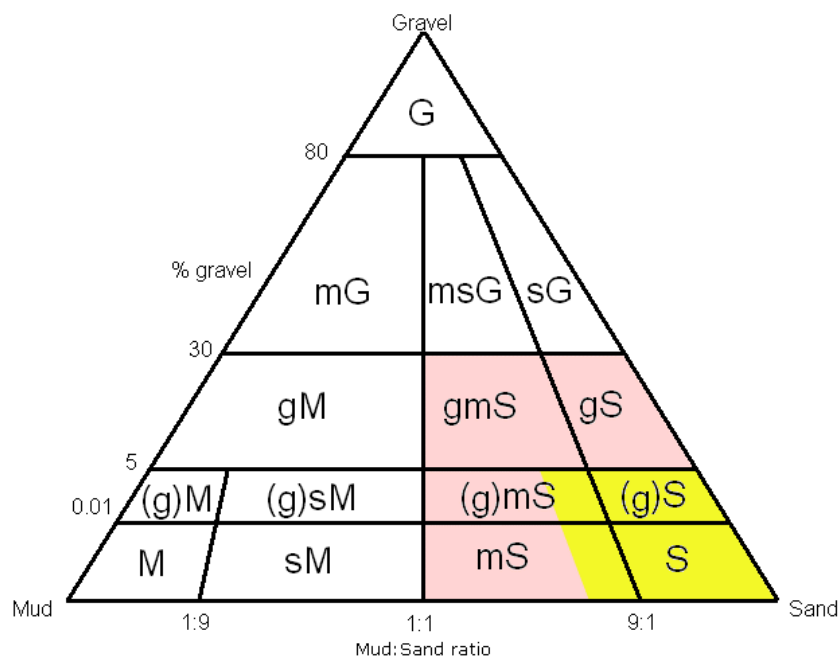


Figure 1: JNCC and CNCB typical interpretation of sand in relation to the EUNIS habitat “A5.2 Sublittoral sand” (Connor et al, 2006) in yellow in comparison to the wider interpretation in relation to Annex I Sandbanks (Ridgeway and Johnston, 2008) in red, show against the classic Folk ternary diagram.

## 2 Method

### 2.1 Data sources

#### 2.1.1 UK Sandbanks (version 2)

Version 2 of the UK Sandbanks product (Duncan, 2016) was used as a starting point. For further information on how this was created, please see Appendix section 7.

#### 2.1.2 Specific CNCB-provided datasets

The Natural England (NE) Evidence Base (June, 2018), supplied by NE, contains current understanding of extent of Annex I Sandbank sub-features within English inshore SACs, derived from a variety of survey information. These data are contained within the Evidence Base and are identifiable via the “SF\_CODE” attribute field. During quality checking the data, it was discovered that some features would not qualify under either of the definitions previously used to determine sandbanks. Following conversations with Natural England, an amended version of the Evidence Base was included in the final UK-wide Annex I sandbanks dataset.

Data supplied by SNH provided their current understanding of Sandbank extent from survey data within Luce Bay and Sands, Sound of Airsaig, Sound of Barra, Sanday, Moray Firth, and Firth of Tay and Eden Estuary SACs. SNH also provided a new dataset based on their predictive mapping of seabed features project (Miller *et al.* 2017); the extent of sandbanks within Scottish territorial waters was extracted from this dataset and included in the final UK-wide Annex I sandbanks dataset.

Data supplied by NRW updated delineations of Sandbanks within Menai Straight and Conwy Bay, and Lleyn peninsula and the Sarnau SACs based on new survey information within the sites.

### **2.1.3 Sandbank drift and uncertainty margins advised by JNCC<sup>3</sup>**

JNCC and NE provided advice to Defra MMO in 2015 regarding uncertainty margins and Sandbank drift on the Sandbanks within Haisborough Hammond & Winterton, and Inner Dowsing, Race Bank & North Ridge candidate SACs /Sites of Community Importance (SCIs). Evidence collected shows that the Sandbanks are highly mobile and the previously delineated extents (in version 1 of this dataset) were likely to underrepresent the current feature. Since version 2, therefore, uncertainty margins of 500 m have been included showing areas where the Sandbanks could now exist with current knowledge of bank movement. In Haisborough Hammond and Winterton cSAC/SCI an additional buffer of 1000 m was advised for Middle and North-Cross Sandbanks to account for an identified north-easterly drift, based on a projected movement over a period of 10 years since the bank delineation in 2010.

### **2.1.4 Official SAC boundaries**

Following JNCC interpretation of biological community analysis within North Norfolk Sandbanks and Saturn Reef (Parry *et al.* 2015), and Bassurelle Sandbank SACs (Clare *et al.* 2020) it has been determined that Sandbank communities exist throughout these two sites. The Annex I habitat has therefore been determined to extend *at least* to the SAC boundary, though possibly further. Since version 2, the official boundaries of these two sites have thus been used as an indicator of Sandbank extent within this dataset, the underlying topographic banks delineated in version 1 of this dataset are retained as a source of additional information.

## **2.2 Method overview**

Data existing from version 2 of the product were taken as an initial input and baseline for the new layer.

Consultation with CNCBs identified new data providing a current understanding of the distribution of Sandbank feature within the territorial waters – as described in the previous section. These data were appended to the working dataset, superseding any underlying extents.

After the above data collation and consolidation phase, the resulting draft product was analysed on a per-feature basis against the additional information sources to determine their suitability according to the Annex I Sandbank definition (see section 2.3). These descriptors were then used in the formulation of a final confidence value (see section 2.4). SNCBs were consulted to provide judgement and additional knowledge to aid in the determination of confidence on top of JNCC held data. Comments and decisions at this stage were recorded for referral at a later date.

All features with a confidence of “High” or “Potential” were extracted from the working copy to produce the final data product. Several banks from the original input datasets failed to

---

<sup>3</sup> Display of these data may differ across websites dependant on the portal's specific requirements and rules. The margins can be viewed in the Annex I sandbank layer provided on the JNCC interactive MPA mapper, however they are not displayed in Natural England's MAGIC interactive mapper.

meet High or Potential confidence values, and a small number were determined to be rocky outcrops in light of new evidence.

## 2.3 Assessment of Sandbank descriptors

The various components of the Annex I Sandbank definition (see section 1.2), may be summarised according to one of three descriptors:

1. **Topography**, i.e. the shape and depth of the seabed is consistent with the Annex I definition;
2. **Substrate or vegetation type**, i.e. the substrate or vegetation type is consistent with that of the Annex I definition;
3. **Proximity to Sandbanks and similarity of benthic communities**, i.e. if the seabed adjacent to Annex I Sandbank has similar benthic communities to those on the Annex I Sandbank, this may indicate an extension of the feature.

Areas of seabed were examined and recorded as being “suitable”, “less suitable or need more data” or “unsuitable” for each of these three descriptors using the criteria in Table 1. Areas for which evidence is lacking (rather than un-supportive) were included within the less suitable category. A variety of sources along with expert knowledge from individuals close to the areas in question were used. Topographical suitability was attributed to features taking into potential designation date of the Sandbanks in question, Sandbanks comprising a protected feature within SACs designated pre-2007 were attributed based on the 2003 interpretation of Topography.

**Table 1: Suitability criteria for Sandbank descriptors used in determining confidence in the UK Sandbank product.**

Descriptor	Suitability		
	Suitable	Less suitable or need more information	Unsuitable
<b>Topography</b>	Permanently submerged & water depth is seldom >20 m & For sites designated post-2007: Predominantly surrounded by deeper water.	Permanently submerged & water depth is seldom > 20 m & For sites designated post-2007: NOT Predominantly surrounded by deeper water OR Uncertain bank edge (e.g. Gradual transition, sand waves, poor data)	NOT Permanently submerged &/OR Top of bank NOT in < 20 m of water depth
<b>Substrate or vegetation type</b>	Composed mainly (>=50%) of sandy sediment - interpreted as sediment <30% gravel and more sand than mud &/OR vegetated with <i>Zostera marina</i> (sea grass) and/or free living species of the <i>Corallinaceae</i> family (maerl) & Associated biota are dependent on the sand rather than any underlying hard substrata	NOT Composed mainly of sandy sediment - i.e. sediment > 30% gravel and less sand than mud & NOT vegetated with <i>Zostera marina</i> (sea grass) and/or free living species of the <i>Corallinaceae</i> family (maerl) OR Associated biota are dependent on hard substrata underlying the sand	Hard substrata at the surface

<b>Proximity to Sandbanks and similarity of benthic communities</b>	Seabed is adjacent to Annex I Sandbank & data shows benthic communities are similar	Seabed is adjacent to Annex I Sandbank & little to no data available to judge similarity of benthic communities	Seabed is NOT adjacent to Annex I Sandbank &/OR data shows benthic communities are NOT similar
---	---	---	--

In inshore waters, CNCBs were contacted for expert interpretation of the features as their local knowledge of the sites provided additional information to aid suitability determination that was not always available in the form of GI data.

## 2.4 Confidence

Areas were classed as either “High” confidence or “Potential” Sandbank from the three descriptor suitability values based on the criteria shown in Table 2. It should be noted that “High” confidence here denotes a high level of supporting background data and “Potential” Sandbank denotes where evidence indicates Annex 1 Sandbank is present but is insufficient to support high confidence. Potential does *not* denote either a lack of confidence in the data or that the area has the potential to support Sandbanks<sup>4</sup>.

Table 2: Combination of descriptor suitability values in relation to final confidence

Topography	Substrate or vegetation type	Proximity to Sandbanks and similarity of benthic communities	Additional information	Final confidence
Suitable	Suitable	Not applicable		<b>High</b>
Suitable	Less suitable or need more information	Suitable		<b>High</b>
Suitable	Less suitable or need more information	Less suitable or need more information	Need more information, but assuming a continuation of communities from an area of high confidence Sandbank	<b>Potential</b>
Less suitable or need more information	Suitable	Suitable		<b>High</b>
Less suitable or need more information	Suitable	Less suitable or need more information	Need more information, but assuming a continuation of communities from an area of high confidence Sandbank	<b>Potential</b>
Less suitable or need more information	Less suitable or need more information	Suitable		<b>High</b>

<sup>4</sup> The latter interpretation of ‘potential’ is more consistent with the definition of the ‘range’ of a habitat.

Less suitable or need more information	Less suitable or need more information	Less suitable or need more information	Assuming a continuation from an area of high confidence bank	<b>Potential</b>
--	--	--	--	------------------

Input data not meeting the criteria to be attributed as “High” or “Potential” as above are not included in the final dataset describing extent of Annex I Sandbank, but areas of suitable sediment in less than 60 m of water connected to sandy sediment in less than 20 m of water may still be considered as part of the ‘range’ of this habitat as in previous versions of this data product.

It is assumed that any data supplied by the CNCBs has been fully delineated and processed based on their local understanding of the sandbank extents, therefore JNCC did not carry out any additional confidence assessments on these data.

### 3 Results

The GIS layer output from this work contains details of the source and decisions in the creation of the product, the suitability of each area regarding the three descriptors and the final confidence (see Table 3).

**Table 3: Attribute descriptions for the UK Sandbanks data product.**

Field name	Description
<b>GUI</b>	Globally unique identifier of a habitat map brought in to the dataset, if relevant.
<b>ORIG_HAB</b>	Additional habitat information (e.g. EUNIS, Marine Habitat Classification for Britain and Ireland, descriptive text) present within the original source file.
<b>Bank</b>	Name for each bank
<b>SACNAME</b>	Name of SAC bank is present within
<b>Identifier</b>	Name of organisation who originally noted presence of the bank
<b>Delineator</b>	Name of organisation who delineated the bank boundary
<b>Delin_Date</b>	Date of boundary delineation
<b>ANNEX 1</b>	The Natura 2000 code for the Annex I habitat in question (1110 for Sandbanks).
<b>SUBTYPE</b>	The Nautra 2000 subtype identified, if present.
<b>SOURCE</b>	The original source of the data in question.
<b>CONFIDENCE</b>	The final confidence of the area in question – “High” or “Potential”.
<b>TOP_SUIT</b>	The topographical suitability of the area in question – “Suitable” or “Less suitable or need more information”
<b>SUB_SUIT</b>	The substrate suitability of the area in question – “Suitable” or “Less suitable or need more information”
<b>BIO_SUIT</b>	The biological suitability of the area in question – “Suitable” or “Less suitable or need more information”
<b>Comments</b>	Comments recorded during the creation of the data product.

## 4 References

Clare, D., Hawes, J. and McBreen, F. (2020). Bassurelle Sandbank SAC Monitoring Report 2017. MPA Monitoring Programme Report No. 19. Department for Environment, Food and Rural Affairs (Defra)

Commission of the European Community (CEC). 2003. The Interpretation Manual of European Union Habitats - EUR25 [online]. Brussels: European Commission DG Environment. Available from: <http://www.scribd.com/doc/59569190/Interpretation-Manual-of-EU-Habitats-2003> [Accessed December 2016]

Commission of the European Community (CEC). 2007. The Interpretation Manual of European Union Habitats - EUR27 [online]. Brussels: European Commission DG Environment. Available from: [http://ec.europa.eu/environment/nature/legislation/habitatsdirective/docs/2007\\_07\\_im.pdf](http://ec.europa.eu/environment/nature/legislation/habitatsdirective/docs/2007_07_im.pdf) [Accessed December 2016]

Commission of the European Community (CEC). 2013. The Interpretation Manual of European Union Habitats - EUR28 [online]. Brussels: European Commission DG Environment. Available from: [http://ec.europa.eu/environment/nature/legislation/habitatsdirective/docs/Int\\_Manual\\_EU28.pdf](http://ec.europa.eu/environment/nature/legislation/habitatsdirective/docs/Int_Manual_EU28.pdf) [Accessed December 2016]

Connor, D.W., Gilliland, P.M. Golding, N. Robinson, P., Todd, D. & Verling, E, (2006), UKSeaMap: the mapping of seabed and water column features of UK Seas, ISBN 86107 590 1

Duncan, G. (2016). Method for creating version 2 of the UK Composite Map of Annex I Sandbanks slightly covered by seawater all of the time.

Ellwood, H., 2014 Method for Creating a Composite Map of Annex I Sandbanks slightly covered by seawater all of the time (version 1.1). Available from: [http://jncc.defra.gov.uk/PDF/20140123\\_UK\\_Sandbanks\\_Method\\_v1.1.pdf](http://jncc.defra.gov.uk/PDF/20140123_UK_Sandbanks_Method_v1.1.pdf) [Accessed December 2016]

Ellwood, H., 2014 Creating a EUNIS level 3 seabed habitat map integrating data originating from maps from field surveys and the EUSeaMap model. Available From <http://jncc.defra.gov.uk/page-6655> [Accessed December 2016]

Ellwood, H., and Duncan, G. 2015 Creating a composite OSPAR threatened and/or declining habitat map for the UK (version 1.0). Available from: [http://jncc.defra.gov.uk/PDF/R20150610\\_compositeOSPARHabitatMapMethod\\_v1.0.pdf](http://jncc.defra.gov.uk/PDF/R20150610_compositeOSPARHabitatMapMethod_v1.0.pdf) [Accessed December 2016]

Folk, R.L 1954. The distinction between grain size and mineral composition in sedimentary nomenclature. *Journal of Geology*, **62**, 344-359.

Klein, A. 2006. Identification of submarine banks in the North Sea and the Baltic Sea with the aid of TIN modelling. In: H. von Nordheim, D. Boedesker, J.C.Krause, eds. *Progress in Marine Conservation in Europe. Natura 2000 Sites in German Offshore Waters*. The Netherlands: Springer, 97 – 110

Miller, F., McCallum, S., White, A., Azzarello, J. & Caryl, F. 2017. Predictive mapping of seabed features within selected Special Areas of Conservation and Nature Conservation



MPAs in Scottish territorial waters using available datasets. *Scottish Natural Heritage Commissioned Report No. 980.*

Parry, M., Flavell, B. and Davies, J. (2015) The extent of Annex I sandbanks in North Norfolk Sandbanks and Saturn Reef CSAC/SCI. Available at: <http://jncc.defra.gov.uk/page-6537>

Ridgeway, A. and Johnston, C. 2008. Completion of the UK SAC network for the Annex I habitat 'Sandbanks slightly covered by seawater all the time'. *Paper to the 19<sup>th</sup> Marine Natura 2000 Project Group. 08/09/2008.*

## Appendix

# European Commission interpretations of 'Sandbanks which are slightly covered by sea water all the time'

## 5 2003

Interpretation extracted from the Interpretation Manual of European Union Habitats - EUR25 (<http://www.scribd.com/doc/59569190/Interpretation-Manual-of-EU-Habitats-2003>).

Sentences not relevant to UK have been replaced with "..."; please consult original document for these sections.

### 1110 Sandbanks which are slightly covered by sea water all the time

1. Sublittoral sandbanks, permanently submerged. Water depth is seldom more than 20 m below Chart Datum. Non-vegetated sandbanks or sandbanks with vegetation belonging to the *Zosteretum marinae* and *Cymodoceion nodosae*.
2. Plants: *Zostera marina*, free living species of the *Corallinaceae* family. ...  
Animals: Important wintering habitat for many bird species, in particular *Melanitta nigra* but also *Gavia stellata* and *Gavia arctica*. Resting places for seals. Invertebrate communities of sandy sublittoral (e.g. polychaetes).
3. Corresponding categories: ...
4. These sandbanks can be found in association with mudflats and sandflats (1140).
5. Ericson, L. & Wallentinus, H.-G. (1979). Sea-shore vegetation around the Gulf of Bothnia. Guide for the International Society for Vegetation Science, July-August 1977. *Wahlenbergia* 5:1-142.  
Lappalainen, A., Hällfors, G. & Kangas, P. (1977). *Littoral benthos of the northern Baltic Sea*. IV. Pattern and dynamics of macrobenthos in a sandy bottom *Zostera marina* community in Tvärminne

## 6 2013

Interpretation extracted from the Interpretation Manual of European Union Habitats - EUR28 ([http://ec.europa.eu/environment/nature/legislation/habitatsdirective/docs/Int\\_Manual\\_EU28.pdf](http://ec.europa.eu/environment/nature/legislation/habitatsdirective/docs/Int_Manual_EU28.pdf)). Sentences not relevant to UK have been replaced with "..."; please consult original document for these sections. The definition of Sandbanks here differs from EUR27 (2007) only in the stated relevant EUNIS habitats.

### 1110 Sandbanks which are slightly covered by sea water all the time

1. Sandbanks are elevated, elongated, rounded or irregular topographic features, permanently submerged and predominantly surrounded by deeper water. They consist mainly of sandy sediments, but larger grain sizes, including boulders and cobbles, or smaller grain sizes including mud may also be present on a sandbank. Banks where sandy sediments occur in a layer over hard substrata are classed as sandbanks if the associated biota are dependent on the sand rather than on the underlying hard substrata.

“Slightly covered by sea water all the time” means that above a sandbank the water depth is seldom more than 20 m below chart datum. Sandbanks can, however, extend beneath 20 m below chart datum. It can, therefore, be appropriate to include in designations such areas where they are part of the feature and host its biological assemblages.

2. Plants: North Atlantic including North Sea - *Zostera* sp., free living species of the Corallinaceae family. On many sandbanks macrophytes do not occur. ...  
Animals: North Atlantic including North Sea - Invertebrate and demersal fish communities of sandy sublittoral (e.g. polychaete worms, crustacea, anthozoans, burrowing bivalves and echinoderms, *Ammodytes* spp., *Callionymus* spp., *Pomatoschistus* spp., *Echiichtys vipera*, *Pleuronectes platessa*, *Limanda limanda*). ...
3. Corresponding categories: ... The National Marine Habitat Classification for Britain and Ireland Version 03.02: Relevant types within “Sublittoral coarse sediments (SCS), Sublittoral sands (SSA) and Sublittoral macrophytes communities (SMP)”. EUNIS classification: Relevant types within “A5.1 Sublittoral coarse sediment, A5.2 Sublittoral sand, A5.4 Sublittoral mixed sediments, A5.5 Sublittoral macrophyte-dominated sediment”.
4. Sandbanks can be found in association with mudflats and sandflats not covered by seawater at low tide (1140), with *Posidonia* beds (1120) and reefs (1170). Sandbanks may also be a component part of habitat 1130 Estuaries and habitat 1160 Large shallow inlets and bays.
5. Augier H. (1982). Inventaire et classification des biocénoses marines benthiques de la Méditerranée. Publication du Conseil de l' Europe, Coll. Sauvegarde de la Nature, 25, 59 pages.  
Dyer Kr & Huntley Da (1999). The origin, classification and modelling of sand banks and ridges. *Continental Shelf Research* 19 1285-1330  
Connor, D.W., Allen, J.H., Golding, N., Lieberknecht, L.M., Northen, K.O. & Reker, J.B. (2003). The National Marine Habitat Classification for Britain and Ireland Version 03.02. Internet version. Joint Nature Conservation Committee, Peterborough.  
([www.jncc.gov.uk/marine/biotopes/default.htm](http://www.jncc.gov.uk/marine/biotopes/default.htm))  
Doniță, N., Popescu, A., Paucă-Comănescu, M., Mihăilescu, S., Biriș, I.A. (2005). *Habitatele din România*. Edit. Tehnică Silvică, București, 500 p. (ISBN 973-96001-4-X)  
Ericson, L. & Wallentinus, H.-G. (1979). Sea-shore vegetation around the Gulf of Bothnia. Guide for the International Society for Vegetation Science, July-August 1977. *Wahlenbergia* 5:1 – 142.  
European Environment Agency (2002). EUNIS habitat classification. Version 2.3. Copenhagen, EEA (Internet publication: <http://eunis.eea.europa.eu/habitats.jsp>)  
Haroun, R.J., Gil-Rodríguez, M.C., Díaz De Castro, J. & Prud'homme Van Reine, W.F. (2002). A check-list of the marine plants from the Canary Islands (Central Eastern Atlantic Ocean). *Botanica Marina*. 45: 139-169.  
Helcom (1998). Red List of Biotopes and Biotope Complexes of the Baltic Sea, the Belt Sea and the Kattegat. *Baltic Sea Environment Proceedings No. 75.*: 126pp.  
Kautsky, N. (1974). Quantitative investigations of the red algae belt in the Askö area, Northern Baltic proper. *Contrib. Askö Lab. Univ. Stockholm* 3: 1-29.  
Lappalainen, A., Hällfors, G. & Kangas, P. (1977). Littoral benthos of the northern Baltic Sea. IV. Pattern and dynamics of macrobenthos in a sandy bottom *Zostera marina* community in Tvärminne.

- Nordheim, H. Von, Norden Andersen, O. & Thissen, J. (Eds.) (1996). Red Lists of Biotopes, Flora and Fauna of the Trilateral Wadden Sea Area 1995. Helgol. Meeresuntersuchungen. 50 (suppl.): 136 pp.
- Nordiska Ministerrådet (2001). Kustbiotoper i Norden. Hotade och representativa biotoper. TemaNord 2001: 536. 345 pp.
- Oulasvirta, P., Leinikki, J. & Reitalu, T. (2001). Underwater biotopes in Väinameri and Kõpu area, Western Estonia. The Finnish Environment 497.
- Pavón-Salas, N., Herrera, R., Hernández-Guerra, A. & Haroun R. (2000). Distributional pattern of sea grasses in the Canary Islands (Central-East Atlantic Ocean). J. Coastal Research, 16: 329-335.
- Påhlsson, L. (Ed.) (1994). Vegetationstyper i Norden. TemaNord 1994: 665. 627 pp.
- Perès J. M. & Picard J. (1964). Nouveau manuel de bionomie benthique de la mer Méditerranée. Rec. Trav. St. Mar. Endoume 31 (47): 5-137.
- Ravanko, O. (1968). Macroscopic Green, Brown And Red Algae In The South-Western Archipelago Of Finland. Acta Bot. Fennica 79: 1-50.
- Riecken, U., Ries, U. & Ssymank, A. (1994). Rote Liste der gefährdeten Biotoptypen der Bundesrepublik Deutschland - Schriftenreihe für Landschaftspflege und Naturschutz. 41: 184 pp

## **7 Extract from “Method for Creating a Composite Map of Annex I Sandbanks slightly covered by seawater all of the time” version 1.1**

### **7.1 Data Sources**

#### **Sandbanks already delineated**

- Sandbanks that have already been delineated using the sandbank slope analysis method
- Sandbanks that have been delineated using another method

#### **Bathymetry, slope, aspect**

- Astrium 1 arc second (~25m) resolution bathymetry layer (digital elevation model (DEM)) – full UK coverage. Note that this is made up of a combination of datasets at varying resolutions that have been re-sampled to a constant 1 arc second resolution, including digital charts originally at a coarser original resolution and digital survey bathymetry originally at a finer resolution.
- Slope layer derived from above
- Aspect layer derived from above
- Contours layer derived from above
- Survey bathymetry and derived slope, aspect and contours – specific areas, high resolution and detailed. Used in preference to 1 sec DEM where present.

#### **Substrate**

- Sand polygons extracted from BGS Seabed Sediments 1:250k product, version 3
- Sand points extracted from Marine Recorder snapshot
- Reef polygons and points from UK Annex I Reefs v6 dataset, indicating potential presence of rock (and hence not sand)
- Old data layers described in section 1.1

**Biology** - polygon and point records of sea grass and maerl beds, which are referred to in the CEC (2003 and 2007) interpretations (see Section 1.2).

## 7.2 Method overview

The work undertaken at JNCC began by mapping sandbanks according to the revised interpretation by CEC (2007). The basic sandbank slope analysis method for identifying and delineating sandbanks according to this interpretation was:

1. Identify possible bank features (elevated, elongated, rounded or irregular topographic features, predominantly surrounded by deeper water) by looking at bathymetry – detailed survey bathymetry where available, otherwise Astrium 1 sec DEM
2. Check whether the area is likely to be sandy using substrate data
3. Check whether the summit is in <20m of water using bathymetry
4. Identify flanks and summit of banks using slope, aspect and bathymetry
5. Based on the approach suggested by Klein (2006)<sup>5</sup>, manually digitise boundaries of bank using a cut-off slope value of 0.5°, or 0.1-0.5° if data resolution is low, using contours lines if suitable.
6. Where it is not possible to draw a boundary due to data quality and/or resolution, create a point, corresponding to the rough centre of the bank.

Note that Klein (2006) suggests that banks with an extent of <1km<sup>2</sup> may be too small to be delineated using bathymetric data alone; however, this depends on the resolution of the data.

Some SACs that were designated before the revised guidelines were published contain sandbanks that are not topographically distinct or predominantly surrounded by deeper water (i.e. meeting the CEC (2003) interpretation but not the CEC (2007) interpretation). For these sandbanks it is not possible to use the sandbank slope analysis method described above. Representing these banks in the dataset requires involvement of the agency that initially proposed the site to delineate the bank according to the same interpretation used at the time. Biotope data may aid this identification. For example, a biotope map indicating the presence of sublittoral sand may provide this data, or for more detail sea grass and maerl data were extracted from biotope maps and Marine Recorder and some of this data may help to draw some of the boundaries (Section 1.2 describes how banks may be vegetated with *Zostera* (sea grass) and/or free-living *Corallinaceae* (maerl)).

---

<sup>5</sup> Klein (2006) suggested a topographic analysis for the identification and delineation of submarine banks in German waters to aid the identification of Annex I sandbanks. Specifically, it was suggested to use the change in slope from >0.5° to <0.5° to mark the boundary between the flank of a sandbank and the surrounding seabed.

## 8 Annex I: Version Control

### BUILD STATUS:

Version	Date	Author	Reason/Comments
1.0	24/04/2020	Jordan Pinder	Final amendments before publishing.
0.2	17/02/20	Jordan Pinder	Addressing initial feedback and comments.
0.1	05/08/19	Jordan Pinder	Updated methods document following 2019 Article 17 reporting round.

### DISTRIBUTION:

Copy	Version	Issue Date	Issued To
Electronic	1.0	24/04/20	JNCC & general public
Eelectronic	0.2	17/02/20	JNCC for final check
Electronic	0.1	05/08/19	JNCC habitat mapping team and site leads for initial feedback.