# Supplementary Advice on Conservation Objectives for Turbot Bank Nature Conservation Marine Protected Area

**April 2018**


JNCC

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# Contents

# Introduction

## What the conservation advice package includes

The information provided in this document sets out JNCC's supplementary advice on the conservation objectives set for this site. This forms part of JNCC's formal conservation advice package for the site and must be read in conjunction with all parts of the package as listed below:

- Background Document explaining where to find the advice package, JNCC's role in the provision of conservation advice, how the advice has been prepared, when to refer to it and how to apply it;
- Conservation Objectives setting out the broad ecological aims for the site;
- Statements on:
    - the site's protected feature condition;
    - conservation benefits that the site can provide; and
    - conservation measures needed to further the conservation objectives stated for the site. This includes information on those human activities that, if taking place within or near the site, can impact it and hinder the achievement of the conservation objectives stated for the site; and
- Supplementary Advice on Conservation Objectives (SACO) providing more detailed and site-specific information on the conservation objectives (this document).

The most up-to-date conservation advice for this site can be downloaded from the conservation advice tab in the Site Information Centre (SIC) on JNCC's website.

The advice presented here describes the ecological characteristics or 'attributes' of the site's protected feature: Sandeels specified in the site's conservation objective. These attributes are: extent and distribution, structure and function and supporting processes.

Figure 1 below illustrates the concept of how a feature's attributes are interlinked: with impacts on one potentially having knock-on effects on another e.g. the impairment of any of the supporting processes on which a feature relies can result in changes to its extent and distribution and structure and function.

Collectively, the attributes set out in the following table describe the desired ecological condition (favourable) for the site's feature. Each feature within the site must be in

favourable condition as set out in the site's conservation objective. All attributes listed in the following table must be taken into consideration when assessing impacts from an activity.

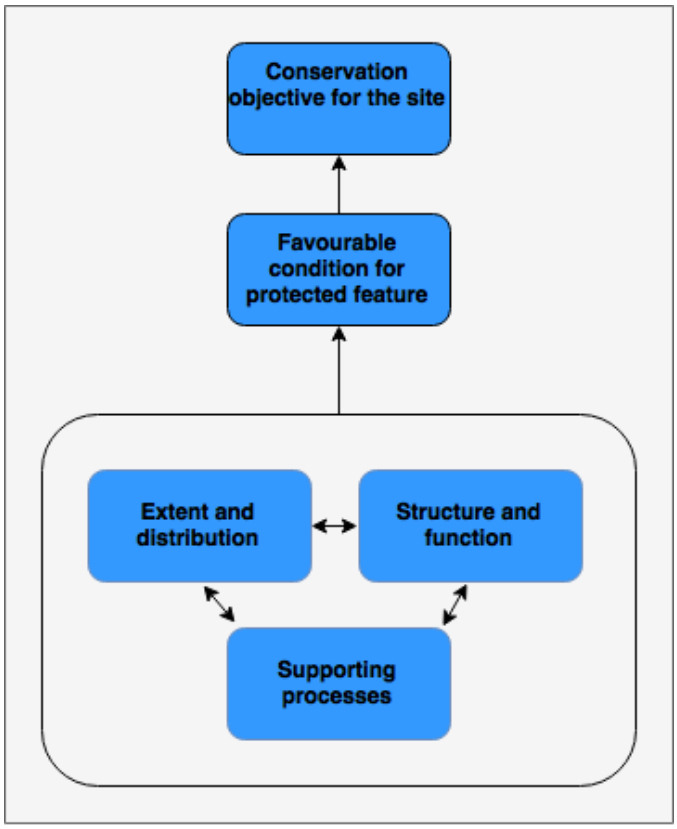


**Figure 1. Conceptual diagram showing how a feature's attributes are interlinked and collectively describe favourable condition and contribute to the conservation objectives stated for the site.**

In Table 1 below, the attributes for Sandeels are listed and a description provided in explanatory notes.

Please note our current understanding of whether the available evidence indicates that each attribute needs to be recovered or conserved is not provided. However, links to available evidence for the site are provided in the table below and should you require further site-specific information on the attributes listed for the site's feature, please contact JNCC at OffshoreMPAs@jncc.gov.uk.

## Table 1: Supplementary advice on the conservation objectives for Sandeels in Turbot Bank NCMPA

| **Attribute: Presence and distribution** |
|---|
| **Objective:**<br>An objective has not been set for this attribute. Links to available evidence are provided below. Please contact JNCC at OffshoreMPAs@jncc.gov.uk for further site-specific information on this attribute. |
| **Explanatory notes**<br>Presence describes Sandeel occurrence, with the spatial distribution providing a more detailed overview of the location(s) and pattern of occurrence within a site, both in the water column and the seabed. Sandeels may use a site for feeding on zooplankton in the water column, courtship or spawning purposes as well as nursery grounds. It is important to consider the key life stages and behaviours of Sandeels within a site as this may influence its distribution within a site which can fluctuate over time and be patchy in nature (Jensen *et al*., 2011).<br><br>Sandeels spawn with a single batch of demersal eggs (per year) between November and January (Macer, 1966; Reay, 1970). The eggs are laid onto sand grains on the seabed and remain there for 1-3 months until hatching (Macer, 1966; Wright, 1993; Wright and Bailey 1996; Jensen, 2001). The hatched larvae are planktonic and after metamorphosis, are recruited as juveniles into the Sandeel population as they settle and bury into the seabed (Winslade, 1971). Sandeels come out of their burrows to feed on zooplankton in the water column during spring and summer. This behaviour is strongly influenced by the availability and distribution of their zooplanktonic prey (*Calanus* species).<br><br>Sandeels have specific sediment requirements which affect presence and density (Wright *et al*., 2000). Sandeels are unlikely to relocate in response to changing conditions, and are therefore considered particularly vulnerable to the impacts of climate change (Engelhard *et al.,* 2008; Heath *et al.,* 2012). Recovery of the feature within a site is likely to be reliant on a supply of recruits from elsewhere/sufficient numbers remaining for self-recruitment and highly dependent on wider environmental pressures, such as climate change.<br><br>The areas of seabed that are known to support Sandeels are important for the conservation of the species and its distribution within a site. Conserving Sandeel presence and distribution within a site involves ensuring the continued access of individuals to resources within the site on which they rely, including, but not limited to, feeding, courtship, spawning or use as nursery grounds. Advice on the conservation of supporting processes, including supporting habitats is provided further down in this table. |

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**Presence and distribution of Sandeels within the site**
The presence and distribution of Sandeels within the site is shown in the site map. For further site-specific information please see the Site Information Centre.

For information on activities capable of affecting the protected features of the site, please see FeAST.

## Attribute: Supporting processes

**Objective:**
An objective has not been set for this attribute. Links to available evidence are provided below. Please contact JNCC at OffshoreMPAs@jncc.gov.uk for further site-specific information on this attribute.

**Explanatory notes**
For the site to fully deliver the conservation benefits set out in the statement on conservation benefits, the following natural supporting processes within a site must remain largely unimpeded:

Hydrodynamic regime;
Structure and function of supporting habitat; and
Water and sediment quality.

**Hydrodynamic regime**
Hydrodynamic regime refers to the speed and direction of currents, seabed shear stress and wave exposure. These mechanisms circulate food resources and propagules, as well as influencing water properties by distributing dissolved oxygen and transferring oxygen from the surface to the seabed (Chamberlain *et al.,* 2001; Biles *et al.,* 2003; Hiscock *et al.,* 2004). Hydrodynamic regime also effects the movement, size structure and sorting of sediment particles. Shelf hydrography effects the distribution and abundance of Sandeels and can affect nutrient and plankton availability (Cushing, 1989; Scott *et al.,* 2006) as well as egg and larval dispersal (Proctor *et al.,* 1998). Sandeel eggs hatch in February and March (Macer, 1966), releasing planktonic larvae into the water column which can then disperse (Conway *et al.,* 1997). Larval drift between areas in the North Sea is driven by the prevailing sea circulation patterns (Wright, 1996).

Biological connectivity is the extent to which populations in different parts of a species' range are linked by the movement of eggs, larvae or other propagules, juveniles or adults. Connectivity is important for maintaining genetic mixing, local stocks and facilitating stock recovery. Sandeel dispersal occurs primarily during the larval stage when the young move into the water column after hatching and is strongly influenced by the prevailing hydrodynamic regime.

The distribution of *Ammodytes marinus* is highly fragmented in the North Sea because of its preference for coarse sand with little silt (Jensen *et al.,* 2011); mixing among subpopulations is therefore dependent on dispersal of planktonic larvae over long distances and the movement of pre-settled juveniles between colonised habitat patches (Wright, 1996; Proctor *et al.,* 1998; Christensen *et al.,* 2008). Dispersal can occur over distances as far as 300 km but typically less than 100 km (Proctor *et al.,* 1998; Christensen *et al.,* 2008). It has been suggested that some sub-populations can act as sources for the rest of the North Sea (Christensen *et al.,* 2008).

The hydrodynamic regime plays a critical role in the natural distribution of Sandeels. Alterations to the natural movement of water could affect the presence, distribution, connectivity and recruitment of Sandeel sub-populations. It is therefore important to avoid impeding the wider natural hydrodynamic regime within a site.

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**Structure and function of supporting habitat**

As mentioned previously, the areas of seabed that are known to support Sandeel are important for the conservation of the species and its distribution within a site. Supporting habitats provide a function for Sandeels by offering refuge from predators. Once settled, adult Sandeels show limited movement between sub-populations (Proctor *et al.,* 1998; Christensen *et al.,* 2008; ICES, 2017). They tend to stay in the same place (Kunzlik *et al.,* 1986; Gauld and Hutcheon, 1990), rarely found further than 15 km away from their initial settlement habitat (Wright, 1996; Engelhard *et al.,* 2008; van der Kooij *et al.,* 2008).

For Sandeels, the structure and function of the supporting habitat plays an important role in determining the presence and distribution of the species. Sandeels are normally buried within seabed sediments for large parts of their life. It is important therefore to avoid infilling burrows occupied by Sandeels. Evidence indicates that Sandeels can typically bury in sediment to between 8 cm and 12 cm depth (Holland et al., 2005). Sandeel seabed habitat preference is particularly important as juveniles select locations to settle, burying into sediments containing a high proportion of coarse sand and little silt (Wright *et al.,* 2000; Holland *et al.,* 2005). Wright *et al.,* (2000) reported that Sandeels were not found in sediment samples in the North Sea where the silt content in the sediment was greater than 10%. To conserve the natural Sandeel

presence and distribution within a site, it is therefore important to avoid changing the natural sediment composition of the supporting habitat, particularly increasing the silt content. It is also important to avoid changing the natural distribution and depth of the supporting habitat.

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**Water and sediment quality**

While little is known about how Sandeels specifically are impacted by contaminants, it is known that contaminants can impact the health of marine fauna through a range of effects, depending on the nature of the contaminant (JNCC, 2004; UKTAG, 2008; EA, 2014). It is important therefore to avoid changing the natural water and sediment quality properties of a site and, as a minimum, ensure compliance with existing Environmental Quality Standards (EQS) as set out below.

**Environmental Quality Standards (EQS)**

The targets listed below for water and sediment contaminants in the marine environment are based on existing targets within OSPAR or the Water Framework Directive (WFD) and require concentrations and effects to be kept within levels agreed in the existing legislation and international commitments. These targets are set out in The UK Marine Strategy Part 1: The UK Initial Assessment, 2012).

Aqueous contaminants must comply with water column annual average (AA) Environmental Quality Standards (EQS) according to the amended Environmental Quality Standards Directive (EQSD) (2013/39/EU), or levels equating to (High/Good) Status (according to Annex V of the Water Framework Directive (WFD) (2000/60/EC), avoiding deterioration from existing levels.

Surface sediment contaminants (<1cm from the surface) must fall below the OSPAR Environment Assessment Criteria (EAC) or Effects Range Low (ERL) threshold. For example, mean cadmium levels must be maintained below the ERL of 1.2 mg per kg. For further information, see Chapter 5 of the OSPAR Quality Status Report (OSPAR, 2010) and associated QSR Assessments.

The following sources provide information regarding historic or existing contaminant levels in the marine environment:

- Marine Environmental and Assessment National Database (MERMAN);
- The UK Benthos database available to download from the Oil and Gas UK website;
- Cefas Green Book;
- Strategic Environmental Assessment Contaminant Technical reports available to download from the British Geological Survey website; and
- Charting Progress 1: The State of the UK Seas (2005) and Charting Progress 2: The State of the UK Seas (2014).

**Water quality**

The water quality properties that can influence the presence and distribution of Sandeels include salinity, pH, temperature, suspended particulate concentration, nutrient concentrations and dissolved oxygen.

Sandeels are particularly sensitive to changes in water temperature; a study on Dogger Bank found that Sandeels were most likely to be present in water temperatures between 8.5 – 9.5°C (van der Kooij *et al.,* 2008). Other studies have shown that changes in temperature have a significant effect on the metabolic rate and energy consumption of Sandeels, affecting their ability to overwinter and therefore impacting on adult reproductive capacity and mortality (Behrens *et al.,* 2007; Behrens and Steffensen, 2007; Wright *et al.,* 2000). A change of two-degrees Celsius could also lead to a substantial change in the structure of the wider biological community, affecting Sandeel food availability (Frederiksen *et al.,* 2007). Water salinity may also impact Sandeel presence and distribution, with a modelling study suggesting that, in areas where Sandeel are present, abundance was highest where surface salinity was 34.9 to 35.0 parts per thousand (ppt) (van der Kooij *et al.,* 2008). In the open offshore marine environment, salinity is not expected to naturally fluctuate.

Sandeels are pelagic feeders with their diet varying as they mature; Sandeel larvae feed on phytoplankton (diatoms in particular) while adults feed on zooplankton (copepods) (Ryland, 1964; Arnott and Ruxton, 2002). Adult Sandeels emerge to feed during spring and summer to increase body condition (to facilitate winter survival) and to produce gonad tissue for spawning (Greenstreet *et al.,* 2006). Zooplankton availability has a strong effect on adult Sandeel distribution and abundance during these seasons. The availability of copepod prey (especially *Calanus finmarchicus*) is an important determinant of Sandeel larval growth rates after larvae hatch in early spring, affecting early survival rates and subsequent recruitment (Wright and Bailey, 1996; Gurkan *et al.,* 2012). It is therefore important to avoid reducing natural water quality within a site so that Sandeels can continue to use the site.

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**Sediment quality**

Sandeels require the presence of oxygen in the seabed sediment to survive when buried (Lohse *et al.,* 1996), therefore a decrease in oxygen levels in sandy sediments could reduce Sandeel habitat availability (Behrens *et al.,* 2007; Behrens and Steffensen, 2007). Sandeels also have a high sensitivity to phytoplankton enrichment of sediment, which has been implicated in some local declines of Sandeels (Jensen, 2001). It is important to avoid reducing natural sediment quality within a site so that Sandeels can continue to use the site.

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**Supporting processes for the feature within the site**
For further site-specific information on the supporting processes for the feature within the site, please see the Site Information Centre.

For information on activities capable of affecting the protected features of the site, please see FeAST.

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