THE PLANNING ACT 2008

THE INFRASTRUCTURE PLANNING (EXAMINATION PROCEDURE) RULES 2010

**Thanet Extension Offshore Windfarm**
**Written Representations of Natural England**

For:
The construction and operation of Thanet Extension Offshore Windfarm, a 340 MW with up to 34 turbines wind farm located approximately 8 km off the Kent coast, covering an area of approximately 70 km$^2$.

Planning Inspectorate Reference: EN010084

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15th January 2019

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# 1. INTRODUCTION

## 1.1. Purpose and structure of these representations

1.1.1. These Written Representations are submitted in pursuance of rule 10(1) of the Infrastructure Planning (Examination Procedure) Rules 2010 ('ExPR') in relation to an application under the Planning Act 2008 for a Development Consent Order ('DCO') for the construction and operation of an offshore wind farm called Thanet Extension and associated infrastructure ('the Project') submitted by Vattenfall Wind Power Ltd, a subsidiary of Vattenfall, ('the Applicant') to the Secretary of State. The wind turbines ("the Array") is situated approximately 8 km off the Kent coast north-east of the Isle of Thanet, with the export cables proposed to make landfall at Pegwell Bay in Kent, and the grid connection at Richborough Port, which will in turn connect to the existing National Grid substation at Richborough Energy Park. The offshore wind farm will be used for the generation of electricity.

1.1.2. Natural England has already provided its principal concerns in its Relevant Representations, submitted to the Planning Inspectorate on 12th September 2018. This document comprises a further detailed statement of Natural England's views, as they have developed in view of the common ground discussions that have taken place with the Applicant to date. The document and our submissions at Deadline 1 are structured as follows:

a. Section 2 introduces the status and functions of Natural England.

b. Section 3 is an account of the legislative framework.

c. Section **Error! Reference source not found.** is an account of the policy framework.

d. Section **Error! Reference source not found.** describes the statutory nature conservation and landscape designations, features and interests that may be affected by the Project and need to be considered.

e. Section **Error! Reference source not found.** comprises Natural England's submissions in respect of the issues that concern it.

f. Section 7: Reference List

g. Annex A: Lists the documents submitted by the Applicant to Natural England since the Relevant Representations.

h. Annex B: Schedule of Natural England's Responses to the Examining Authority's first round of written questions.

i. Annex C: Natural England's Summary of Written Representations.

j. Annex D: Natural England’s Summary of Relevant Representations.

k. Annex E: Natural England’s review of other Relevant Representations.

l. A folder containing documents of interest for the Examining Authority including (but not limited to) designated site and conservation objectives.

1.1.3. In its letter of 18th December 2018 the Examining Authority asked the parties, including Natural England, a number of initial written questions. The answers to those questions are contained within Annex B, which has been submitted alongside these Written Representations entitled ‘Annex B - Schedule of Natural England‘s responses to Examining Authority‘s first round of written questions’.

## 2. STATUS AND FUNCTIONS OF NATURAL ENGLAND AND JNCC

### 2.1. Natural England

2.1.1. Natural England is a statutory body established under the Natural Environment and Rural Communities Act 2006 ('NERC Act'). Natural England is the Government's statutory advisor on the natural environment, helping to protect England's nature and landscapes for people to enjoy and for the services they provide. Natural England is an executive non-departmental public body, sponsored by the Department for Environment, Food and Rural Affairs ('Defra'). It provides advice to Government and others, forming its own views based on the best scientific evidence available.

2.1.2. Natural England works for people, places and nature, to enhance biodiversity, landscapes and wildlife in rural, urban, coastal and marine areas; promoting access, recreation and public well-being, and contributing to the way natural resources are managed so that they can be enjoyed now and by future generations.

2.1.3. Section 2 of the NERC Act provides that Natural England's general statutory purpose is:

*'… to ensure that the natural environment is conserved, enhanced and managed for the benefit of present and future generations, thereby contributing to sustainable development.'*

2.1.4. Section 2(2) states that Natural England's general purpose includes:

a. promoting nature conservation and protecting biodiversity;

b. conserving and enhancing the landscape;

c. securing the provision and improvement of facilities for the study, understanding and enjoyment of the natural environment;

d. promoting access to the countryside and open spaces and encouraging open-air recreation; and

e. contributing, in other ways, to social and economic well-being through management of the natural environment.

2.1.5. Natural England is required to keep under review all matters relating to its general purpose,[1] and to provide public authorities with advice where they request this.[2]

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[1] NERC Act, s.3(1).
[2] NERC Act, s.4(1).

Natural England's remit extends to the territorial sea adjacent to England, up to the 12 nautical mile limit from the coastline.[3]

2.1.6. Natural England is a statutory consultee in respect of (amongst other matters):

a. all applications for consent for Nationally Significant Infrastructure Projects which are likely to affect land in England;[4] and

b. the environmental information submitted pursuant to the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 ('the EIA Regulations').[5]

c. Plans or projects that are subject to the requirements of the Conservation of Habitats and Species Regulations 2017 ('the Habitats Regulations') or the Offshore Marine Conservation (Natural Habitats etc) Regulations 2017 ('Offshore Regulations') which are likely to have a significant effect on European protected sites – that is, sites designated as Special Areas of Conservation ('SACs') (and candidate SACs ('cSACs'))[6] and Special Protection Areas ('SPAs') and potential SPAs ('pSPAs')[7] for the purposes of the EU Habitats and Birds Directives – in England;[8]

d. proposals likely to damage any of the flora, fauna or geological or physiographical features for which a Site of Special Scientific Interest ('SSSI') has been notified pursuant to the Wildlife and Countryside Act 1981 (as amended) ('WCA 1981');[9]

e. proposals relating to the English territorial sea capable of affecting, other than insignificantly, any of the protected features of a Marine Conservation Zone ('MCZ') or any ecological or geomorphological process on which the conservation of any protected feature of an MCZ is (wholly or

[3] NERC Act, s.1(3).

[4] Planning Act s.42; Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009, reg. 3 and sched.1.

[5] Regs. 3(1), 10(6), 11(1), 16(2)(b), 20(3)(g), 22(3)(f), 24(5)(f) of the EIA Regs.

[6] As a matter of law cSACs are protected as they are included within the definition of 'European site' set out at regulation 8 of the Habitats Regs. A cSAC is the term given to sites which Member States have decided are Sites of Community Importance ('SCI') within their borders containing either species prescribed in Annex II of the Habitats Directive or which have Annex I habitat types. Sites containing priority habitats or species must be listed as SCIs and then designated as SACs. These sites are known as cSACs until such time as those sites are confirmed as SACs or a decision is taken that they should not be SACs.

[7] As a matter of policy, the Government expects public authorities to treat pSPAs as if they are fully designated European Sites, for the purpose of considering development proposals that may affect them. National Planning Policy Framework (July 2018), para 176; PINS Advice Note 10: Habitats Regulation Assessment for nationally significant infrastructure projects, p.3.

[8] Regulation 63 of the Habitats Regs; regulations 24(1) and (3) and 25(3)(b) of the Offshore Regs.

[9] Section 28E(1) of the 1981 Act.

in part) dependent, where the Examining Authority believes that there is or may be a significant risk of the act hindering the achievement of the conservation objectives stated for the MCZ.[10]

2.1.7. It is also the Government's policy to consult Natural England in respect of sites listed for the purposes of the Convention on Wetlands of International Importance especially as Waterfowl Habitat signed at Ramsar on 2 February 1971 ('Ramsar sites'), as if they were European protected sites.[11]

2.1.8. In addition, Natural England performs duties relating to SSSIs under the WCA 1981, and in relation to European protected sites and species under the Habitats Regulations.

## 2.2. Authorisation to delegate

2.2.1. The Examination Authority should note that pursuant to an authorisation made on the 9th December 2013 by the JNCC under paragraph 17(c) of Schedule 4 to the Natural Environment and Rural Communities Act 2006, Natural England is authorised to exercise the JNCC's functions as a statutory consultee in respect of applications for offshore renewable energy installations in offshore waters (0-200 nm) adjacent to England. This application was included in that authorisation and therefore Natural England will be providing statutory advice in respect of that delegated authority.

[10] Marine and Coastal Access Act 2009, ss.126(2) and 147(1). The first MCZs were designated in 2013. It is submitted that where an expanse of sea is under consideration for designation as an MCZ this is a material consideration.

[11] Revised National Planning Policy Framework (July 2018), para 176; PINS Advice Note 10: Habitats Regulation Assessment for nationally significant infrastructure projects, p.3.

## 3. LEGISLATIVE FRAMEWORK

### 3.1. Environmental Impact Assessment

3.1.1. The Infrastructure Planning (Environmental Impact Assessment) Regulations 2010 ('EIA Regs') transposed Council Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment (as amended). That directive and its amending instruments have since been repealed and replaced by consolidated Council Directive 2011/92/EU ('the EIAD'). Development consent cannot lawfully be granted for EIA development unless there has been substantial compliance with the EIA Regs.[12]

3.1.2. The descriptions in the schedules apply broadly, and are not to be interpreted as mutually exclusive 'pigeonholes'.[13] In assessing whether a development is likely to have a significant effect on the environment, the Planning Inspectorate must have regard to criteria in Schedule 3 of the EIA Regs.[14]

3.1.3. Where the Examining Authority is considering adopting a scoping opinion in which it specifies what information should be required in the environmental statement (ES), it must consult Natural England in respect of proposed applications likely to affect land in England and the marine environment.[15]

3.1.4. The ES must meet the requirements of Schedule 4 to the EIA Regulations. These include providing:

a. an outline of the main alternatives studied by the Applicant and an indication of the main reasons for the Applicant's choice, taking into account the environmental effects;

b. a description of the development, its construction and operation phases, its production processes, and an estimate by type and quantity of its emissions and residues;

c. a description of the aspects of the environment likely to be significantly affected by the development including air, water, soil, fauna and flora, and landscape;

d. a description of the likely significant effects of the development on the environment, including direct, indirect, secondary, cumulative, long- and short-term, temporary and permanent effects;

[12] *Berkeley v SSE* [2001] 2 AC 603, HL which also concerned the materially identical Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999..

[13] *R(Warley) v Wealden DC* [2011] EWHC 2083 (Admin) at [41]-[44] and [63]-[64] per Singh J, in relation to the materially identical Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999.

[14] EIA Regs, reg 7(1).

[15] Regulation 8(6) of the EIA Regs.

e. a description of the measures envisaged in order to prevent/avoid, reduce and remedy/offset the significant adverse effects on the environment;

f. the data required to identify and assess the main effects which the development is likely to have on the environment.

3.1.5. Regulation 3(2) of the EIA Regs provides that a DCO must not be made unless environmental information has been taken into consideration. 'Environmental information' means the required ES, including any further information requested, any other relevant information, and any duly made representations made about the environmental effects of the development and of any associated development.[16] The ES must meet the required standard before consent may be granted.[17] Consideration of the environmental information must be done conscientiously. Where the development qualifies as EIA Development consent will be unlawful if the decision ignores issues relating to the significance of environmental impacts or the effectiveness of mitigation.[18]

## 3.2. Duty to conserve biodiversity

3.2.1. Section 40 of the NERC Act imposes a '*duty to conserve biodiversity*' on public authorities, and as a minimum they should have regard to conserving biodiversity, including members of the Examining Authority and the Secretary of State. In pursuance of this, section 40(1) states:

*'Every public authority must, in exercising its functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity.'*

3.2.2. For the purposes of the NERC Act, conservation includes restoring or enhancing a habitat or population of organisms.[19] The Secretary of State must in particular have regard to the Convention on Biological Diversity when performing their duty.[20]

3.2.3. Section 41 of the NERC Act requires the Secretary of State to publish a list of the living organisms and types of habitat which in the Secretary of State's opinion are of principal importance for the purpose of conserving biodiversity in England. Section 41(3) states:

'the Secretary of State must–

(a) Take such steps as appear to the Secretary of State to be reasonably practicable to further the conservation of the living organisms and types of habitat included in any list published under this section, or

(b) Promote the taking by others of such steps.'

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[16] EIA Regs, reg. 2(1).
[17] *R v Cornwall CC, ex p Hardy* [2001] Env LR 25.
[18] *Smith v SSETR* [2003] EWCA Civ 262.
[19] NERC Act, s.40(3).
[20] NERC Act, s.40(2).

## 3.3. European Sites

3.3.1. The Secretary of State and the individual members of the Examining Authority are each a 'competent authority' for the purposes of the Habitats Regulations, with a duty to have regard to the requirements of Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora ('the Habitats Directive') and Directive 2009/147/EC of the European Parliament and of the Council on the conservation of wild birds ('the Wild Birds Directive').[21] So far as lies within their powers, a competent authority in exercising any function in or in relation to the United Kingdom must use all reasonable endeavours to avoid any pollution or deterioration of habitats of wild birds.[22]

3.3.2. The Secretary of State is also the 'appropriate authority' for the purposes of the Habitats Regulations.[23] They must accordingly exercise their functions which are relevant to nature conservation so as to secure compliance with the requirements of the Habitats Directive and Wild Birds Directive.[24] The Secretary of State must furthermore take such steps as they consider appropriate to secure the objective of the preservation, maintenance and re-establishment of a sufficient diversity and area of habitat for wild birds in the United Kingdom, including by means of the upkeep, management and creation of such habitat, as appropriate, having regard to the requirements of article 2 of the Wild Birds Directive.[25]

3.3.3. The Wild Birds Directive applies to all species of naturally occurring birds in the wild state in the European territory of the UK, including their nests, eggs and habitats.[26] Article 2 of the Wild Birds Directive requires populations of wild birds to be maintained 'at a level which corresponds in particular to ecological, scientific and cultural requirements, while taking account of economic and recreational requirements'.[27] Article 3 requires Member States, in the light of Article 2, to 'take the requisite measures to preserve, maintain or re-establish a sufficient diversity and area of habitats'. Article 5 requires Member States to take the requisite measures to establish a general system of protection for all their wild birds, prohibiting the deliberate killing or capture, deliberate destruction or removal of nests and eggs, and deliberate disturbance of the birds insofar as this is significant having regard to the objectives of the Directive. Article 4 requires SPAs to be established in respect of particular species, in order to ensure the survival and reproduction of these species in their area of distribution. In respect of SPAs, Article 4 requires that the Member States 'shall take appropriate steps to avoid pollution or deterioration of habitats or any disturbances affecting the birds, in so far as these would be significant having regard to the objectives of this Article'. It also requires that 'outside these protection areas, Member States shall also strive to avoid pollution or deterioration of habitats.' Article 13 provides that application

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[21] Habitats Regs, regs 7(1)(a), 3(1), and 9(3). Directive 2009/147/EC has replaced Council Directive 79/409/EEC of 2 April 1979 on the conservation of wild birds.

[22] Habitats Regs, reg.10(8)

[23] Habitats Regs, reg.3(1).

[24] Habitats Regulations, reg. 9(1) and (2).

[25] Habitats Regs, reg 10(1), (3)

[26] Wild Birds Directive, art.1.

[27] Wild Birds Directive, article 2.

of measures taken pursuant to the Directive may not lead to a deterioration in the present situation as regards the conservation of wild birds.

3.3.4. The Habitats Directive aims to contribute towards ensuring biodiversity through the conservation of natural habitats and of wild fauna and flora. It provides that measures taken pursuant to the Directive shall be designed to maintain or restore, at favourable conservation status, natural habitats and species of wild fauna and flora of community interest.[28] Member States, in consultation with the European Commission, must select and designate areas for protection as SACs pursuant to articles 3 and 4 of the Habitats Directive. Together with SPAs, these sites make up the Natura 2000 ecological network, which establishes a coherent ecological European network that enables 'the natural habitat types and the species' habitats concerned to be maintained or, where appropriate, restored at a favourable conservation status in their natural range'.[29]

3.3.5. Article 6 of the Habitats Directive applies both to SACs and to SPAs.[30] Article 6(2) requires that Member States shall take appropriate steps to avoid, the deterioration of natural habitats and the habitats of species as well as disturbance of the species for which the areas have been designated, in so far as such disturbance could be significant in relation to the objectives of the Habitats Directive. Article 6(3) requires that any project not directly connected with or necessary to the management of the European site, but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site, the competent national authorities shall agree to the project only after having ascertained that it will not adversely affect the integrity of the site concerned, unless it meets the criteria for derogation.

3.3.6. If an adverse effect on the integrity of the site cannot be ruled out, then the effect of Article 6(4) is that the project may only be carried out where (i) there are no alternative solutions, (ii) it must go ahead for imperative reasons of overriding public interest, including reasons of a social or economic nature; and (iii) all compensatory measures necessary to protect the overall coherence of the Natura 2000 network are secured. Where the site concerned hosts a priority natural habitat type and/or a priority species, the only considerations which may be raised as 'imperative reasons of overriding public importance' are those relating to human health or public safety, to beneficial consequences of primary importance for the environment or such other matters contained in an opinion of the European Commission.[31]

3.3.7. SACs and SPAs are protected as European sites in inshore waters off England (up to 12 nautical miles) by the Habitats Regulations and in offshore waters (i.e. outside 12 nautical miles) by the Offshore Regulations, which transpose the relevant parts of the Habitats Directive into domestic law. The provisions of Article 6 of the Habitats Directive which are noted above are found at regulations 63, 64

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[28] Habitats Directive, art.2.

[29] Habitats Directive, art.3(1).

**[30]** Habitats Directive, art. 6 applies to SACs and art.7 applies it to SPAs designated under the Wild Birds Directive.

[31] Regulations 64 and 68 of the Habitats Regulations, transposing Article 6(4) of the Habitats Directive.

and 68 of the Habitats Regulations and regulations 28, 29 and 36 of the Offshore Regulations. In determining these applications, the Secretary of State will be acting as a competent authority for the purposes of those Regulations.

3.3.8. The Regulations describe a sequence of steps to be taken by the competent authority in respect of a European site when deciding whether to authorise a project. Those steps are:

**Step 1** Consider whether the project is directly connected with or necessary to the management of the site?[32] If not —

**Step 2** Consider[33] whether the project is likely to have a significant effect on the site, either alone or in combination with other plans or projects. If such an effect cannot be excluded then –

**Step 3** Make an appropriate assessment of the implications for the site in view of its conservation objectives.[34] In so doing, the competent authority must consult Natural England[35] and have regard to its representations. If appropriate, it can also obtain the opinion of the general public.[36] The competent authority is also empowered to require the Applicant to provide information for the purposes of the appropriate assessment, or to enable the authority to determine whether such an assessment is required.[37]

**Step 4** Consider[38] whether the project will adversely affect the integrity of the site, having regard to the manner in which it is proposed to be carried out, and any conditions or restrictions subject to which that authorisation might be given (the 'Integrity Test').

**Step 5** The competent authority may agree to the plan or project **only after having ascertained that the project will not adversely affect the integrity of the site**.[39]

**Step 6** If the project fails the Integrity Test in respect of the site's conservation objectives, it can only proceed if the competent authority is satisfied that there are no alternative solutions[40] and that:

**Step 7** There are imperative reasons of overriding public interest for the project.[41] If these criteria are met, the competent authority must:

[32] Under regulation 63(1)(b) of the Habitats Regs or reg. 28(1)(c) of the Offshore Regs.
[33] Under regulation 63(1)(a) of the Habitats Regs or reg.28(1)(b) of the Offshore Regs.
[34] Under regulations 63(1) of the Habitats Regs.or 28(1) of the Offshore Regs.
[35] under regulations 63(3) of the Habitats Regs or 28(3)(b) of the Offshore Regs.
[36] under regulation 63(4) of the Habitats Regs or 28(3)(f) of the Offshore Regs.
[37] By regulation 63(2) of the Habitats Regs or 28 (2) of the Offshore Regs.
[38] Pursuant to regulation 63(5) and (6) of the Habitats Regs or 28(4) and (5) of the Offshore Regs.
[39] Applying regulation 63(5) of the Habitats Regs, subject to regulation 64, or reg 28(4) of the Offshore Regs subject to reg.26.
[40] in accordance with regulation 64(1) of the Habitats Regs or 29(1) of the Offshore Regs.
[41] in accordance with regulation 64(1) of the Habitats Regs or 29(1) of the Offshore Regs.

**Step 8** Secure any necessary compensatory measures to ensure the overall coherence of Natura 2000, implemented in the appropriate timeframe.[42]

3.3.9. The Directives are both to be construed purposively in the light of Article 191 of the Treaty on the Functioning of the European Union ('TFEU'). Article 191(1) TFEU provides that 'Union policy on the environment shall contribute to the pursuit of the…objectives [of] preserving, protecting and improving the quality of the environment'; and Article 191(2) provides that Union policy on the environment shall aim at a high level of protection, and shall be based on the precautionary principle and on the principle that preventive action should be taken.

3.3.10. Further to this, case law of the Court of Justice of the European Union has established the following points:

a. Articles 6(2) and 6(3) are aimed at achieving the same level of protection. The Habitats Directive therefore requires that Member States take systematic and effective measures pursuant to Article 6(3) which guarantee the avoidance in fact of significant deterioration of the habitats or disturbance of the species for which SPAs and SACs have been designated.[43]

b. Article 6(3) of [the] Directive makes the requirement for an appropriate assessment of the implications of a plan or project conditional on there being a probability or a risk that that plan or project will have a significant effect on the site concerned. In light of the precautionary principle in particular, such a risk exists if it cannot be excluded on the basis of objective information that the plan or project will have a significant effect on the site concerned. It follows that the Habitats Directive requires that any plan or project undergo an appropriate assessment of its implications if it cannot be excluded on the basis of objective information that that plan or project will have a significant effect on the site concerned.[44]

c. Under Article 6(3) of the Habitats Directive, 'an appropriate assessment of the implications for the site concerned of the plan or project implies that, prior to its approval, all aspects of the plan or project which can, by themselves or in combination with other plans or projects, affect the site's conservation objectives must be identified in the light of the best scientific knowledge in the field'.[45]

d. 'An assessment made under Article 6(3) of the Habitats Directive cannot be regarded as appropriate if it contains gaps and lacks complete, precise and definitive findings and

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[42] As required by regulation 68 of the Habitats Regs or 36 of the Offshore Regs.
[43] CJEU, Case C-241/08 *Commission v France* at paras 30-36; Case C-535/07 *Commission v Austria* at paras 57-58.
[44] CJEU Case C-418/04 *Commission v Ireland* at paras 226 to 227; Case C-127/02, *Landelijke Vereniging tot Behoud van de Waddenzee v Staatsecretaris van Landbouw, Natuurbeheer en Visserij* at paras 43-45
[45] CJEU Case C-127/02 *Waddenzee* at para 61.

conclusions capable of removing all reasonable scientific doubt as to the effects of the works proposed on the SPA concerned'.[46]

e. In the context of priority habitats within SACs, 'a plan or project not directly connected with or necessary to the management of a site will adversely affect the integrity of that site if it is liable to prevent the lasting preservation of the constitutive characteristics of the site that are connected to the presence of a priority natural habitat whose conservation was the objective justifying the designation of the site in the list of SCIs, in accordance with the directive. The precautionary principle should be applied for the purposes of that appraisal'[47] and these impacts should be appropriately assessed. Furthermore, the CJEU has held that the loss of SPA habitat cannot be mitigated for by not reducing the total SPA habitat or enhancing it. Instead, those compensatory measures should be considered, if necessary, under Article 6(4) and not as part of the appropriate assessment.[48]. As a matter of policy, this case law also applies to habitat designated under the Ramsar Convention.

f. In order to determine whether it is necessary to carry out, subsequently, an appropriate assessment of the implications, for a site concerned, of a plan or project, it is not appropriate, at the screening stage, to take account of the measures intended to avoid or reduce the harmful effects of the plan or project (mitigation) on that site.[49]

## 3.4. Ramsar Convention

3.4.1. The UK is a party to the 1971 Convention on Wetlands of International Importance, done at Ramsar, Iran ('the Ramsar Convention').

3.4.2. Article 2(1) of the Convention provides that 'Each Contracting Party shall designate suitable wetlands within its territory for inclusion in a List of Wetlands of International Importance'.

3.4.3. Article 4 of the Convention provides:

46 CJEU Case C-404/09 *Commission v Spain* at para 100; cf case C-304/05 *Commission* v *Italy* [2007] ECR I-7495, paras 58-59, 67-70 and judgement of 25th July 2018, *Grace and Sweetman*, C-164/17, EU:C:2018:593, paragraph 39.

47 CJEU Case C-258/11 *Peter Sweetman and Others v An Bord Pleanála* [2013] ECR-000, para 48. See also judgement of 17 April 2018, *Commission vs. Poland (Białowieża Forest)*, C-441/17, EU:C:2018:255, paragraph 116.

48 CJEU Case -164/17 Grace and Sweetman vs An Bord Pleanala [2018]

49 CJEU Case C-323-17 *People Over Wind and Sweetman vs Coillte Teoranta,* para 40.

a. Each Contracting Party shall promote the conservation of wetlands and waterfowl by establishing nature reserves on wetlands, whether they are included in the List or not, and provide adequately for their wardening.

b. Where a Contracting Party in its urgent national interest, deletes or restricts the boundaries of a wetland included in the List, it should as far as possible compensate for any loss of wetland resources, and in particular it should create additional nature reserves for waterfowl and for the protection, either in the same area or elsewhere, of an adequate portion of the original habitat.

c. The Contracting Parties shall encourage research and the exchange of data and publications regarding wetlands and their flora and fauna.

d. The Contracting Parties shall endeavour through management to increase waterfowl populations on appropriate wetlands.'

3.4.4. The Government designates Ramsar sites in accordance with the criteria set out in the Convention, in recognition of the international importance of these sites as a wetland wildlife habitat.

3.4.5. In accordance with Government Circular: Biodiversity and Geological Conservation Statutory Obligations and their Impact within the Planning System (ODPM 06/2005), and the National Planning Policy Framework (2018), paragraph 176, Ramsar sites are subject to the same procedures described in the preceding section (in relation to European sites) as a matter of UK Government Policy, in order to assist the Government in fully meeting its obligations under the Ramsar Convention.

## 3.5. **Sites of Special Scientific Interest (SSSIs)**

3.5.1. SSSIs are notified as such by Natural England under section 28 of the WCA 1981(as amended), where we are of the opinion that land is of special interest by reason of any of its flora, fauna, or geological or physiographical features.

3.5.2. Section 28G of the WCA 1981 places legal obligations on public authorities in relation to SSSIs. These authorities are known as 'section 28G authorities', and the definition given at s.28G(3) embraces all public office-holders including the Secretary of State and the Examining Authority.

3.5.3. An authority to whom section 28G applies has a duty in exercising its functions so far as their exercise is likely to affect the flora, fauna or geological or physiographical features by reason of which a SSSI is of special interest to:

*'take reasonable steps, consistent with the proper exercise of the authority's functions, to further the conservation and enhancement of the flora, fauna or geological or physiographical features by reason of which the site is of special scientific interest.'*

3.5.4. In addition, where the permission of a section 28G authority is needed before proposed operations may be carried out, the section 28G authority must, in accordance with section 28I(5) of the WCA 1981, take any advice received from Natural England into account:

a. in deciding whether or not to permit the proposed operations; and

b. if it does decide to do so, in deciding what (if any) conditions are to be attached to the permission.

3.5.5. 'Permission' is defined so as to include any kind of consent or authorisation.[50] As the Applicant requires development consent from the Secretary of State in order to proceed with its proposals, and as the Secretary of State is a section 28G authority, the duties under section 28I(5) apply to the Secretary of State.[51]

3.5.6. Section 35 of the WCA 1981 empowers Natural England to declare as a 'National Nature Reserve' ('NNR') any land which is managed as a nature reserve and is of national importance. Protection is afforded to the NNR through the management of the SSSI, European and Ramsar features that share a boundary and habitats of the NNR.

## 3.6. Marine Conservation Zones

3.6.1. In respect of Marine Conservation Zones (MCZs), where Natural England is the appropriate statutory conservation body, it has the power under section 127 of the Marine and Coastal Access Act 2009 to give advice and guidance as to:

a. The matters which are capable of damaging or otherwise affecting any protected feature of an MCZ;

b. The matters which are capable of affecting any ecological or geomorphological process on which the conservation of any protected feature or features of an MCZ is (wholly or in part) dependent;

c. How any conservation objectives stated for an MCZ may be furthered, or how the achievement of any such objectives may be hindered;

d. How the effect of any activity or activities on an MCZ or MCZs may be mitigated; and

e. Which activities are, or are not, of equivalent environmental benefit to any particular damage to the environment.

## 3.7. European Protected Species

3.7.1. Regulation 9(3) of the Habitats Regulations, headed 'Duties relating to compliance with the Directives', stipulates that:

[50] WCA 1981, s.28I(7).

[51] Natural England accepts that the notice requirements of section 28I(2) to (4) have been satisfied for the purposes of the Secretary of State's determination of the planning applications at issue here.

*'a competent authority, in the exercising of any of their functions, must have regard to the requirements of the Habitats Directive so far as they may be affected by the exercise of those functions'.*

The Examining Authority and Secretary of State are both 'competent authorities' by virtue of reg.7(1), which includes any person holding a public office.

3.7.2. In relation to species of animals and plants listed in Annex IV of the Habitats Directive, article 12 of the Directive provides that the UK must take the requisite measures to ensure that they are subject to a system of strict protection.

3.7.3. In relation to the animal species, the system must in particular prevent the deliberate capture or killing of specimens of these species in the wild; deliberate disturbance of these species; deliberate destruction or taking of eggs from the wild; and deterioration or destruction of breeding sites or resting places. Disturbance or destruction may be indirect, for instance through noise or light pollution, or loss of habitat.[52]

3.7.4. The plant species must be protected in particular from deliberate picking, collecting, cutting, uprooting or destruction in their natural range in the wild.

3.7.5. Article 16 of the Habitats Directive provides that this strict protection may be derogated from only where (i) there is no satisfactory alternative, (ii) the derogation is not detrimental to the maintenance of the populations of the species concerned at a favourable conservation status in their natural range, and (iii) the purpose is (a) protecting wild fauna and flora and conserving natural habitats; (b) preventing serious damage to crops, livestock, forests, fisheries and water and other types of property; (c) public health and safety, or for other imperative reasons of overriding public interest, including those of a social or economic nature and beneficial consequences of primary importance for the environment; (d) research, education, and repopulating and re-introducing these species; or (e) to allow, under strictly supervised conditions, on a selective basis and to a limited extent, the taking or keeping of certain specimens of the species listed in Annex IV in limited numbers specified by the competent national authorities.

3.7.6. Regulation 43 of the Habitats Regs and the provisions of the WCA 1981 make it a criminal offence to engage in the behaviour prohibited by the Habitats Directive. However, prohibitions enforced by penalties for infractions are not in themselves adequate to implement the Directive if they will not prevent significant destruction or disturbance taking place in fact: 'such protection requires that individuals be prevented in advance from engaging in potentially harmful activities'.[53]

3.7.7. The Court of Justice of the European Union has accordingly ruled that Member States must not only adopt a comprehensive legislative framework, but also to implement concrete and specific protection measures that are coherent, co-ordinated and preventive in nature.[54] Such a system of strict protection must

[52] CJEU Case C-103/00, *Commission v Greece*, judgment para 34 and Opinion of Léger AG delivered on 25 October 2001, paras 46, 56 and 57; *R(Morge) v Hampshire CC* [2010] EWCA Civ 608 at [49]. [2011] UKSC 2 at [19].

[53] CJEU, Case C-418/04 *Commission v Ireland* at para 208.

[54] CJEU Case C-183/05, *Commission v Ireland*, paras 29-30.

enable the effective avoidance of deterioration or destruction of breeding sites or resting places caused by development.[55] Strict protection must be enforced even if the population of the species is not declining.[56]

3.7.8. The Secretary of State should follow the guidance in paragraphs 99 and 116 of Circular 06/2005, and take care to ensure that any disturbance of protected species, including harm to their habitats, food-sources, resting-places or breeding sites, is avoided unless they consider that the derogation criteria are likely to be met, in which case they should require any necessary licence to be obtained before development commences.[57]

## 3.8. Nationally Protected Species

3.8.1. Certain birds, other animals and plants which are listed in the schedules to the WCA 1981 are protected from disturbance, injury and capture or taking by the provisions of Part 1 that Act, which makes it a criminal offence to disturb, injure, capture or take them.

3.8.2. Under section 16 of the WCA 1981, licences may be issued to authorise these activities, provided that certain conditions are met. The conditions do **not** include derogation for the purpose of facilitating development, nor for general social or economic purposes.

3.8.3. Badgers and their setts are also protected under the Protection of Badgers Act 1992, which makes it illegal to kill, injure or take badgers or to interfere with a badger sett. There is provision within the legislation for Natural England to permit activities affecting badgers or their setts where there is suitable justification and the problem cannot be resolved by alternative means.

## 3.9. Areas of Outstanding Natural Beauty ('AONBs')

3.9.1. Section 85(1) of the Countryside and Rights of Way Act 2000 ('CRWA 2000') requires all persons holding public office, public bodies and Ministers of the Crown, when exercising or performing any functions so as to affect land in an AONB to 'have regard to the purpose of conserving and enhancing the natural beauty of the area of outstanding natural beauty'. By section 92(2) of the CRWA 2000, this includes having regard for conserving its fauna, flora and geological and physiographical features.

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[55] CJEU Case C-383/09 *Commission v France,* opinion of Advocate-General Kokott *at* para 89; judgment at paras 21, 35, 37.

[56] CJEU Case C-103/00 *Commission v Greece* para 31; CJEU Case C-518/04 *Commission v Greece*, para 21.

[57] That was the approach endorsed by the High Court in *R(Woolley) v East Cheshire DC* [2010] Env. L.R. 5 at [27]-[28]. In *Morge v Hampshire CC*, the Supreme Court appears to have thought that it would not be unlawful to grant permission for a development unconditionally, unless it were thought unlikely that the criteria would be met. This was on the premise that it was sufficient for the prohibited conduct to be subject to criminal penalties if no species licence were obtained. However, the CJEU authorities cited above - which the Supreme Court did not consider in that case – make it clear that a preventive approach must be taken by the planning authority. It would be unsafe for the Secretary of State to grant consent without ensuring, so far as he can, that the requirements of the Directive would be met.

## 3.10. National Parks

3.10.1. National Parks, along with AONBs, have been confirmed by the Government as having the highest status of protection in relation to landscape and scenic beauty. National Park purposes are to conserve and enhance their natural beauty, wildlife and cultural heritage and to promote opportunities for the understanding and enjoyment of their special qualities by the public.

3.10.2. The statutory duties are provided for in Section 11A(2) of the National Parks and Access to the Countryside Act 1949 (National Parks). Specifically, they state that, “in exercising or performing any functions in relation to, or so as to affect, land” in these areas, relevant authorities “shall have regard” to their purposes.

## 4. POLICY FRAMEWORK

### 4.1. Introduction

4.1.1. The documents referred to below are statements of overarching policy which are central and applicable to planning decisions affecting biodiversity. It is presumed that the Examining Authority has copies of them, and therefore it has not been thought necessary to include them as Annexes to these Written Representations.

### 4.2. National Policy Statements

4.2.1. This section summarises the provisions of *EN-1: Overarching Policy Statement for Energy* and *EN-3 National Policy Statement for Renewable Energy Infrastructure* that are most relevant to Natural England's case in relation to particular topics[58]. Bracketed references are made to the corresponding sections of each NPS.

4.2.2. **Environmental Statement** - When considering an application for a DCO, the Secretary of State and the Examining Authority should satisfy themselves that likely significant effects, including any significant residual effects taking account of any proposed mitigation measures or any adverse effects of those measures, have been adequately assessed [EN-1 at 4.24]. Where necessary, the Secretary of State and the Examining Authority should request further information where necessary to ensure compliance with the EIA Directive [EN-1 at 4.24].

4.2.3. **Habitats and Species Regulations** - Prior to granting a DCO, the Secretary of State must, under the Habitats Regulations, consider whether the project may have a significant effect on a European site (including Ramsar sites), either alone or in combination with other plans or projects [EN-1 at 4.3.1].

4.2.4. The Applicant should seek the advice of Natural England and provide the Examining Authority, with such information as it may reasonably require, to determine whether an Appropriate Assessment is required [EN-1 at 4.3.1]. In the event that an Appropriate Assessment is required, the Applicant must provide the Examining Authority with such information as may be reasonably be required to enable it to conduct the Appropriate Assessment [EN-1 at 4.3.1].

4.2.5. **National Designations** - In sites with nationally recognised designations (including Sites of Special Scientific Interest and National Parks) consent for renewable energy projects should only be granted where it can be demonstrated that the objectives of designation of the area will not be compromised by the development, and any significant adverse effects on the qualities for which the area has been designated are clearly outweighed by the environmental, social and economic benefits [EN-3 at 2.5.33].

[58] References to EN-1 and EN-3 are combined for purposes of this section for purposes of organising the section by topic. This is consistent with, eg, EN-1.3.1, which requires EN-1 to be read "in conjunction" with EN-3. The exact wording of any provision may have been modified in order to remove outdated or irrelevant references (e.g., "IPC" is replaced with "Secretary of State" or "Examining Authority" where relevant, or references to designations that are irrelevant to the facts of this case, such as AoNBs have been removed) in order to adapt these provisions to the circumstances of this case for the purposes of these Written Representations.

4.2.6. **Impacts on Biodiversity and Geological Conservation** - Where the development is subject to EIA, the Applicant should ensure that the ES clearly sets out any effects on internationally, nationally, and locally designated sites of ecological or geological conservation importance, on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity [EN-1 at 5.3.3]. The Applicant should also show how the project has taken advantage of opportunities to conserve and enhance biodiversity and geological conservation interests [EN-1 at 5.3.3].

4.2.7. As a general principle, development should aim to avoid significant harm to biodiversity and geological conservation interests, including through mitigation and consideration of reasonable alternatives. Where significant harm cannot be avoided, compensation measures should be sought [EN-1 at 5.3.7].

4.2.8. In taking decisions, the Secretary of State should ensure that appropriate weight is attached to designated sites of international, national and local importance; protected species; habitats and other species of principal importance for the conservation of biodiversity; and to biodiversity and geological interests within the wider environment [EN-1 at 5.3.8].

4.2.9. Where a development proposal is located outside of a SSSI and is likely to have an adverse effect on the SSSI (either individually or in combination with other developments), development should not normally be granted. Where an adverse effect, after mitigation, on the SSSI's notified special interest features is likely, an exception should only be made where the benefits (including need) clearly outweigh both the impacts that it is likely to have on the features of the site that make it of special scientific interest and any broader impacts on the national network of SSSIs [EN-1 at 5.3.11]. The Secretary of State should use requirements and/or planning obligations to mitigate the harmful aspects of the development and, where possible, to ensure the conservation and enhancement of the site's biodiversity or geological interest [EN-1 at 5.3.11].

4.2.10. For species and habitats that have been identified as being of principal importance for the conservation of biodiversity in England, the Secretary of State should ensure that these are protected from the adverse effects of development by using requirements or planning obligations [EN-1 at 5.3.17]. The Secretary of State should refuse consent where harm to the habitats or species would result, unless the benefits (including need) of the development outweigh that harm [EN-1 at 5.3.17]. In this context the Secretary of State should give substantial weight to any such harm to the detriment of biodiversity features of national or regional importance which it considers may result from the proposed development [EN-1 at 5.3.17].

4.2.11. The Applicant should include appropriate mitigation measures as an integral part of the development. These include measures that will minimise harm to species or habitats during the construction of the operation and, where practicable, restore habitats after construction work have finished [EN-1 at 5.3.18]. Where the Applicant cannot demonstrate this, the Secretary of State (and the Examining Authority) should consider what appropriate requirements should be attached to any consent and/or planning obligations entered into [EN-1 at 5.3.19].

4.2.12. The Secretary of State (and the Examining Authority) will need to take account of what mitigation measures may have been agreed between Natural England or the Marine Management Organisation, and whether these bodies have granted or refused or intends to grant or refuse, any relevant licences, including protected species mitigation licences [EN1 at 5.3.20].

4.2.13. The following provisions of EN-3 are of particular relevant to Natural England's case in relation to the topic of Biodiversity and Geological Conservation:

4.2.14. **Impacts on Birds** -The Secretary of State (and the Examining Authority) will want to be satisfied that the collision risk assessment has been conducted to a satisfactory standard having had regard to the advice from the relevant statutory advisor [EN-3 at 2.6.104].

4.2.15. Subject to other constraints, wind turbines should be laid out within a site, in a way that minimises collision risk, where the collision risk assessment shows there is a significant risk of collision [EN-3 at 2.6.108].

4.2.16. **Impacts on Marine Mammals** - If piling associated with an offshore windfarm is likely to lead to the committing of an offence (which would include deliberately disturbing, killing or capturing a European Protected Species), an application may have to be made for a wildlife licence (to the Marine Management Organisation) to allow the activity to take place [EN-3 at 2.6.91].

4.2.17. Where assessment shows that noise from offshore piling may reach noise levels likely to lead to such an offence, the Applicant should look at possible alternatives or appropriate mitigation before applying for a licence [EN-3 at 2.6.93].

4.2.18. The Secretary of State (and the Examining Authority) should be satisfied that the preferred methods of construction, in particular the construction method needed for the proposed foundations and the preferred foundation type, where known at the time of application, are designed so as to reasonably minimise effects on marine mammals [EN-3 at 2.6.94]. Unless suitable noise mitigation measures can be imposed by requirements to any development consent the Secretary of State may refuse the application [EN-3 at 2.6.94].

4.2.19. **Impacts on Fish, Intertidal and Subtidal Habitats** - The Applicant's assessment should include relevant information about the impacts of development activities (including cabling) on the likely receptors, including the potential loss of habitats [EN-3 at 2.6.74, 2.6.81 and 2.6.113].

4.2.20. The Secretary of State (and the Examining Authority) should be satisfied that activities during the construction, operational and decommissioning phases (including cabling) have been appropriately designed, including in relation to the mitigation of adverse effects on fish and intertidal and subtidal habitats, to avoid or minimise harm to those features wherever possible in accordance with the relevant NPS policies on biodiversity [EN-3 at 2.6.72 to 2.6.89 and 2.6.111 to 2.6.119; see also EN-1 at 5.3.7 & 5.3.8]. Any consent that is granted by the Secretary of State should be flexible to allow for necessary micro-siting of elements of the proposed wind farm during its construction [EN-3 at 2.6.194].

4.2.21. **Impacts on Physical Environment** - The assessment should include predictions of the physical effect that will result from the construction and operation of the required infrastructure and include effects such as the scouring that may result from the proposed development [EN-3 at 2.6.194].

4.2.22. The Secretary of State (and the Examining Authority) should be satisfied that the methods of construction, including use of materials, are such as to reasonably minimise the potential for impact on the physical environment [EN-3 at 2.6.196].

4.2.23. Mitigation measures which the Secretary of State (and the Examining Authority) should expect, include the burying of cables to a necessary depth and using scour protection techniques around offshore structures to prevent scour effects around them, and Applicants should consult the statutory consultees appropriate mitigation [EN-3 at 2.6.197].

4.2.24. **Future Monitoring of Environmental Impacts** - The Secretary of State (and the Examining Authority) should consider whether the Applicant should be required to undertake monitoring prior to and during the development's construction, and during its operation, in order to measure and document the effects of the development. This enables an assessment of the accuracy of the original predictions and may inform the scope of future EIAs [EN-3 at 2.6.5.1].

4.2.25. Ecological monitoring is likely to be appropriate during the construction and operational phases to identify the actual impact so that, where appropriate, adverse effects can then be mitigated and enable further useful information to be published relevant to future projects [EN-3 at 2.6.71].

## 4.3. National Planning Policy and Guidance on Protected Sites and Species

4.3.1. **National Planning Policy Framework ("NPPF")** - Although the NPPF does not contain specific policies for NSIPs, and defers to the NPSs in this respect, it is submitted that the provisions of the NPPF, including those relevant to the conservation and enhancement of the natural environment, are both important and relevant considerations, and should be taken into account by the Secretary of State and the Examining Authority for purposes of assessing this DCO application[59].

4.3.2. NPPF makes it clear that setting is an important consideration in relation to heritage assets. It notes that the significance of a heritage asset derives not only from its physical presence, but also from its setting (para 172 and 173).

4.3.3. **Government Circular: Biodiversity and Geological Conservation – Statutory Obligations and their Impact within the Planning System (ODPM 06/2005)** - This Circular is relevant here, as indicated in EN-1 at, *e.g.*, 5.3.2. Reference to certain provisions of that Circular has already been made in relation to Section 3 of these Written Representations (the Legislative Framework).

4.3.4. In addition, Natural England refers to the following provisions of the Circular that are relevant to Natural England's case for the purposes of this examination.

4.3.5. *European sites*: In relation to Step 2 of paragraph 3.3.8, *supra* (the 'likely significant effect' determination under the Habitats Regulations Assessment steps), the Circular provides:

[59] See NPPF at paragraph 45.

a. The decision on whether an appropriate assessment is necessary should be made on a precautionary basis. An appropriate assessment is required where there is a probability or a risk that the plan or project will have significant effects on the site. This is in line with the ruling of the European Court of Justice in Case C-127/02 (the Waddenzee Judgement) which said '*any plan or project not directly connected with or necessary to the management of the site is to be subject to an appropriate assessment of its implications for the site in view of the site's conservation objectives if it cannot be excluded, on the basis of objective information, that it will have a significant effect on that site, either individually or in combination with other plans or project*[60].

b. If an appropriate assessment is required, [it] is for the decision-taker to consider the likely and reasonably foreseeable effects and <u>to ascertain that the proposal will not have an adverse effect on the integrity of the site</u> before it may grant permission. If the proposal would adversely affect integrity, or the effects on integrity are uncertain, but could be significant the decision-taker should not grant permission, subject to the provisions of regulations' 64 and 68 of the Habitats Regulations (or regulations 28 and 36 of the Offshore Regulations).[61]

c. In the Waddenzee judgement, the European Court of Justice ruled that a plan or project may be authorised only if a competent authority has made **certain** that the plan or project will not adversely affect the integrity of the site. 'That is the case where <u>*no reasonable scientific doubt*</u> remains as to the absence of such effects.' Competent national authorities must be '***convinced***' that that there will not be an adverse effect.[62]

4.3.6. *Protected Species*: With respect to wild plant and animal species (including all species of wild bird) protected under the 1981 Act or the Habitats Regulations

a. It is essential that the presence [of] protected species, and the extent that they may be affected by the proposed development, is established before the planning permission is granted, otherwise all relevant material considerations may not have been addressed in making the decision.[63]

[60] Circular 06/2005 at paragraph 13.
[61] *Id* at paragraph 20; references to the Habitats Regulations and Offshore Regulations are as amended.
[62] *Id* at paragraph 21.
[63] *Id* at paragraph 99.

4.3.7. **Advice Note 10: Habitats Regulation Assessment** - The Examining Authority is also reminded of the Planning Inspectorate's own Advice note 10: Habitats Regulations Assessment (April 2012).

## 4.4. European Commission Guidance

4.4.1. The European Commission has produced guidance on the protected sites and species procedures. This includes the following relevant guidance:

- Managing Natura 2000 sites: The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC (2018);
- EC (2001) Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Article 6 (3) and (4) of the Habitats Directive 92/43/EEC (November 2001);
- Guidance document on Article 6(4) of the Habitats Directive 92/43/EEC (2007);
- The implementation of the Birds and Habitats Directives in estuaries and coastal zones (2011);
- Wind energy developments and Natura 2000 (October 2010);
- Non-energy mineral extraction and Natura 2000 (July 2010); and
- Guidance document on the strict protection of animal species of Community interest under the Habitats Directive 92/43/EEC (final version February 2007).

## 5. CONSERVATION DESIGNATIONS, FEATURES AND INTEREST THAT COULD BE AFFECTED BY THE PROPOSED PROJECT

The following is a brief summary of the interest features of the relevant designated areas of concern in this matter. Designation citations are provided as links (where available) and documents that are available offline have been provided to the Examining Authority as part of Deadline 1.

### 5.1. International Conservation Designations -Special Protection Areas (SPAs)

#### 5.1.1. Thanet Coast and Sandwich Bay SPA

a. The Thanet Coast and Sandwich Bay SPA was classified by the UK Government as an SPA under the provisions of the Birds Directive in 1994.

b. The SPA covers 1870.16 ha and is located at the north-eastern tip of Kent in Southern England. It is a coastal site consisting of a long stretch of rocky shore, adjoining areas of estuary, sand dune, maritime grassland, saltmarsh and grazing marsh.

c. The proposed offshore windfarm is located outside of the SPA, but the landfall export cable will intersect the site.

d. The site qualifies under Article 4.1 of the Birds Directive (79/409/EEC) by supporting populations of European importance of the following species (taken from the 1992 citation):

i. During the breeding season the area regularly supports a nationally important breeding population of little tern *Sterna albifrons* (30 pairs – over 1 % of the British population). N.B. It should be noted that breeding terns are not thought to be breeding at the site. It should be noted that the landfall area is not a key historical breeding site. However Natural England’s new conservation advice (in draft) has set a restore objective for the attribute of population abundance, to increase the size of the population to a level which is above 30 pairs.

ii. A nationally important over-wintering population of European golden plover *Pluvialis apricaria*. During the five year period 1985/86 – 1989/90, an average peak count of 1,980 golden plover was recorded, representing 1 % of the British wintering population.

e. The site also qualifies under Article 4.2 of the Birds Directive (79/409/EEC) by regularly supporting an internationally important over-wintering population of turnstone *Arenaria interpres*. In the five year period 1986/97 – 1990/91, an average peak count of 1,340 turnstone was recorded, representing 2 % of the East Atlantic Flyway population and 3 % of the British over-wintering population (taken from 1992 citation). More recent data (5 year peak mean 1991/2 – 1995/6) counted 940 individuals representing at least 1.3 % of the over-wintering Western Palearctic – over-wintering population.

f. The citation and conservation objectives for the Thanet and Sandwich Bay SPA can be found by following this link: http://publications.naturalengland.org.uk/publication/6009926887407616. The relevant documents within that link have also been provided as part of Deadline 1.

g. Currently only high level conservation objectives for this site have been published, which provide a framework for informing any Habitats Regulations Assessment. These high level objectives have been provided at Deadline 1. Conservation advice for the site is available within the regulation 33 package (http://publications.naturalengland.org.uk/publication/3217253)however it should be noted that Natural England are currently updating conservation advice for all its European marine sites. A draft of the new package is in draft, which should be publically available by April 2019. Natural England have been using the principles of the updated packages to provide advice on this application. Supplementary advice to support the conservation objectives is not currently available.

### 5.1.2. Outer Thames Estuary SPA

a. The Outer Thames Estuary SPA was classified by the UK Government as an SPA under the provisions of the Birds Directive in August 2010.

b. The SPA covers 392,400 ha and is located along the east coast of England, predominantly in the coastal waters of the southern North Sea between the Thames Estuary and the east Norfolk coast.

c. The proposed offshore windfarm is approximately located 8 km from the SPA.

d. The site qualifies under Article 4.1 of the Birds Directive (79/409/EEC) by supporting populations of European importance of the following species:

i. A nationally important over-wintering population of Red-throated diver *Gavia stellata.* This population represents 38 % of the population in Great Britain (6,466 individuals – peak mean over the period 1989 – 2006/7).

ii. In the breeding season: Little tern *Sternula albifrons*, this population consists of 746 individuals (2011-2015), which represents 19.64 % of the Great Britain population.

iii. Common tern *Sterna hirundo*, this population consists of 532 individuals (2011 – 2015), which represents 2.66 % of the Great Britain population.

e. The most up to date departmental brief for the SPA can be found here: http://jncc.defra.gov.uk/pdf/outer-thames-estuary-departmental-brief.pdf. The conservation objectives for this site are currently in draft form but should be used for the Habitats Regulations Assessment. These draft objectives plus additional consultation documents can be found here: http://publications.naturalengland.org.uk/publication/3233957. The relevant documents within these links have also been provided as part of Deadline 1.

f. The draft conservation objectives can be found in the “Outer Thames Estuary SPA – Draft Advice” package upon page 35 in Appendix A. This document, as stated above, has been provided at Deadline 1.

5.1.3. **Flamborough and Filey Coast SPA**

a. The Flamborough and Filey Coast SPA has now been classified as an SPA under the provisions of the Birds Directive. The public consultation concluded in April 2014 and the minister publicly noted the intention to classify the site as an SPA in late 2018.

b. The SPA is in two sections: the southern section extends north from South Landing around Flamborough Head to Speeton; the northern section covers the peninsula of Filey Brigg before extending North West to Cunstone Nab. The seaward boundary extends 2 km throughout the two sections of the site into the marine environment, running parallel to the landward boundaries to include the adjacent coastal waters. The SPA covers an area of 7857.99 hectares.

c. The proposed offshore windfarm is approximately located 315 km from the Flamborough and Filey Coast SPA.

d. The site qualifies under Article 4.2 of the Birds Directive (2009/147/EC) by supporting over 1% of the biogeographical populations of four regularly occurring migratory species and a breeding seabird assemblage of European importance. This includes:

i. Black-legged kittiwake *Rissa tridactyla* – 44,520 pairs, 89040 breeding adults (2008-2011) representing 2 % of the North Atlantic population.

ii. Northern Gannet *Morus bassanus* – 8,469 pairs, 16, 938 breeding adults (2008-2012) representing 2.6 % of the North Atlantic population.

iii. Common guillemot *Uria aalge* – 41,607 pairs, 83,214 breeding adults (2008-2011) representing 15.6 % of the population.

iv. Razorbill *Alca torda* – 10,570 pairs, 21,140 breeding adults representing 2.3 % of the population.

v. The breeding seabird assemblages represents 216,730 individuals (2008-2012).

e. The citation and the high level conservation objectives for the Flamborough and Filey Coast SPA can be found by following the link: [http://publications.naturalengland.org.uk/publication/5400434877399040](http://publications.naturalengland.org.uk/publication/5400434877399040). The relevant documents within these links have also been provided as part of Deadline 1.

f. Currently only high level conservation objectives for this site have been published, which provide a framework for informing any Habitats Regulations Assessment. These high level objectives have been provided at deadline 1. Supplementary advice to support the conservation objectives is not currently available.

## 5.2. International Conservation Designations - Wetlands of International Importance Designated under the Ramsar Convention (Ramsar sites)

### 5.2.1. Thanet Coast and Sandwich Bay Ramsar

a. The Thanet Coast and Sandwich Bay Ramsar was designated in July 1994 under the Ramsar Convention.

b. The site covers an area of 2,169 ha and lies on the east Kent coast, between Deal to the south-east and Whitstable to the north-west. It is a coastal site, consisting of a long stretch of rocky shore, adjoining areas of estuary, sand dune, maritime grassland, saltmarsh and grazing marsh. It follows much of the same boundary as the Thanet Coast and Sandwich Bay SPA.

c. The proposed offshore windfarm is located outside of the Ramsar, but the landfall export cable will intersect the site.

d. The site is listed for the following criteria:

i. Ramsar Criterion 2 – Wetland Invertebrate Assemblage. In the past the site has been known to support 15 British Red Data Book wetland invertebrates.

ii. Ramsar Criterion 3 – Species / populations occurring at levels of international importance. Species with peak counts in winter: Ruddy turnstone *Arenaria interpres*, 1007 individuals, representing an average of 1 % of the population (5 year peak mean 1998/9 – 2002/3).

e. The Information Sheet on Ramsar Wetlands (RIS) can be found at the following link: http://jncc.defra.gov.uk/pdf/RIS/UK11070.pdf. A further Ramsar information sheet can also be found at the following link: https://rsis.ramsar.org/RISapp/files/RISrep/GB664RIS.pdf. These documents has also been provided as part of Deadline 1.

f. Conservation objectives do not currently exist for this Ramsar site. However, further information can be gathered from the underlying SPA conservation objectives as many of the bird features in particular are shared between each designation.

## 5.3. International Conservation Designations - Special Areas of Conservation (SAC)

### 5.3.1. Thanet Coast SAC

a. The Thanet Coast SAC was first designated by the UK government as an SAC under the provision of the EC Directive 92/43 on the Conservation of Natural Habitats and of Wild Fauna and Flora in April 2005.

b. The site covers 2803.84 ha and covers an area extending from Birchington to Cliffs End near Ramsgate on the north Kent coastline.

c. The proposed offshore windfarm is located outside of the SAC, but part of the proposed cable corridor passes through the site.

d. The site is designated under article 4(4) of the Directive as it hosts the following habitats listed in Annex I:

i. Reefs;

ii. Submerged or partially submerged caves.

e. Natural England's Conservation Advice for the site can be found here (online only): https://designatedsites.naturalengland.org.uk/Marine/MarineSiteDetail.aspx?SiteCode=UK0013107&SiteName=gate&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=#SiteInfo. The Natura 2000 –Standard Data Form can be found at the following link also: http://jncc.defra.gov.uk/protectedsites/sacselection/n2kforms/UK0013107.pdf. This document has also been provided at Deadline 1.

f. The supplementary advice on conservation objectives have now been published on Natural England's Designated Sites View, and can be found by following this link (online only): https://designatedsites.naturalengland.org.uk/Marine/SupAdvice.aspx?SiteCode=UK0013107&SiteName=gate&SiteNameDisplay=Thanet+Coast+SAC&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=%20-%20SiteInfo

### 5.3.2. Southern North Sea SCI

a. The Southern North Sea SCI was submitted to the European Commission to become designated as a SAC. While it is in a process of being designated as a SAC, under the provisions of the EC Directive 92/43 on the Conservation of Natural Habitats and of Wild Fauna and Flora in 2009, the SCI is legally afforded the same protection as an SAC.

b. The SCI covers an area of 36,958 $km^2$ stretching from the central North Sea north of the Dogger Bank southwards to the Strait of Dover.

c. The proposed offshore wind farm is located within the Southern North Sea SCI.

d. The qualifying features for the site are:

i. Harbour Porpoise *Phocoena phocoena*

e. Links to further information on site selection, Standard Data Form, Draft Advice on Activities and Management Options Paper for the Southern North Sea SCI can be found here: http://jncc.defra.gov.uk/page-7243. As part of Deadline 1 the SAC selection assessment document and the draft conservation objectives and advice on activities document have been submitted.

f. As highlighted above, the draft conservation objectives for this site can be found on page 9 within the "SNS Conservation Objectives & Advice on Activities," which was provided to the ExA at Deadline 1.

## 5.4. National Conservation Designations - Sites of Special Scientific Interest

### 5.4.1. Sandwich Bay and Hacklinge Marshes SSSI

a. Sandwich Bay and Hacklinge Marshes SSSI was first notified in 1951, and amended in 1984 under section 28C of the Wildlife and Countryside Act 1981.

b. This SSSI covers 1790 ha and runs along the coastline from the south of Ramsgate to just north of Deal. The SSSI takes in both Pegwell and Sandwich Bay.

c. The proposed offshore windfarm is located outside the SSSI, however the proposed export cable landfall location and export cable corridor will interact with the interest features of the site.

d. Reason for notification: This site contains the most important sand dune system and sandy coastal grassland in South East England and also includes a wide range of other habitats such as mudflats, saltmarsh, chalk cliffs, freshwater grazing marsh, scrub and woodland. Associated with the various constituent habitats of the site are outstanding assemblages of both terrestrial and marine plants with over 30 nationally rare and nationally scarce species, having been recorded. Invertebrates are also of interest with recent records including 19 nationally rare, and 149 nationally scarce species. These areas provide an important landfall for migrating birds and also support large wintering populations of waders, some of which regularly reach levels of national importance. The cliffs at Pegwell Bay are also of geological interest.

e. The Sandwich Bay and Hacklinge Marshes SSSI citation and other relevant information can be found here: Citation: https://designatedsites.naturalengland.org.uk/PDFsForWeb/Citation/1001128.pdf and Designated sites (online only):

https://designatedsites.naturalengland.org.uk/SiteDetail.aspx?SiteCode=S1001128&SiteName=Hack&countyCode=&responsiblePerson. These documents have also been provided as part of Deadline 1.

f. For SSSIs the favourable condition tables provide an assessment of what condition each notified feature is currently in. If the feature is unfavourable further comment is made of why the feature is in its current state and what actions are being taken to recover the feature. The following link takes you to the condition table for this particular site (online only): https://designatedsites.naturalengland.org.uk/ReportUnitCondition.aspx?SiteCode=S1001128&ReportTitle=Sandwich%20Bay%20to%20Hacklinge%20Marshes%20SSSI

## 5.5. National Conservation Designations - Marine Conservation Zones

### 5.5.1. Goodwin Sands proposed Marine Conservation Zone (pMCZ)

a. Goodwin Sands pMCZ is a large inshore site which covers an area of 277 $km^2$ and is located off Sandwich Bay on the Kent Coast.

b. The proposed offshore windfarm is located outside of the pMCZ, but part of the proposed export cable corridor passes through the site.

c. Goodwin Sands is a large dynamic and constantly changing area of sand and coarse sediments that is regularly exposed at low tide. Around the sands themselves, the site includes deeper areas of subtidal coarse sediment that are known to be of particularly high biodiversity. The site also contain Ross worm reefs *Sabllaria spinulosa*, blue mussel beds *Mytilus Edulis* and moderate energy circalittoral rock, which is animal-dominated rock found on deeper or shaded vertical rock faces.

d. The site is proposed for designation to the protect the following features (and their associated habitats):

i. Subtidal sand
ii. Subtidal coarse sediment
iii. Blue mussel Beds
iv. English Channel outburst flood features
v. Moderate energy circalittoral rock
vi. Ross worm reefs (*Sabellaria spinulosa*)

e. Further information on Goodwin Sands proposed Marine Conservation Zone (pMCZ) can be found within the MCZ factsheet: https://consult.defra.gov.uk/marine/consultation-on-the-third-tranche-of-marine-conser/supporting_documents/Goodwin%20Sands%20Factsheet.pdf and the post survey site report: http://randd.defra.gov.uk/Document.aspx?Document=12832_Goodwin_Sands_rMCZ_Summary_Site_Report_v4.pdf. Both these documents have been provided at Deadline 1.

f. As this site has not formally been designated conservation objectives and supplementary advice on conservation objectives have not yet been produced. However, Thanet Coast MCZ shares many of the same designated features as Goodwin Sands pMCZ and we have advised the Applicant to use the supplementary advice that is published for Thanet Coast MCZ as a proxy to base their assessment on. The following link take you to the supplementary advice on conservation objectives for Thanet Coast MCZ (online only): https://designatedsites.naturalengland.org.uk/Marine/SupAdvice.aspx?SiteCode=UKMCZ0017&SiteName=gate&SiteNameDisplay=Thanet+Coast+MCZ&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=

5.5.2. **Thanet Coast MCZ**

a. Thanet Coast MCZ was designated in November 2013. It is an inshore site located on the Kent coast. The site boundary stretches from the east of Herne Bay, around Thanet to the northern wall of Ramsgate harbour. The site protects an area of approximately 64 $km^2$.

b. The proposed offshore windfarm site is located outside of the MCZ, but part of the proposed export cable corridor passes through the site.

c. This MCZ contains the best examples of a variety of features found within the south-east region, including an area of subtidal chalk that extends seawards from the chalk reefs, cliffs and coves also afforded protection by the Thanet Coast SAC. The chalk seabed within the area is the longest continuous stretch of coastal chalk in the UK. This is the only designated MCZ to protect the stalked jellyfish *Lucernariopsis cruxmelitensis*.

d. The site is designated to protect the following features:

i. Blue mussel (*Mytilus edulis*) beds
ii. Moderate energy circalittoral rock
iii. Moderate energy infralittoral rock
iv. Peat and clay exposures
v. Ross worm (*Sabellaria spinulosa*) reefs

vi. Stalked jellyfish (*Calvadosia cruxmelitensis*)
vii. Subtidal chalk
viii. Subtidal coarse sediment
ix. Subtidal mixed sediments
x. Subtidal sand

e. Further information on Thanet Coast MCZ can be found on Designated Sites (online only): https://designatedsites.naturalengland.org.uk/Marine/MarineSiteDetail.aspx?SiteCode=UKMCZ0017&SiteName=gate&countyCode=&responsiblePerson=&SeaArea=&IFCAArea= and within the factsheet: http://publications.naturalengland.org.uk/publication/5573527184867328. The fact sheet has been provided as part of Deadline 1.

f. The supplementary advice on conservation objectives have now been published on Natural England's Designated Sites View, and can be found by following this link (online only): https://designatedsites.naturalengland.org.uk/Marine/SupAdvice.aspx?SiteCode=UKMCZ0017&SiteName=gate&SiteNameDisplay=Thanet+Coast+MCZ&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=

## 5.6. Nationally and Internationally Protected Species

### 5.6.1. European Protected Species (EPS)

a. An application for a wildlife licence may be required, if noise levels associated with piling and unexploded ordnance offshore are predicted to reach noise levels likely to lead to an offence. This would include deliberately killing or capturing an EPS.

b. Such relevant EPS species could include: Porpoises, Bats, Great Crested Newt, Natterjack Toad and Great Crested Newt.

### 5.6.2. Nationally Protected Species

a. The Applicant has determined that no Nationally Protected Species (NPS) will be impacted from the project. However, should any NPS be detected from pre-construction surveys which could be impacted from the project a licence may be required, and Natural England should be contacted as soon as possible.

b. Such relevant NPS species could include: badgers, water voles, otters, wild birds, ancient woodland and reptiles.

## 6. NATURAL ENGLAND'S CONCERNS AND ADVICE

6.1. In this section Natural England will set out its concerns and advice regarding the project at the time of submission of these representations.

### 6.2. The Principal Issues

6.2.1. Natural England identified the following issues in our **relevant representations** which were submitted to PINS on the 12th September 2018.

6.2.2. **Site Selection and Alternatives**

Natural England raised concerns within our relevant representations regarding the reasoning and information as to why Pegwell Bay was chosen as the cable landfall site over options further south in Sandwich Bay. Natural England considers that should the Sandwich Bay option be chosen, it could potentially have a lesser environmental impact if further investigations could demonstrate that HDD could be used to avoid any interaction with habitats in Sandwich bay, such as shingle or sand dunes. In comparison, the worst case landfall scenario at Pegwell Bay would result in a potential permanent loss of 1,400 $m^2$ of saltmarsh habitat. Natural England are therefore not confident that this Pegwell Bay landfall option is less environmentally damaging than a potential landfall at Sandwich Bay.

6.2.3. If the Applicant however commits to HDD within Pegwell Bay, under the saltmarsh and avoid this loss of habitat through a DCO/DML condition, and this is reassessed as the worst case scenario, then the HDD option would be highly likely to avoid an adverse effect on integrity.

6.2.4. **The Proposed Loss of Saltmarsh**

Natural England does not support the proposed landfall option 2 within Pegwell Bay, which involves the permanent loss of up to 1400 $m^2$ of SSSI and SPA and Ramsar supporting habitat. Natural England advise that option 1 is committed to, which involves the use of HDD, avoiding the saltmarsh and the proposed permanent habitat loss associated with option 2. Consequently, we do not agree with the conclusions reached within the Report to Inform Appropriate Assessment (RIAA) which determines the potential loss of saltmarsh as having no Adverse Effect on Integrity (AEoI). Natural England do not agree with this conclusion and advise that we cannot currently conclude that there will not be an AEoI on the SPA and Ramsar site, nor an adverse effect on the SSSI. Natural England is of the view that the Applicant's conclusion of no AEoI is based on limited survey data which determines that the saltmarsh is not a functioning supporting habitat for the SPA birds and represents a lower quality of saltmarsh when compared to other areas within the bay. As a result, the Applicant should take a precautionary approach. Additionally, there is a lack of hydrodynamic information from extending the seawall out onto the saltmarsh, where there could be a further loss due to changes in erosion rates.

6.2.5. **MCZ Assessment**

Natural England considers there is not enough site specific data and information provided to determine the potential impacts upon the Goodwin Sands pMCZ and therefore cannot agree with the conclusions presented. There needs to be a meaningful assessment of the ecological impacts of the installation, maintenance and decommissioning of any potential cables, particularly upon the proposed features of the pMCZ. This should include an assessment of likely volumes of rock protection, dredged and pre-swept material that will be displaced, including an in-combination assessment with other activities, such as the proposed aggregate extraction by Dover Harbour Board. As the Goodwin Sands pMCZ is only currently proposed, there is currently no published conservation objectives. However, Natural England have previously advised the Applicant use the Thanet MCZ package as a proxy as it shares many of the same designated features and thus the advice on operations is still relevant. Please see section 5.6.2 (e) for the link to the web page. Furthermore, the Thanet Coast MCZ factsheet (provided as part of Deadline 1) does provide the General Management Approaches (GMA) for the features of this particular site, these GMAs can also be used as a proxy for the features of Goodwin Sands pMCZ.

6.2.6. Natural England advises against the use of cable protection within designated sites as the addition of hard substrata is often incompatible with the conservation objectives. As suggested above, the Applicant needs to justify and asses the implication of potentially protecting the whole route through the pMCZ with further site specific data provided. A license condition limiting the Applicant to a certain percentage of rock protection with the pMCZ could ensure minimal impacts upon the designated site features. This, alongside a condition to monitor and map the locations and amount of any potential rock protection, would provide further confidence to Natural England that damaging effects can be avoided. Natural England also note that not all the proposed export cable corridor enters the Goodwin Sands pMCZ and encourage the Applicant to install their cables within this northern section to avoid any impacts upon the pMCZ.

Currently, and as stated previously, Natural England have little confidence in the Applicant's assessment of the pMCZ and more precaution needs to be built into the assessment to ensure any potential impacts are fully understood. This requested further information needs to be provided prior to the pre-construction stage to allow time for further alternatives and methodologies to be discussed and conditioned.

6.2.7. **Offshore Ornithology**

Natural England has identified data and methodological deficiencies relating to the information that underpins the ornithological assessments within the Environmental Impact Assessment and Habitats Regulations Assessment.

This includes: the methodology for assessing the displacement of red throated diver does not follow agreed Statutory Nature Conservation Body (SNCB) guidance; collision risk modelling predictions using Band model option 1 should be presented alongside Band model option 2 outputs and the figures used in the cumulative displacement and cumulative CRM assessments. Until these methodological issues are addressed, Natural England are therefore unable to agree with the Applicant's conclusions of no AEoI for red throated diver as a feature of Outer Thames Estuary SPA or kittiwake from Flamborough and Filey Coast SPA due to in-combination effects with other plans and projects.

6.2.8. **Marine Mammals**

Natural England identified the following (not limited to) concerns regarding marine mammals within our relevant representations (issues which still remain are discussed in section 6.4.38 and the SoCG):

a. The current effectiveness of soft start for mitigation purposes and the implication this has upon the modelling.

b. The potential number of UXO detonations has been underestimated.

c. Natural England does not agree with the Applicant's approach of not including Tier 2 projects within the in-combination assessment.

d. Concerns regarding Harbour seals and the potential for disturbance, especially if piling is carried out during the pupping / weaning season.

## 6.3. Progress since the Relevant Representations

6.3.1. Since the Relevant Representations were submitted to PINS on the 12th September 2018 Natural England has had further communications with the Applicant to discuss our submission and outstanding points of concern. During this period Natural England has also engaged with the Applicant to set out matters of agreement and disagreement across many technical topic areas. The full details of these matters, and where agreement has or has not been reached, is set out in the Technical Topics and Ornithological Statements of Common Ground (SoCG) which are to be submitted by the Applicant at Deadline 1.

6.3.2. A schedule of meetings that took place **after** the Relevant Representations is provided below:

a. 26th September 2018 – A teleconference to discuss the Proposed Site Investigation Works.

b. 5th October 2018 – A meeting to discuss Natural England's relevant representations and the development of a SoCG.

c. 20th November 2018 – A teleconference to discuss Natural England's comments on marine mammals from the relevant representations.

d. 23rd November 2018 – A teleconference to discuss Ornithological issues highlighted in Natural England's relevant representations. It was also an opportunity to discuss the four clarification notes that had been produced by the Applicants regarding ornithology.

e. 27th November 2018 – A teleconference to discuss the draft SoCG provided by the Applicant.

f. Monday 7th January 2019 – A short teleconference to discuss the Applicant's decision to remove landfall option 2 from the application.

6.3.3. During these discussions, the Applicant has supplied a number of clarification notes. The full list of documents provided is included **Annex A**.

6.3.4. Natural England has made every effort to review these additional documents and incorporate the information into the Written Representations. We have tried to highlight where a new document has been received and whether this information has been taken into account in formulating our comments. The Statements of Common Ground (SoCG) submitted at Deadline 1 should also guide the Examining Authority in our current positions.

## 6.4. Further Discussion on The Principle Issues

### 6.4.1. Offshore Ornithology

This section of Natural England's Written Representation covers issues relating to ornithology associated with the offshore elements of the Thanet Extension Offshore Windfarm application. It draws on the information contained in the original application documents, as well as from discussions with the Applicant and various clarification documents that have been provided to Natural England (see Annex A) by the Applicant in advance of Deadline 1. Natural England identified a number of areas of uncertainty within the original ornithological information provided by the Applicant. Some of these issues have however been addressed by the Applicant, and these are captured in the draft Statement of Common Ground (SoCG) on Offshore Ornithology between the two parties.

6.4.2. In our relevant representations, Natural England set out the main issues in relation to offshore ornithology in detail. This written representation is intended to update the examining authority on progress made on those issues with the Applicant during the pre-examination period. Where appropriate, this written representation will refer to the specific sections of the relevant representation. A draft SoCG for Offshore Ornithology between Natural England and the Applicant will be submitted at Deadline 1. This SoCG highlights progress made and those matters that are still outstanding between the two parties.

Following a review of the environmental material submitted by the Applicant, in our Relevant Representations Natural England identified the key issues as:

a. Inappropriate methodology for assessing displacement for red throated diver;

b. Inappropriate methodology for assessing displacement of auks and gannet;

c. Concern that the collision risk modelling underestimates the predicted collisions;

d. Disagreement regarding the cumulative and in-combination totals;

e. A lack of post construction ornithological monitoring proposals.

6.4.3. **Methodology for assessing displacement for red throated diver**

As highlighted in our relevant representations, the methodology used by the Applicant to assess red throated diver displacement does not follow agreed the Statutory Nature Conservation Body (SNCB) guidance, and which is agreed by the SNCBs to be the best approach to assess displacement effects. As a result, the number of red throated divers predicted to be displaced by the proposed project may well be underestimated in the ES. Natural England also advises that the recommended percentage of displacement and buffer distances from the SNCB guidance should be presented in the main body of the ES, as they are not currently.

6.4.4. Our relevant representations concluded that based on the best available evidence, Natural England currently considers that there is no clear justification to change our current advice of assuming 100 % displacement out to 4 km, and we advise that this scenario is presented alongside the Applicant's preferred scenario. We have highlighted that there are issues with the site post-consent monitoring that the Applicant has based their assessment assumptions on, namely the post-consent monitoring from Thanet and Kentish Flats Offshore wind Farms. Both of these have significant limitations, such as the extent of coverage and the use of a sub-optimal survey platform (boat based surveys) for a species that is sensitive to the presence of boats. Furthermore, the survey buffer used for the post-consent monitoring at Thanet Offshore windfarm was 2 km around the windfarm, and therefore it would be impossible for that post-consent monitoring to detect any effects beyond that distance. However, whilst there may be some merit in presenting predicted effects based on the results of these studies, given these concerns we continue to advocate presenting predictions from displacement out to 4 km.

6.4.5. On 24th October 2018 the Applicant provided Natural England with the document: "Clarification note on red-throated diver cumulative impact assessment methodology (November 2018)". Natural England provided written comments to the Applicant on 16th November 2018 and discussed our comments with the Applicant at a meeting on 23rd November 2018.

6.4.6. Natural England's main points in response to the draft clarification note on red throated diver cumulative impact assessment were:

a. We have an outstanding concern that the numbers of likely displaced birds have not been presented, only the percentage figures. Presenting the number of displaced birds would enable a sense check on the total figures attributed to all projects. The Applicants were willing to present percentages of divers displaced but were unwilling to allocate specific numbers of displaced birds to particular projects. However, we suggested project names can be anonymised, as it was important to see the figures that the percentages are based on.

b. We advised that the numbers of divers predicted to be displaced by each project should be provided and not combined with all non-Thanet sites into Tiers. This will enable a judgement to be made on where Thanet Extension sits in the rank order of effects as well as for Thanet Extension to be appraised in its own right.

c. The cumulative increase in baseline mortality of the Biologically Defined Minimum Population Scale (BDMPS) population exceeded 1% in some of the scenarios considered. This could be considered as a significant effect at the EIA / biographic population scale (particularly as all continental offshore windfarms inside the BDMPS region have been omitted).

d. Although Natural England agreed in principle with the general methodology of using a single source of data rather than extracting data from individual ESs, we had recommended using the JNCC designation data rather than the Seabird Mapping and Sensitivity Tool (SeaMaST) data set. However, following the meeting on 23rd November 2018, we accepted that for the purposes of an assessment of the relative contribution from Thanet Extension, that Natural England would accept the use of SeaMaST.

e. Whilst we **agree** that the contribution from Thanet Extension to red throated diver displacement is comparatively small, we disagree with the statement: “There is, therefore, no potential for AEoI to the red-throated diver feature of the Outer Thames Estuary SPA in relation to **in-combination** disturbance and displacement effects.” We cannot rule out beyond reasonable scientific doubt the potential for an AEoI on red throated diver feature from the Outer Thames Estuary SPA from displacement effects in-combination with other plans and projects. However, we agree with the Applicant that Thanet Extension does not make a material contribution to the potential displacement effects from offshore windfarms that have been consented and are already operational.

6.4.7. With regards to the HRA for the Outer Thames Estuary SPA the in-combination scale of displacement predicted (10% - 21%) is in line with previous estimates that have led Natural England to advise that an AEoI cannot be ruled out. However, we agree with the concluding paragraph of the clarification note on red throated diver cumulative (EIA) and in-combination (HRA) impact assessment methodology (Red Throated Diver Cumulative In Combination Methodology – Revision B) that the project does not make a material contribution to the in-combination displacement total. Our advice on the scale of the cumulative displacement remains that it is not possible to rule out adverse effect on integrity of the red throated diver population of the Outer Thames Estuary SPA in-combination with other plans and projects. However, we do agree with the Applicant that Thanet Extension **alone** is unlikely to have an adverse effect on the integrity of the Outer Thames Estuary SPA, and that Thanet Extension does not make a material contribution to the in-combination displacement of red throated diver displaced from the Outer Thames Estuary SPA.

6.4.8. **Other comments on the clarification note on red throated diver cumulative impact assessment:**

a. Table 5 - 'Tier 4 – applications in process ' Natural England questions the accuracy of the figure provided of 0.01% of the relative red throated diver distribution, as it appears to be too low. As Figure 1 shows, part of the EA2 array is within a high density area, and therefore it is surprising to see a figure of 0.01%. As stated previously, it would be helpful to include some actual figures rather than percentages, to enable a better evidenced analysis. An action from the meeting held on the 23rd November 2018 was for the Applicant to check these figures.

b. At an EIA level, the assessment ideally should be considering all offshore windfarms in the SW North Sea including some of those in NW North sea i.e. Denmark, Germany, Netherlands, Belgium and also those in other BDMPSs e.g. NW England and Wales. When the focus is explicitly on the cumulative displacement across this BDMPS then Natural England's advice is that all OWFs need to be included into that assessment not just those in the English waters. As the SeaMaST data set cannot do that, it needs to be acknowledged that this cumulative percentage BDMPS displaced is only a partial figure and underestimates the true cumulative scale of displacement of this "population".

c. It is not clear on what basis the limits of 1 to 5 % mortality have been chosen. There is no such recommendations in the SNCB guidance note. Also, in using the whole SW North Sea BDMPS population, consideration needs to be given to the potential displacement across that entire BDMPS, including continental OWFs, or at least acknowledge that this has not been done in the assessment. As a result Natural England would question the Applicant's assessment of negligible and whether it can be made with any confidence if the assessment omits the effect of continental OWFs. By omitting effects of continental OWFs it seems that not all the OWFs potentially affecting the SW North Sea winter BDMPS have been included.

d. Although we would agree with the conclusion that Thanet Extension is likely to be small, we would not necessarily endorse this method of assessment based on using the SeaMaST dataset, for the assessment of other projects. Natural England advise that the consideration of the best available evidence available at the time is used.

e. Table 9, 10, 11 and 12 - As noted above we would prefer to also see the percentage listed against each windfarm separately. This would enable an understanding of where Thanet Extension sits in that hierarchy.

f. Paragraph 56 - As previously highlighted, it is not clear where the rationale for using 1 % and 5 % has appeared from. It is not in the SNCB displacement advice note. Using the SNCB's guidance note's recommended worst case scenario of 10 % mortality and 100 % displacement, the mortality figure for the winter BDPMS exceeds 1 % baseline mortality (1.87%).

g. From an HRA point of view, whether the displaced birds survive or not outside the SPA is not the most important factor. What matters is how many of them are likely to be able to continue to be present within the SPA. Therefore, when interpreting the matrix approach to displacement of non-breeding features within an SPA, effects should not only be considered in terms of percentage mortality, but also as a percentage of birds not being able to continue to exist inside the SPA.

6.4.9. Natural England does not agree with the statement "no potential for AEoI to the red-throated diver feature of the Outer Thames Estuary SPA in relation to in-combination disturbance and displacement effects…" Natural England are already of the opinion that an adverse effect on integrity of the red throated diver population of the Outer Thames Estuary SPA cannot be ruled out beyond all reasonable scientific doubt due to the scale of in-combination displacement due to consented and operational projects within the SPA(Natural England Advice to DECC, 2013) . Whilst Thanet Extension will add a relatively small amount to that total, our previous advice remains that AEoI in-combination cannot be ruled out. However, as the proposed Thanet Extension is 8 km from the Outer Thames Estuary SPA boundary, we would agree that the contribution of Thanet Extension to the in-combination total is likely to be very small, compared to projects within the SPA, and as a result will not contribute a material contribution to the in-combination total.

6.4.10. To summarise, although Natural England disagrees with some aspects of the methodology used to assess red throated diver displacement, we acknowledge that if the recommended methodology were used, it is likely that the overall conclusions would remain the same. This is that there is no AEoI or significant effect from the project alone, and the contribution made to the in-combination and cumulative totals is small enough not to make a material difference.

6.4.11. **Methodology for assessing displacement of auks and gannet**

As stated in our relevant representations, the methodology in the ES does not follow the advice given in the SNCB advice note on assessing displacement (SNCBs, 2017). Whilst we acknowledge that there is some evidence from post consent monitoring that indicates the extent of displacement does not extend to 2 km for auks and gannet, we advise that data based on SNCB endorsed methodology is also presented in the ES. This is to provide a range of values and to provide figures that are consistent with displacement levels presented by other projects.

6.4.12. A draft ‘Clarification note on displacement of seabirds (other than red-throated diver)’ was submitted to Natural England on 15th November 2018 and discussed at a meeting between the Applicant’s ornithological consultants and Natural England on 23rd November 2018.

6.4.13. It is not clear how this draft note clarifies the points raised by Natural England, which essentially was to undertake an assessment based on the assumption of displacement out to 2 km and consider a range of percentage displacement and percentage mortality to determine where within the matrix 1 % of baseline mortality is exceeded. What is presented in this note is a comparison of densities of birds within the Thanet OWF and a 4 km buffer, and Thanet Extension and a 4km buffer. It would have been more informative to undertake that exercise using the densities with a 2 km buffer and run them through the matrix as a comparison.

6.4.14. We note that displacement matrices up to 2 km are provided in the ES Document reference 6.2.4 (Offshore Ornithology). Although we understand from discussions with the Applicant that the abundance figures are not birds counted within a 2 km boundary, instead an assumption has been made that they are equally distributed throughout the 4 km buffer area. The site only matrix and 2 km buffer can be added to obtain the totals and calculated.

6.4.15. This issue is raised here because we want to highlight that we disagree with the methodology, and also that given the potential cumulative impacts it is important that projects assess impacts in a consistent, standardised manner. Nevertheless, it is acknowledged that even if the SNCB guidance on assessing displacement were followed, it is unlikely to change the conclusions that there is no significant effect from the project alone.

6.4.16. **Collision risk modelling**

In our relevant reps Natural England has raised concerns around the parameters used in the collision risk modelling, notably flight height. In evidence plan meetings we have also raised concerns over the use of nocturnal activity factors in collision risk modelling that are not advocated by Natural England.

6.4.17. On 15th November 2018 Natural England also received a draft ‘Clarification note on collision risk modelling parameters and Thanet Extension’s contribution to cumulative and in-combination totals’. Natural England welcomed the Applicant’s willingness to use the stochastic version of the Band collision risk model (Masden 2015) during the Preliminary Environmental Information report (PEIR). However, as stated in the draft clarification note, due to errors in the code it was necessary to use Band (2012) instead of the Masden model. As a result, Natural England recommended that the Applicant revert to using outputs from Band (2012) but presented alongside any outputs to reflect the variability around each estimate.

6.4.18. **Flight heights**

Natural England accepted the use of Option 2 which uses generic flight height distributions, on the basis that there was no reliable site specific flight height data that could be used based on the digital aerial surveys. We remain concerned however that by using generic Potential Collision Height (PCH) this may lead to an underestimate in the predicted mortality from CRM.

6.4.19. As stated in our Relevant Representations, the proportion of birds flying at potential collision height using the site specific flight height data (both from Thanet Extension digital aerial surveys and the PCHs derived from the Offshore Renewables Joint Industries Project (ORJIP) Bird Collision Avoidance (BCA) Study using laser rangefinders) was significantly greater than the generic flight height data. Natural England agree that a reasonable sample size is required, and accept that there were reasons for not using the flight height data derived from the digital aerial surveys due to a small sample size and therefore advised that flight height from the ORJIP project are also used in collision risk modelling.

6.4.20. It became clear that the data collected for the ORJIP study in relation to avoidance behaviour, termed empirical avoidance rates, may not be directly comparable to the avoidance rates as presently used by collision risk models, such as the Band model. In response, the Joint Nature Conservation Committee (JNCC) commissioned the BTO (British Trust for Ornithology) to carry out work with the aim of considering how best to use the data collected as part of the ORJIP BCA study in order to inform pre-construction assessments of collision risk at offshore wind farms. This report (Cook and Bowgen, 2018) was provided to the Applicant on 16th November 2018.

6.4.21. The Applicant agreed to undertake revised Collision Risk modelling using the data from the ORJIP BCA study, if these data became available early in the Examination phase for the Thanet Extension Project. Table 8 from the BTO report is reproduced below (Table 1).

6.4.22. We note that the flight height figures from the ORJIP BCA study are significantly higher than the generic data used by the Applicant for collision risk modelling (Band Option 2). The BTO provide several potential explanations for differences between the observed flight height distributions and the generic data:

a. The laser rangefinder data may be biased against birds flying closer to the sea surface. Birds close to the sea surface may be harder for observers to detect if flying between the troughs of waves and/or less conspicuous against the background.

b. There is also the possibility that the generic data may be biased as a result of birds being attracted to survey vessels or due to observers detecting birds as they were flushed from the sea surface by the survey vessels.

c. The flight heights of birds differed inside and outside the wind farm. There is some evidence that gulls may fly higher inside a wind farm than outside from both the ORJIP BCA study and previous studies.

d. There are site-specific differences in seabird flight heights. Previous studies have shown that seabird flight heights may vary on a site-specific basis (Johnston & Cook 2016; Ross-Smith *et al.,* 2016). Such differences may relate to behavioural characteristics such as whether birds are using an area for foraging or commuting flights. In contrast, data from (Johnston *et al.,* 2014) averaged flight heights across a broad range of habitats.

e. Wind speed and direction are likely to influence seabird flight altitudes. The laser rangefinder data available to the ORJIP BCA study analyses were constrained by the limited range of weather conditions during which observers were able to safely access turbines to collect these data i.e. during relatively calm weather conditions. Consequently the laser rangefinder data may be biased towards behavioural flight height responses to calm weather.

f. The fact remains that using site specific flight height data instead of the generic flight height data will produce higher estimates of predicted mortality from collisions. Whilst there may be arguments as to why the ORJIP flight height data may over-estimate the collision mortality, equally the generic flight height may result in an underestimate. Natural England therefore advise that the range between the two estimates are considered. Estimates from collision risk modelling using these flight heights (and the recommended Nocturnal Activity Factors) are presented below.

**Table 1.** Proportion of birds at collision risk height in relation to turbines installed at Thanet (25-115m) recorded using laser rangefinders as part of the ORJIP BCA project and predicted from generic data (Johnston et al. 2014).

| | **ORJIP BCA** | **(Johnston et al. 2014)** |
|---|---|---|
| Herring gull | 0.768 | 0.239 |
| Lesser black-backed Gull | 0.725 | 0.205 |
| Great black-backed Gull | 0.826 | 0.245 |
| Black-legged Kittiwake | 0.744 | 0.090 |
| Northern gannet | 0.285 | 0.075 |

6.4.23. **Nocturnal Activity Factors**

The Applicant has used nocturnal activity rates for gannet, kittiwake and the large gulls lower than those rates used in the PEIR. These are also lower than those currently advised by Natural England. We recognise from recent evidence presented e.g. by MacArthur Green (2015) and Furness et al. (2018), that nocturnal activity levels relative to daytime levels for some species may be lower than the levels that equate to the nocturnal activity factors currently used in collision risk modelling (CRM). However, we also note that there is uncertainty and variability about the empirical activity levels derived from tracking studies, uncertainty around the models that are used to derive daylight hours and how day-length is defined, and uncertainty about how these might translate into nocturnal factors applicable to the Band model.

6.4.24. Given the uncertainty as well as variability in the data on activity levels (both during the daytime and during night), Natural England advises that collision risk outputs covering a range of nocturnal activity factors are considered to account for the uncertainty/variability (in the same way as has been recommended for bird densities, avoidance rates and flight heights). The suggested range of nocturnal flight activities to be considered within the Band model CRM are:

a. Gannet: 1-2 (equating to 0-25% nocturnal activity)
b. Kittiwake: 2-3 (equating to 25-50% nocturnal activity)
c. Large gulls: 2-3 (equating to 25-50% nocturnal activity)

6.4.25. We note in the draft ‘Clarification note on Collision Risk modelling parameters and Thanet Extension’s contribution to cumulative and in-combination totals’ (received on 15th November 2018) table 2 provides the annual predicted mortality using the recommended nocturnal activity factors. Natural England agrees with the figures presented in the Collision Risk modelling parameters clarification note (November 2018), which uses the recommended nocturnal activity factors. We advise that these are the collision mortality rates that should be the lower part of the range and the upper part of the range should be outputs using Option 1 (digital aerial site-specific % PCHs) and recommended range of Nocturnal Activity Factor (2 for gannet and 3 for KI and gulls).

6.4.26. **Collision Risk Modelling**

Natural England’s view is by using generic flights (Option 2) and by only using the lower end of the range for nocturnal activity factors it is possible that the predicted mortality from collision risk for the 5 key species are under-estimated.

6.4.27. Using all the same parameters as presented in Annex 4-4: Collision Risk modelling report (Ref: 6.4.4.4 of the ES) some simple collision risk modelling for Kittiwake was carried out by Natural England, without confidence limits, to demonstrate the difference of using site specific PCHs from the ORJIP work and the higher range of nocturnal activity factors. Please note this was a simple exercise purely to illustrate the difference that varying the model option and nocturnal activity factors can make.

**Table 2:** Comparison of collision risk modelling results using SNCB recommended avoidance rates for 'Basic' Band model but without +/-SDs (98.9% for gannet and kittiwake).

| Species | Option 2 and using lower range of Nocturnal Activity Factor (1 for gannet and 2 for KI) | Option 2 and higher range for nocturnal activity factor (2 for gannet and 3 for KI) | Option 1 using ORJIP % PCHs and lower range of Nocturnal Activity Factor (1 for gannet 2 for KI) | Option 1 using ORJIP % PCHs and higher range for nocturnal activity factor 2 for gannet and 3 for KI) | Option 1 using digital aerial site-specific % PCHs and lower range of Nocturnal Activity Factor (1 for gannet and 2 for KI) | Option 1 using digital aerial site-specific % PCHs and higher range of Nocturnal Activity Factor (2 for gannet and 3 for KI) |
|---|---|---|---|---|---|---|
| Kittiwake | 15 | 19 | 121 | 152 | 79 | 99 |
| Gannet | 14 | 19 | 53 | 72 | 38 | 52 |

6.4.28. **Gannet**

The predicted collision mortality for gannet used in the ES is 14, and is based on Option 2 and a nocturnal activity factor of 1 (0 % nocturnal activity). Using a PCH, based on the flight height estimates using laser range finders, and predicted mortality, which is significantly higher. However, it is acknowledged that if the higher Avoidance Rates and lower flight speeds generated from the ORJIP study were utilised this would produce a lower figure.

6.4.29. Therefore, although we have concerns that there is potentially an underestimate of collision mortality, we do not think it will change the overall conclusions that there is no significant effect either alone or in-combination.

6.4.30. **Kittiwake**

The figure used for kittiwake collision in the ES is 14. This figure appears to be generated by using a nocturnal activity factor of 1, although clarification regarding this point is needed. This assumes that the nocturnal activity is 0 %. The recent evidence review by MacArthur Green found that there was evidence to suggest assuming 50% is too high, but it was clear in every study that there was some nocturnal activity, and therefore no justification for assuming 0%. Natural England advise a range between of nocturnal activity factors between 2 and 3 for kittiwake, which equates to 25% and 50% nocturnal activity. We assume that the use of nocturnal activity factor of 1 was a mistake made in the collision risk modelling by the Applicant, and this potential error was raised at the meeting on 23rd November 2018. Due to the errors and the lack of site specific flight height data used in the modelling, Natural England advised the Applicant to re-run the collision risk modelling using the stochastic CRM tool.

6.4.31. Natural England considers that the impacts from the project alone are not likely have an adverse effect on the integrity of Flamborough and Filey Coast SPA. However, given that the collision mortality may be higher than those figures presented in the ES, consideration needs to be given to what proportion of this mortality can be apportioned to Flamborough and Filey Coast SPA. The reason for apportioning kittiwake mortality from Flamborough and Filey Coast SPA is to have a complete in-combination total for HRA assessment. We accept that the contribution from Thanet Extension project alone will not be an AEoI, and will not make a material contribution to the in-combination total, but it is important that it is captured in the in-combination total.

6.4.32. **Large gulls**

The total predicted mortality for lesser black-backed gull in the ES is 2 birds. However, in Table 2 of the draft CRM clarification note it refers to 14 and 17. This looks to be an error, and the figures for herring gull and lesser black-backed gull appear to have been swapped.

6.4.33. Natural England seeks clarity from the Applicant regarding the avoidance rate that has used for calculating greater black-backed gulls. SNCB advice is that a 99.5% rate should be used, however the values presented appear to be higher than expected if that were the case.

6.4.34. **Cumulative and in-combination totals**

Cumulative and in-combination impacts are an area of concern in relation to predicted impact levels for Natural England. The key concerns are summarised below:

a. We disagree with the collision and displacement predicted mortality figures presented for Thanet Extension as this may be underestimating the predicted mortality.

b. Exclusion of impacts from Tier 3 and some Tier 2 projects in the Cumulative Effect Assessment (including Moray West and Norfolk Boreas).

6.4.35. Table 4.38 in the Offshore Ornithology chapter (Ref: 6.2.4 of the ES) does not fully take account of all the cumulative effects. When there are agreed figures for Thanet Extension, Norfolk Vanguard and Hornsea 3 these should be included in a revised table of cumulative totals.

6.4.36. In the draft ‘Clarification note on collision risk modelling parameters and Thanet Extension’s contribution to cumulative and in-combination totals’ it states that “…they [Natural England] did agree that the principle of adding Thanet Extension to their cumulative and in-combination totals for each species…” This was not agreed, and it is not Natural England’s responsibility to compile cumulative and in-combination totals. Natural England advised that Thanet Extension’s total together with other projects, i.e. Norfolk Vanguard and Hornsea 3 could be added to the final revised tables submitted by East Anglia 3.

6.4.37. **Lack of post construction ornithological monitoring proposals**

There is no proposed monitoring for key environmental receptors, including ornithological interests. Furthermore, no ‘in-principle monitoring plan’ has been submitted. Natural England has already highlighted in our relevant representations that a key area of monitoring will be validating the assumptions around red throated diver displacement, particularly as the Applicants are asserting there is no evidence of displacement into the buffer area based on boat based surveys at Thanet offshore windfarm. The recent discussions around red throated diver displacement has highlighted that this is one area of concern that remains. We therefore advise that an in principle monitoring plan should be a condition of the license and that surveys to validate assumptions around red throated diver displacement are a key component of that plan, not least because of the significant concerns regarding the methodology previously used for post-construction monitoring at Thanet Offshore Windfarm.

6.4.38. **Marine Mammals**

At the relevant representations stage Natural England raised a number of issues regarding the potential impacts to marine mammals, see section 6.2.8. As highlighted in section 6.3.2 (c), we have since had discussions with the Applicant and awaiting receipt of a clarification note.

Areas of agreement between Natural England and the Applicant are included in the Technical Topics SoCG provided by the Applicant. Issues which have not been addressed since the relevant representations, and thus not agreed within the Technical Topics SoCG, are reiterated and discussed in further detail below:

a. ***Joint Cetacean Protocol (JCP) Density Estimates*** – Natural England questioned within our Relevant Representations and our PEIR response, why the JCP density estimates were not used within the impact assessment. Furthermore, it is unclear why both the Small Cetacean in European Atlantic waters and the North Sea (SCANS) III and site specific densities have been used when they are so similar. The JCP would have provided a greater range (1.16 porpoises/km$^2$ compared to 0.607 and 0.61 porpoises / km$^2$ respectively). Natural England are currently awaiting a clarification note where the 1.16 density estimates from JCP are used, which is looking to highlight that using this density doesn't not alter the conclusions of the impact assessment.

b. ***Coastline Monitoring*** – Disturbance thresholds i.e. the level of sound known to cause disturbance, for porpoise hit the coastline for monopole and pin piles, as highlighted by figure 7.19 in the marine mammal's chapter. Natural England acknowledge the Applicant's comments in their response to our relevant representations (see section 4.6 of the technical Topics SoCG submitted by the applicant) regarding the probability of animals moving along the coastline to adjacent quieter areas to the north and south of this area. However, there is no scientific evidence that porpoise movement will be north or south along the coastline as a result of the disturbance, and not cause any live strandings. Therefore, monitoring along this stretch of coast will enable the detection of strandings that may have resulted from disturbance caused by piling.

c. ***The Cumulative Assessment of UXOs*** - The impact of UXO detonation needs to be assessed with seismic activity and all the other wind farm piling, rather than just in isolation with the Thanet Extension piling. As a point of principle, all noisy activities should be assessed together as part of the cumulative assessment. Natural England would argue that currently this is not a complete Cumulative Effects Assessment (CEA). However, given the levels of seismic activity in the porpoise management unit and their potential for disturbance, combined with UXO detonations, there is unlikely to be a population level impact on harbour porpoises, given the Booth et al findings using the iPCoD model. However, the same cannot be said for the RIAA and HRA assessment.

d. ***HRA Concerns*** - The BEIS Review of Consents has concluded that as long as Site Integrity Plans (SIPs) are placed on all DCOs (in relation to HRA and in combination impacts on the Southern North Sea SCI for harbour porpoise), there will be no adverse impact on site integrity. While Natural England agrees that SIPs are a method to prevent an adverse effect on site integrity, there is also a need to put a timeframe on the SIP and a mechanism for assessing multiple SIPs at the same time. At what stage will the developer be required to reassess whether the parameters that have been assessed within the BEIS HRA have been exceeded? We suggest at the next Contracts for Differences (CfD) stage and then again as each project reaches their Final Investment Decision (FID) stage in case further mitigation is required. Assessment will also need to be made of possible EPS requirements – as the Applicant stated in response to Natural England's relevant representations, comment NE-103, that an updated assessment of the potential for cumulative disturbance will be carried out to inform an EPS licence application if deemed necessary at the appropriate stage. This should take place within the SIP.

More information is required from the MMO / BEIS on how spatio-temporal impacts will be managed to prevent exceedance of the SNCB noise guidance thresholds. A process will need to be developed to ensure continuing adherence to the Site of Community Imortance (SCI) thresholds as multiple SIPs are developed over time, especially when piling can take place over several years, and new projects can come online during this time. Should potential exceedance of the thresholds occur, a process for dealing with this issue needs to be in place – the affected developers / industries will need to work together with the regulator and SNCBs to prevent adverse effect on the SCI. However, this process needs to be developed and agreed before SIPs are placed onto DCOs.

While this list is not exhaustive, Natural England would expect the following to be included in the SIP:

i. A finalised design plan;
ii. An updated HRA;
iii. Updated mitigation measures (if required) – outlining potential mitigation that can and cannot be used and the reasoning.
iv. Where modelling via the RoC has been updated (e.g. the Dogger projects), further mitigation may be required to ensure porpoises are out of an enlarged Permanent Threshold Shift zone than was predicted in the original EIA.
v. Detail the requirement for EPS licences and Marine Licences for UXO detonation.
vi. Provide a timetable for development of the plan. E.g. Post CfD, and again pre FID to ensure timely agreements and timeframes for finances to be agreed.

6.4.39. **Benthic Ecology**

Areas of agreement between Natural England and the Applicant are included in the Technical Topics SoCG provided by the Applicant.

6.4.40. For any points not agreed in the SoCG, the submission made in the relevant representations are still valid and should be considered as outstanding points of concern, these include:

a. Further consideration needs to be given to impacts, sensitivity and recoverability of habitats to deposition of material from sandwave clearance / pre-sweeping including the habitat and size of area affected. Disposal areas should avoid protected sites and areas of habitats of conversation interest.

b. As highlighted below in section 6.4.52, we consider there is not currently enough information to determine the potential impacts from cabling within the Goodwin Sands pMCZ and therefore cannot agree with the conclusions presented. Natural England advises against the use of cable protection within designated sites as it would be likely to lead to footprint loss / modification to designated features and habitats. This footprint loss is pertinent to features such as Blue Mussel (*Mytilus edulis)* beds and Ross worm reefs (*Sabellaria spinulosa*) which are fixed features upon the seabed and do not recover as easily or quickly as mobile sediment features.

c. A full and thorough assessment of the likely cable repairs and the likely impacts on benthic features needs to be produced.

d. Natural England also notes that the development could result in the damage to or loss of subtidal chalk habitat, which is protected under the section 41 of the NERC act, outside of designated sites. We advise that the Applicant provides further detail on how this loss could be avoided, mitigated or compensated prior to the granting of any permission.

6.4.41. **Intertidal Ecology (Saltmarsh Loss)**

Natural England does not support the proposed landfall option 2, which involves the permanent loss of up to 1400 $m^2$ of SSSI and SPA and Ramsar supporting habitat. Our overarching and associated issues regarding the saltmarsh loss are highlighted within our relevant representations, and above in section 6.2.4. Very little common ground has been agreed regarding this topic at this current time.

6.4.42. Natural England do acknowledge that the Applicant has committed to do site investigation (SI) works to determine the viability of horizontal directional drilling (HDD) (option 1) under the saltmarsh to avoid any permanent loss. However, due to various reasons this data has not been collected in time to inform the examination and unfortunately option 2, involving the permanent loss of saltmarsh, still remains within the project envelope. As stated in section 6.2.4, we would like option 1 (HDD) to be committed to, as currently we cannot conclude that there will not be an AEoI of the site. There is also option 3, which involves trenching through the saltmarsh. Although this represents a better option than option 2 and we have advised the Applicant on best practices and lessons learnt from other projects, the recent NEMO cable installation has proven that recovery cannot be assumed to be good as anticipated. Therefore, we still want to see HDD pursued to avoid impacts and remove any uncertainty about the future recovery.

6.4.43. **Marine Physical Processes**

At the relevant representations stage, Natural England raised some impacts and issues regarding the project's potential effect on marine physical processes. Some of these issues and concerns are still valid and currently should be considered as outstanding points of concern. The main points are summarised below:

a. The advancement of the sea wall onto the saltmarsh will likely to also cause an increase in scour to the remaining saltmarsh and therefore would create an additional, potentially permanent, loss of habitat extent which has not been fully assessed. A wall would be inherently reflective and therefore scour would be expected at the toe of the wall causing potential changes in hydrodynamics increasing the rate of erosion upon the saltmarsh. With increasing sea levels (Horton *et al.,* 2018) this erosion could be amplified further.

b. The information highlighted in section 2.7.15 of the Marine Physical Processes chapter on seabed sediments and geology should be used to provide a robust assessment of the likelihood of cable burial in the different areas and refine the locations needed for sandwave clearance and cable protection.

6.4.44. **Marine Water and Sediment Quality**

Natural England noted within our relevant representations (section 5.8 of Natural England's Relevant Representations) concerns relating to the potential deterioration of the water quality associated with seawall works and interactions with the historical landfill site at this location. Natural England also questions how this will be monitored. Following further information provided by the Applicant within their response to our relevant representations, it was stated that a "Contaminated land and groundwater plan" has been secured within the DCO to mitigate the potential release of contaminants, which is to be reviewed after consultation with the Environment Agency (EA). Natural England deem this is an appropriate measure, along with the plan and any associated mitigation measures, to ensure there is no deterioration of the water quality. However, considering the potential for contaminants to interact with protected sites, Natural England would also like to be consulted on this plan prior to it being finalised. Areas of agreement on Marine Water and Sediment Quality between Natural England and the Applicant are included in the Technical Topics SoCG provided by the Applicant.

6.4.45. **Fisheries**

Areas of agreement on fisheries between Natural England and the Applicant are included in the Technical Topics SoCG provided by the Applicant. It should be noted, minor, but associated comments which did not require extra work have been addressed in the SoCG.

6.4.46. **Onshore Ecology and Outline Landscape and Ecological Management Plan (OLEMP)**

This section will focus on purely terrestrial themes with the saltmarsh loss and intertidal issues discussed above in section 6.4.39 and 6.4.41.

6.4.47. At the relevant representations stage Natural England raised some issues regarding the potential impacts to onshore ecology. This was primarily around the potential impacts to some bird and invertebrate species that were designated site interest features of the Sandwich Bay and Hackling Marshes SSSI and the Thanet Coast and Sandwich Bay SPA and Ramsar. Natural England have clarified with the Applicant the species of concern in relation to the designated sites and hope these are fed into any specific mitigation requirements. In terms of EPS and NPS for which Natural England might be required to issue a licence, we were satisfied that the proposed development is highly unlikely to impact on these species. Therefore, there is currently no requirement for Natural England to provide any Letters of No Impediment (LONI's) as part of the examination process. However, Natural England still encourage further pre-construction surveys to again determine the likelihood of needing any licences.

6.4.48. The OLEMP is a key document in determining mitigation and reinstatement measures both during and after construction has taken place. Natural England raised a few issues within its relevant representations regarding sufficient commitments to monitoring and aftercare. Following these comments, Natural England have had further discussions with the Applicant regarding this document and we have been in receivership of an updated OLEMP (Revision B). We have recently provided comments on this updated OLEMP.

6.4.49. Consequently, following these updates Natural England have been able to determine areas of agreement with the Applicant, which are highlighted in the Technical Topics SoCG which has been provided by the Applicant.

6.4.50. **Draft Development Consent Order (DCO) / Deemed Marine Licence (DML)**

Currently there has not been much progress on the issues raised regarding the draft Development Consent Order (DCO) and Deemed Marine Licences (DML). As such the points raised within our relevant representations remain valid (section 5.1 of Natural England's Relevant Representations), however please see below some of Natural England's main outstanding concerns:

a. Natural England does not believe the provision made for arbitration within this DCO is appropriate. As a Statutory Nature Conservation Body, Natural England cannot be bound in the statutory advice it provides by the findings of another organisation or individual such as is proposed within this provision. Natural England is, therefore, unable to agree to a mechanism whereby its advice may be compromised or its ability to meet its statutory responsibilities are fettered by a third party.

b. Discrepancies exist between the disposal volumes highlighted within the DMLs compared to volumes provided for within the disposal site characterisation report and provided for within the DCO. Similar discrepancies exist for the amount of scour protection described in the ES compared to the DCO.

c. The definition of "commence" in both the DCO and DMLs is not acceptable to Natural England. The works detailed include seabed preparation and clearance as not part of commencement. Works such as seabed preparation and clearance could have significant impacts and need to be incorporated in pre-construction plans and documentation.

d. Natural England are concerned there is no In-Principle Monitoring Plan (IPMP) included within the application. This document allows the relevant stakeholders to agree the objectives of any monitoring required by the DMLs prior to the grant of consent. Without this information there is no clarity or certainty on what relevant monitoring will be carried out to validate conclusions within the ES. This therefore needs to be included as a licence condition.

6.4.51. **RIAA**

a. ***Thanet Coast and Sandwich Bay SPA & Ramsar Concerns*** – As highlighted within Natural England's relevant representations we disagree with the conclusions that the permanent loss of saltmarsh should be screened out. Therefore, Natural England advise the competent authority to assess this loss of habitat in further detail at the appropriate assessment stage to fully determine the impacts upon these protected sites. This disagreement is highlighted within section 4.1 of the Technical Topics SoCG.

b. ***Thanet Coast SAC*** – Natural England note the commitment made by the Applicant that if any chalk reefs are identified during pre-construction surveys then micro-siting will be utilised to avoid these areas. Natural England also note the commitment that there will be no cable protection in the Thanet Coast SAC, which should be conditioned within the DCO/DML, and therefore no loss of habitat. In addition to this in the first SoCG meeting on the 5th October 2018, the Applicant stated that in the context of the HRA there will be no cabling within the Thanet Coast SAC, and that this will be ensured through the introduction of the Cable Exclusion Area for Ramsgate Harbour. Natural England are content with this statement and this removes much of our concerns regarding the potential affects upon the Thanet Coast SAC. However, we believe that this needs to be conditioned within the DCO to remove any doubt and chance that cabling will occur in this area. Areas of agreement regarding Thanet Coast SAC are included in the Technical Topics SoCG provided by the Applicant and by ourselves at Deadline 1.

c. ***Margate and Long Sands SAC*** – Natural England stated that outstanding concerns remained regarding Margate and Long Sands SAC in our relevant representations (section 2.2.2). After further discussions internally and with the Applicant we are now satisfied that there would be no adverse effect on the integrity of Margate and Long Sands SAC, either alone or in combination as a result of the proposed activities. This position is also highlighted within the Technical Topics SoCG provided by the Applicant and by ourselves at Deadline 1.

6.4.52. **MCZ Assessment**

As highlighted in Natural England's relevant representations, and in section 6.2.5 of these written representations, we consider there is not currently enough information to determine the potential impacts upon the Goodwin Sands pMCZ and therefore cannot agree with the conclusions presented.

6.4.53. The comments highlighted in section 5.10 of Natural England's relevant representations are still valid and should be considered as outstanding points of concern. In our meeting with the Applicant on the 5th October 2018 it was stated that further information regarding the pMCZ and the assessment would be provided. Natural England awaits receipt of this information.

6.4.54. **Monitoring and Mitigation Plans**

a. ***In-Principle Monitoring* -** As highlighted within section 5.1.1 of its relevant representations Natural England is concerned with the lack of In-Principle Monitoring Plans submitted and proposed within the ES and draft DCO respectively. There should be a commitment to these documents and their content secured. We understand that the plans highlighted below do secure monitoring for areas of concern, however there is no proposed monitoring for other key environmental receptors such as offshore ornithology or benthic ecology (apart from a swath bathymetry survey for one year post construction). We welcome further discussions with the Applicant around targeted post-construction surveys where areas of concern still exist, for example around issues associated with cabling through protected sites or species of concern for offshore ornithology.

b. ***Saltmarsh Mitigation, Reinstatement and Monitoring Plan (SMRMP)*** - Natural England has reviewed this document as part of our relevant representations and our comments can be found within section 5.11. We have not yet been in receipt of an updated SMRMP, however we are of the understanding that further discussions regarding the subject of the saltmarsh are forthcoming in the near future and Natural England would welcome these discussions as soon as possible. Therefore, currently the comments we have highlighted within our relevant representations remain valid and this current area of disagreement is reflected in the latest version of the Technical Topics SoCG submitted by the Applicant.

c. ***Outline Landscape and Ecological Management Plan (OLEMP)*** - Natural England provided comments upon this document within section 5.11 of our relevant representations have subsequently been in receipt of an updated OLEMP (received on the 28th November 2018) following the submission of our relevant representations. Comments regarding this document have been provided to the Applicant. Following the review and addressing of these comments by the Applicant, Natural England anticipate that this plan will be agreed in principle. This position is highlighted within the Technical Topics SoCG provided by the Applicant.

d. ***Biogenic Reef Mitigation Plan (BRMP)*** - Comments were provided by Natural England in section 5.11 of our relevant representations and as a result we have been in receipt of an updated BRMP (received on the 16th November 2018). Comments regarding revision B have been provided to the Applicant. Following the review and addressing of these comments by the Applicant, Natural England anticipate that this plan will be agreed in principle. This position is highlighted within the Technical Topics SoCG provided by the Applicant.

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## 8. ANNEX LIST

1. Annex A – lists the documents submitted by the applicant to Natural England since the relevant representations.

2. Annex B - Natural England’s response to the examining authority’s first round of written questions.

3. Annex C - Natural England’s summary of our written representations.

4. Annex D - Natural England’s summary of our relevant representations.

5. Annex E - Natural England’s response to other relevant representations.

6. A folder containing documents of interest for the examining authority including (but not limited to) designated site citations and conservation objectives.

# EC Directive 2009/147/EC on the Conservation of Wild Birds Special Protection Area (SPA)

**Name:** Flamborough and Filey Coast

**Counties/Unitary Authorities:** The coastal section of the SPA covers a slender strip of cliffs and hinterland along the coastline of the counties of North Yorkshire and the East Riding of Yorkshire between Bridlington and Scarborough. The marine portion of the site lies entirely in UK territorial waters adjacent to the aforementioned coastal strip.

**Boundary of the SPA:** The SPA is in two sections: the southern section extends north from South Landing around Flamborough Head to Speeton; the northern section covers the peninsula of Filey Brigg before extending north west to Cunstone Nab. The seaward boundary extends 2km throughout the two sections of the site into the marine environment, running parallel to the landward boundaries to include the adjacent coastal waters.

**Size of SPA:** The SPA covers an area of 7857.99 hectares.

**Site description:**

Flamborough and Filey Coast SPA is located on the Yorkshire coast between Bridlington and Scarborough. It includes the RSPB reserve at Bempton Cliffs, the Yorkshire Wildlife Trust Flamborough Cliffs nature reserve and the East Riding of Yorkshire Council Flamborough Head Local Nature Reserve. The cliffs of Flamborough Head rise to 135 metres and are composed of chalk and other sedimentary rocks. These soft cliffs have been eroded into a series of bays, arches, pinnacles and gullies with an extensive system of caves at sea-level. The cliffs from Filey Brigg to Cunstone Nab comprise a range of sedimentary rocks including shales and sandstones. The cliff top vegetation comprises maritime grassland vegetation growing alongside species more typical of chalk grassland. The intertidal area below the cliffs is predominantly rocky and part of a series of reefs that extend into the subtidal area. The adjacent sea out to 2 km off Flamborough Head as well as Filey Brigg to Cunstone Nab is characterised by reefs supporting kelp forest communities in the shallow subtidal and faunal turf communities below 2 metre water depths. The southern side of Filey Brigg shelves off gently from the rocks to the sandy bottom of Filey Bay.

**Qualifying species:** The site qualifies under article 4.2 of the Directive (2009/147/EC) by supporting over 1% of the biogeographical populations of four regularly occurring migratory species and a breeding seabird assemblage of European importance.

| Species | Count (period) | % of subspecies or population (pairs) |
|---|---|---|
| Black-legged kittiwake<br>*Rissa tridactyla* | 44,520 pairs[1]<br>89,040 breeding adults[2]<br>(2008-2011) | 2% North Atlantic[3] |

[1] Data from: Seabird Monitoring Programme (SMP) for original SPA (2008); RSPB counts for terrestrial extension (2009-2011), unpublished; black-legged kittiwakes are counted as "apparently occupied nests" (AONs); 1 AON equates to 1 breeding pair.
[2] Pairs multiplied by 2 to arrive at breeding adults; this rule applies to all species listed within the table.
[3] Data from: AEWA (2012); 6,600,000 Ind. translated to pairs by dividing by 3 and compared to pairs reported for the revised SPA to derive % population.

| | | |
|---|---|---|
| Northern gannet *Morus bassanus* | 8,469 pairs[4] 16,938 breeding adults (2008-2012) | 2.6% North Atlantic[5] |
| Common guillemot *Uria aalge* | 41,607 pairs[6] 83,214 breeding adults (2008-2011) | 15.6% (*Uria aalge albionis*)[7] |
| Razorbill *Alca torda* | 10,570 pairs[8] 21,140 breeding adults (2008-2011) | 2.3% *(Alca torda islandica)*[9] |

| | Count period | Average number of individuals |
|---|---|---|
| Seabird Assemblage | 2008-2012 | 216,730 |


**References:**

AEWA – African-Eurasian Waterbird Agreement (2012): Report on the Conservation Status of Migratory Waterbirds in the Agreement Area. Fifth Edition. AEWA, Bonn.
*Available here:* http://www.unep-aewa.org/meetings/en/stc_meetings/stc7docs/info_docs_pdf/stc_inf_7_4_csr5.pdf

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*Available at:* http://onlinelibrary.wiley.com/doi/10.1111/j.1474-919X.1989.tb02747.x/abstract


**Status of the SPA:**

1. Flamborough Head and Bempton Cliffs was classified as an SPA on 5 March 1993.

2. The site was extended and renamed Flamborough and Filey Coast SPA on 23rd August 2018

[4] Data from: SMP for original SPA (2008, 2009); RSPB counts for original SPA (2012), (Aitken et al. 2012); northern gannets are counted as AONs; 1 AON equates to 1 breeding pair.
[5] Data from: AEWA (2012); 967,000 Ind. translated to pairs by dividing by 3 and compared to pairs reported for the revised SPA to derive % population.
[6] Data from: SMP for original SPA (2008); RSPB counts for terrestrial extension (2009-2011), unpublished; common guillemots are counted as “individuals on land” (62,100 individuals on land (mean of counts 2008-2011)); individuals on land are multiplied by a correction factor of 0.67 (Harris 1989) to translate to breeding pairs.
[7] Data from: AEWA (2012); 800,000 Ind. translated to pairs by dividing by 3 and compared to pairs reported for the revised SPA to derive % population.
[8] Data from: SMP for original SPA (2008); RSPB counts for terrestrial extension (2009-2011), unpublished; razorbills are counted as “individuals on land” (15,776 individuals on land (mean of counts 2008-2011)); individuals on land are multiplied by a correction factor of 0.67 (Harris 1989) to translate to breeding pairs.
[9] Data from: AEWA (2012); 1,380,000 Ind. translated to pairs by dividing by 3 and compared to pairs reported for the revised SPA to derive % population.

This citation relates to a site entered in the Register of European Sites for Great Britain.
Register reference number: UK000610
Date of registration: 25 August 1998
Date amended: 23 August 2018

Signed: [redacted]

On behalf of the Secretary of State for Environment, Food and Rural Affairs

**Department for Environment, Food and Rural Affairs**

# Goodwin Sands

## Recommended Marine Conservation Zone

**June 2018**

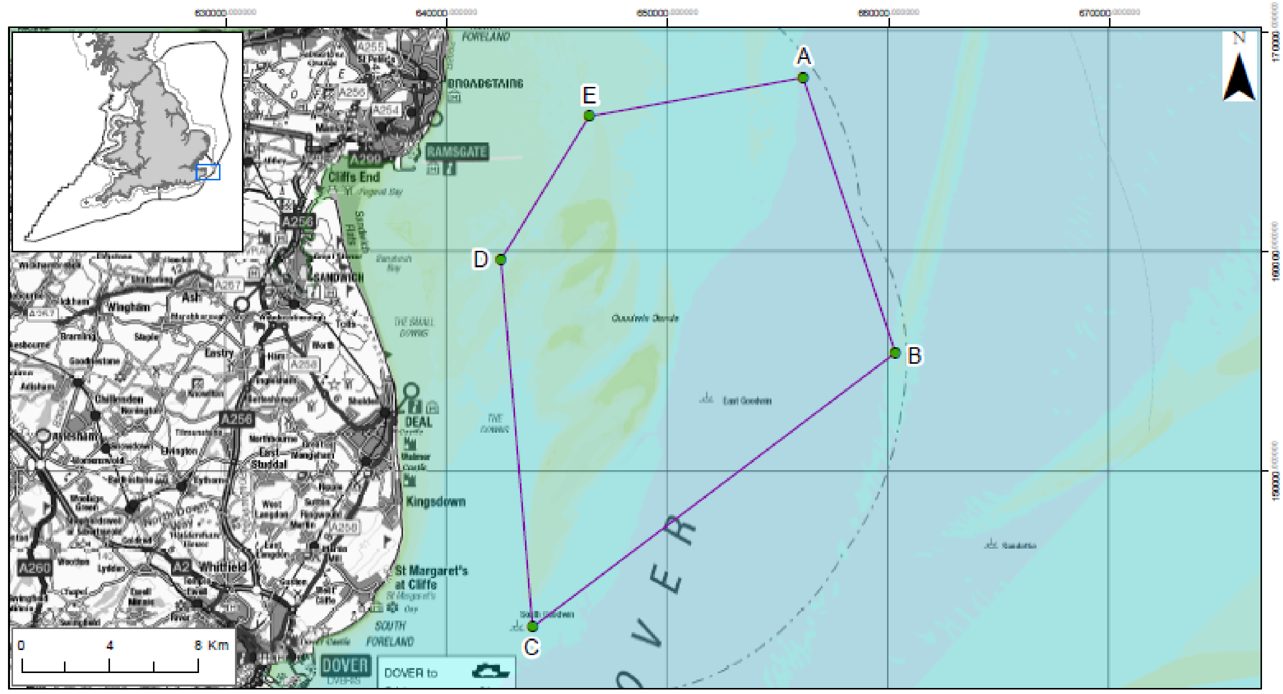
### Consultation on Sites Proposed for Designation in the Third Tranche of Marine Conservation Zones

Subtidal coarse sediment © JNCC

## Contents

# Where is the site located?

The Goodwin Sands recommended Marine Conservation Zones (MCZ) is a large inshore site which covers an area of 277 $km^2$ and is located off Sandwich Bay on the Kent coast within the Southern North Sea region.




**Goodwin Sands rMCZ Boundary**

- Recommended MCZ
- rMCZ boundary co-ordinates
- 6nM Limit
- 12nM Territorial Seas Limit
- Land

| Point | Lat | Long |
|---|---|---|
| A | 51° 21' 8.804" N | 1° 40' 37.504" E |
| B | 51° 14' 17.689" N | 1° 43' 39.935" E |
| C | 51° 8' 0.646" N | 1° 29' 4.454" E |
| D | 51° 17' 3.014" N | 1° 28' 31.196" E |
| E | 51° 20' 27.260" N | 1° 32' 13.339" E |

**Depth Areas (metres)**

- -20.0 - -10.0
- -9.9 - -5.0
- -4.9 - 0.0
- 0.1 - 5.0
- 5.1 - 10.0
- 10.1 - 25.0
- 25.1 - 50.0
- 50.1 - 100.0
- 100.1 - 250.0
- 250.1 - 500.0
- 500.1 - 1000.0


NOT TO BE USED FOR NAVIGATION
Map produced by Natural England 2016.
Reference: Theme ID: 1477560
Map Projection: British National Grid

# Why is the site environmentally important?

Goodwin Sands is a large dynamic and constantly changing area of sand and coarse sediments off the coastline of Kent that is regularly exposed at low tide, providing an important haul out site for harbour seals and grey seals, and good foraging grounds for bird species. Around the Sands themselves, the site includes deeper areas of subtidal coarse sediment that are known to be of particularly high biodiversity.

The site also contains Ross worm reefs and blue mussel beds. Both are dependant on the underlying habitat, with Ross worms particularly occuring on coarser areas of sediment, including pebbles and boulders.

The site also includes moderate energy circalittoral rock, which is animal-dominated rock found on deeper or shaded vertical rock faces. This habitat supports a range of species, including fragile Ross bryozoan, pink sea fans, cup corals, anemones, dead man's fingers, sponges, sea squirts and red algaes, as well as commercially important shellfish and fish.


Blue mussel bed © Natural England/Ross Bullimore

The site would also protect the English Channel outburst flood features which occur within the site forming a deep channel in the eastern side. This feature is evidence of a megaflood that occurred approximately 200,000 years ago leading to the separation of England from mainland Europe.

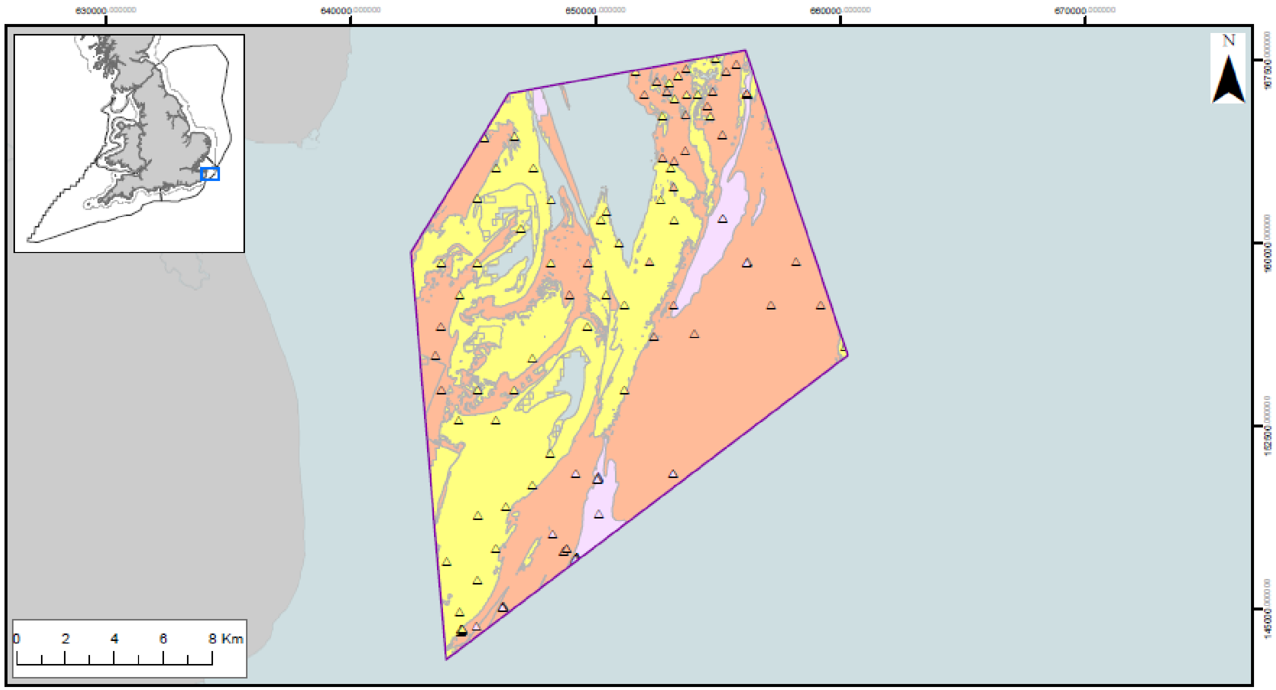
## What would this site protect?

Designation would protect the following features. You can read more about the features this site protects and why they are important here.

| Feature | General management approach |
|---|---|
| Subtidal sand | Maintain in favourable condition |
| Subtidal coarse sediment | |
| Blue mussel beds | |
| English Channel outburst flood features | |
| Moderate energy circalittoral rock | Recover to favourable condition |
| Ross worm reefs (*Sabellaria spinulosa*) | |

# Where are the features located?

The following maps show the location of the features to be protected within the site. A range of different types of surveys have been used to create these maps. More detailed information on the techniques used can be found [here](#).




**Goodwin Sands rMCZ**
**Broad Scale Habitats**

Recommended MCZ
Regional MCZ Project Area
12nM Territorial Seas Limit
Sea
Land

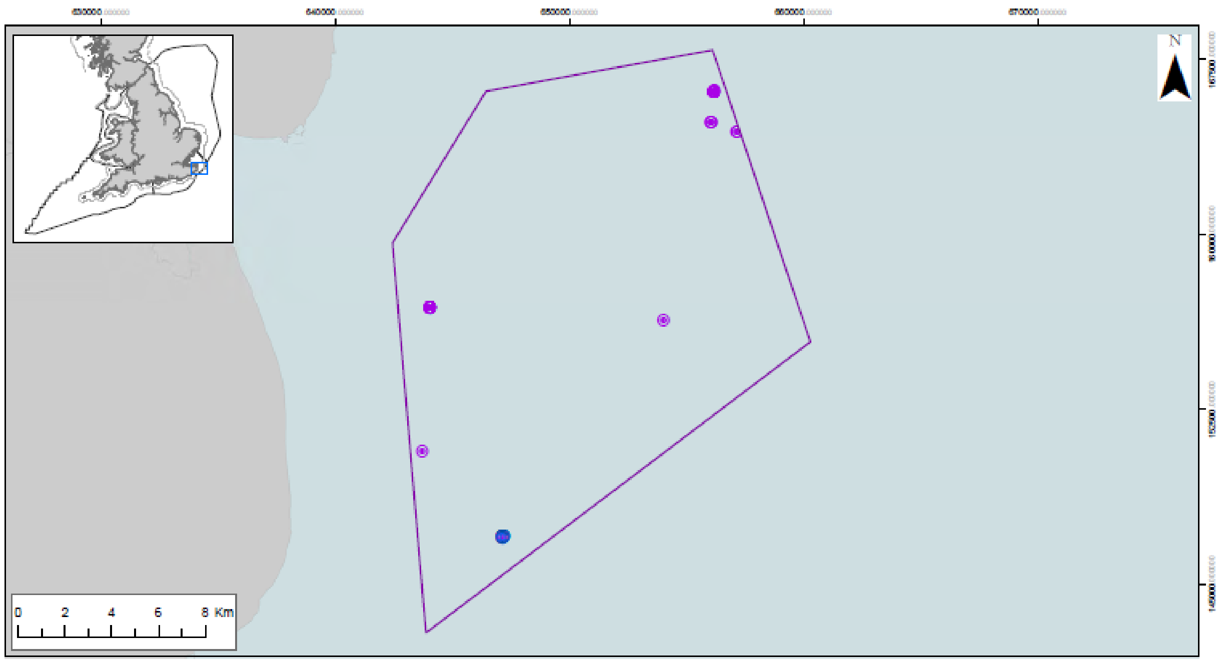
**Features recommended for designation**

Moderate energy circalittoral rock (A4.2)
Subtidal coarse sediment (A5.1)
Subtidal sand (A5.2)

Groundtruthing sampling points, such as diver survey, grab sampling, drop down video, walk over survey or core sampling

Shaded areas represent habitats mapped according to data originating from surveys and mathematical models


Reference: Theme ID: 1477560
Map Projection: British National Grid




**Goodwin Sands rMCZ**
**Features of Conservation Importance**

Recommended MCZ
Regional MCZ Project Area
12nM Territorial Seas Limit
Sea
Land

**Features recommended for designation**

Blue Mussel Beds
Ross worm (*Sabellaria spinulosa*) reefs


Reference: Theme ID: 1477560
Map Projection: British National Grid

# Which activities are likely to be affected?

Management decisions are taken on a case by case basis by relevant regulators. If an activity is identified as requiring management this does not necessarily mean that it will need to be significantly restricted. Decisions will be based on the specifics of each case and any restrictions will depend on the sensitivity of the species, habitats or geological/geomorphological features to be protected to the activity taking place. More detail is available in the Impact Assessment.

| Sectors and activities likely to be affected by designation | | |
|---|---|---|
| **Sector** | **Activity Affected** | **Best Cost Estimate (£) per year** (rounded to nearest £100) |
| Commercial Fishing UK | Bottom trawls and dredges | £2,000 |
| Commercial Fishing non-UK | Bottom trawls and dredges | Unquantified |
| Marine aggregates | Environmental Impact Assessments | £1,000 |
| Ports and harbours | Environmental Impact Assessments | £4,000 |
| **Best estimate total cost** | | **£7,000** |

## Commercial Fishing UK

The following gears are known to be used within the site:

- Bottom trawls and dredges
- Static gear

Bottom trawls and dredges are known to operate in this area although some fishing restrictions are already in place for these gear types. Local fishing fleets from Ramsgate and Deal use predominantly static gear and operate from smaller, under 10 metre, vessels. Species caught within the area include cockles, whelks, horse mackerel, cod and sole.

The activities likely to be affected by designation are shown in the table above.

## Commercial Fishing non-UK

Vessels from Belgium, Denmark, France and The Netherlands fish within the site. The majority of landings are by Belgian vessels.

Although impacts outside the UK are not quantified as part of the impact assessment, the implications of designation on non-UK commercial fishing vessels are considered in deciding which sites to designate. The activities likely to be affected by designation are shown in the table above.

## Marine Aggregates

Minerals exploration and option agreements are held within this area and the area presents an opportunity for future mineral extraction. Future applications will need to consider the possible effects on the features designated and are likely to incur additional costs as part of the Environmental Impact Assessment.

## Ports and Harbours

The site lies within 5 km of three disposal sites, two of which are specifically used only for the disposal of material associated with the bed levelling and removal of sandbanks required for the Nemo interconnector cable route. Future applications will need to consider the possible effects on the features designated and are likely to incur additional costs as part of the Environmental Impact Assessment.

# Which activities are not likely to be affected?

These activities are known to take place at this site but at their current levels of intensity the best available evidence indicates they are not likely to be damaging the features to be protected:

- Archaeological Heritage
- Cables - power and telecommunication cables currently intersect this site
- Commercial fishing – static gear
- Commercial shipping
- National Defence
- Oil and gas exploration and/or production
- Recreation
- Renewable energy

# Additional Information

To read the advice provided by Natural England, please visit

http://publications.naturalengland.org.uk/publication/6079955233931264

To read the advice provided by the Joint Nature Conservation Committee, please visit

http://jncc.defra.gov.uk/page-7119

For further information, please contact Defra on

- 03459 33 55 77 (UK only)
- +44 20 7238 6951 (from outside the UK)
- defra.helpline@defra.gsi.gov.uk

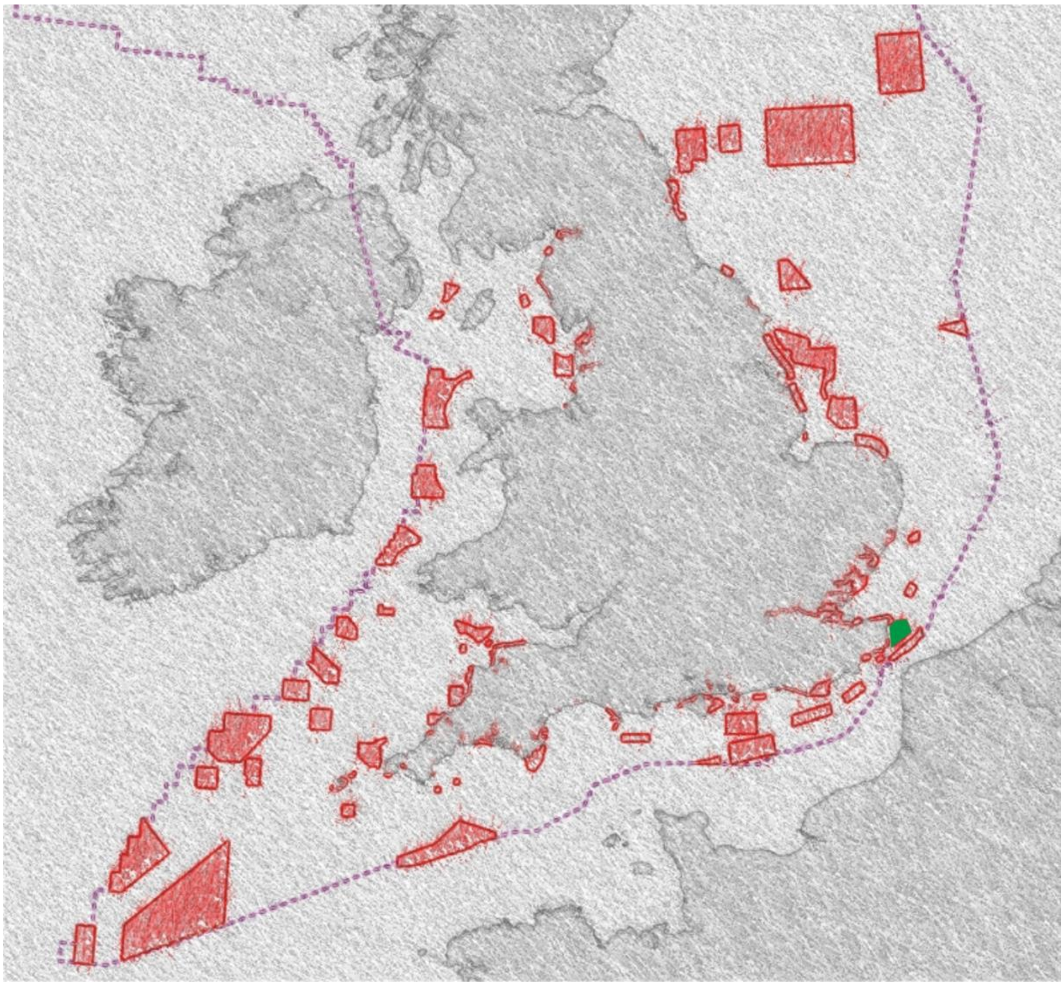


This publication is available at www.gov.uk/government/publications

Department for Environment Food & Rural Affairs

# Goodwin Sands rMCZ Post-survey Site Report

Contract Reference: MB0120
Report Number: 35
Version 4
June 2015



Cefas NATURAL ENGLAND JNCC Joint Nature Conservation Committee Environment Agency

Project Title: Marine Protected Areas Data and Evidence Co-ordination Programme
Report No 35. Title: Goodwin Sands rMCZ Post-survey Site Report
Defra Project Code: MB0120
Defra Contract Manager: Carole Kelly

Funded by:

Department for Environment, Food and Rural Affairs (Defra)
Marine Science and Evidence Unit
Marine Directorate
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**Acknowledgements**

We thank Markus Diesing and Chris Barrio Frojan for reviewing earlier drafts of this report.

# Cefas Document Control

## Title: Goodwin Sands rMCZ Post-survey Site Report

| | |
|---|---|
| **Submitted to:** | Marine Protected Areas Survey Co-ordination & Evidence Delivery Group |
| **Date submitted:** | June 2015 |
| **Project Manager:** | David Limpenny |
| **Report compiled by:** | Dayton Dove, Rhys Cooper, Sophie Green |
| **Quality control by:** | C Barrio Frojan, M Diesing, K Weston |
| **Approved by & date:** | Keith Weston (16/06/2015) |
| **Version:** | V4 |

| **Version Control History** | | | |
|---|---|---|---|
| **Author** | **Date** | **Comment** | **Version** |
| Dove, D., Cooper, R & Green, S. | 09/01/2014 | 1st draft to internal reviewer | V1 |
| Dove, D., Cooper, R & Green, S. | 03/02/2014 | 2nd draft to internal reviewer | V2 |
| Dove, D., Cooper, R & Green, S. | 13/05/2015 | External reviewers' comments received | V3 |
| Weston, K. | 16/06/2015 | Amended following Defra comments | V4 |

# Table of Contents

# List of Tables

# List of Figures

# 1 Executive Summary: Report Card

This report details the findings of a dedicated seabed survey at the Goodwin Sands recommended Marine Conservation Zone (rMCZ). The site is being considered for inclusion in a network of Marine Protected Areas (MPAs) in UK waters, designed to meet conservation objectives under the Marine and Coastal Access Act 2009. Prior to the dedicated survey, the site assessment had been made on the basis of best available evidence, drawn largely from historical data, modelled habitat maps and stakeholder knowledge of the area. The purpose of the survey was to provide direct evidence of the presence and extent of the broadscale habitats (BSH) and habitat FOCI (Features of Conservation Importance) that had been detailed in the original Site Assessment Document (SAD) (Balanced Seas, 2011)

This Executive Summary is presented in the form of a Report Card comparing the characteristics predicted in the original SAD with the updated habitat map and new sample data that result from the analysis of available data. Data analysed was from surveys of the site conducted by the UKHO's Civil Hydrography Programme (CHP) in September, 2009, and by Cefas in January, April, May, and September, 2014. The comparison covers broadscale habitats and habitat FOCI.

## 1.1 Features proposed in the SAD for inclusion within the MCZ designation

| Feature | Extent according to SAD | Extent according to updated habitat map* | Accordance between SAD and updated habitat map | |
|---|---|---|---|---|
| **Broadscale Habitats (BSH)** | | | **Presence** | **Extent** |
| A3.2 Moderate energy infralittoral rock | 0.65 $km^2$ | 0 $km^2$ | × | -0.65 $km^2$ |
| A4.2 Moderate energy circalittoral rock | 0.58 $km^2$ | 11.19 $km^{2*}$ | ✓ | 10.61 $km^2$ |
| A5.1 Subtidal coarse sediment | 115.55 $km^2$ | 133.19 $km^2$ | ✓ | 17.64 $km^2$ |
| A5.2 Subtidal sand | 159.97 $km^2$ | 89.48 $km^2$ | ✓ | -70.49 $km^2$ |
| **Habitat FOCI** | | | | |
| Blue Mussel Beds | 312.57 $m^2$ | N/A** | ✓ | N/A** |
| Ross Worm (*Sabellaria spinulosa*) Reefs | 625.29 $m^2$ | N/A** | ✓ | N/A** |
| **Species FOCI** | | | | |
| None proposed | N/A | N/A | × | N/A |

***The rMCZ area incorporates the intertidally exposed Goodwin Sands banks, and these areas were not surveyed. 93% of the rMCZ area was surveyed and classification was only performed on surveyed areas, thus reflected in the updated extent values.***
***** Habitat FOCI proposed were observed in ground truth samples but could not be confidently identified in the hydrographic data and thus it was not possible to map the spatial extent of these features.***

## 1.2 Features present but not proposed in the SAD for inclusion within the rMCZ designation

| Feature | Extent according to SAD | Extent according to updated habitat map | Accordance between SAD and updated habitat map | |
|---|---|---|---|---|
| **Broadscale Habitats (BSH)** | | | **Presence** | **Extent** |
| A5.4 Subtidal mixed sediments | Not listed | 24.09 km$^2$ | × | +24.09 km$^2$ |
| **Habitat FOCI** | | | | |
| Subtidal Sands and Gravels | Not listed | 222.68 km$^2$ | × | +222.68 km$^2$ |
| Subtidal Chalk | Not listed | 11.19 km$^2$ | × | +11.19 km$^2$ |
| **Species FOCI** | | | | |
| High mobility species | | | | |
| European Eel (*Anguilla anguilla*) | Occurrence not certain | N/A | × | N/A |
| Smelt (*Osmerus eperlanus*) | Occurrence not certain | N/A | × | N/A |
| Undulate Ray (*Raja undulata*) | Occurrence not certain | N/A | × | N/A |

## 1.3 Evidence of human activities occurring within the rMCZ

There is evidence from the multibeam bathymetry and backscatter data of multiple wrecks as well as rare occurrences of trawl scars present within the boundaries of the rMCZ.

# 2 Introduction

In accordance with the Marine and Coastal Access Act 2009, the UK is committed to the development and implementation of a network of Marine Protected Areas (MPAs). The network will incorporate existing designated sites (e.g., Special Areas of Conservation and Special Protection Areas) along with a number of newly designated sites which, within the English territorial waters and offshore waters of England, Wales and Northern Ireland, will be termed Marine Conservation Zones (MCZs). In support of this initiative, four regional projects were set up to select sites that could contribute to this network because they contain one or more features specified in the Ecological Network Guidance (ENG; Natural England and the JNCC, 2010). The regional projects proposed a total of 127 recommended MCZs (rMCZs) and compiled a Site Assessment Document (SAD) for each site. The SAD summarises what evidence was available for the presence and extent of the various habitat, species and geological features specified in the ENG and for which the site was being recommended.

Due to the scarcity of survey-derived seabed habitat maps in UK waters, these assessments were necessarily made using best available evidence, which included historical data, modelled habitat maps and stakeholder knowledge of the areas concerned.

It became apparent that the best available evidence on features for which some sites had been recommended as MCZs was of variable quality. Consequently, Defra initiated a number of measures aimed at improving the evidence base, one of which took the form of a dedicated survey programme, implemented and co-ordinated by Cefas, to collect and interpret new survey data at selected rMCZ sites. This report provides an interpretation of the survey data collected jointly by the Maritime and Coastguard Agency's (MCA) Civil Hydrography Programme and Cefas. The rMCZ was surveyed by the MCA in July-September, 2009, and further hydrographic and ground truth surveys were conducted by Cefas during three separate surveys in January, April/May, and September/October 2014.

## 2.1 Location of the rMCZ

The Goodwin Sands rMCZ is located in the southern North Sea (just north of the English Channel), approximately 5 km east offshore from the Kent coast (Figure 1).

Location of Goodwin Sands rMCZ

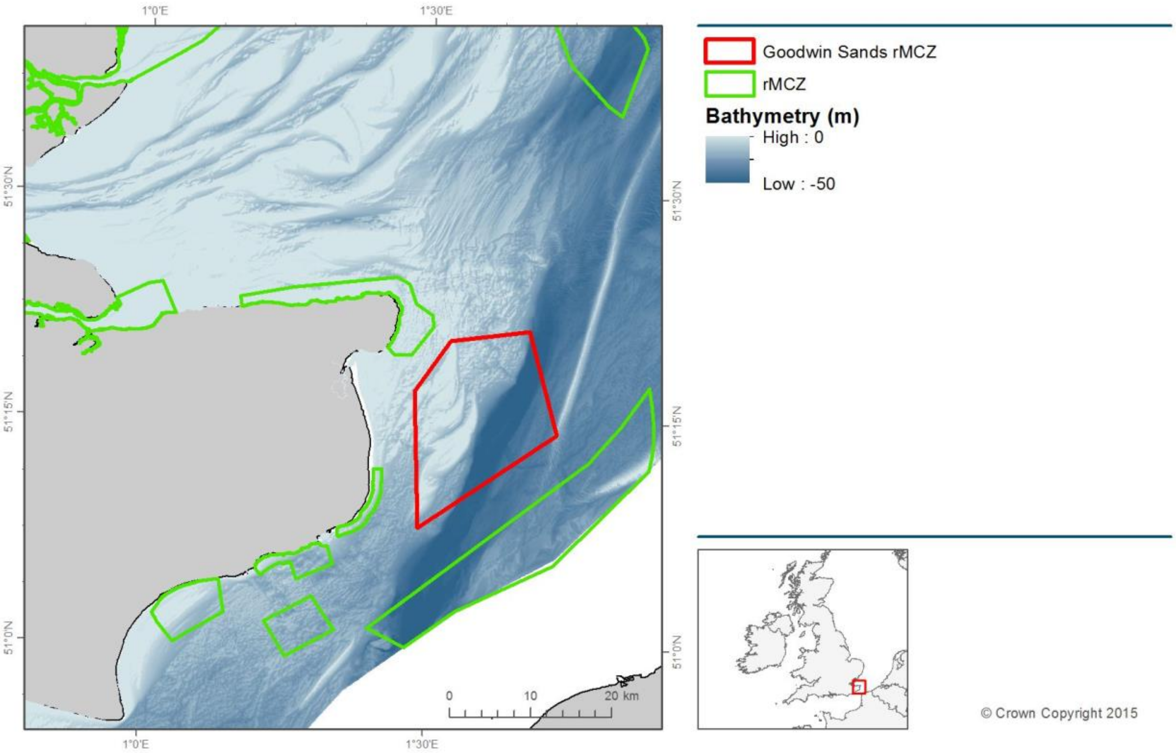



**Figure 1. Location of the Goodwin Sands rMCZ. Bathymetry is from the Defra Digital Elevation Model (Astrium, 2011).**

## 2.2 Rationale for site position and designation

The Goodwin Sands rMCZ was included in the proposed network because of its contribution to Ecological Network Guidance (ENG) criteria to broadscale habitats, and its added ecological importance. For a detailed site description Balanced Seas (2011) and 'The Marine Conservation Zone Project: Ecological Network Guidance' (Natural England and the JNCC, 2010).

### 2.2.1 Broadscale habitats proposed for designation

Four broadscale habitats were included in the recommendations for designation at this site (Table 1). See Annex 1 for full list of broadscale habitat features listed in the ENG.

**Table 1. Broadscale habitats for which this rMCZ was proposed for designation.**

| EUNIS code & Broadscale Habitat | Spatial extent according to the SAD |
|---|---|
| A3.2 Moderate energy infralittoral rock | 0.65 km$^2$ |
| A4.2 Moderate energy circalittoral rock | 0.58 km$^2$ |
| A5.1 Subtidal coarse sediment | 115.55 km$^2$ |
| A5.2 Subtidal sand | 159.97 km$^2$ |

### 2.2.2 Habitat FOCI proposed for designation

Two habitat FOCI were included in the recommendations for designation at this site (Table 2). 'Blue Mussel Beds' and 'Ross Worm (*Sabellaria spinulosa*) Reefs' were observed in ground truth samples but could not be confidently identified in the acoustic data. They are presented on the habitat FOCI map as point observations only as it was not possible to map the spatial extent of these features. Annex 2 presents the habitat FOCI listed in the ENG.

**Table 2. Habitat FOCI for which this rMCZ was proposed for designation.**

| Habitat FOCI | Spatial extent according to SAD |
|---|---|
| Blue Mussel Beds | 312.57 $m^2$ |
| Ross Worm (*Sabellaria spinulosa*) Reefs | 625.29 $m^2$ |

### 2.2.3 Species FOCI proposed for designation

No 'Low or limited mobility species' were included in the recommendations for designation of this rMCZ (Table 3). Three 'Highly mobile species' FOCI were included. The full list of these species FOCI is presented in Annexes 3 and 4.

**Table 3. Species FOCI for which this rMCZ was proposed for designation.**

| Species FOCI | Extent according to SAD |
|---|---|
| **Low or limited mobility species FOCI** | |
| None proposed | None |
| **Highly mobile species FOCI** | |
| European Eel (*Anguilla anguilla*) | Occurrence not certain |
| Smelt (*Osmerus eperlanus*) | Occurrence not certain |
| Undulate Ray (*Raja undulata*) | Occurrence not certain |

## 2.3 Rationale for prioritising this rMCZ for additional evidence collection

Prioritisation of rMCZ sites for further evidence collection was informed by a gap analysis and evidence assessment. The prime objective was to elevate the confidence status for as many rMCZs as feasible to support designation in terms of the amount and quality of evidence for the presence and extent of broadscale habitat features and habitat FOCI and, where possible, species FOCI. The confidence status was originally assessed in the SADs according Technical Protocol E (Natural England and the JNCC, 2012).

The confidence score for the presence and extent of broad scale habitats and habitat FOCI reported for the Goodwin Sands rMCZ was Low/Moderate (JNCC and Natural England, 2012). This site was therefore prioritised for additional evidence collection.

## 2.4 Survey aims and objectives

### Primary objectives

- To collect acoustic and groundtruthing data to allow the production of an updated map which could be used to inform the presence of broadscale habitats and habitat FOCI, and allow estimates to be made of their spatial extent within the rMCZ.

**Secondary objectives**

- To provide evidence, where possible, of the presence of species FOCI listed in the ENG (Annexes 3 and 4) within the rMCZ.
- To report evidence of human activity occurring within the rMCZ found during the course of the survey.

It should be emphasised that surveys were not primarily designed to address the secondary objectives under the current programme of work.

Whilst the newly collected data will be utilised for the purposes of reporting against the primary objectives of the current programme of work (given above), it is recognised that these data will be valuable for informing the assessment and monitoring of condition of given habitat features in the future.

# 3 Methods

## 3.1 Acoustic data acquisition

Two separate acoustic survey datasets were used in the Goodwin Sands rMCZ, one acquired prior to the MCZ programme for the purposes of safety at sea, and another acquired specifically for the rMCZ. In the western sector, existing multibeam bathymetry data were used to assist in the planning and interpretation of seabed habitats. These data were collected in September 2009 as part of the UK's Civil Hydrography Programme (CHP), managed by the Maritime and Coastguard Agency (MCA). The data are archived by the United Kingdom Hydrographic Office (UKHO) and were provided to Cefas as fully processed and cleaned bathymetry data, as well as raw data files for further backscatter processing by Cefas. The bathymetric data were collected and processed in accordance with the International Hydrographic Organisation (IHO) Standards for Hydrographic Surveys - Order 1 (Special Publication 44, Edition 4). Further details on the acquisition and processing of multibeam bathymetry data can be found in HI1294 Report of Survey (2009). Processing of the backscatter data was undertaken by Cefas using the raw data provided. The software package QPS FM Geocoder Toolkit (FMGT) was used to produce fully compensated and corrected backscatter mosaic images, and these were exported as floating point geotiff files for further analysis. Both bathymetry and backscatter datasets were gridded at 2 m resolution for analysis (see Appendix 2 for images derived from acoustic data).

To cover the remainder of the rMCZ, Cefas acquired further acoustic data in April and May 2014 (Cruise code: CEND0614, Lyman et al., 2014). Processing of the acoustic data followed the same protocols as listed above for the CHP data, and the two datasets were combined into single bathymetry and backscatter floating point geotiffs gridded at 2 m resolution. Each survey achieved 100% coverage, but there remains a small, unsurveyed gap between the CHP and Cefas data (Appendix 2). There are further gaps in the data record over the Goodwin Sands banks themselves, which were periodically exposed by low tides and thus could not be surveyed. In total, 93% of the rMCZ area was surveyed.

## 3.2 Ground truth sample acquisition

Ground truth samples were collected during three separate surveys, two of which were conducted by Cefas in January and April/May, 2014 (Cruise code: CEND0114, Nicolaus and Ware, 2014; Cruise code: CEND0614, Lyman et al., 2014 respectively). A further inshore survey was conducted on behalf of Cefas in September/October 2014 by the Environment Agency (EA) (Project code: C5784A; Miller and Godsell, 2014).

Across the Goodwin Sands rMCZ, ground truth samples were collected from 372 stations (Figure 2; Appendix 1). A combination of physical sediment grabs and seabed imagery were acquired during each survey. Unless stated otherwise, video and still images were analysed using an established protocol developed and used by Cefas (Coggan et al., 2007). As part of the January 2014 survey, groundtruthing samples were acquired from the RV *Cefas Endeavour* in the deeper areas of the Goodwin Sands rMCZ following a 2 km triangular lattice grid, as there was no acoustic data available to inform site selection. Groundtruthing was achieved using sediment grabs and drop-camera (DC) video and stills at 39 stations. Sediment grabs were acquired using a 0.1 $m^2$ mini Hamon grab, and were sub-sampled for particle size analysis (PSA). Complete sediment analysis was conducted post cruise by Cefas scientists, and samples were classified into both Folk and EUNIS BSH classes. Video and stills imagery were acquired with a drop-camera (DC) system, which was deployed at all stations. Video transects lasting a minimum of 2 minutes were carried out as standard during the tow, though longer video transects (minimum 10 minutes) were carried out at a subset of stations (ca. ⅓ of stations).

Groundtruthing samples were acquired from shallower areas of the Goodwin Sands rMCZ with site selection informed by preliminary acoustic data interpretation. Groundtruthing samples were collected at 23 stations in April/May 2014 using the same acquisition and instrument setup as described for the January 2014 survey.

Finally, during the September/October 2014 survey, groundtruthing samples were taken aboard the coastal survey vessels *Thames Guardian* and *Solent Guardian* within the inshore areas of the Goodwin Sands rMCZ. Groundtruthing was achieved using sediment grabs and drop-camera (DC) video and stills imagery at 86 stations. All the ground-truthing stations were initially surveyed using drop camera equipment (DC). A preliminary assessment of the video footage and still images collected was subsequently carried out to identify locations suitable for sediment grab deployment. Sediment grabs were acquired using a 0.1$m^2$ mini Hamon grab, and were sub-sampled for PSA.

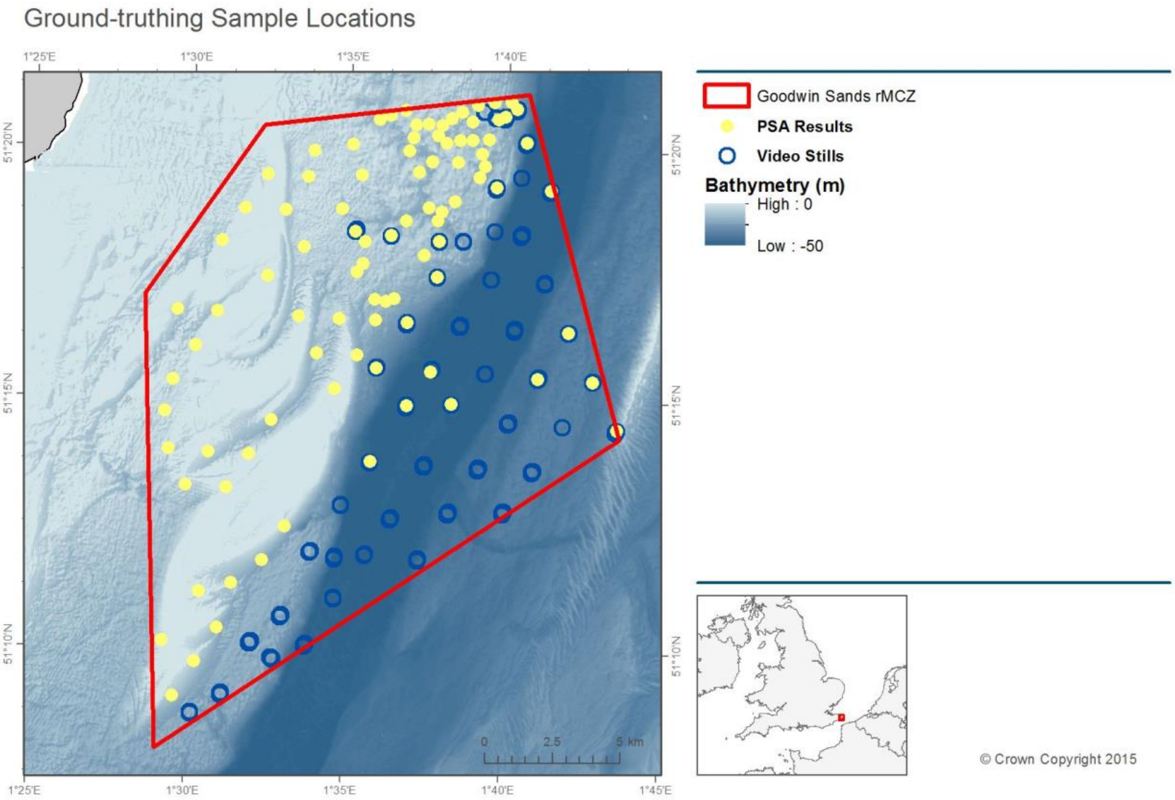



**Figure 2. Location of groundtruthing sampling sites in the Goodwin Sands rMCZ. Bathymetry displayed is from Defra's Digital Elevation Model (Astrium, 2011).**

## 3.3 Production of the updated habitat map

All new maps and their derivatives have been based on a WGS84 datum. A new habitat map for the site was produced by analysing and interpreting the available acoustic data (as detailed above) and the ground-truth data collected by the dedicated surveys of this site. The process is a combination of two approaches, auto-classification (image analysis) and expert interpretation, as described below. The routine for auto-classification is flexible and dependent on site-specific data, allowing for application of a bespoke routine to maximise the acoustic data available.

ArcGIS was used to perform an initial unsupervised classification on the backscatter image. The single-band backscatter mosaic was filtered and smoothed prior to the application of an Iso cluster/maximum likelihood classification routine. Python scripting language was used to automate the workflow. Each stage in the process is numbered and described in detail below.

**Stage 1. Data preparation**

Prior to analysis, the bathymetry and backscatter data were re-sampled onto a common grid at 2 m resolution. This data preparation results in a spatial grid with a single value for bathymetry (depth) and a single value for backscatter (acoustic reflectance) in each 2 m by 2 m grid cell, and it is these data values that were used in the rest of the process.

**Stage 2. Derivatives calculated**

From the bathymetry data a range of derivatives were calculated, as detailed in Table .

**Table 4. Description of derivatives calculated for bathymetry using ArcGIS/Fledermaus.**

| Derivative | Description |
|---|---|
| **Slope** | The slope in degrees using the maximum change in elevation of each cell and its 8 neighbours (3*3) |
| **Roughness/Rugosity** | Calculated as the difference between the maximum and minimum value of each cell and its 8 neighbours (3*3) |
| **Aspect** | Identifies the downslope direction of the maximum rate of change in value from each cell to its neighbours. It can be thought of as the slope direction. |

**Stage 3. Unsupervised classification**

The following steps outline the routine performed using standard ArcGIS functionality to automatically classify the single-band backscatter mosaic. This functionality was accessed and performed using a single Python script.

***Smoothing/generalisation of the backscatter image***

The initial step involved the generalisation and smoothing of the single band backscatter mosaic prior to application of the classification tools, to remove the influence of noise and 'striping' from within the backscatter image. This makes the production of smooth, topologically correct, 'realistic' polygons easier for later modification and attribution during the manual phase.

The raster was down-sampled to a 20 m resolution. Focal statistics were used to populate the cell values of a new 3 m resolution grid based on the mean of a 3 x

3 cell neighbourhood.  The focal statistic command was repeated up to 10 times to ensure a smooth, noise-free grid, as illustrated in Figure 3.  The initial coarse resolution ensures the removal of any striping whilst maintaining the general trend in sediment distribution.  Converting the raster back to a finer resolution is essential for the production of smooth, realistic vector output.  The choice of cell size combination is crucial in determining feature size to be preserved.  The cell size is chosen after consultation with the mapping geologist regarding the most appropriate scale of mapping in order to maximise the removal of noise from the data set, whilst preserving the required feature visibility.

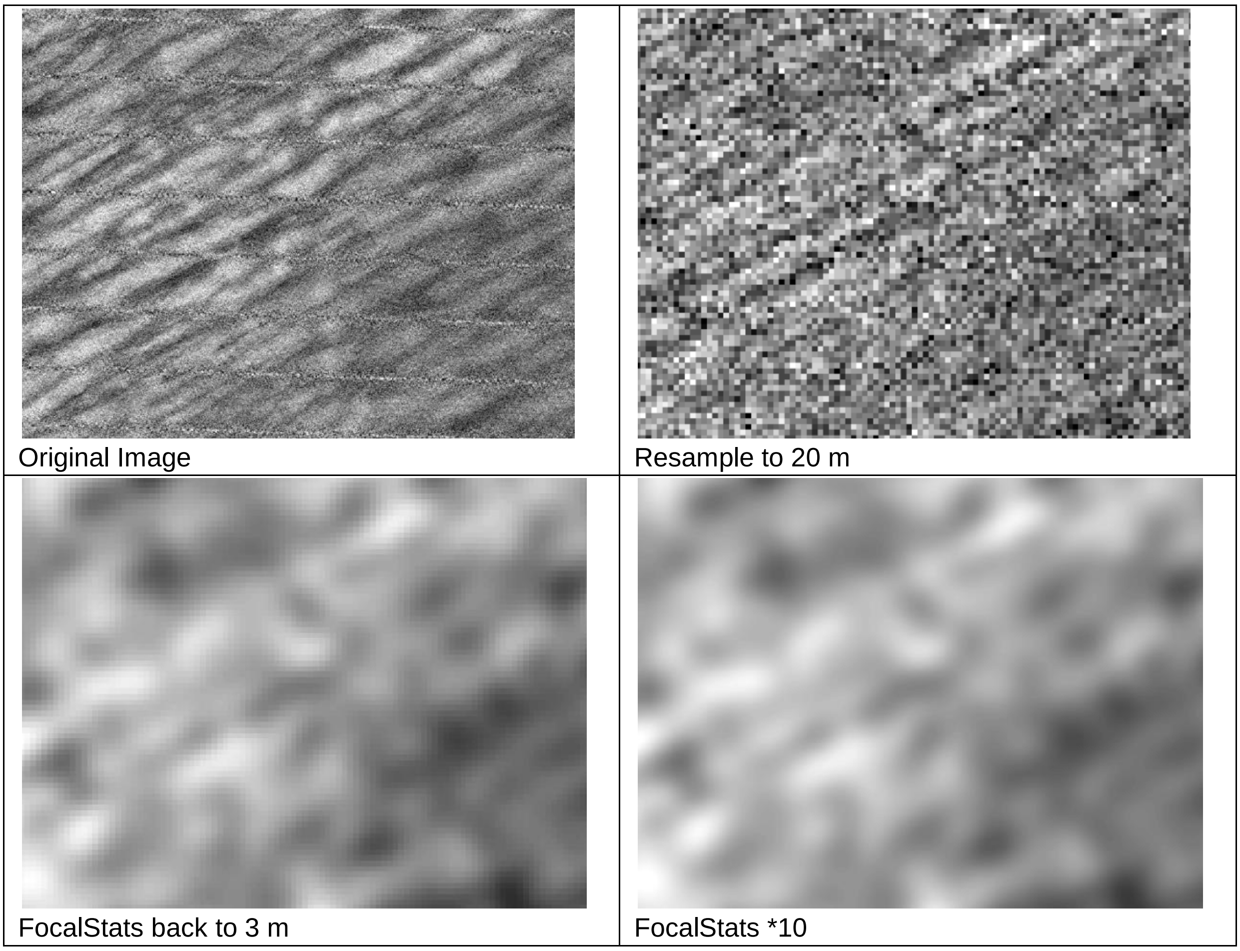



**Figure 3.  Backscatter mosaic generalisation/smoothing prior to autoclassification routine.**

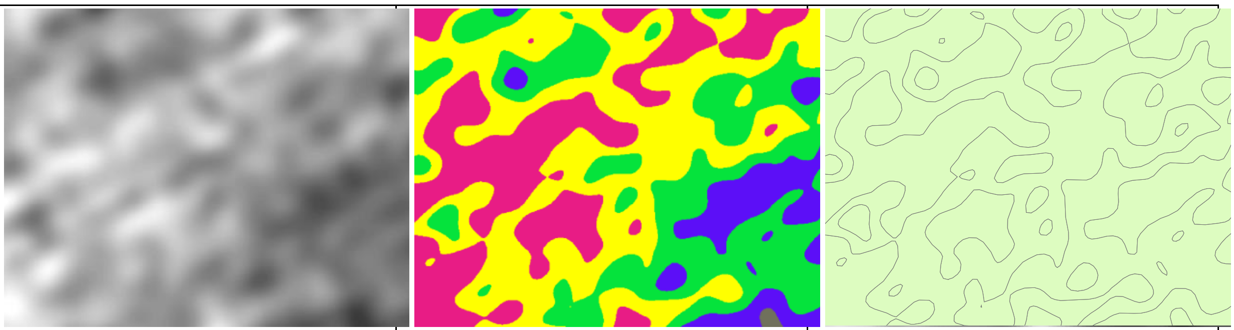
***ArcGIS Iso Cluster Unsupervised Classification Tool***

This tool is part of the classification toolset available on the image classification toolbar within ArcGIS 10.1.  The Iso cluster tool was chosen as it produced the best results from the single band image of backscatter intensity.  The tool uses an iterative clustering procedure, also known as a migrating means technique, to find the natural groupings of cells and produce a signature file to be used as an input requirement for the maximum likelihood tool.  The analyst chooses an unrealistically high number of potential sediment classes to group each cell into.  The algorithm separates each cell into one of these clusters/groupings by calculating an arbitrary mean for each and assigning a cell to the most suitable cluster based on the shortest Euclidean distance.  The mean of each group is then recalculated based on this first reiteration of groupings. The process is repeated for the number of iterations specified, which should be greater than the number of classes and enough to ensure that the movement of cells across classes has become stable.

The maximum likelihood classification tool uses the output signature file from the Iso cluster procedure to create a classified raster. The tool will consider the variance and co-variance of the class signature when assigning each cell to one of the classes. With the assumption that the distribution of a class sample is normal, a class can be characterised by the mean vector and the covariance matrix. The statistical probability is computed for each class to determine the membership of cells to a class. An a priori probability weighting option is the default value of the maximum likelihood routine, whereby each cell is assigned to the class to which it has the highest probability of being a member.

***Raster to polygon conversion***

The classified raster obtained from the above steps is converted to a vector polygon shapefile to produce a final fully attributed, topologically clean, smooth vector dataset (Figure 4).



| Result of FocalStats/ Generalising | Iso Cluster Tool | Raster to Polygon |
|---|---|---|

**Figure 4. Iso cluster maximum likelihood classification routine.**

The resultant classified output represents a numeric, thematic map. The number of classes created is simply an over-estimation of the potential number of sediment types present in the study area. The analyst can assess the resulting map and change the number of classes until satisfied all likely changes in seabed substrate have been represented.

## Stage 4. Expert judgement

The vectorised output of the semi-automated process is reviewed manually to assign sedimentological classifications in accordance with the EUNIS habitat classification system. An appreciation of the geological characteristics of the area also means that the analyst can sense check the outputs. Polygons can be amended, modified and merged to best represent the acoustic data, groundtruthing samples with the influence of geological judgement.

In this case, final mapped boundaries between rock and sediment substrate classes are dependent on assessing the bathymetry, backscatter, and derived products together with the ground-truthing data, as the backscatter data alone, on which the semi-automated classification is conducted, does not provide a unique correlation between backscatter amplitude and sediment class.

As confirmed by the grab samples, high backscatter intensities indicate gravel percentages of greater than 5%, indicating either ‘coarse’ or ‘mixed’ sediments. The practical result is that both ‘coarse’ and ‘mixed’ sediment areas are similarly sensed by the clustering process. The expert analyst must utilize the groundtruthing results to further sub-divide these areas of high backscatter into segregated ‘coarse’ and ‘mixed’ classes. Taking into account that the PSA data provide a more quantitative assessment of sediment fractions than that of the video/still image analysis, the PSA data were used as the primary groundtruthing dataset for purposes of mapping broadscale habitats.

As the video and still imagery provided the only evidence of the BSH ‘A4.2 Moderate energy circalittoral rock’, these groundtruthing observations were extrapolated according to the bathymetry and backscatter data to map the extent of rock at the seabed. Areas where rock was observed at the seabed are also regularly characterized by coarse sediment waves. Because of this and the variable occurrence of coarse vs. sand dominated sediments adjacent to rock across the site, manual interpretation was used in favour of a semi-automated approach to map the extent of rock.

Habitat FOCI ‘Blue Mussel Beds’ and ‘Ross Worm (*Sabellaria spinulosa*) Reefs’ were also observed on the video/stills imagery but could not be confidently and consistently identified using the acoustic data. It was thus not possible to map the geographic extent of these features and they are presented as point observations only.

## 3.4 Quality of the updated map

The technical quality of the updated habitat map was assessed using the MESH Confidence Assessment Tool[1], originally developed by an international consortium of marine scientists working on the MESH (Mapping European Seabed Habitats) project. This tool considers the provenance of the data used to make a biotope/habitat map, including the techniques and technology used to characterise the physical and biological environment and the expertise of the people who had made the map. In its original implementation, it was used to make an auditable judgement of the confidence that could be placed in a range of existing, local biotope maps that had been developed using different techniques and data inputs, but were to be used in compiling a full coverage map for north-west Europe. Where two of the original maps overlapped, that with the highest MESH confidence score would take precedence in the compiled map.

Subsequent to the MESH project, the confidence assessment tool has been applied to provide a benchmark score that reflects the technical quality of newly developed habitat/biotope maps. Both physical and biological survey data are required to achieve the top mark of 100 but, as the current exercise requires the mapping of broadscale physical habitats not biotopes, it excludes the need for biological data. In the absence of biological data, the maximum score attainable for a purely physical map is 88.

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[1] http://emodnet-seabedhabitats.eu/confidence/confidenceAssessment.htm [Accessed 19/01/2015]

In applying the tool to the current work, none of the weighting options were altered; that is, the tool was applied in its standard form, as downloaded from the internet.

# 4 Results

## 4.1 Site Assessment Document (SAD) habitat map

The SAD habitat map (Figure 5) was produced using modelled data from the UKSeaMap (McBreen, 2010). For further details see Balanced Seas (2011).

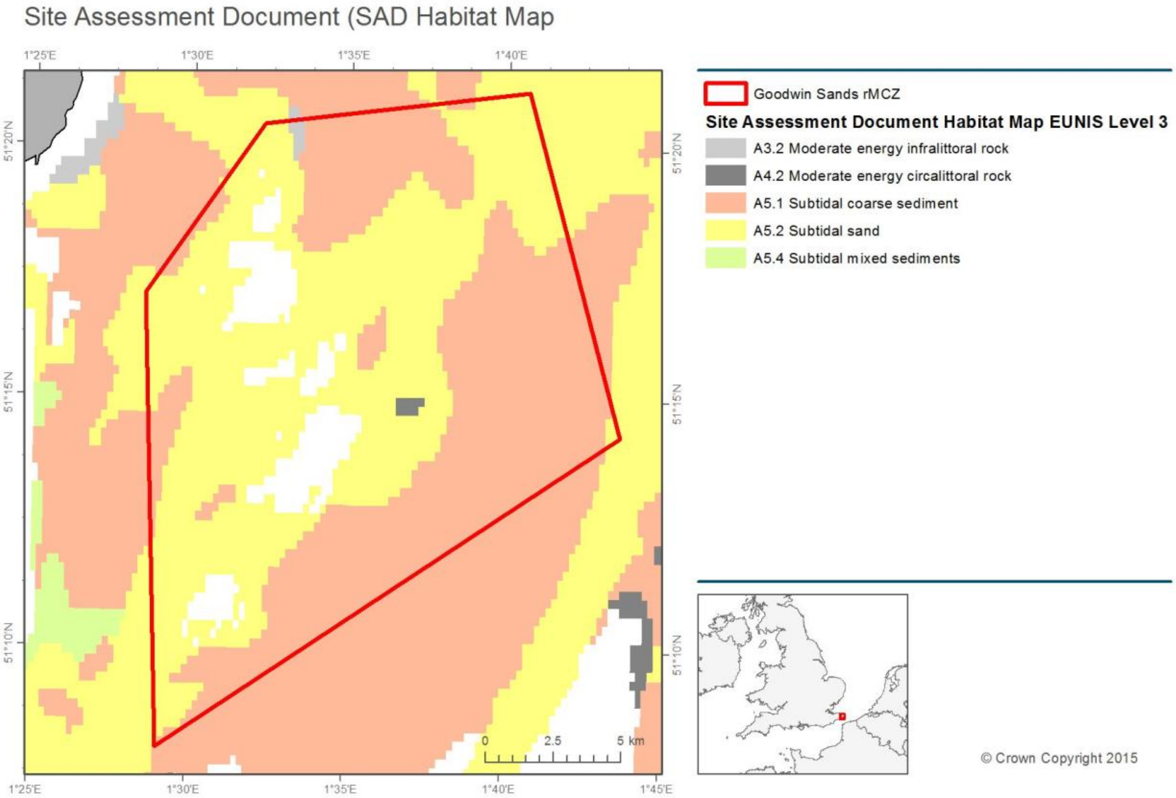


**Figure 5. Habitat map from the Site Assessment Document.**

## 4.2 Updated habitat map based on new survey data

The updated habitat map resulting from an integrated analysis of the pre-existing CHP survey data from 2009, and the 2014 dedicated survey data is presented in Figure 6.

The list of benthic taxa found in the grab and video samples is presented in Appendix 4; a total of 395 infaunal and 57 epifaunal taxa were recorded. No species FOCI listed in the ENG were recorded.

A summary of the PSA of the grab samples is given in Appendix 5. Of the 93 stations where a sample was obtained, coarse sediment was recorded at 26 stations, sand at 43 stations, mud at 2 stations and mixed sediment at 22 stations.

The analysis of the seabed video and stills is summarised in Appendix 6. Example images taken during the survey of the BSHs and habitat FOCI recorded in the video analysis are given in Appendices 7 and 8 respectively.

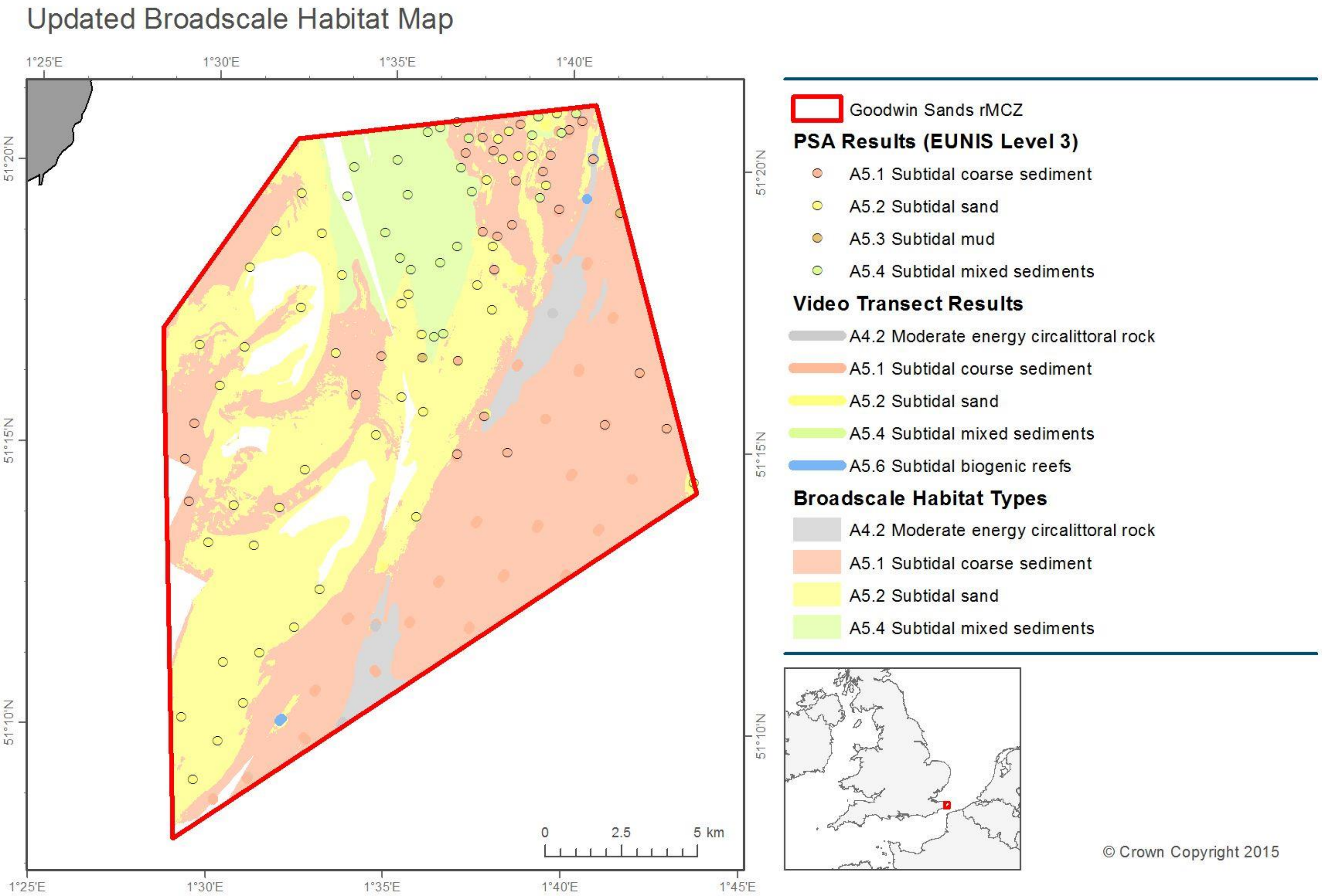


**Figure 6. Updated map of broadscale habitats based on newly acquired survey data.**

## 4.3 Quality of the updated habitat map

This map attained a score of 83 from the MESH Confidence Assessment Tool (Figure 7), which is good, given that the maximum possible score for a purely physical map is 88.

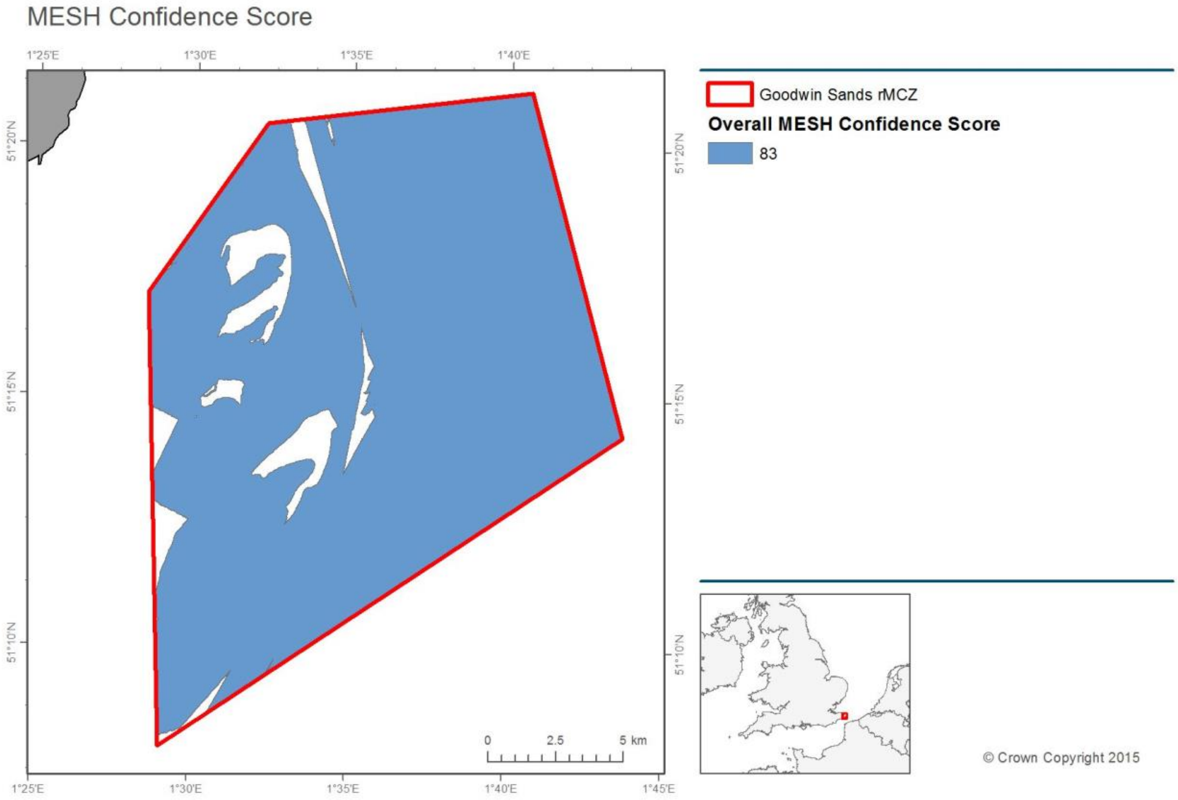


**Figure 7. Overall MESH confidence score for the updated broadscale habitat map.**

## 4.4 Broadscale habitats identified

'A5.1 Subtidal coarse sediment' is the most widespread habitat type, occupying 52% of the rMCZ (Figure 6; Table 5). 'A5.2 Subtidal sand' occupies 35%, 'A5.4 Subtidal mixed sediments' occupy 9%, and 'A4.2 Moderate energy circalittoral rock' occupies 4% of the rMCZ.

According to the SAD, this rMCZ incorporates two notable large-scale geomorphological features which influence the regional sediment distribution: the Goodwin Sands banks; and an erosional valley associated with the English Channel palaeovalley system. The Goodwin Sands banks are sand-dominated features which formed during the Holocene transgression, and are sub-aerially exposed in places during low tides (e.g. D'Olier, 2009). The banks are maintained by active sediment influx and local hydrodynamic conditions. Multiple mobile sand wave fields are active along the margins of the banks. The distribution of 'A5.2 Subtidal sand' is predominantly associated with the extent of the Goodwin Sands banks and affiliated mobile sand waves.

The English Channel palaeovalleys are wide and frequently flat valleys as they incise bedrock, in this case Cretaceous Chalk. Their origin is disputed; they may be the result of catastrophic flooding following the outburst of a glacial lake in the North Sea, previously damned by the Dover Isthmus (e.g. Gupta et al., 2007), or may result from more steady-state erosion from the drainage of Northern European river systems that fed the North Sea basin and English Channel (e.g. Mellett et al., 2013). A large palaeovalley extends NNE-SSW across the rMCZ area and is dominated by ‘A5.1 Subtidal coarse sediment’. The valley terrace in the far east of the area is also dominated by ‘A5.1 Subtidal coarse sediment’. ‘A4.2 Moderate energy circalittoral rock’ is mapped in places along the eastern margin of the palaeovalley where no superficial sediment is present. There is likely further rock exposed at seabed within, and along the margins of the valley as confirmed by several video/stills imagery observations; however it is not possible to extrapolate these point observations according to the acoustic data. The bases of the valleys are frequently characterized by gravel and cobble-rich sediment waves atop bedrock. In places bedrock is exposed within the troughs of these waves, but in other places this relationship does not hold. As the acoustic backscatter data provides an ambiguous signal between the coarse sediment and rock at these fine scales, the occurrences of ‘A4.2 Moderate energy circalittoral rock’ were mapped only where we were confident that both the sample and acoustic data predict the dominant presence of rock at seabed.

‘A5.4 Subtidal mixed sediments’ are mapped exclusively within the northern part of the rMCZ area. Acoustically, these areas cannot be discriminated from ‘A5.1 Subtidal coarse sediment’ as both exhibit similar backscatter intensities and there are no distinguishing morphological characteristics observed within the bathymetry data. For this reason, the extent of ‘A5.4 Subtidal mixed sediments’ is manually mapped according to PSA sample results where it shares a boundary with ‘A5.1 Subtidal coarse sediment’. The results from the unsupervised (clustering) classification were honoured where both ‘A5.4 Subtidal mixed sediments’ and ‘A5.1 Subtidal coarse sediment’ border ‘A5.2 Subtidal sand’.

**Table 5. Broadscale habitats identified in this rMCZ.**

| Broadscale Habitat Type (EUNIS Level 3) | Spatial extent according to the SAD | Spatial extent according to the updated habitat map |
|---|---|---|
| A3.2 Moderate energy infralittoral rock | 0.65 $km^2$ | 0 $km^2$ |
| A4.2 Moderate energy circalittoral rock | 0.58 $km^2$ | 11.19 $km^2$ |
| A5.1 Subtidal coarse sediment | 115.55 $km^2$ | 133.19 $km^2$ |
| A5.2 Subtidal sand | 159.97 $km^2$ | 89.48 $km^2$ |
| A5.4 Subtidal mixed sediments | Not listed | 24.09 $km^2$ |

## 4.5 Habitat FOCI identified

The SAD estimates the presence of ‘Blue Mussel Beds’ (312.57 $m^2$) and ‘Ross Worm (*Sabellaria spinulosa*) Reefs’ (625.29 $m^2$) (Table 6; Figure 8). These features could not be confidently identified using the acoustic bathymetry or backscatter data and were observed on video and stills imagery only. For this reason they are presented on the habitat FOCI map as point observations only as it was not possible to extrapolate the spatial extent of these features according to the acoustic data.

Of the surveyed areas, ‘Subtidal Sands and Gravels’ occupy 222.68 $km^2$, or approximately 86% of the surveyed area. ‘Subtidal Chalk’ occupies 11.19 $km^2$, or approximately 4% of the surveyed area. The habitat FOCI 'Subtidal Chalk' was not listed in the SAD.

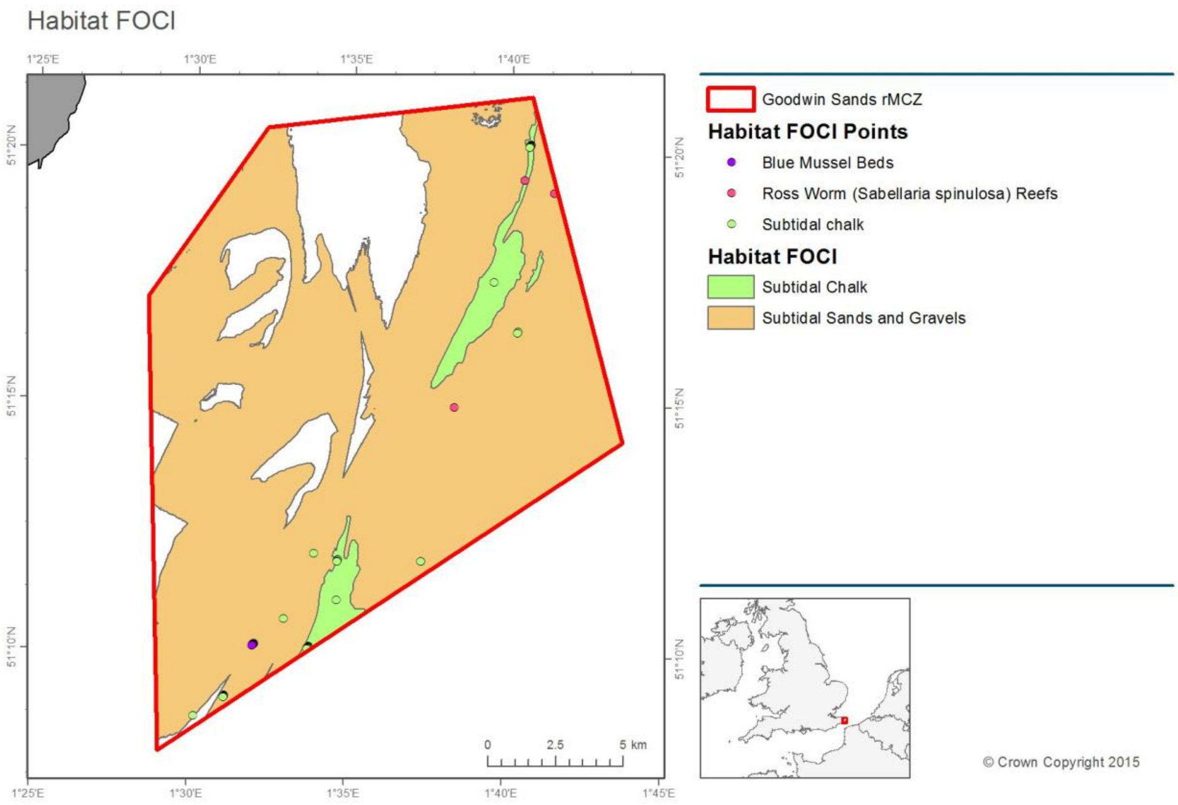


**Figure 8. Habitat FOCI identified.**

**Table 4. Habitat FOCI identified in this rMCZ.**

| Habitat FOCI | Spatial extent according to the SAD | Spatial extent according to the updated habitat map |
|---|---|---|
| Blue Mussel Beds | 312.57 km$^2$ | N/A* |
| Ross Worm (*Sabellaria spinulosa*) Reefs | 625.29 km$^2$ | N/A* |
| Subtidal Sands and Gravels | Not listed** | 222.68km$^2$ |
| Subtidal Chalk | Not listed | 11.19 km$^2$ |

* ***These features are presented on the habitat FOCI map as point observations only as it was not possible to extrapolate the spatial extent of these features according to the acoustic data.***
*****The presence of habitat FOCI 'Subtidal Sands and Gravels' is not listed in the SAD, but inferred by the listing of BSH classes 5.1 and 5.2.***

## 4.6 Species FOCI identified

No species FOCI were recorded from the newly acquired survey data (Table 5). The list of species identified from grab and video samples collected by the dedicated 2014 surveys as presented in Appendix 4.

**Table 5. Species FOCI identified in this rMCZ.**

| Species FOCI | Previously recorded within rMCZ | Identified during evidence gathering survey |
|---|---|---|
| Low or Limited Mobility Species FOCI | None recorded | None recorded |
| Highly Mobile Species FOCI | None recorded | None recorded |

## 4.7 Quality Assurance (QA) and Quality Control (QC)

### 4.7.1 Acoustic data

The acoustic data utilised for production of the updated habitat map were collected under the CHP as well as by the RV *Cefas Endeavour*. The acquisition and processing of the bathymetry data complied with the International Hydrographic Organisation (IHO) Standards for Hydrographic Surveys-Order 1 (Special Publication 44, Edition 4). The accompanying multibeam backscatter data were reviewed and processed by specialist Cefas staff to ensure these data were suitable for use in the subsequent interpretations and production of the updated habitat map.

### 4.7.2 Particle Size Analysis of sediments

PSA was carried out by Cefas scientists following standard laboratory practice following the recommendations of the National Marine Biological Analytical Quality Control (NMBAQC) scheme (Mason, 2011). Results of the PSA are shown in Appendix 5.

### 4.7.3 Infaunal samples from grabs

Infaunal samples were processed by MIES and APEM following standard laboratory practices, and results checked following the recommendations of the National Marine Biological Analytical Quality Control (NMBAQC) scheme (Worsfold et al., 2010).

### 4.7.4 Video and still images and analysis

Video and photographic stills were processed by OceanEcology Ltd in accordance with the guidance documents developed by Cefas and the Joint Nature Conservation Committee (JNCC) for the acquisition and processing of video and stills data (Coggan and Howell, 2005; JNCC, in prep.; summarised in Annex 5).

## 4.8 Data limitations and adequacy of the updated habitat map

The quality of the derived habitat map is assessed to be High (MESH assessment tool). A source of potential misclassification of habitats arises from the location of groundtruthing samples in relation to habitat types.

The surveys have provided substantial, robust evidence for the presence of the mapped habitats. However, as it is impractical (and undesirable) to sample the entire area of the site with grabs and video, there is a chance that a BSH or FOCI may exist within the site but has not been recorded, especially if it was limited in extent.  Given the relatively homogeneous nature of the site, the likelihood of this is low.

The precise location of the boundaries between the broadscale habitats depicted on the new habitat map should be regarded as indicative, not definitive.  In nature, such boundaries are rarely abrupt.  Instead it is typical for one BSH to grade into another across a transitional boundary.  In contrast, the mapped boundaries are abrupt and have been placed using best professional judgment.  This may have implications when calculating the overall extent of any of the mapped habitats or FOCI.

### 4.8.1 Presence of species FOCI

No species FOCI were included in the recommendations for proposal of this rMCZ, or recorded during the dedicated 2014 surveys conducted.

## 4.9 Observations of human impacts on the seabed

A large number (59) of wrecks are visible in the multibeam bathymetry for this site, as shown in Appendix 3. Most of the wrecks rest on the seabed in and around the Goodwin Sands banks. Occasional trawl marks are also found in the north of the rMCZ (Appendix 3).

# 5 Conclusions

## 5.1 Presence and extent of broadscale habitats

### 5.1.1 Presence

- The 2009 CHP, and 2014 dedicated surveys have confirmed the presence of the ‘A4.2 Moderate energy circalittoral rock’, ‘A5.1 Subtidal coarse sediments’ and ‘A5.2 Subtidal sand’ broadscale habitats that were included in the recommendations made by the SAD for designating this site as an MCZ.
- The 2009 CHP, and 2014 dedicated surveys have not confirmed the presence of the ‘A3.2 Moderate energy infralittoral rock’ broadscale habitat that was included in the recommendations made by the SAD for designating this site as an MCZ.
- The 2009 CHP, and 2014 dedicated surveys have confirmed the presence of ‘A5.4 Subtidal mixed sediments’ broadscale habitat. This BSH was not included in the recommendations made by the SAD for designating this site as an MCZ.

### 5.1.2 Extent

- The spatial extent of the ‘A4.2 Moderate energy circalittoral rock’ BSH on the updated habitat map is 11.19 $km^2$. This is 10.61 $km^2$ more than its spatial extent in the SAD habitat map.
- The spatial extent of the ‘A5.1 Subtidal coarse sediment’ BSH on the updated habitat map is 133.19 $km^2$. This is 17.64 $km^2$ more than its spatial extent in the SAD habitat map.
- The spatial extent of the ‘A5.2 Subtidal sand’ BSH on the updated habitat map is 89.48 $km^2$. This is 70.49 $km^2$ less than its spatial extent in the SAD habitat map.
- The spatial extent of the ‘A5.4 Subtidal mixed sediments’ BSH on the updated habitat map is 24.09 $km^2$. This was not identified in the SAD habitat map.

## 5.2 Presence and extent of habitat FOCI

### 5.2.1 Presence

- The 2009 CHP and 2014 dedicated surveys have confirmed the presence of the habitat FOCI ‘Blue Mussel Beds’ that was included in the recommendations made by the SAD for designating this site as an MCZ.
- The 2009 CHP and 2014 dedicated surveys have confirmed the presence of the habitat FOCI ‘Ross Worm (*Sabellaria spinulosa*) Reefs’ that was included in the recommendations made by the SAD for designating this site as an MCZ.

- The 2009 CHP, and 2014 dedicated surveys have confirmed the presence of the habitat FOCI ‘Subtidal Sands and Gravels’ and ‘Subtidal chalk’ at this site. These habitat FOCI were not included in the recommendations made by the SAD for designating this site as an MCZ.

### 5.2.2 Extent and distribution

- The spatial extent of the habitat FOCI ‘Blue Mussel Beds’ was not possible to determine as the ground truth observations could not be extrapolated according to the acoustic data. This habitat FOCI was listed as 312.57 $m^2$ in the SAD.
- The spatial extent of the habitat FOCI ‘Ross Worm (*Sabellaria spinulosa*) Reefs’ was not possible to determine as the ground truth observations could not be extrapolated according to the acoustic data. This habitat FOCI was listed as 625.29 $m^2$ in the SAD.
- The spatial extent of the habitat FOCI ‘Subtidal Sands and Gravels’ on the updated habitat map is 222.68 $km^2$. This was not identified in the SAD habitat map.
- The spatial extent of the habitat FOCI ‘Subtidal Chalk’ on the updated habitat map is 11.19 $km^2$. This was not identified in the SAD habitat map.

## 5.3 Presence and distribution of species FOCI

### 5.3.1 Low or limited mobility species

- No ‘Low or limited mobility’ species FOCI were recorded at this site by the 2014 dedicated survey. These observations are consistent with the evidence presented in the SAD.

### 5.3.2 Highly mobile species FOCI

- No highly mobile species FOCI were recorded at this site by the 2012 dedicated survey. These observations are consistent with the evidence presented in the SAD.

## 5.4 Evidence of human activities impacting the seabed

Fifty-nine wrecks are visible in the multibeam bathymetry for this site, as shown in Appendix 3. Occasional trawl marks are also found in the north of the rMCZ area (Appendix 3).

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# Data sources

All enquiries in relation to this report should be addressed to the following e-mail address: marinescience@defra.gsi.gov.uk

# Annexes

## Annex 1. Broadscale habitat features listed in the ENG.

| Broadscale Habitat Type | EUNIS Level 3 Code |
|---|---|
| High energy intertidal rock | A1.1 |
| Moderate energy intertidal rock | A1.2 |
| Low energy intertidal rock | A1.3 |
| Intertidal coarse sediment | A2.1 |
| Intertidal sand and muddy sand | A2.2 |
| Intertidal mud | A2.3 |
| Intertidal mixed sediments | A2.4 |
| Coastal saltmarshes and saline reed beds | A2.5 |
| Intertidal sediments dominated by aquatic angiosperms | A2.6 |
| Intertidal biogenic reefs | A2.7 |
| High energy infralittoral rock* | A3.1 |
| Moderate energy infralittoral rock* | A3.2 |
| Low energy infralittoral rock* | A3.3 |
| High energy circalittoral rock** | A4.1 |
| Moderate energy circalittoral rock** | A4.2 |
| Low energy circalittoral rock** | A4.3 |
| Subtidal coarse sediment | A5.1 |
| Subtidal sand | A5.2 |
| Subtidal mud | A5.3 |
| Subtidal mixed sediments | A5.4 |
| Subtidal macrophyte-dominated sediment | A5.5 |
| Subtidal biogenic reefs | A5.6 |
| Deep-sea bed*** | A6 |

**** Infralittoral rock includes habitats of bedrock, boulders and cobble which occur in the shallow subtidal zone and typically support seaweed communities***
***** Circalittoral rock is characterised by animal dominated communities, rather than seaweed dominated communities***
****** The deep-sea bed*** **broadscale habitat** ***encompasses several different habitat sub-types, all of which should be protected within the MPA network. The*** **broadscale habitat** ***deep-sea bed habitat is found only in the south-west of the MCZ project area and MCZs identified for this*** **broadscale habitat** ***should seek to protect the variety of sub-types known to occur in the region.***

## Annex 2. Habitat FOCI listed in the ENG.

| Habitat Features of Conservation Importance (FOCI) |
|---|
| Blue Mussel Beds (including Intertidal Beds on Mixed and Sandy Sediments)** |
| Cold-Water Coral Reefs *** |
| Coral Gardens*** |
| Deep-Sea Sponge Aggregations*** |
| Estuarine Rocky Habitats |
| File Shell Beds*** |
| Fragile Sponge and Anthozoan Communities on Subtidal Rocky Habitats |
| Intertidal Underboulder Communities |
| Littoral Chalk Communities |
| Maerl Beds |
| Horse Mussel (*Modiolus modiolus*) Beds |
| Mud Habitats in Deep Water |
| Sea-Pen and Burrowing Megafauna Communities |
| Native Oyster (*Ostrea edulis*) Beds |
| Peat and Clay Exposures |
| Honeycomb Worm (*Sabellaria alveolata*) Reefs |
| Ross Worm (*Sabellaria spinulosa*) Reefs |
| Seagrass Beds |
| Sheltered Muddy Gravels |
| Subtidal Chalk |
| Subtidal Sands and Gravels |
| Tide-Swept Channels |

**** Habitat FOCI have been identified from the 'OSPAR List of Threatened and/or Declining Species and Habitats' and the 'UK List of Priority Species and Habitats (UK BAP)'.***
***** Only includes 'natural' beds on a variety of sediment types. Excludes artificially created mussel beds and those which occur on rocks and boulders.***
****** Cold-Water Coral Reefs, Coral Gardens, Deep-Sea Sponge Aggregations and File Shell Beds currently do not have distributional data which demonstrate their presence within the MCZ project area.***

## Annex 3. Low or limited mobility species FOCI listed in the ENG.

| Group | Scientific name | Common Name |
|---|---|---|
| Brown Algae | *Padina pavonica* | Peacock's Tail |
| Red Algae | *Cruoria cruoriaeformis*<br>*Grateloupia montagnei*<br>*Lithothamnion corallioides*<br>*Phymatolithon calcareum* | Burgundy Maerl Paint Weed<br>Grateloup's Little-Lobed Weed<br>Coral Maerl<br>Common Maerl |
| Annelida | *Alkmaria romijni***<br>*Armandia cirrhosa*** | Tentacled Lagoon-Worm**<br>Lagoon Sandworm** |
| Teleostei | *Gobius cobitis*<br>*Gobius couchi*<br>*Hippocampus guttulatus*<br>*Hippocampus hippocampus* | Giant Goby<br>Couch's Goby<br>Long Snouted Seahorse<br>Short Snouted Seahorse |
| Bryozoa | *Victorella pavida* | Trembling Sea Mat |
| Cnidaria | *Amphianthus dohrnii*<br>*Eunicella verrucosa*<br>*Haliclystus auricula*<br>*Leptopsammia pruvoti*<br>*Lucernariopsis campanulata*<br>*Lucernariopsis cruxmelitensis*<br>*Nematostella vectensis* | Sea-Fan Anemone<br>Pink Sea-Fan<br>Stalked Jellyfish<br>Sunset Cup Coral<br>Stalked Jellyfish<br>Stalked Jellyfish<br>Starlet Sea Anemone |
| Crustacea | *Gammarus insensibilis***<br>*Gitanopsis bispinosa*<br>*Pollicipes pollicipes*<br>*Palinurus elephas* | Lagoon Sand Shrimp**<br>Amphipod Shrimp<br>Gooseneck Barnacle<br>Spiny Lobster |
| Mollusca | *Arctica islandica*<br>*Atrina pectinata*<br>*Caecum armoricum***<br>*Ostrea edulis*<br>*Paludinella littorina*<br>*Tenellia adspersa*** | Ocean Quahog<br>Fan Mussel<br>Defolin's Lagoon Snail**<br>Native Oyster<br>Sea Snail<br>Lagoon Sea Slug** |

**** Species FOCI have been identified from the 'OSPAR List of Threatened and/or Declining Species and Habitats', the 'UK List of Priority Species and Habitats (UK BAP)' and Schedule 5 of the Wildlife and Countryside Act.***

***** Those lagoonal species FOCI may be afforded sufficient protection through coastal lagoons designated as SACs under the EC Habitats Directive. However, this needs to be assessed by individual regional projects.***

## Annex 4. Highly mobile species FOCI listed in the ENG.

| Group | Scientific name | Common Name |
|---|---|---|
| Teleostei | *Osmerus eperlanus*<br>*Anguilla anguilla* | Smelt<br>European Eel |
| Elasmobranchii | *Raja undulata* | Undulate Ray |

**** Species FOCI have been identified from the 'OSPAR List of Threatened and/or Declining Species and Habitats', the 'UK List of Priority Species and Habitats (UK BAP)' and Schedule 5 of the Wildlife and Countryside Act.***

## Annex 5. Video and stills processing protocol.

The purpose of the analysis of the video and still images is to identify which habitats exist in a video record, provide semi-quantitative data on their physical and biological characteristics and to note where one habitat changes to another. A minimum of 10% of the videos should be re-analysed for QA purposes.

### Video Analysis

- The video record is initially viewed rapidly (at approximately 4x normal speed) in order to segment it into sections representing different habitats. The start and end points of each segment are logged, and each segment subsequently subject to more detailed analysis. Brief changes in habitat type lasting less than one minute of the video record are considered as incidental patches and are not logged.

- For each segment, note the start and end time and position from the information on the video overlay. View the segment at normal or slower than normal speed, noting the physical and biological characteristics, such as substrate type, seabed character, species and life forms present. For each taxon record an actual abundance (where feasible) or a semi quantitative abundance (e.g. SACFOR scale).

- Record the analyses on the video pro-forma provided (paper and/or electronic), which is a modified version of the Sublittoral Habitat Recording Form used in the Marine Nature Conservation Review (MNCR) surveys.

- When each segment has been analysed, review the information recorded and assign the segment to one of the broadscale habitat (BSH) types or habitat FOCI listed in the Ecological Network Guidance (as reproduced in Annexes 1 and 2 above). Note also any species FOCI observed (as per Annex 3 above).

### Stills analysis

- Still images should be analysed separately, to supplement and validate the video analysis, and provide more detailed (i.e. higher resolution) information than can be extracted from a moving video image.

- For each segment of video, select three still images that are representative of the BSH or FOCI to which the video segment has been assigned. For each image, note the time and position it was taken, using information from the associated video overlay.

- View the image at normal or greater than normal magnification, noting the physical and biological characteristics, such as substrate type, seabed character, species and life forms present. For each taxon record an actual abundance (where feasible) or a semi quantitative abundance (e.g. SACFOR scale).

- Record the analysis on the stills pro-forma provided (paper and/or electronic), which is a modified version of the Sublittoral Habitat Recording Form used in the MNCR surveys. Assign each still image to the same BSH or habitat FOCI as its ‘parent’ segment in the video.

### Taxon identification

In all analyses, the identification of taxa should be limited to a level that can be confidently achieved from the available image. Hence, taxon identity could range from the 'life form' level (e.g. sponge, hydroid, anemone) to the species level (e.g. *Asterias rubens*, *Alcyonium digitatum*). Avoid the temptation to guess the species identity if it cannot be determined positively from the image. For example, *Spirobranchus* sp. would be acceptable, but *Spirobranchus triqueter* would not, as the specific identification normally requires the specimen to be inspected under a microscope.

# Appendices

## Appendix 1. Survey metadata

Groundtruthing Survey CEND 01/14

| Date sampled | Time sampled | Station code | Station number | Gear code | Latitude (degrees) | Longitude (degrees) |
|---|---|---|---|---|---|---|
| 15/01/2014 | 20:41 | GWSD026 | 190 | HG | 51.34748 | 1.67099 |
| 15/01/2014 | 20:47 | GWSD026 | 190 | HG | 51.34753 | 1.67103 |
| 15/01/2014 | 21:09 | GWSD031 | 191 | HG | 51.33651 | 1.67646 |
| 15/01/2014 | 21:14 | GWSD031 | 191 | HG | 51.33649 | 1.67639 |
| 15/01/2014 | 21:20 | GWSD031 | 191 | HG | 51.33646 | 1.67635 |
| 15/01/2014 | 22:37 | GWSD035 | 194 | HG | 51.32032 | 1.68927 |
| 15/01/2014 | 22:43 | GWSD035 | 194 | HG | 51.32029 | 1.68932 |
| 15/01/2014 | 22:51 | GWSD035 | 194 | HG | 51.32069 | 1.68956 |
| 15/01/2014 | 23:17 | GWSD025 | 195 | HG | 51.32142 | 1.66077 |
| 16/01/2014 | 01:29 | GWSD030 | 199 | HG | 51.30501 | 1.67366 |
| 16/01/2014 | 01:37 | GWSD030 | 199 | HG | 51.30503 | 1.67369 |
| 16/01/2014 | 01:42 | GWSD030 | 199 | HG | 51.30504 | 1.67367 |
| 16/01/2014 | 03:54 | GWSD033 | 203 | HG | 51.25792 | 1.68405 |
| 16/01/2014 | 04:19 | GWSD037 | 204 | HG | 51.2735 | 1.7 |
| 16/01/2014 | 04:23 | GWSD037 | 204 | HG | 51.27347 | 1.70001 |
| 16/01/2014 | 05:13 | GWSD038 | 207 | HG | 51.25716 | 1.71308 |
| 16/01/2014 | 05:17 | GWSD038 | 207 | HG | 51.25715 | 1.71307 |
| 16/01/2014 | 05:24 | GWSD038 | 207 | HG | 51.25719 | 1.71313 |
| 16/01/2014 | 05:45 | GWSD039 | 208 | HG | 51.24135 | 1.72629 |
| 16/01/2014 | 06:45 | GWSD036 | 211 | HG | 51.24196 | 1.69721 |
| 16/01/2014 | 06:49 | GWSD036 | 211 | HG | 51.24192 | 1.6972 |
| 16/01/2014 | 06:53 | GWSD036 | 211 | HG | 51.24191 | 1.69719 |
| 16/01/2014 | 07:15 | GWSD032 | 212 | HG | 51.22712 | 1.6816 |
| 16/01/2014 | 07:19 | GWSD032 | 212 | HG | 51.22709 | 1.68168 |
| 16/01/2014 | 07:22 | GWSD032 | 212 | HG | 51.22708 | 1.68168 |
| 16/01/2014 | 11:07 | GWSD023 | 218 | HG | 51.25901 | 1.65566 |
| 16/01/2014 | 11:12 | GWSD023 | 218 | HG | 51.25898 | 1.65564 |
| 16/01/2014 | 11:18 | GWSD023 | 218 | HG | 51.25908 | 1.65575 |
| 16/01/2014 | 11:45 | GWSD020 | 219 | HG | 51.24926 | 1.63855 |
| 16/01/2014 | 11:52 | GWSD020 | 219 | HG | 51.24915 | 1.63847 |
| 16/01/2014 | 11:59 | GWSD020 | 219 | HG | 51.24915 | 1.63847 |
| 16/01/2014 | 13:14 | GWSD017 | 222 | HG | 51.25987 | 1.62713 |
| 16/01/2014 | 13:22 | GWSD017 | 222 | HG | 51.2599 | 1.62714 |
| 16/01/2014 | 13:55 | GWSD021 | 223 | HG | 51.27538 | 1.64254 |
| 16/01/2014 | 14:01 | GWSD021 | 223 | HG | 51.27542 | 1.64258 |
| 16/01/2014 | 14:08 | GWSD021 | 223 | HG | 51.27533 | 1.64249 |
| 16/01/2014 | 15:12 | GWSD018 | 226 | HG | 51.29101 | 1.62959 |
| 16/01/2014 | 15:18 | GWSD018 | 226 | HG | 51.2913 | 1.62981 |
| 16/01/2014 | 15:40 | GWSD014 | 227 | HG | 51.27615 | 1.61443 |
| 16/01/2014 | 16:34 | GWSD011 | 230 | HG | 51.26089 | 1.59849 |
| 16/01/2014 | 16:52 | GWSD013 | 231 | HG | 51.2486 | 1.61474 |
| 16/01/2014 | 18:33 | GWSD010 | 234 | HG | 51.2297 | 1.59597 |
| 16/01/2014 | 18:59 | GWSD012 | 235 | HG | 51.21069 | 1.60719 |
| 16/01/2014 | 19:04 | GWSD012 | 235 | HG | 51.21065 | 1.60716 |
| 16/01/2014 | 19:09 | GWSD012 | 235 | HG | 51.21061 | 1.60716 |
| 16/01/2014 | 22:37 | GWSD009 | 241 | HG | 51.19862 | 1.59385 |
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| 15/01/2014 | 20:33 | GWSD026 | 189 | DC EOL | 51.34778 | 1.671133 |
| 15/01/2014 | 21:42 | GWSD031 | 192 | DC SOL | 51.33647 | 1.676574 |

| Date sampled | Time sampled | Station code | Station number | Gear code | Latitude (degrees) | Longitude (degrees) |
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| 15/01/2014 | 22:29 | GWSD035 | 193 | DC EOL | 51.31979 | 1.68916 |
| 15/01/2014 | 23:29 | GWSD025 | 196 | DC SOL | 51.32131 | 1.660739 |
| 15/01/2014 | 23:39 | GWSD025 | 196 | DC EOL | 51.32064 | 1.660435 |
| 16/01/2014 | 00:27 | GWSD024 | 197 | DC SOL | 51.29039 | 1.65812 |
| 16/01/2014 | 00:29 | GWSD024 | 197 | DC EOL | 51.29022 | 1.65798 |
| 16/01/2014 | 01:07 | GWSD030 | 198 | DC SOL | 51.3054 | 1.674102 |
| 16/01/2014 | 01:17 | GWSD030 | 198 | DC EOL | 51.30467 | 1.673493 |
| 16/01/2014 | 02:17 | GWSD034 | 200 | DC SOL | 51.28958 | 1.686787 |
| 16/01/2014 | 02:23 | GWSD034 | 200 | DC EOL | 51.28911 | 1.686488 |
| 16/01/2014 | 02:53 | GWSD029 | 201 | DC SOL | 51.27431 | 1.671257 |
| 16/01/2014 | 03:04 | GWSD029 | 201 | DC EOL | 51.27348 | 1.670691 |
| 16/01/2014 | 03:35 | GWSD033 | 202 | DC SOL | 51.25845 | 1.684455 |
| 16/01/2014 | 03:45 | GWSD033 | 202 | DC EOL | 51.25767 | 1.683861 |
| 16/01/2014 | 04:35 | GWSD037 | 205 | DC SOL | 51.27354 | 1.700117 |
| 16/01/2014 | 04:38 | GWSD037 | 205 | DC EOL | 51.27335 | 1.699924 |
| 16/01/2014 | 05:02 | GWSD038 | 206 | DC SOL | 51.25735 | 1.713306 |
| 16/01/2014 | 05:04 | GWSD038 | 206 | DC EOL | 51.25721 | 1.713181 |
| 16/01/2014 | 05:58 | GWSD039 | 209 | DC SOL | 51.24117 | 1.726147 |
| 16/01/2014 | 06:08 | GWSD039 | 209 | DC EOL | 51.24042 | 1.725577 |
| 16/01/2014 | 06:34 | GWSD036 | 210 | DC SOL | 51.24215 | 1.697416 |
| 16/01/2014 | 06:36 | GWSD036 | 210 | DC EOL | 51.24203 | 1.697315 |
| 16/01/2014 | 08:01 | GWSD032 | 213 | DC SOL | 51.22672 | 1.681492 |
| 16/01/2014 | 08:11 | GWSD032 | 213 | DC EOL | 51.22742 | 1.682218 |
| 16/01/2014 | 08:43 | GWSD027 | 214 | DC SOL | 51.21286 | 1.666276 |
| 16/01/2014 | 08:55 | GWSD027 | 214 | DC EOL | 51.21369 | 1.666918 |
| 16/01/2014 | 09:28 | GWSD022 | 215 | DC SOL | 51.2282 | 1.653376 |
| 16/01/2014 | 09:38 | GWSD022 | 215 | DC EOL | 51.22738 | 1.652761 |
| 16/01/2014 | 10:07 | GWSD028 | 216 | DC SOL | 51.24335 | 1.669071 |
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| 16/01/2014 | 12:32 | GWSD020 | 220 | DC SOL | 51.2491 | 1.638444 |
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| 16/01/2014 | 13:00 | GWSD017 | 221 | DC SOL | 51.26011 | 1.627382 |
| 16/01/2014 | 13:02 | GWSD017 | 221 | DC EOL | 51.25996 | 1.627232 |
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| 16/01/2014 | 15:02 | GWSD018 | 225 | DC SOL | 51.291263 | 1.629771 |
| 16/01/2014 | 15:04 | GWSD018 | 225 | DC EOL | 51.291102 | 1.629639 |
| 16/01/2014 | 15:51 | GWSD014 | 228 | DC SOL | 51.276001 | 1.614308 |
| 16/01/2014 | 16:01 | GWSD014 | 228 | DC EOL | 51.275287 | 1.613785 |
| 16/01/2014 | 16:25 | GWSD011 | 229 | DC SOL | 51.261112 | 1.598568 |
| 16/01/2014 | 16:27 | GWSD011 | 229 | DC EOL | 51.260975 | 1.598499 |
| 16/01/2014 | 17:45 | GWSD013 | 232 | DC SOL | 51.248515 | 1.614729 |
| 16/01/2014 | 17:55 | GWSD013 | 232 | DC EOL | 51.247727 | 1.614384 |
| 16/01/2014 | 18:21 | GWSD010 | 233 | DC SOL | 51.229444 | 1.595836 |
| 16/01/2014 | 18:23 | GWSD010 | 233 | DC EOL | 51.229615 | 1.595931 |
| 16/01/2014 | 19:20 | GWSD012 | 236 | DC SOL | 51.210674 | 1.6072 |
| 16/01/2014 | 19:30 | GWSD012 | 236 | DC EOL | 51.211417 | 1.607778 |
| 16/01/2014 | 19:52 | GWSD016 | 237 | DC SOL | 51.228472 | 1.624438 |
| 16/01/2014 | 20:02 | GWSD016 | 237 | DC EOL | 51.22917 | 1.625059 |
| 16/01/2014 | 20:35 | GWSD019 | 238 | DC SOL | 51.212686 | 1.637521 |
| 16/01/2014 | 20:45 | GWSD019 | 238 | DC EOL | 51.213441 | 1.638176 |
| 16/01/2014 | 21:40 | GWSD015 | 239 | DC SOL | 51.197909 | 1.622259 |

| Date sampled | Time sampled | Station code | Station number | Gear code | Latitude (degrees) | Longitude (degrees) |
|---|---|---|---|---|---|---|
| 16/01/2014 | 21:50 | GWSD015 | 239 | DC EOL | 51.19702 | 1.62174 |
| 16/01/2014 | 22:21 | GWSD009 | 240 | DC SOL | 51.198971 | 1.593945 |
| 16/01/2014 | 22:26 | GWSD009 | 240 | DC EOL | 51.198595 | 1.59367 |
| 18/01/2014 | 00:29 | GWSD008 | 244 | DC SOL | 51.214835 | 1.580576 |
| 18/01/2014 | 00:31 | GWSD008 | 244 | DC EOL | 51.214698 | 1.580467 |
| 18/01/2014 | 01:08 | GWSD006 | 245 | DC SOL | 51.199794 | 1.565378 |
| 18/01/2014 | 01:17 | GWSD006 | 245 | DC EOL | 51.19925 | 1.564596 |
| 18/01/2014 | 01:57 | GWSD007 | 246 | DC SOL | 51.183854 | 1.578196 |
| 18/01/2014 | 02:02 | GWSD007 | 246 | DC EOL | 51.183413 | 1.578592 |
| 18/01/2014 | 02:35 | GWSD005 | 247 | DC SOL | 51.168606 | 1.562944 |
| 18/01/2014 | 02:47 | GWSD005 | 247 | DC EOL | 51.167685 | 1.561971 |
| 18/01/2014 | 03:13 | GWSD004 | 248 | DC SOL | 51.178156 | 1.550292 |
| 18/01/2014 | 03:23 | GWSD004 | 248 | DC EOL | 51.177472 | 1.549532 |
| 18/01/2014 | 03:45 | GWSD003 | 249 | DC SOL | 51.169457 | 1.534478 |
| 18/01/2014 | 03:55 | GWSD003 | 249 | DC EOL | 51.168798 | 1.533634 |
| 18/01/2014 | 04:21 | GWSD002 | 250 | DC SOL | 51.152076 | 1.51914 |
| 18/01/2014 | 04:31 | GWSD002 | 250 | DC EOL | 51.151521 | 1.518802 |
| 18/01/2014 | 04:49 | GWSD001 | 251 | DC SOL | 51.145588 | 1.503158 |
| 18/01/2014 | 05:10 | GWSD001 | 251 | DC EOL | 51.145057 | 1.503014 |

**Key**: HG – mini Hamon Grab

## Groundtruthing Survey CEND 06/14

| Date sampled | Time sampled | Station code | Station number | Gear code | Latitude (degrees) | Longitude (degrees) |
|---|---|---|---|---|---|---|
| 01/05/2014 | 12:44:25 | GWSD137 | 196 | HG | 51.2769727 | 1.597555 |
| 01/05/2014 | 12:49:21 | GWSD137 | 196 | HG | 51.2769348 | 1.597564 |
| 01/05/2014 | 13:12:26 | GWSD138 | 197 | HG | 51.2840078 | 1.607099 |
| 01/05/2014 | 131651 | GWSD138 | 197 | HG | 51.284098 | 1.607124 |
| 01/05/2014 | 140559 | GWSD110 | 199 | HG | 51.2829979 | 1.60266 |
| 01/05/2014 | 141012 | GWSD110 | 199 | HG | 51.2829999 | 1.602708 |
| 01/05/2014 | 141440 | GWSD110 | 199 | HG | 51.2830258 | 1.602656 |
| 01/05/2014 | 143136 | GWSD154 | 200 | HG | 51.2837093 | 1.59707 |
| 01/05/2014 | 145919 | GWSD134 | 202 | HG | 51.2926482 | 1.587163 |
| 01/05/2014 | 151706 | GWSD156 | 203 | HG | 51.2955284 | 1.590588 |
| 01/05/2014 | 152026 | GWSD156 | 203 | HG | 51.2955043 | 1.590574 |
| 01/05/2014 | 152336 | GWSD156 | 203 | HG | 51.2954663 | 1.590553 |
| 01/05/2014 | 153921 | GWSD155 | 204 | HG | 51.3028748 | 1.591227 |
| 01/05/2014 | 154216 | GWSD155 | 204 | HG | 51.3028587 | 1.591179 |
| 01/05/2014 | 164113 | GWSD105 | 206 | DC SOL | 51.3069208 | 1.586742 |
| 01/05/2014 | 165103 | GWSD105 | 206 | DC EOL | 51.3061707 | 1.586232 |
| 01/05/2014 | 165700 | GWSD105 | 207 | HG | 51.306129 | 1.586202 |
| 01/05/2014 | 170009 | GWSD105 | 207 | HG | 51.3061738 | 1.586177 |
| 01/05/2014 | 170352 | GWSD105 | 207 | HG | 51.3062167 | 1.586178 |
| 01/05/2014 | 172537 | GWSD111 | 208 | HG | 51.3049319 | 1.605172 |
| 01/05/2014 | 172845 | GWSD111 | 208 | HG | 51.3049253 | 1.605177 |
| 01/05/2014 | 173151 | GWSD111 | 208 | HG | 51.3049749 | 1.605203 |
| 01/05/2014 | 173936 | GWSD111 | 209 | DC SOL | 51.3048965 | 1.605151 |
| 01/05/2014 | 174126 | GWSD111 | 209 | DC EOL | 51.3047529 | 1.605076 |
| 01/05/2014 | 182453 | GWSD142 | 211 | DC SOL | 51.2988954 | 1.62288 |
| 01/05/2014 | 182723 | GWSD142 | 211 | DC EOL | 51.2987142 | 1.622705 |
| 01/05/2014 | 183432 | GWSD142 | 212 | HG | 51.2986757 | 1.622671 |
| 01/05/2014 | 184735 | GWSD159 | 213 | HG | 51.3033049 | 1.630703 |
| 01/05/2014 | 185552 | GWSD159 | 214 | DC SOL | 51.3031881 | 1.630598 |
| 01/05/2014 | 185732 | GWSD159 | 214 | DC EOL | 51.3030658 | 1.630505 |

| Date sampled | Time sampled | Station code | Station number | Gear code | Latitude (degrees) | Longitude (degrees) |
|---|---|---|---|---|---|---|
| 01/05/2014 | 191437 | GWSD145 | 214 | DC SOL | 51.3101519 | 1.630184 |
| 01/05/2014 | 191617 | GWSD145 | 214 | DC EOL | 51.3101848 | 1.629878 |
| 01/05/2014 | 192359 | GWSD145 | 216 | HG | 51.3101989 | 1.629721 |
| 01/05/2014 | 194027 | GWSD119 | 217 | HG | 51.3131204 | 1.631792 |
| 01/05/2014 | 195430 | GWSD130 | 218 | HG | 51.3165096 | 1.638433 |
| 01/05/2014 | 201401 | GWSD143 | 219 | HG | 51.314494 | 1.624837 |
| 01/05/2014 | 203612 | GWSD115 | 220 | HG | 51.309798 | 1.61302 |
| 01/05/2014 | 203929 | GWSD115 | 220 | HG | 51.3098271 | 1.613042 |
| 01/05/2014 | 204224 | GWSD115 | 221 | HG | 51.3098324 | 1.61304 |
| 01/05/2014 | 210440 | GWSD108 | 221 | HG | 51.3153315 | 1.595581 |
| 01/05/2014 | 210738 | GWSD108 | 221 | HG | 51.3153473 | 1.595594 |
| 01/05/2014 | 211029 | GWSD108 | 221 | HG | 51.3153469 | 1.595597 |
| 01/05/2014 | 212822 | GWSD103 | 222 | HG | 51.313633 | 1.578763 |
| 01/05/2014 | 213124 | GWSD103 | 222 | HG | 51.3136446 | 1.578791 |
| 01/05/2014 | 213406 | GWSD103 | 222 | HG | 51.3136357 | 1.578785 |
| 01/05/2014 | 215519 | GWSD106 | 223 | HG | 51.3248319 | 1.588987 |
| 01/05/2014 | 215821 | GWSD106 | 223 | HG | 51.32483 | 1.58898 |
| 01/05/2014 | 220239 | GWSD106 | 223 | HG | 51.3248475 | 1.588976 |
| 01/05/2014 | 222022 | GWSD104 | 224 | HG | 51.3351895 | 1.584158 |
| 01/05/2014 | 222325 | GWSD104 | 224 | HG | 51.3351927 | 1.584163 |
| 01/05/2014 | 222613 | GWSD104 | 224 | HG | 51.3352004 | 1.58415 |
| 01/05/2014 | 225150 | GWSD101 | 225 | HG | 51.3350289 | 1.563005 |
| 01/05/2014 | 225443 | GWSD101 | 225 | HG | 51.335032 | 1.563045 |
| 01/05/2014 | 225759 | GWSD101 | 225 | HG | 51.3350512 | 1.562991 |
| 01/05/2014 | 233113 | GWSD157 | 226 | HG | 51.3434272 | 1.598117 |
| 01/05/2014 | 233607 | GWSD157 | 226 | HG | 51.3434679 | 1.598133 |
| 02/05/2014 | 3454 | GWSD113 | 229 | HG | 51.3449585 | 1.603826 |
| 02/05/2014 | 10511 | GWSD139 | 230 | HG | 51.3465773 | 1.611786 |
| 02/05/2014 | 12416 | GWSD125 | 231 | HG | 51.3419698 | 1.617284 |
| 02/05/2014 | 14211 | GWSD158 | 232 | HG | 51.3422232 | 1.623935 |
| 02/05/2014 | 14712 | GWSD158 | 232 | HG | 51.3421521 | 1.623915 |
| 02/05/2014 | 20213 | GWSD118 | 233 | HG | 51.3419549 | 1.631271 |
| 02/05/2014 | 20744 | GWSD118 | 233 | HG | 51.3418972 | 1.631254 |
| 02/05/2014 | 21246 | GWSD118 | 233 | HG | 51.3418179 | 1.631291 |
| 02/05/2014 | 22948 | GWSD122 | 234 | HG | 51.3441805 | 1.636526 |
| 02/05/2014 | 23412 | GWSD122 | 234 | HG | 51.3442078 | 1.636474 |
| 02/05/2014 | 32223 | GWSD162 | 236 | HG | 51.346401 | 1.641593 |
| 02/05/2014 | 32641 | GWSD162 | 236 | HG | 51.3464172 | 1.641561 |
| 02/05/2014 | 34635 | GWSD161 | 237 | HG | 51.3487313 | 1.650008 |
| 02/05/2014 | 35216 | GWSD161 | 237 | HG | 51.3487166 | 1.649902 |
| 02/05/2014 | 41600 | GWSD153 | 238 | HG | 51.3496251 | 1.65883 |
| 02/05/2014 | 43622 | GWSD132 | 239 | HG | 51.3498845 | 1.667978 |
| 02/05/2014 | 44105 | GWSD132 | 239 | HG | 51.3498969 | 1.667988 |
| 02/05/2014 | 44529 | GWSD132 | 239 | HG | 51.349944 | 1.668041 |
| 02/05/2014 | 50052 | GWSD131 | 240 | HG | 51.3503373 | 1.674066 |
| 02/05/2014 | 50518 | GWSD131 | 240 | HG | 51.3503855 | 1.67403 |
| 02/05/2014 | 50914 | GWSD131 | 240 | HG | 51.350413 | 1.674007 |
| 02/05/2014 | 53304 | GWSD124 | 241 | HG | 51.3450206 | 1.664732 |
| 02/05/2014 | 54208 | GWSD124 | 242 | DC SOL | 51.3449857 | 1.664704 |
| 02/05/2014 | 55220 | GWSD124 | 242 | DC EOL | 51.3441197 | 1.664413 |
| 02/05/2014 | 60500 | GWSD160 | 243 | HG | 51.3440753 | 1.661086 |
| 02/05/2014 | 62046 | GWSD149 | 244 | HG | 51.3431089 | 1.647367 |
| 02/05/2014 | 62410 | GWSD149 | 244 | HG | 51.3430948 | 1.647394 |
| 02/05/2014 | 70004 | GWSD120 | 245 | HG | 51.3384331 | 1.629375 |
| 02/05/2014 | 70343 | GWSD120 | 245 | HG | 51.338387 | 1.629354 |
| 02/05/2014 | 70737 | GWSD120 | 245 | HG | 51.3383412 | 1.629334 |

| Date sampled | Time sampled | Station code | Station number | Gear code | Latitude (degrees) | Longitude (degrees) |
|---|---|---|---|---|---|---|
| 02/05/2014 | 73141 | GWSD141 | 247 | HG | 51.3376134 | 1.61593 |
| 02/05/2014 | 74645 | GWSD116 | 248 | HG | 51.3333099 | 1.614018 |
| 02/05/2014 | 80341 | GWSD147 | 249 | HG | 51.3359513 | 1.633746 |
| 02/05/2014 | 82103 | GWSD128 | 250 | HG | 51.3370037 | 1.641042 |
| 02/05/2014 | 83618 | GWSD151 | 251 | HG | 51.3370257 | 1.647417 |
| 02/05/2014 | 84052 | GWSD151 | 251 | HG | 51.3371094 | 1.647488 |
| 02/05/2014 | 85659 | GWSD129 | 252 | HG | 51.3373727 | 1.656323 |
| 02/05/2014 | 90111 | GWSD129 | 252 | HG | 51.3374377 | 1.65637 |
| 02/05/2014 | 90602 | GWSD129 | 252 | HG | 51.337447 | 1.656336 |
| 02/05/2014 | 92713 | GWSD123 | 253 | HG | 51.3325 | 1.652688 |
| 02/05/2014 | 93157 | GWSD123 | 253 | HG | 51.3323864 | 1.652741 |
| 02/05/2014 | 93631 | GWSD123 | 253 | HG | 51.3324564 | 1.652836 |
| 02/05/2014 | 95741 | GWSD152 | 254 | HG | 51.3285107 | 1.654256 |
| 02/05/2014 | 102024 | GWSD133 | 255 | HG | 51.3246473 | 1.651415 |
| 02/05/2014 | 102419 | GWSD133 | 255 | HG | 51.3246846 | 1.65146 |
| 02/05/2014 | 104212 | GWSD148 | 256 | HG | 51.3295647 | 1.640006 |
| 02/05/2014 | 105702 | GWSD127 | 257 | HG | 51.331792 | 1.633334 |
| 02/05/2014 | 110035 | GWSD127 | 257 | HG | 51.3318368 | 1.633348 |
| 02/05/2014 | 110349 | GWSD127 | 257 | HG | 51.3318443 | 1.633326 |
| 02/05/2014 | 112121 | GWSD144 | 258 | HG | 51.3297155 | 1.626184 |
| 02/05/2014 | 112516 | GWSD144 | 258 | HG | 51.3297378 | 1.626187 |
| 02/05/2014 | 112850 | GWSD144 | 258 | HG | 51.3298184 | 1.626262 |
| 02/05/2014 | 114355 | GWSD117 | 259 | HG | 51.3261671 | 1.619465 |
| 02/05/2014 | 114859 | GWSD117 | 259 | HG | 51.3261882 | 1.619502 |
| 05/05/2014 | 144049 | GWSD221 | 341 | DC SOL | 51.1640969 | 1.545167 |
| 05/05/2014 | 145139 | GWSD221 | 341 | DC EOL | 51.1634747 | 1.546206 |
| 05/05/2014 | 163853 | GWSD215 | 343 | DC SOL | 51.1980036 | 1.578228 |
| 05/05/2014 | 164839 | GWSD215 | 343 | DC EOL | 51.1972379 | 1.57776 |
| 05/05/2014 | 181919 | GWSD220 | 346 | DC SOL | 51.3033836 | 1.643281 |
| 05/05/2014 | 182119 | GWSD220 | 346 | DC EOL | 51.3032377 | 1.64316 |
| 05/05/2014 | 184312 | GWSD218 | 347 | DC SOL | 51.3069201 | 1.660043 |
| 05/05/2014 | 184513 | GWSD218 | 347 | DC EOL | 51.3067468 | 1.65996 |
| 05/05/2014 | 191010 | GWSD219 | 348 | DC SOL | 51.3248712 | 1.673737 |
| 05/05/2014 | 191150 | GWSD219 | 348 | DC EOL | 51.32473 | 1.673717 |
| 05/05/2014 | 193713 | GWSD214 | 349 | DC SOL | 51.344578 | 1.659738 |
| 05/05/2014 | 194013 | GWSD214 | 349 | DC EOL | 51.3447711 | 1.659505 |
| 05/05/2014 | 195050 | GWSD213 | 350 | DC SOL | 51.3463998 | 1.653752 |
| 05/05/2014 | 195310 | GWSD213 | 350 | DC EOL | 51.3465377 | 1.653522 |

**Key**: HG – mini Hamon Grab

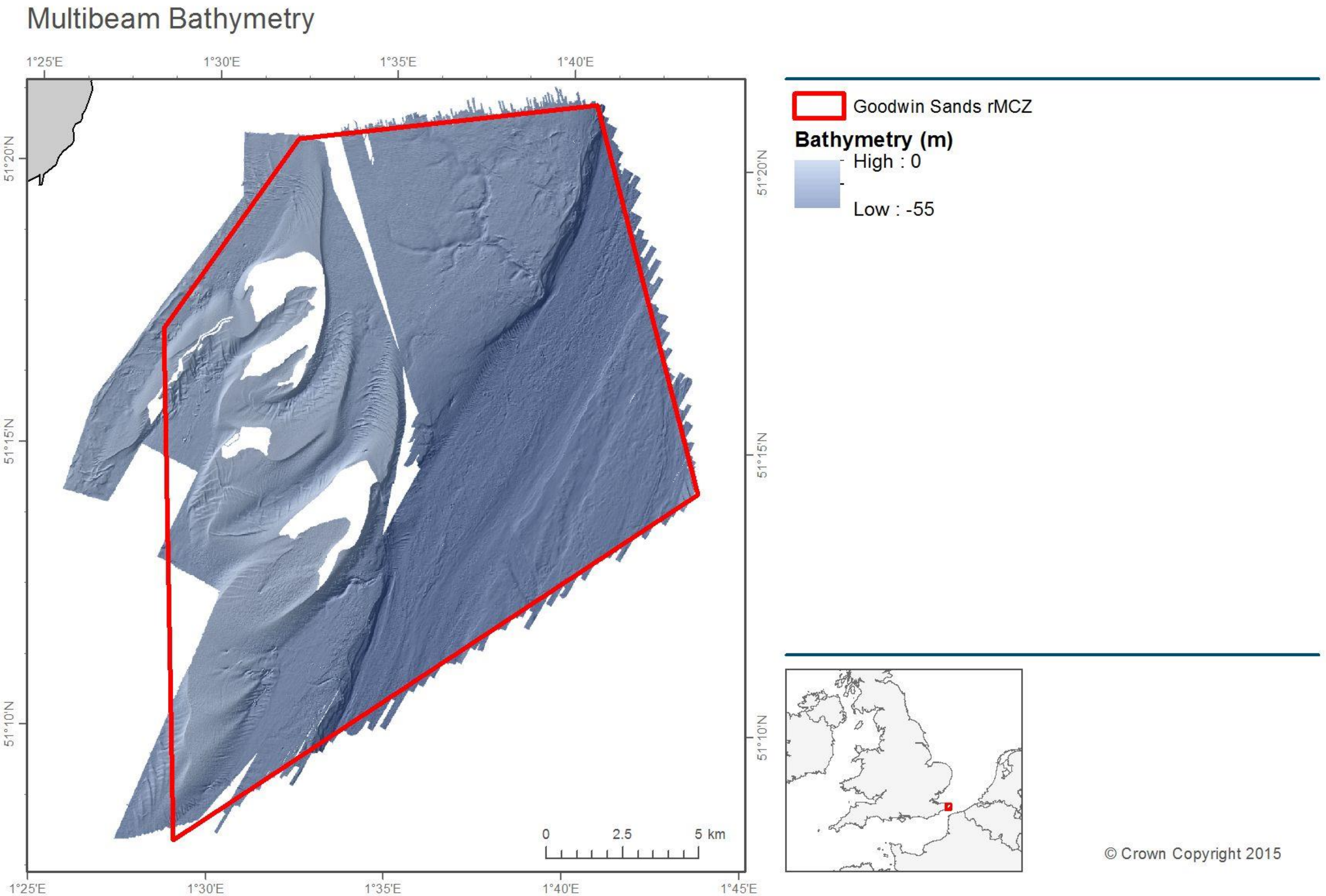
## Groundtruthing Survey by the EA Goodwin Sands rMCZ (Inshore)

| Date sampled | Time sampled | Station code | Station number | Gear code | Latitude (degrees) | Longitude (degrees) |
|---|---|---|---|---|---|---|
| 22/09/2014 | 15:48:09 | GWSD190 | 1 | DC SOL | 51.33339 | 1.56314 |
| 22/09/2014 | 15:49:23 | GWSD190 | 1 | DC EOL | 51.33292 | 1.5634 |
| 22/09/2014 | 16:01:53 | GWSD197 | 2 | DC SOL | 51.31348 | 1.5701 |
| 22/09/2014 | 16:03:12 | GWSD197 | 2 | DC EOL | 51.31294 | 1.57042 |
| 22/09/2014 | 16:17:48 | GWSD181 | 3 | DC SOL | 51.31428 | 1.52816 |
| 22/09/2014 | 16:18:51 | GWSD181 | 3 | DC EOL | 51.31396 | 1.52817 |
| 23/09/2014 | 07:43:36 | GWSD170 | 4 | DC SOL | 51.15097 | 1.493841 |
| 23/09/2014 | 07:44:24 | GWSD170 | 4 | DC EOL | 51.15062 | 1.493275 |
| 23/09/2014 | 07:53:40 | GWSD173 | 5 | DC SOL | 51.16245 | 1.506383 |
| 23/09/2014 | 07:53:58 | GWSD173 | 5 | DC EOL | 51.16234 | 1.506228 |
| 23/09/2014 | 08:17:31 | GWSD164 | 6 | DC SOL | 51.16931 | 1.488486 |

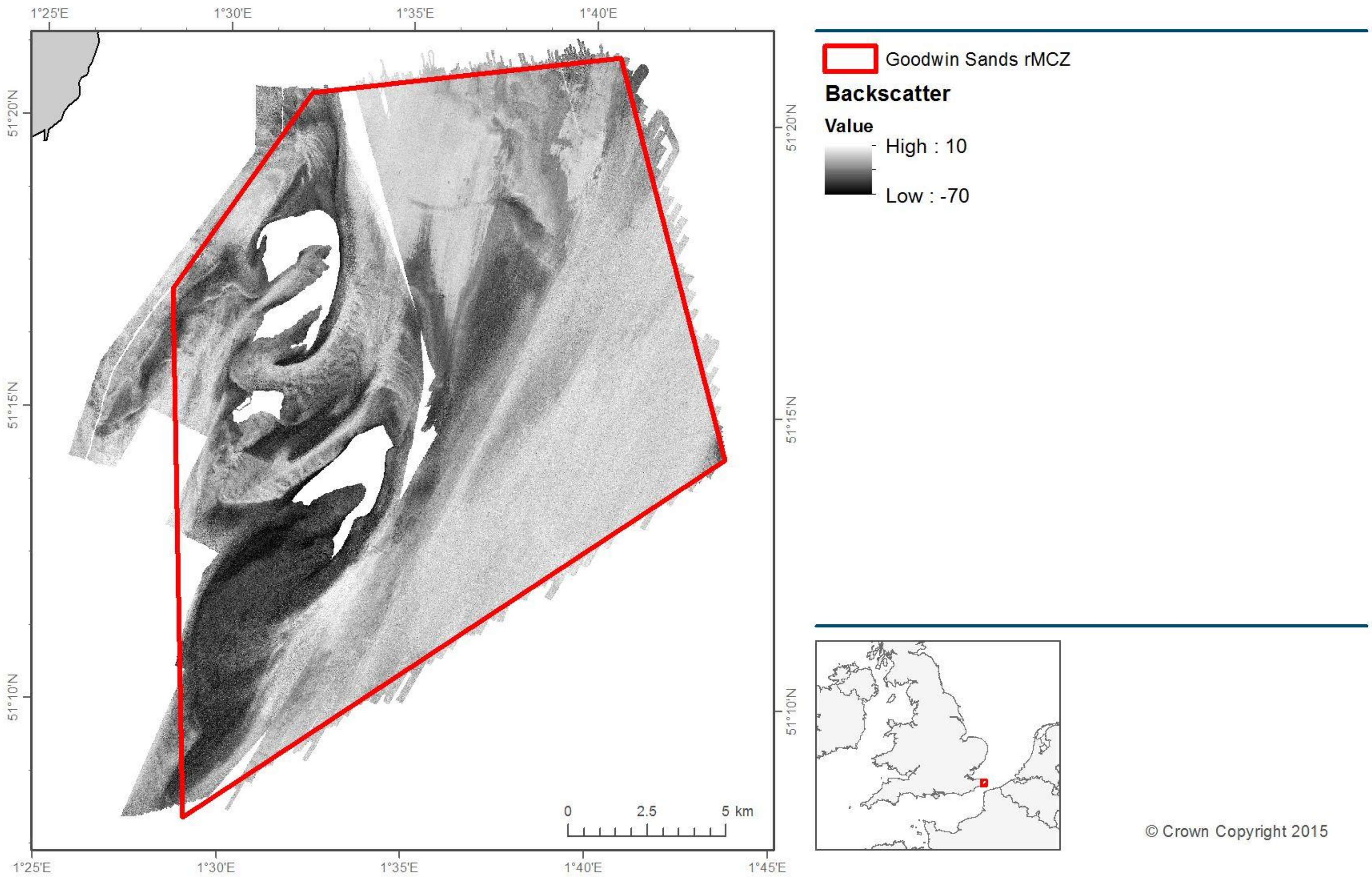
| Date sampled | Time sampled | Station code | Station number | Gear code | Latitude (degrees) | Longitude (degrees) |
|---|---|---|---|---|---|---|
| 23/09/2014 | 08:18:15 | GWSD164 | 6 | DC EOL | 51.16929 | 1.487995 |
| 23/09/2014 | 08:38:44 | GWSD179 | 7 | DC SOL | 51.17305 | 1.517089 |
| 23/09/2014 | 08:39:31 | GWSD179 | 7 | DC EOL | 51.17283 | 1.516823 |
| 23/09/2014 | 08:58:22 | GWSD191 | 8 | DC SOL | 51.208 | 1.552619 |
| 23/09/2014 | 08:59:35 | GWSD191 | 8 | DC EOL | 51.20769 | 1.552344 |
| 23/09/2014 | 09:19:44 | GWSD198 | 9 | DC SOL | 51.25353 | 1.57794 |
| 23/09/2014 | 09:21:20 | GWSD198 | 9 | DC EOL | 51.25319 | 1.577877 |
| 23/09/2014 | 09:35:18 | GWSD199 | 10 | DC SOL | 51.27731 | 1.579164 |
| 23/09/2014 | 09:37:05 | GWSD199 | 10 | DC EOL | 51.27707 | 1.579183 |
| 23/09/2014 | 09:49:13 | GWSD193 | 11 | DC SOL | 51.30135 | 1.560045 |
| 23/09/2014 | 09:51:19 | GWSD193 | 11 | DC EOL | 51.30135 | 1.56042 |
| 23/09/2014 | 10:25:06 | GWSD188 | 12 | DC SOL | 51.2898 | 1.535182 |
| 23/09/2014 | 10:26:21 | GWSD188 | 12 | DC EOL | 51.29025 | 1.535875 |
| 23/09/2014 | 10:48:21 | GWSD168 | 13 | DC SOL | 51.25583 | 1.49099 |
| 23/09/2014 | 10:49:14 | GWSD168 | 13 | DC EOL | 51.25642 | 1.491295 |
| 23/09/2014 | 11:02:05 | GWSD176 | 14 | DC SOL | 51.23185 | 1.510794 |
| 23/09/2014 | 11:03:00 | GWSD176 | 14 | DC EOL | 51.23233 | 1.511375 |
| 23/09/2014 | 11:21:47 | GWSD166 | 15 | DC SOL | 51.20823 | 1.492853 |
| 23/09/2014 | 11:22:35 | GWSD166 | 15 | DC EOL | 51.20883 | 1.493257 |
| 02/10/2014 | 09:54:00 | GWSD190_A1 | 17 | HG | 51.33276 | 1.56384 |
| 02/10/2014 | 09:56:00 | GWSD190_A2 | 17 | HG | 51.33291 | 1.56318 |
| 02/10/2014 | 09:59:00 | GWSD190_A3 | 17 | HG | 51.33294 | 1.5636 |
| 02/10/2014 | 10:08:00 | GWSD194_A1 | 18 | HG | 51.32427 | 1.56064 |
| 02/10/2014 | 10:11:00 | GWSD194_A2 | 18 | HG | 51.32414 | 1.56083 |
| 02/10/2014 | 10:22:00 | GWSD189_A1 | 19 | HG | 51.31305 | 1.54921 |
| 02/10/2014 | 10:31:00 | GWSD197_A1 | 20 | HG | 51.31227 | 1.5702 |
| 02/10/2014 | 10:34:00 | GWSD197_A2 | 20 | HG | 51.31219 | 1.57036 |
| 02/10/2014 | 10:36:00 | GWSD197_A3 | 20 | HG | 51.31222 | 1.57022 |
| 02/10/2014 | 10:45:00 | GWSD193_A1 | 21 | HG | 51.30079 | 1.55876 |
| 02/10/2014 | 10:54:00 | GWSD196_A1 | 22 | HG | 51.28894 | 1.56814 |
| 02/10/2014 | 10:56:00 | GWSD196_A2 | 22 | HG | 51.28886 | 1.56842 |
| 02/10/2014 | 10:59:00 | GWSD196_A3 | 22 | HG | 51.28893 | 1.56834 |
| 02/10/2014 | 11:02:00 | GWSD196_A4 | 22 | HG | 51.28872 | 1.56823 |
| 02/10/2014 | 11:04:00 | GWSD196_A5 | 22 | HG | 51.28893 | 1.56828 |
| 02/10/2014 | 11:14:00 | GWSD192_A1 | 23 | HG | 51.27754 | 1.55668 |
| 02/10/2014 | 11:18:00 | GWSD192_A2 | 23 | HG | 51.27767 | 1.5567 |
| 02/10/2014 | 11:19:00 | GWSD192_A3 | 23 | HG | 51.27774 | 1.55668 |
| 02/10/2014 | 11:29:00 | GWSD199_A1 | 24 | HG | 51.27705 | 1.57816 |
| 02/10/2014 | 11:38:00 | GWSD195_A1 | 25 | HG | 51.26547 | 1.56668 |
| 02/10/2014 | 11:47:00 | GWSD200_A1 | 26 | HG | 51.26504 | 1.58796 |
| 02/10/2014 | 11:56:00 | GWSD198_A1 | 27 | HG | 51.25375 | 1.57629 |
| 02/10/2014 | 12:10:00 | GWSD186_A1 | 28 | HG | 51.243 | 1.54333 |
| 02/10/2014 | 12:37:00 | GWSD191_A1 | 29 | HG | 51.20778 | 1.55109 |
| 02/10/2014 | 12:46:00 | GWSD185_A1 | 30 | HG | 51.1964 | 1.53948 |
| 02/10/2014 | 12:55:00 | GWSD182_A1 | 31 | HG | 51.18851 | 1.52379 |
| 02/10/2014 | 12:57:00 | GWSD182_A2 | 31 | HG | 51.18852 | 1.52376 |
| 02/10/2014 | 13:01:00 | GWSD182_A3 | 31 | HG | 51.1888 | 1.52362 |
| 02/10/2014 | 13:08:00 | GWSD174_A1 | 32 | HG | 51.18574 | 1.50671 |
| 02/10/2014 | 13:16:00 | GWSD179_A1 | 33 | HG | 51.17371 | 1.51638 |
| 02/10/2014 | 13:26:00 | GWSD173_A1 | 34 | HG | 51.16235 | 1.50486 |
| 02/10/2014 | 13:32:00 | GWSD170_A1 | 35 | HG | 51.15098 | 1.49343 |
| 02/10/2014 | 13:42:00 | GWSD164_A1 | 36 | HG | 51.16931 | 1.48728 |
| 02/10/2014 | 13:51:00 | GWSD165_A1 | 37 | HG | 51.1863 | 1.48524 |
| 02/10/2014 | 13:54:00 | GWSD165_A2 | 37 | HG | 51.18629 | 1.48534 |
| 02/10/2014 | 13:57:00 | GWSD165_A3 | 37 | HG | 51.18637 | 1.48546 |
| 02/10/2014 | 14:00:00 | GWSD165_A4 | 37 | HG | 51.18625 | 1.48554 |

| Date sampled | Time sampled | Station code | Station number | Gear code | Latitude (degrees) | Longitude (degrees) |
|---|---|---|---|---|---|---|
| 02/10/2014 | 14:10:00 | GWSD166_A1 | 38 | HG | 51.2083 | 1.49103 |
| 02/10/2014 | 14:13:00 | GWSD166_A2 | 38 | HG | 51.20841 | 1.49123 |
| 02/10/2014 | 14:15:00 | GWSD166_A3 | 38 | HG | 51.20861 | 1.49067 |
| 02/10/2014 | 14:23:00 | GWSD171_A1 | 39 | HG | 51.22106 | 1.49841 |
| 02/10/2014 | 14:31:00 | GWSD180_A1 | 40 | HG | 51.2204 | 1.51999 |
| 02/10/2014 | 14:38:00 | GWSD183_A1 | 41 | HG | 51.23171 | 1.53154 |
| 02/10/2014 | 14:45:00 | GWSD176_A1 | 42 | HG | 51.23223 | 1.51028 |
| 02/10/2014 | 14:52:00 | GWSD167_A1 | 43 | HG | 51.2331 | 1.48891 |
| 02/10/2014 | 15:01:00 | GWSD163_A1 | 44 | HG | 51.24574 | 1.4866 |
| 02/10/2014 | 15:03:00 | GWSD163_A2 | 44 | HG | 51.24559 | 1.48672 |
| 02/10/2014 | 15:10:00 | GWSD168_A1 | 45 | HG | 51.25615 | 1.49062 |
| 02/10/2014 | 15:14:00 | GWSD168_A2 | 45 | HG | 51.25637 | 1.49077 |
| 02/10/2014 | 15:17:00 | GWSD168_A3 | 45 | HG | 51.25628 | 1.49053 |
| 02/10/2014 | 15:24:00 | GWSD172_A1 | 46 | HG | 51.26743 | 1.50233 |
| 02/10/2014 | 15:33:00 | GWSD169_A1 | 47 | HG | 51.27951 | 1.49264 |
| 02/10/2014 | 15:53:00 | GWSD177_A1 | 48 | HG | 51.27905 | 1.51371 |
| 02/10/2014 | 16:04:00 | GWSD188_A1 | 49 | HG | 51.29097 | 1.54007 |
| 02/10/2014 | 16:23:00 | GWSD178_A1 | 50 | HG | 51.30246 | 1.51542 |
| 02/10/2014 | 16:31:00 | GWSD181_A1 | 51 | HG | 51.31353 | 1.52738 |

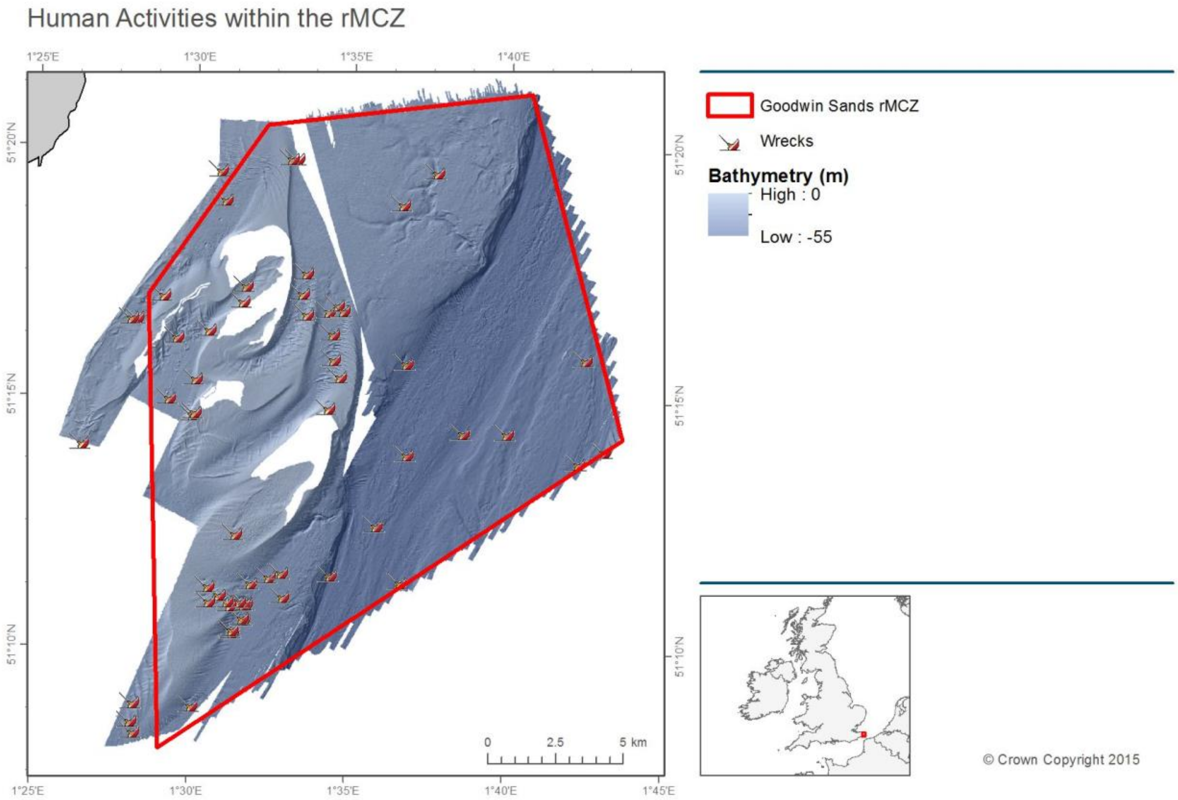
## Appendix 2. Outputs from acoustic surveys

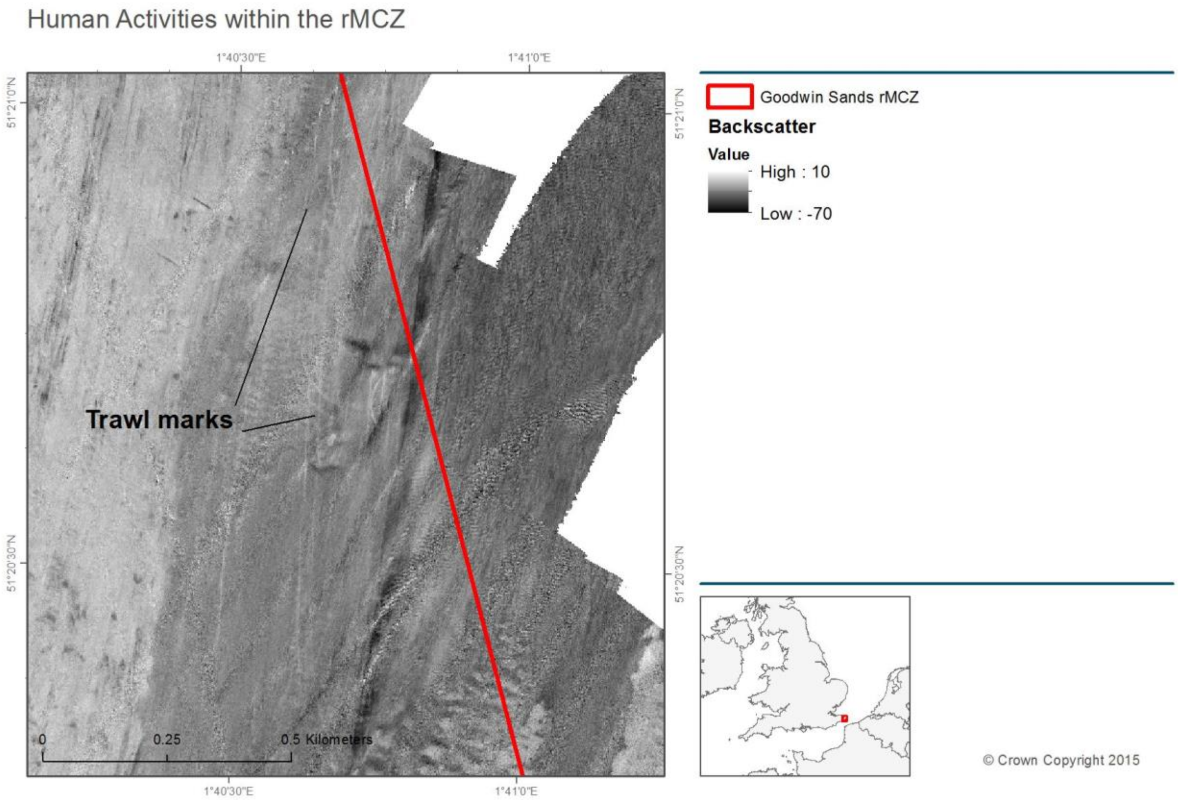


Multibeam Backscatter



# Appendix 3.  Evidence of human activities within the rMCZ



## Appendix 4. Species list

Species list for grab samples (Species FOCI indicated by grey shading, if present). Percentage occurrence was calculated as the 'Number of samples where the species occurs/total number of samples' x 100.

| Taxa | % Occurrence |
|---|---|
| FORAMINIFERA | |
| Lagotia viridis | 12 |
| HYDROIDS, CORALS, JELLYFISH, ANEMONES | |
| Actiniaria | 38 |
| *Hydrallmania falcata* | 23 |
| *Sertularia cupressina* | 20 |
| *Tubularia indivisa* | 14 |
| *Alcyonium digitatum* | 13 |
| *Obelia dichotoma* | 11 |
| *Clytia hemisphaerica* | 9 |
| *Calycella syringa* | 6 |
| *Sertularia* (juv.) | 4 |
| *Cerianthus lloydii* | 3 |
| *Eudendrium rameum* | 3 |
| Campanulariidae | 2 |
| *Coryne muscoides* | 2 |
| *Halecium halecinum* | 2 |
| *Hydractinia echinata* | 2 |
| *Bougainvillia ramosa* | 1 |
| *Hydractinia proboscidea* | 1 |
| *Laomedea flexuosa* | 1 |
| *Leuckartiara* | 1 |
| *Sertularella polyzonias* | 1 |
| *Tubularia larynx* | 1 |
| Tubulariidae | 1 |
| Zoantharia | 1 |
| FLATWORMS | |
| Turbellaria | 4 |
| RIBBON WORMS | |
| Nemertea | 48 |
| *Cerebratulus* | 1 |
| ROUND WORMS | |
| Nematoda | 14 |
| PEANUT WORMS | |
| *Golfingia vulgaris* | 11 |
| *Golfingia elongata* | 8 |
| *Nephasoma minutum* | 3 |
| SEGMENTED WORMS | |
| *Sabellaria spinulosa* | 49 |
| *Lumbrineris cingulata* | 46 |
| Annelida | 39 |
| *Spirobranchus lamarcki* | 37 |
| *Ophelia borealis* | 31 |
| *Pholoe baltica* (sensu Petersen) | 31 |
| *Goniada maculata* | 26 |

| Taxa | % Occurrence |
|---|---|
| *Glycera lapidum* (agg.) | 24 |
| *Eunereis longissima* | 23 |
| *Caulleriella alata* | 22 |
| *Notomastus latericeus* | 22 |
| *Mediomastus fragilis* | 21 |
| *Lysidice unicornis* | 20 |
| *Polycirrus medusa* | 19 |
| *Lanice conchilega* | 18 |
| *Nephtys cirrosa* | 18 |
| *Aonides oxycephala* | 17 |
| *Malmgrenia darbouxi* | 17 |
| *Polycirrus norvegicus* | 17 |
| *Spiophanes bombyx* | 17 |
| *Dipolydora flava* | 16 |
| *Dipolydora caulleryi* | 14 |
| *Nephtys* (juv.) | 14 |
| *Lepidonotus squamatus* | 13 |
| *Harmothoe glabra* | 12 |
| *Paradoneis lyra* | 12 |
| *Pholoe inornata* (sensu Petersen) | 12 |
| *Poecilochaetus serpens* | 12 |
| *Syllis parapari* | 12 |
| *Clymenura* | 11 |
| *Dodecaceria* | 11 |
| *Glycinde nordmanni* | 11 |
| *Myrianida* | 11 |
| *Petaloproctus borealis* | 11 |
| *Thelepus cincinnatus* | 11 |
| *Eteone flava* (agg.) | 10 |
| *Jasmineira* | 10 |
| *Lagis koreni* | 10 |
| *Owenia fusiformis* | 10 |
| *Polycirrus* | 10 |
| *Sthenelais boa* | 10 |
| *Ampharete lindstroemi* | 9 |
| *Chaetozone zetlandica* | 9 |
| *Dipolydora giardi* | 9 |
| *Eulalia ornata* | 9 |
| Glyceridae (juv.) | 9 |
| *Pseudopotamilla reniformis* | 9 |
| *Syllis variegata* | 9 |
| *Anaitides maculata* | 8 |
| *Eumida* (juv.) | 8 |
| *Eumida sanguinea* | 8 |
| *Galathowenia oculata* | 8 |
| *Magelona johnstoni* | 8 |
| *Scoloplos armiger* | 8 |
| *Thelepus setosus* | 8 |
| *Aonides paucibranchiata* | 7 |
| *Asclerocheilus intermedius* | 7 |

| Taxa | % Occurrence |
|---|---|
| *Glycera oxycephala* | 7 |
| *Harmothoe clavigera* | 7 |
| *Laonice bahusiensis* | 7 |
| Polynoidae | 7 |
| *Scalibregma inflatum* | 7 |
| *Dipolydora coeca* | 6 |
| *Eusyllis blomstrandi* | 6 |
| *Gattyana cirrhosa* | 6 |
| *Lysilla loveni* | 6 |
| *Magelona alleni* | 6 |
| *Marphysa bellii* | 6 |
| *Marphysa sanguinea* | 6 |
| *Polycirrus* (juv.) | 6 |
| *Praxillella* (juv.) | 6 |
| *Protodorvillea kefersteini* | 6 |
| *Schistomeringos rudolphi* | 6 |
| *Syllidia armata* | 6 |
| *Syllis armillaris* | 6 |
| *Anaitides rosea* | 4 |
| *Euclymene* | 4 |
| *Flabelligera affinis* | 4 |
| *Harmothoe impar* | 4 |
| *Nephtys caeca* | 4 |
| Nereididae (juv.) | 4 |
| *Polynoe scolopendrina* | 4 |
| *Sphaerodorum gracilis* | 4 |
| *Spirobranchus triqueter* | 4 |
| *Travisia forbesii* | 4 |
| *Anaitides lineata* | 3 |
| *Clymenura tricirrata* | 3 |
| *Eulalia bilineata* | 3 |
| *Eulalia mustela* | 3 |
| *Exogone verugera* | 3 |
| *Harmothoe imbricata* | 3 |
| *Hesionura elongata* | 3 |
| *Lysilla nivea* | 3 |
| *Mysta picta* | 3 |
| *Nicolea venustula* | 3 |
| *Praxillella affinis* | 3 |
| *Pseudopolydora pulchra* | 3 |
| *Spio goniocephala* | 3 |
| *Spio martinensis* | 3 |
| *Terebellides stroemi* | 3 |
| *Amaeana trilobata* | 2 |
| *Aphelochaeta* (Type A) | 2 |
| *Eteone* (juv.) | 2 |
| *Eteone longa* (agg.) | 2 |
| *Euclymene oerstedii* | 2 |
| *Harmothoe* | 2 |
| *Magelona mirabilis* | 2 |

| Taxa | % Occurrence |
|---|---|
| *Malmgrenia andreapolis* | 2 |
| *Nephtys kersivalensis* | 2 |
| *Notomastus* | 2 |
| *Owenia* | 2 |
| *Paraonis fulgens* | 2 |
| *Pherusa plumosa* | 2 |
| *Pisione remota* | 2 |
| *Podarkeopsis capensis* | 2 |
| *Pseudonotomastus southerni* | 2 |
| Serpulidae | 2 |
| *Syllis hyalina* | 2 |
| Ampharetidae | 1 |
| *Amphicteis midas* | 1 |
| *Anaitides groenlandica* | 1 |
| *Anaitides longipes* | 1 |
| *Aphelochaeta* | 1 |
| *Aphelochaeta marioni* | 1 |
| *Arenicola marina* | 1 |
| Arenicolidae (juv.) | 1 |
| *Atherospio guillei* | 1 |
| *Aurospio banyulensis* | 1 |
| Capitellidae | 1 |
| *Caulleriella bioculata* | 1 |
| *Chaetozone* | 1 |
| *Chaetozone christiei* | 1 |
| *Chaetozone setosa* | 1 |
| *Diplocirrus stopbowitzi* | 1 |
| *Dipolydora flava* (juv.) | 1 |
| *Eulalia* (juv.) | 1 |
| *Eumida bahusiensis* | 1 |
| Eunicidae (juv.) | 1 |
| *Exogone hebes* | 1 |
| *Glycera alba* | 1 |
| *Glycera tridactyla* | 1 |
| Goniadidae | 1 |
| *Grania* | 1 |
| *Harmothoe extenuata* | 1 |
| *Lipobranchius jeffreysii* | 1 |
| Lumbrineridae | 1 |
| *Magelona* | 1 |
| Maldanidae | 1 |
| *Malmgrenia arenicolae* | 1 |
| *Malmgrenia castanea* | 1 |
| *Megalomma* | 1 |
| *Monticellina* | 1 |
| *Neoamphitrite figulus* | 1 |
| *Nephtys assimilis* | 1 |
| *Nephtys hombergii* | 1 |
| *Nereis pelagica* | 1 |
| *Notoproctus* (juv.) | 1 |

| Taxa | % Occurrence |
|---|---|
| *Ophelia* (juv.) | 1 |
| *Ophiodromus pallidus* | 1 |
| *Parasabella torulis* | 1 |
| *Perkinsiana rubra* | 1 |
| Phyllodocidae | 1 |
| Pirakia punctifera | 1 |
| Polycirrus aurantiacus | 1 |
| *Prionospio* (juv.) | 1 |
| *Prionospio multibranchiata* | 1 |
| *Protodriloides chaetifer* | 1 |
| *Protodrilus* | 1 |
| *Psamathe fusca* | 1 |
| Sabellidae | 1 |
| *Scalibregma celticum* | 1 |
| *Schistomeringos neglecta* | 1 |
| *Scolelepis* | 1 |
| *Scolelepis bonnieri* | 1 |
| *Scolelepis foliosa* | 1 |
| *Sphaerosyllis bulbosa* | 1 |
| *Sphaerosyllis taylori* | 1 |
| Spionidae | 1 |
| *Syllides japonicus* | 1 |
| *Syllis armillaris* (agg.) | 1 |
| *Syllis garciai* | 1 |
| *Syllis gerlachi* | 1 |
| *Syllis gracilis* | 1 |
| Terebellidae (juv.) | 1 |
| SEA SPIDERS | |
| *Anoplodactylus petiolatus* | 4 |
| *Nymphon brevirostre* | 4 |
| *Achelia echinata* | 1 |
| *Achelia longipes* (agg.) | 1 |
| *Callipallene brevirostris* | 1 |
| CRUSTACEANS | |
| *Urothoe brevicornis* | 28 |
| *Unciola crenatipalma* | 20 |
| *Ampelisca spinipes* | 19 |
| *Urothoe elegans* | 19 |
| *Pisidia longicornis* | 18 |
| *Anthura gracilis* | 14 |
| *Dyopedos monacantha* | 14 |
| *Galathea intermedia* | 13 |
| *Gammaropsis maculata* | 13 |
| *Bathyporeia elegans* | 12 |
| *Pagurus bernhardus* | 12 |
| *Bathyporeia pelagica* | 11 |
| *Verruca stroemia* | 11 |
| *Amphilochus neapolitanus* | 10 |
| *Abludomelita obtusata* | 8 |
| *Gastrosaccus spinifer* | 7 |

| Taxa | % Occurrence |
|---|---|
| Paguridae (megalopa) | 7 |
| *Balanus crenatus* | 6 |
| *Stenothoe marina* | 6 |
| *Tanaopsis graciloides* | 6 |
| *Monocorophium sextonae* | 4 |
| *Photis pollex* | 4 |
| *Acidostoma neglectum* | 3 |
| *Atylus swammerdamei* | 3 |
| *Bathyporeia guilliamsoniana* | 3 |
| *Haustorius arenarius* | 3 |
| *Janira maculosa* | 3 |
| *Liocarcinus holsatus* | 3 |
| *Pilumnus hirtellus* | 3 |
| *Anapagurus hyndmanni* | 2 |
| *Atelecyclus rotundatus* | 2 |
| *Bodotria scorpioides* | 2 |
| *Callianassa subterranea* | 2 |
| *Ebalia tuberosa* | 2 |
| *Ericthonius punctatus* | 2 |
| *Iphimedia minuta* | 2 |
| *Liocarcinus pusillus* | 2 |
| *Othomaera othonis* | 2 |
| Paguridae (zoea) | 2 |
| *Socarnes erythrophthalmus* | 2 |
| *Urothoe poseidonis* | 2 |
| *Abludomelita gladiosa* | 1 |
| *Ampelisca diadema* | 1 |
| *Amphilochus manudens* | 1 |
| Amphipoda | 1 |
| Aoridae (female) | 1 |
| *Astacilla longicornis* | 1 |
| *Axius stirhynchus* | 1 |
| Decapoda | 1 |
| *Ebalia tumefacta* | 1 |
| *Eurydice pulchra* | 1 |
| *Gammaropsis cornuta* | 1 |
| *Gnathia oxyuraea* | 1 |
| *Hyas coarctatus* | 1 |
| *Iphimedia perplexa* | 1 |
| *Jassa pusilla* | 1 |
| *Lepidepecreum longicorne* | 1 |
| *Macropodia* | 1 |
| *Macropodia linaresi* | 1 |
| *Macropodia rostrata* | 1 |
| *Mesopodopsis slabberi* | 1 |
| *Necora puber* | 1 |
| *Nototropis guttatus* | 1 |
| *Nototropis vedlomensis* | 1 |
| Paguridae (juv.) | 1 |
| *Pandalina brevirostris* | 1 |

| Taxa | % Occurrence |
|---|---|
| *Pariambus typicus* | 1 |
| *Photis longicaudata* | 1 |
| *Pinnotheres pisum* | 1 |
| *Pontocrates arenarius* | 1 |
| Portunidae (juv.) | 1 |
| *Pseudoprotella phasma* | 1 |
| *Schistomysis kervillei* | 1 |
| *Stenopleustes nodifera* | 1 |
| Thoracica (juv.) | 1 |
| *Thoralus cranchii* | 1 |
| *Upogebia deltaura* | 1 |
| MOLLUSCS | |
| *Kurtiella bidentata* | 29 |
| *Sphenia binghami* | 16 |
| *Abra* (juv.) | 12 |
| *Abra alba* | 9 |
| *Leptochiton asellus* | 9 |
| *Nucula nucleus* | 9 |
| *Mytilus edulis* | 8 |
| *Doto* | 7 |
| *Buccinum undatum* | 6 |
| *Mya truncata* (juv.) | 6 |
| *Barnea parva* | 4 |
| *Heteranomia squamula* | 4 |
| *Hiatella arctica* | 4 |
| Mytilidae (juv.) | 4 |
| *Aequipecten opercularis* | 3 |
| Anomiidae (juv.) | 3 |
| *Mytilus edulis* (juv.) | 3 |
| Mactridae (juv.) | 2 |
| *Modiolus* (juv.) | 2 |
| *Spisula elliptica* | 2 |
| *Thracia distorta* | 2 |
| *Acanthodoris pilosa* (juv.) | 1 |
| *Calliostoma zizyphinum* | 1 |
| *Dendronotus frondosus* | 1 |
| *Embletonia pulchra* | 1 |
| *Ensis* (juv.) | 1 |
| *Epitonium* (juv.) | 1 |
| *Epitonium clathratulum* | 1 |
| *Fabulina fabula* | 1 |
| *Gibbula cineraria* | 1 |
| *Glycymeris glycymeris* | 1 |
| *Leptochiton cancellatus* | 1 |
| *Lucinoma borealis* | 1 |
| *Lutraria* (juv.) | 1 |
| *Mimachlamys varia* | 1 |
| *Modiolus adriaticus* (juv.) | 1 |
| *Modiolus barbatus* | 1 |
| *Moerella donacina* | 1 |

| Taxa | % Occurrence |
|---|---|
| *Mya* | 1 |
| *Mya arenaria* | 1 |
| *Odostomia* | 1 |
| *Onchidoris muricata* | 1 |
| *Tergipes tergipes* | 1 |
| *Thracia* (juv.) | 1 |
| *Timoclea ovata* | 1 |
| *Tritonia* (juv.) | 1 |
| *Venerupis senegalensis* (juv.) | 1 |
| BRYOZOANS | |
| *Conopeum reticulum* | 20 |
| *Electra monostachys* | 20 |
| *Escharella immersa* | 20 |
| *Schizomavella auriculata* | 19 |
| *Aspidelectra melolontha* | 18 |
| *Electra pilosa* | 14 |
| *Schizomavella teresae* | 13 |
| *Bicellariella ciliata* | 9 |
| *Vesicularia spinosa* | 8 |
| *Escharella labiosa* | 6 |
| *Escharella ventricosa* | 6 |
| *Escharina johnstoni* | 6 |
| *Disporella hispida* | 4 |
| *Schizomavella* | 4 |
| *Alcyonidium diaphanum* | 3 |
| Cyclostomatida | 3 |
| *Flustra foliacea* | 3 |
| *Reptadeonella violacea* | 3 |
| *Callopora discreta* | 2 |
| *Cellepora pumicosa* | 2 |
| *Porella concinna* | 2 |
| *Puellina* | 2 |
| *Turbicellepora avicularis* | 2 |
| *Alcyonidioides mytili* | 1 |
| *Alcyonidium* | 1 |
| *Alcyonidium parasiticum* | 1 |
| *Hippothoa flagellum* | 1 |
| *Microporella ciliata* | 1 |
| *Phylactella labrosa* | 1 |
| *Plagioecia patina* | 1 |
| *Schizoporella unicornis* | 1 |
| *Triticella* | 1 |
| HORSESHOE WORMS | |
| Phoronis | 16 |
| SEA STARS, URCHINS, SEA CUCUMBERS | |
| *Amphipholis squamata* | 30 |
| Ophiuridae (juv.) | 19 |
| *Psammechinus miliaris* | 17 |
| *Ophiura albida* | 12 |
| *Echinocyamus pusillus* | 11 |

| **Taxa** | **% Occurrence** |
|---|---|
| *Asterias rubens* | 2 |
| *Ophiothrix fragilis* | 2 |
| HEMICHORDATA | |
| *Rhabdopleura compacta* | 3 |
| Enteropneusta | 1 |
| *SEA SQUIRTS* | |
| *Dendrodoa grossularia* | 12 |
| *Ascidiacea (juv.)* | 2 |
| *Molgulidae (juv.)* | 2 |
| *Polycarpa pomaria* | 2 |
| *Ascidiella scabra* | 1 |
| *Eugyra arenosa* | 1 |
| *Molgula manhattensis* | 1 |
| *Styela coriacea* | 1 |
| FISH | |
| Ammodytidae | 1 |

Species list for video samples (Species FOCI indicated by grey shading, if present). Percentage occurrence was calculated as the 'Number of samples where the species occurs/total number of samples' x 100.

| **Taxa** | **% Occurrence** |
|---|---|
| SPONGES | |
| Porifera | 15 |
| *Polymastia* | 2 |
| HYDROIDS, CORALS, JELLYFISH, ANEMONES | |
| Hydrozoa | 64 |
| Actiniaria | 53 |
| Ceriantharia | 51 |
| *Alcyonium digitatum* | 42 |
| *Tubularia* | 18 |
| *Urticina* | 16 |
| Sertulariidae | 13 |
| *Nemertesia* | 13 |
| *Halecium* | 7 |
| *Actinothoe sphyrodeta* | 2 |
| Anthozoa | 2 |
| SEGMENTED WORMS | |
| Serpulidae (tubes) | 82 |
| *Sabellaria spinulosa* (tubes) | 18 |
| *Lanice conchilega* (tubes) | 4 |
| CRUSTACEANS | |
| Paguridae | 71 |
| Cirripedia | 15 |
| Decapoda | 7 |
| *Liocarcinus* | 4 |
| *Macropodia* | 4 |
| *Necora puber* | 4 |
| Pandalidae | 4 |
| *Ebalia* | 2 |
| *Homarus gammarus* | 2 |
| *Inachus* | 2 |
| Majidae | 2 |
| Palaemonidae | 2 |
| *Pisidia longicornis* | 2 |
| MOLLUSCS | |
| *Gibbula* | 24 |
| Pectinidae | 11 |
| *Buccinum undatum* | 4 |
| *Calliostoma* | 4 |
| Mytilidae | 4 |
| *Mytilus edulis* | 4 |
| *Pecten maximus* | 2 |
| Polyplacophora | 2 |
| BRYOZOANS | |
| Bryozoa | 73 |
| *Flustra* | 27 |
| *Electra pilosa* | 4 |

| Taxa | % Occurrence |
|---|---|
| *Cellaria* | 2 |
| SEA STARS, URCHINS, SEA CUCUMBERS | |
| *Echinaster sepositus* | 64 |
| *Psammechinus miliaris* | 24 |
| Ophiurida | 20 |
| *Ophiura* | 5 |
| *Crossaster papposus* | 4 |
| Ophiuroidea | 4 |
| *Henricia* | 2 |
| SEA SQUIRTS | |
| Ascidiacea | 7 |
| FISH | |
| Actinopterygii | 13 |
| *Scyliorhinus canicula* | 11 |
| Ammodytidae | 5 |
| *Callionymus* | 4 |
| Gadidae | 4 |
| Pleuronectiformes | 4 |
| *Pleuronectes platessa* | 2 |
| *Solea solea* | 2 |

## Appendix 5. Analyses of sediment samples: classification and composition

| Station number | Station code | Latitude (degrees) | Longitude (degrees) | Sediment Description | EUNIS Level 3/BSH | Gravel (%) | Sand (%) | Silt/clay (%) |
|---|---|---|---|---|---|---|---|---|
| 44 | GT163 | 51.24559 | 1.4867167 | coarse sediment | A5.1 - Subtidal Coarse Sediment | 59.29 | 38.35 | 2.35 |
| 36 | GT164 | 51.169312 | 1.48728 | sand and muddy sand | A5.2 - Subtidal Sand | 0.00 | 97.78 | 2.22 |
| 43 | GT167 | 51.233097 | 1.48891 | coarse sediment | A5.1 - Subtidal Coarse Sediment | 57.29 | 40.80 | 1.90 |
| 45 | GT168 | 51.256147 | 1.4906217 | coarse sediment | A5.1 - Subtidal Coarse Sediment | 24.11 | 69.61 | 6.28 |
| 47 | GT169 | 51.279505 | 1.4926467 | sand and muddy sand | A5.2 - Subtidal Sand | 0.64 | 98.60 | 0.76 |
| 35 | GT170 | 51.15098 | 1.4934267 | sand and muddy sand | A5.2 - Subtidal Sand | 0.00 | 100.00 | 0.00 |
| 39 | GT171 | 51.221062 | 1.498415 | sand and muddy sand | A5.2 - Subtidal Sand | 0.01 | 99.01 | 0.98 |
| 46 | GT172 | 51.267425 | 1.50233 | sand and muddy sand | A5.2 - Subtidal Sand | 2.04 | 96.86 | 1.10 |
| 34 | GT173 | 51.162348 | 1.504865 | sand and muddy sand | A5.2 - Subtidal Sand | 0.02 | 99.98 | 0.00 |
| 32 | GT174 | 51.185738 | 1.506705 | sand and muddy sand | A5.2 - Subtidal Sand | 0.01 | 98.50 | 1.50 |
| 42 | GT176 | 51.232223 | 1.5102717 | sand and muddy sand | A5.2 - Subtidal Sand | 4.23 | 94.04 | 1.73 |
| 48 | GT177 | 51.279047 | 1.513715 | sand and muddy sand | A5.2 - Subtidal Sand | 1.99 | 96.67 | 1.34 |
| 50 | GT178 | 51.302462 | 1.515425 | sand and muddy sand | A5.2 - Subtidal Sand | 0.09 | 99.91 | 0.00 |
| 33 | GT179 | 51.173707 | 1.5163717 | sand and muddy sand | A5.2 - Subtidal Sand | 0.68 | 98.47 | 0.85 |
| 40 | GT180 | 51.2204 | 1.5199883 | sand and muddy sand | A5.2 - Subtidal Sand | 0.02 | 99.98 | 0.00 |
| 51 | GT181 | 51.31352 | 1.527385 | sand and muddy sand | A5.2 - Subtidal Sand | 0.06 | 97.79 | 2.15 |
| 31 | GT182 | 51.188798 | 1.523625 | sand and muddy sand | A5.2 - Subtidal Sand | 0.00 | 98.66 | 1.34 |
| 41 | GT183 | 51.231708 | 1.5315417 | sand and muddy sand | A5.2 - Subtidal Sand | 3.65 | 95.40 | 0.94 |
| 16 | GT184 | 51.32481 | 1.5390183 | sand and muddy sand | A5.2 - Subtidal Sand | 2.20 | 96.30 | 1.50 |
| 30 | GT185 | 51.19639 | 1.5394817 | sand and muddy sand | A5.2 - Subtidal Sand | 0.01 | 99.99 | 0.00 |
| 28 | GT186 | 51.242993 | 1.5433367 | sand and muddy sand | A5.2 - Subtidal Sand | 0.00 | 100.00 | 0.00 |
| 49 | GT188 | 51.290963 | 1.540065 | sand and muddy sand | A5.2 - Subtidal Sand | 3.39 | 95.29 | 1.32 |
| 19 | GT189 | 51.313045 | 1.5492067 | sand and muddy sand | A5.2 - Subtidal Sand | 0.01 | 94.71 | 5.28 |
| 17 | GT190 | 51.332938 | 1.5636083 | mixed sediments | A5.4 - Subtidal Mixed Sediments | 44.69 | 49.48 | 5.82 |
| 29 | GT191 | 51.207785 | 1.5510983 | sand and muddy sand | A5.2 - Subtidal Sand | 0.00 | 98.06 | 1.94 |
| 23 | GT192 | 51.277727 | 1.5566767 | sand and muddy sand | A5.2 - Subtidal Sand | 3.85 | 94.74 | 1.41 |
| 21 | GT193 | 51.300787 | 1.55876 | sand and muddy sand | A5.2 - Subtidal Sand | 0.11 | 97.62 | 2.27 |
| 18 | GT194 | 51.32414 | 1.5608333 | mixed sediments | A5.4 - Subtidal Mixed Sediments | 50.18 | 42.34 | 7.48 |
| 25 | GT195 | 51.265465 | 1.566685 | coarse sediment | A5.1 - Subtidal Coarse Sediment | 12.96 | 82.19 | 4.85 |
| 27 | GT198 | 51.253738 | 1.5762833 | sand and muddy sand | A5.2 - Subtidal Sand | 0.14 | 98.50 | 1.37 |
| 24 | GT199 | 51.277045 | 1.578155 | coarse sediment | A5.1 - Subtidal Coarse Sediment | 18.17 | 80.39 | 1.43 |
| 26 | GT200 | 51.265032 | 1.58796 | sand and muddy sand | A5.2 - Subtidal Sand | 0.11 | 98.91 | 0.98 |
| 190 | GWSD026 | 51.34748 | 1.670994 | coarse sediment | A5.1 - Subtidal Coarse Sediment | 71.91 | 25.91 | 2.18 |

| Station number | Station code | Latitude (degrees) | Longitude (degrees) | Sediment Description | EUNIS Level 3/BSH | Gravel (%) | Sand (%) | Silt/clay (%) |
|---|---|---|---|---|---|---|---|---|
| 191 | GWSD031 | 51.33646 | 1.676349 | coarse sediment | A5.1 - Subtidal Coarse Sediment | 55.27 | 40.48 | 4.25 |
| 194 | GWSD035 | 51.32069 | 1.689564 | mud and sandy mud | A5.3 - Subtidal Mud | 2.36 | 71.58 | 26.07 |
| 195 | GWSD025 | 51.32142 | 1.660766 | coarse sediment | A5.1 - Subtidal Coarse Sediment | 60.52 | 37.15 | 2.33 |
| 203 | GWSD033 | 51.25792 | 1.684049 | coarse sediment | A5.1 - Subtidal Coarse Sediment | 50.06 | 48.76 | 1.17 |
| 204 | GWSD037 | 51.27347 | 1.70001 | coarse sediment | A5.1 - Subtidal Coarse Sediment | 45.05 | 52.81 | 2.14 |
| 207 | GWSD038 | 51.25719 | 1.713129 | coarse sediment | A5.1 - Subtidal Coarse Sediment | 45.88 | 51.78 | 2.34 |
| 208 | GWSD039 | 51.24135 | 1.726289 | sand and muddy sand | A5.2 - Subtidal Sand | 0.00 | 100.00 | 0.00 |
| 219 | GWSD020 | 51.24915 | 1.638465 | coarse sediment | A5.1 - Subtidal Coarse Sediment | 36.84 | 62.14 | 1.03 |
| 222 | GWSD017 | 51.2599 | 1.62714 | coarse sediment | A5.1 - Subtidal Coarse Sediment | 10.50 | 82.45 | 7.05 |
| 226 | GWSD018 | 51.2913 | 1.629806 | sand and muddy sand | A5.2 - Subtidal Sand | 0.00 | 99.11 | 0.89 |
| 227 | GWSD014 | 51.27615 | 1.614426 | coarse sediment | A5.1 - Subtidal Coarse Sediment | 5.43 | 91.73 | 2.85 |
| 230 | GWSD011 | 51.26089 | 1.598489 | sand and muddy sand | A5.2 - Subtidal Sand | 0.00 | 100.00 | 0.00 |
| 231 | GWSD013 | 51.2486 | 1.614744 | coarse sediment | A5.1 - Subtidal Coarse Sediment | 6.74 | 92.28 | 0.98 |
| 234 | GWSD010 | 51.2297 | 1.595972 | sand and muddy sand | A5.2 - Subtidal Sand | 0.09 | 98.85 | 1.06 |
| 196 | GWSD137 | 51.27694 | 1.597564 | mud and sandy mud | A5.3 - Subtidal Mud | 0.57 | 71.15 | 28.28 |
| 197 | GWSD138 | 51.28401 | 1.607099 | mixed sediments | A5.4 - Subtidal Mixed Sediments | 11.54 | 65.37 | 23.09 |
| 199 | GWSD110 | 51.28303 | 1.602656 | mixed sediments | A5.4 - Subtidal Mixed Sediments | 40.38 | 51.31 | 8.31 |
| 200 | GWSD154 | 51.28371 | 1.59707 | sand and muddy sand | A5.2 - Subtidal Sand | 0.33 | 88.34 | 11.33 |
| 202 | GWSD134 | 51.29265 | 1.587163 | sand and muddy sand | A5.2 - Subtidal Sand | 0.15 | 98.18 | 1.67 |
| 203 | GWSD156 | 51.29547 | 1.590553 | sand and muddy sand | A5.2 - Subtidal Sand | 2.32 | 97.68 | 0.00 |
| 204 | GWSD155 | 51.30286 | 1.591179 | mixed sediments | A5.4 - Subtidal Mixed Sediments | 32.08 | 58.42 | 9.49 |
| 207 | GWSD105 | 51.30613 | 1.586202 | mixed sediments | A5.4 - Subtidal Mixed Sediments | 24.29 | 59.84 | 15.88 |
| 208 | GWSD111 | 51.30493 | 1.605172 | mixed sediments | A5.4 - Subtidal Mixed Sediments | 44.95 | 42.92 | 12.13 |
| 212 | GWSD142 | 51.29868 | 1.622671 | sand and muddy sand | A5.2 - Subtidal Sand | 1.12 | 98.88 | 0.00 |
| 213 | GWSD159 | 51.30331 | 1.630703 | coarse sediment | A5.1 - Subtidal Coarse Sediment | 12.20 | 86.68 | 1.12 |
| 216 | GWSD145 | 51.3102 | 1.629721 | sand and muddy sand | A5.2 - Subtidal Sand | 0.01 | 94.62 | 5.37 |
| 217 | GWSD119 | 51.31312 | 1.631792 | coarse sediment | A5.1 - Subtidal Coarse Sediment | 59.60 | 39.95 | 0.44 |
| 218 | GWSD130 | 51.31651 | 1.638433 | coarse sediment | A5.1 - Subtidal Coarse Sediment | 15.00 | 83.75 | 1.25 |
| 219 | GWSD143 | 51.3145 | 1.624837 | mixed sediments | A5.1 - Subtidal Coarse Sediment | 25.07 | 57.22 | 17.71 |
| 220 | GWSD115 | 51.30983 | 1.613042 | mixed sediments | A5.4 - Subtidal Mixed Sediments | 35.10 | 43.75 | 21.15 |
| 222 | GWSD103 | 51.31364 | 1.578785 | mixed sediments | A5.4 - Subtidal Mixed Sediments | 32.79 | 54.67 | 12.54 |
| 223 | GWSD106 | 51.32483 | 1.58898 | mixed sediments | A5.4 - Subtidal Mixed Sediments | 52.13 | 40.97 | 6.90 |
| 224 | GWSD104 | 51.3352 | 1.58415 | mixed sediments | A5.4 - Subtidal Mixed Sediments | 32.85 | 51.96 | 15.19 |
| 226 | GWSD157 | 51.34347 | 1.598133 | mixed sediments | A5.4 - Subtidal Mixed Sediments | 33.22 | 53.57 | 13.20 |
| 229 | GWSD113 | 51.34496 | 1.603826 | mixed sediments | A5.4 - Subtidal Mixed Sediment | 39.21 | 45.63 | 15.16 |

| Station number | Station code | Latitude (degrees) | Longitude (degrees) | Sediment Description | EUNIS Level 3/BSH | Gravel (%) | Sand (%) | Silt/clay (%) |
|---|---|---|---|---|---|---|---|---|
| 230 | GWSD139 | 51.34658 | 1.611786 | sand and muddy sand | A5.2 - Subtidal Sand | 3.90 | 91.38 | 4.72 |
| 231 | GWSD125 | 51.34197 | 1.617284 | mixed sediments | A5.4 - Subtidal Mixed Sediments | 53.64 | 39.60 | 6.76 |
| 232 | GWSD158 | 51.34215 | 1.623915 | coarse sediment | A5.1 - Subtidal Coarse Sediment | 7.27 | 86.23 | 6.50 |
| 233 | GWSD118 | 51.34182 | 1.631291 | sand and muddy sand | A5.2 - Subtidal Sand | 5.00 | 93.54 | 1.46 |
| 234 | GWSD122 | 51.34421 | 1.636474 | sand and muddy sand | A5.2 - Subtidal Sand | 4.81 | 93.90 | 1.29 |
| 236 | GWSD162 | 51.34642 | 1.641561 | coarse sediment | A5.1 - Subtidal Coarse Sediment | 24.15 | 74.74 | 1.11 |
| 237 | GWSD161 | 51.34872 | 1.649902 | mixed sediments | A5.4 - Subtidal Mixed Sediments | 19.79 | 70.15 | 10.06 |
| 238 | GWSD153 | 51.34962 | 1.65883 | sand and muddy sand | A5.2 - Subtidal Sand | 4.73 | 92.58 | 2.69 |
| 239 | GWSD132 | 51.34988 | 1.667978 | mixed sediments | A5.4 - Subtidal Mixed Sediments | 22.54 | 66.47 | 10.99 |
| 241 | GWSD124 | 51.34502 | 1.664732 | coarse sediment | A5.1 - Subtidal Coarse Sediment | 20.23 | 72.02 | 7.75 |
| 243 | GWSD160 | 51.34407 | 1.661086 | mixed sediments | A5.4 - Subtidal Mixed Sediments | 5.76 | 61.78 | 32.46 |
| 244 | GWSD149 | 51.34309 | 1.647394 | mixed sediments | A5.4 - Subtidal Mixed Sediment | 14.87 | 74.65 | 10.48 |
| 245 | GWSD120 | 51.33834 | 1.629334 | coarse sediment | A5.1 - Subtidal Coarse Sediment | 51.64 | 47.48 | 0.88 |
| 247 | GWSD141 | 51.33761 | 1.61593 | coarse sediment | A5.1 - Subtidal Coarse Sediment | 11.37 | 87.49 | 1.14 |
| 248 | GWSD116 | 51.33331 | 1.614018 | mixed sediments | A5.4 - Subtidal Mixed Sediments | 54.06 | 34.29 | 11.65 |
| 249 | GWSD147 | 51.33595 | 1.633746 | sand and muddy sand | A5.2 - Subtidal Sand | 1.69 | 97.07 | 1.24 |
| 250 | GWSD128 | 51.337 | 1.641042 | sand and muddy sand | A5.2 - Subtidal Sand | 3.48 | 94.13 | 2.39 |
| 251 | GWSD151 | 51.33711 | 1.647488 | sand and muddy sand | A5.2 - Subtidal Sand | 2.69 | 94.59 | 2.72 |
| 252 | GWSD129 | 51.33745 | 1.656336 | coarse sediment | A5.1 - Subtidal Coarse Sediment | 12.50 | 82.88 | 4.62 |
| 253 | GWSD123 | 51.33245 | 1.652836 | coarse sediment | A5.1 - Subtidal Coarse Sediment | 40.85 | 53.61 | 5.54 |
| 254 | GWSD152 | 51.32851 | 1.654256 | sand and muddy sand | A5.2 - Subtidal Sand | 1.95 | 79.19 | 18.86 |
| 255 | GWSD133 | 51.32468 | 1.65146 | mixed sediments | A5.4 - Subtidal Mixed Sediments | 37.08 | 54.35 | 8.57 |
| 256 | GWSD148 | 51.32956 | 1.640006 | coarse sediment | A5.1 - Subtidal Coarse Sediment | 15.66 | 82.00 | 2.34 |
| 258 | GWSD144 | 51.32982 | 1.626262 | sand and muddy sand | A5.2 - Subtidal Sand | 2.00 | 96.37 | 1.64 |
| 259 | GWSD117 | 51.32619 | 1.619502 | mixed sediments | A5.4 - Subtidal Mixed Sediments | 30.65 | 57.79 | 11.56 |

## Appendix 6. BSH/EUNIS Level 3 descriptions derived from video and stills

| Station No. | Station Code | Latitude | Longitude | Habitat No. | No. of stills | Sediment Description | EUNIS Level 3/BSH | MNCR Code |
|---|---|---|---|---|---|---|---|---|
| 189 | GWSD026 | 51.346991 | 1.6708391 | 1 | 12 | Sand veneer over coarse sediment and chalk bedrock with Serpulidae and occasional discrete patches of *Sabellaria spinulosa* reef | A5.1 - Subtidal Coarse Sediment | SS.SCS.CCS |
| 192 | GWSD031 | 51.336603 | 1.676508 | 1 | 8 | Dense *Sabellaria spinulosa* reef on attached to underlying chalk bedrock with sand veneer. | A5.6 - Subtidal Biogenic Reef | SS.SBR.PoR |
| 192 | GWSD031 | 51.33605 | 1.676354 | 2 | 6 | Chalk bedrock with sand veneer and some coarse sediment, occasional *Sabellaria spinulosa* reef | A4.2 - Moderate Energy Circalittoral Rock | CR.MCR.SfR |
| 193 | GWSD035 | 51.320687 | 1.6894979 | 1 | 7 | Sand with discrete areas of *Sabellaria spinulosa* reef and boulders/cobbles | A5.2 - Subtidal Sand | SS.SSa.CFiSa |
| 193 | GWSD035 | 51.320143 | 1.689291 | 2 | 5 | Boulders and cobbles with occasional encrusting *Sabellaria spinulosa* reef and sand | A5.1 - Subtidal Coarse Sediment | SS.SCS.CCS |
| 196 | GWSD025 | 51.321462 | 1.6607301 | 1 | 11 | Coarse sediment with Serpulidae and *Alcyonium digitatum* | A5.1 - Subtidal Coarse Sediment | SS.SCS.CCS |
| 197 | GWSD024 | 51.290721 | 1.6585479 | 1 | 4 | Chalk bedrock (bored) with cobbles and pebbles encrusted with Serpulidae | A4.2 - Moderate Energy Circalittoral Rock | CR.MCR.SfR |
| 198 | GWSD030 | 51.305845 | 1.6746087 | 1 | 23 | Coarse sediment with encrusting fauna | A5.1 - Subtidal Coarse Sediment | SS.SCS.CCS |
| 200 | GWSD034 | 51.289899 | 1.687138 | 1 | 12 | Coarse sediment with Serpulidae and other sessile fauna | A5.1 - Subtidal Coarse Sediment | SS.SCS.CCS |
| 201 | GWSD029 | 51.274585 | 1.6715493 | 1 | 21 | Coarse sediment and occasional exposed bored chalk bedrock with Serpulidae, Anemones, Ophirothrix and other sessile fauna | A5.1 - Subtidal Coarse Sediment | SS.SCS.CCS |
| 202 | GWSD033 | 51.258548 | 1.6845506 | 1 | 11 | Coarse sediment and sand with sparse fauna | A5.1 - Subtidal Coarse Sediment | SS.SCS.CCS |
| 205 | GWSD037 | 51.273558 | 1.7001863 | 1 | 4 | Coarse sediment and sand with sparse fauna | A5.1 - Subtidal Coarse Sediment | SS.SCS.CCS |

| Station No. | Station Code | Latitude | Longitude | Habitat No. | No. of stills | Sediment Description | EUNIS Level 3/BSH | MNCR Code |
|---|---|---|---|---|---|---|---|---|
| 206 | GWSD038 | 51.257347 | 1.7133133 | 1 | 3 | Coarse sediment and sand with sparse fauna | A5.1 - Subtidal Coarse Sediment | SS.SCS.CCS |
| 209 | GWSD039 | 51.24132 | 1.7261969 | 1 | 14 | Clean sand with sparse fauna | A5.2 - Subtidal Sand | SS.SSa.CFiSa |
| 210 | GWSD036 | 51.2423 | 1.6974854 | 1 | 5 | Coarse sediment with shell fragments | A5.1 - Subtidal Coarse Sediment | SS.SCS.CCS |
| 213 | GWSD032 | 51.226708 | 1.6814155 | 1 | 14 | Cobbles and pebbles with encrusting and sessile fauna and occasional mobile echinoderms | A5.1 - Subtidal Coarse Sediment | SS.SCS.CCS |
| 214 | GWSD027 | 51.212872 | 1.666206 | 1 | 17 | Cobbles and pebbles with encrusting, sessile fauna and mobile echinoderms | A5.1 - Subtidal Coarse Sediment | SS.SCS.CCS |
| 215 | GWSD022 | 51.228146 | 1.6533885 | 1 | 11 | Coarse sediment with Serpulidae and encrusting Bryozoans | A5.1 - Subtidal Coarse Sediment | SS.SCS.CCS |
| 216 | GWSD028 | 51.243354 | 1.6691398 | 1 | 14 | Coarse sediment with Serpulidae and encrusting Bryozoans | A5.1 - Subtidal Coarse Sediment | SS.SCS.CCS |
| 217 | GWSD023 | 51.259485 | 1.6560891 | 1 | 3 | Sandy gravel with sparse fauna | A5.1 - Subtidal Coarse Sediment | SS.SCS.CCS |
| 220 | GWSD020 | 51.249237 | 1.6386314 | 1 | 3 | Sand with elevated clumps of *Sabellaria spinulosa* aggregations | A5.6 - Subtidal Biogenic Reef | SS.SBR.PoR |
| 221 | GWSD017 | 51.260549 | 1.6277873 | 1 | 5 | Coarse sand with shell and sparse fauna | A5.2 - Subtidal Sand | SS.SSa.CFiSa |
| 224 | GWSD021 | 51.274938 | 1.6423622 | 1 | 13 | Pebbles and some cobbles with sand and some exposed chalk bedrock and moble crustaceans and echinoderms | A5.1 - Subtidal Coarse Sediment | SS.SCS.CCS |
| 225 | GWSD018 | 51.291062 | 1.6298126 | 1 | 4 | Sand ripples (mega ripples?) with patches of coarse sediment, sparse fauna | A5.2 - Subtidal Sand | SS.SSa.CFiSa |
| 228 | GWSD014 | 51.275799 | 1.6143491 | 1 | 11 | Sand ripples (mega ripples?) with patches of coarse sediment, sparse fauna | A5.2 - Subtidal Sand | SS.SSa.CFiSa |
| 229 | GWSD011 | 51.260918 | 1.5986642 | 1 | 5 | Sand ripples, sparse fauna | A5.2 - Subtidal Sand | SS.SSa.CFiSa |
| 232 | GWSD013 | 51.24832 | 1.6148197 | 1 | 12 | Sand ripples (mega ripples?) with patches of coarse sediment, sparse fauna | A5.1 - Subtidal Coarse Sediment | SS.SCS.CCS |
| 233 | GWSD010 | 51.229328 | 1.5956936 | 1 | 3 | Sand ripples with shell and no fauna | A5.2 - Subtidal Sand | SS.SSa.CFiSa |
| 236 | GWSD012 | 51.210492 | 1.6069084 | 1 | 11 | Cobble reef with abundant Anthozoans and encrusting fauna | A5.1 - Subtidal Coarse Sediment | SS.SCS.CCS |

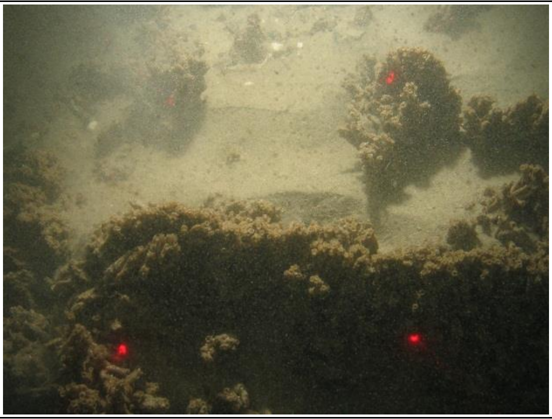
| Station No. | Station Code | Latitude | Longitude | Habitat No. | No. of stills | Sediment Description | EUNIS Level 3/BSH | MNCR Code |
|---|---|---|---|---|---|---|---|---|
| 237 | GWSD016 | 51.228315 | 1.6242482 | 1 | 11 | Cobble reef with chalk bedrock exposures with hydroid/bryozoan turf and anenomes | A5.1 - Subtidal Coarse Sediment | SS.SCS.CCS |
| 238 | GWSD019 | 51.212527 | 1.6372909 | 1 | 12 | Cobble reef dominated by *Ophiothrix fragilis*, Actiniaria and Alcyonium digitatum | A5.1 - Subtidal Coarse Sediment | SS.SCS.CCS |
| 239 | GWSD015 | 51.197709 | 1.6223188 | 1 | 11 | Cobble reef with exposed chalk bedrock with *Ophiothrix fragilis* and Actiniaria | A5.1 - Subtidal Coarse Sediment | SS.SCS.CCS |
| 240 | GWSD009 | 51.198922 | 1.593967 | 1 | 6 | Cobble reef with sand veneer dominated by *Ophiothrix fragilis*/, Actiniaria and *Alcyonium digitatum* | A5.1 - Subtidal Coarse Sediment | SS.SCS.CCS |
| 244 | GWSD008 | 51.214566 | 1.5803666 | 1 | 8 | Sand and cobbles with encrusting fauna and Paguridae | A5.2 - Subtidal Sand | SS.SSa.CFiSa |
| 245 | GWSD006 | 51.199568 | 1.5650652 | 1 | 11 | Chalk cobbles and pebbles with sand chalk bedrock exposures. Sparse fauna. | A5.1 - Subtidal Coarse Sediment | SS.SCS.CCS |
| 246 | GWSD007 | 51.183576 | 1.5780199 | 1 | 7 | Pebbles, sand with chalk exposures with encrusting fauna, hydroids and bryozoans | A5.1 - Subtidal Coarse Sediment | SS.SCS.CCS |
| 247 | GWSD005 | 51.168891 | 1.5634462 | 1 | 15 | Chalk bedrock with cobble, pebble and sand veneer with hydroid/bryozoan turf | A4.2 - Moderate Energy Circalittoral Rock | CR.MCR.SfR |
| 248 | GWSD004 | 51.178111 | 1.5505416 | 1 | 12 | Coarse chalk sediment with some exposed chalk bedrock | A5.1 - Subtidal Coarse Sediment | SS.SCS.CCS |
| 249 | GWSD003 | 51.169455 | 1.5345796 | 1 | 16 | *Mytilus edulis* bed mixed with *Sabellaria spinulosa* aggregations on coarse sediment with mobile sands | A5.6 - Subtidal Biogenic Reef | SS.SBR.SMus .MytSS |
| 250 | GWSD002 | 51.152045 | 1.5192091 | 1 | 7 | Coarse chalk sediment with some exposed chalk bedrock | A5.1 - Subtidal Coarse Sediment | SS.SCS.CCS |
| 250 | GWSD002 | 51.151862 | 1.518977 | 2 | 3 | Chalk bedrock with coarse sediment and sand veneer | A4.2 - Moderate Energy Circalittoral Rock | CR.MCR.SfR |
| 250 | GWSD002 | 51.151751 | 1.51891 | 3 | 5 | Coarse chalk sediment with some exposed chalk bedrock | A5.1 - Subtidal Coarse Sediment | SS.SCS.CCS |
| 251 | GWSD001 | 51.145568 | 1.5032405 | 1 | 13 | Coarse chalk sediment with some exposed chalk bedrock and sand | A5.1 - Subtidal Coarse Sediment | SS.SCS.CCS |
| 206 | GWSD105 | 51.30692 | 1.586742 | 1 | 14 | Coarse sediment with mud veneer & faunal turf | A5.4 - Subtidal Mixed Sediment | SS.SMx.CMx |

| Station No. | Station Code | Latitude | Longitude | Habitat No. | No. of stills | Sediment Description | EUNIS Level 3/BSH | MNCR Code |
|---|---|---|---|---|---|---|---|---|
| 209 | GWSD111 | 51.304900 | 1.605151 | 1 | 3 | Coarse sediment with mud veneer, with *Alcyonium digitatum, Echinaster sepositus*, Serpulidae & faunal turf | A5.4 - Subtidal Mixed Sediment | SS.SMx.CMx |
| 214 | GWSD159 | 51.303190 | 1.630598 | 1 | 3 | Shelly gravel on sand mega ripples with no visible fauna. | A5.1 - Subtidal Coarse Sediment | SS.SCS.CCS |
| 242 | GWSD124 | 51.344990 | 1.664704 | 1 | 20 | Coarse sediment with sand veneer. Serpulidae & *Psammechinus miliaris* | A5.1 - Subtidal Coarse Sediment | SS.SCS.CCS |
| 341 | GWSD221 | 51.164100 | 1.545167 | 1 | 12 | Chalk cobbles & pebbles with Actiniaria & Echinaster sepositus | A5.1 - Subtidal Coarse Sediment | SS.SCS.CCS |
| 343 | GWSD215 | 51.198000 | 1.578228 | 1 | 8 | Chalk stony/cobble reef with areas of bored chalk bedrock with sparse fauna | A5.1 - Subtidal Coarse Sediment | SS.SCS.CCS |
| 343 | GWSD215 | 51.197480 | 1.577908 | 2 | 3 | Bored chalk bedrock reef with sparse fauna | A4.2 - Moderate Energy Circalittoral Rock | CR.MCR.SfR |
| 346 | GWSD220 | 51.303380 | 1.643281 | 1 | 4 | Shelly sand with patches of pebbles & sparse fauna | A5.2 - Subtidal Sand | SS.SSa.CFiSa |
| 347 | GWSD218 | 51.306920 | 1.660043 | 1 | 3 | Coarse sediment with mobile sand & sparse fauna | A5.1 - Subtidal Coarse Sediment | SS.SCS.CCS |
| 348 | GWSD219 | 51.324870 | 1.673737 | 1 | 4 | *Sabellaria spinulosa* reef with veneer of mobile sands | A5.6 - Subtidal Biogenic Reef | SS.SBR.PoR |
| 349 | GWSD214 | 51.344580 | 1.659738 | 1 | 3 | Coarse sediment with mobile sand & sparse fauna | A5.1 - Subtidal Coarse Sediment | SS.SCS.CCS |
| 350 | GWSD213 | 51.346400 | 1.653752 | 1 | 3 | Clean sand with no visible fauna | A5.2 - Subtidal Sand | SS.SSa.CFiSa |

## Appendix 7.  Example images from survey for broadscale habitats

| Broadscale Habitats | Description | Example Image taken during survey |
|---|---|---|
| **A4.2 Moderate energy circalittoral rock** | Clean medium to fine sands or non-cohesive slightly muddy sands on open coasts, offshore or in estuaries and marine inlets. |  |
| **A5.1 Subtidal coarse sediment** | Sand veneer over coarse sediment and chalk bedrock with Serpulidae and occasional discrete patches of Sabellaria spinulosa reef |  |
| **A5.2 Subtidal sand** | Sand ripples with shell and no fauna |  |
| **A5.4 Subtidal mixed sediments** | Coarse sediment with mud veneer, with *Alcyonium digitatum, Echinaster sepositus*, Serpulidae & faunal turf |  |

## Appendix 8.  Example images from survey for habitat FOCI

| Habitat FOCI | Description | Example Image taken during survey |
|---|---|---|
| **Blue Mussel Beds** | *Mytilus edulis* bed mixed with *Sabellaria spinulosa* aggregations on coarse sediment with mobile sands |  |
| **Ross worm (*Sabellaria spinulosa*) Reefs** | Sand with elevated clumps of *Sabellaria spinulosa* aggregations |  |
| **Subtidal Sands and Gravels** | Sand and gravel seabeds widespread around the UK |  |
| **Subtidal Chalk** | Bored chalk bedrock reef with sparse fauna |  |

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Department
for Environment
Food & Rural Affairs

# Information Sheet on Ramsar Wetlands (RIS)

*Categories approved by Recommendation 4.7 (1990), as amended by Resolution VIII.13 of the 8th Conference of the Contracting Parties (2002) and Resolutions IX.1 Annex B, IX.6, IX.21 and IX. 22 of the 9th Conference of the Contracting Parties (2005).*

Notes for compilers:

1. The RIS should be completed in accordance with the attached *Explanatory Notes and Guidelines for completing the Information Sheet on Ramsar Wetlands*. Compilers are strongly advised to read this guidance before filling in the RIS.

2. Further information and guidance in support of Ramsar site designations are provided in the *Strategic Framework for the future development of the List of Wetlands of International Importance* (Ramsar Wise Use Handbook 7, 2nd edition, as amended by COP9 Resolution IX.1 Annex B). A 3rd edition of the Handbook, incorporating these amendments, is in preparation and will be available in 2006.

3. Once completed, the RIS (and accompanying map(s)) should be submitted to the Ramsar Secretariat. Compilers should provide an electronic (MS Word) copy of the RIS and, where possible, digital copies of all maps.

---

**1. Name and address of the compiler of this form:**

FOR OFFICE USE ONLY.

| DD | MM | YY |
|---|---|---|
| | | |

Designation date

| | | | | | |
|---|---|---|---|---|---|
| | | | | | |

Site Reference Number


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**2. Date this sheet was completed/updated:**

Designated: 28 July 1994

**3. Country:**

**UK (England)**

**4. Name of the Ramsar site:**

**Thanet Coast and Sandwich Bay**

**5. Designation of new Ramsar site or update of existing site:**

**This RIS is for:** Updated information on an existing Ramsar site

**6. For RIS updates only, changes to the site since its designation or earlier update:**

**a) Site boundary and area:**

** Important note: If the boundary and/or area of the designated site is being restricted/reduced, the Contracting Party should have followed the procedures established by the Conference of the Parties in the Annex to COP9 Resolution IX.6 and provided a report in line with paragraph 28 of that Annex, prior to the submission of an updated RIS.

**b) Describe briefly any major changes to the ecological character of the Ramsar site, including in the application of the Criteria, since the previous RIS for the site:**

## 7. Map of site included:

Refer to Annex III of the *Explanatory Notes and Guidelines*, for detailed guidance on provision of suitable maps, including digital maps.

**a) A map of the site, with clearly delineated boundaries, is included as:**

i) **hard copy** (required for inclusion of site in the Ramsar List): *yes* ✓ -or- *no* □;
ii**) an electronic format** (e.g. a JPEG or ArcView image) Yes
iii) **a GIS file providing geo-referenced site boundary vectors and attribute tables** *yes* ✓ -or- *no* □;

**b) Describe briefly the type of boundary delineation applied:**
e.g. the boundary is the same as an existing protected area (nature reserve, national park etc.), or follows a catchment boundary, or follows a geopolitical boundary such as a local government jurisdiction, follows physical boundaries such as roads, follows the shoreline of a waterbody, etc.

The site boundary is the same as, or falls within, an existing protected area.

For precise boundary details, please refer to paper map provided at designation

## 8. Geographical coordinates (latitude/longitude):

51 18 18 N 01 22 47 E

## 9. General location:

Include in which part of the country and which large administrative region(s), and the location of the nearest large town.

Nearest town/city: Margate and Ramsgate

The site lies on the east Kent coast, between Deal to the south-east and Whitestable to the north-west.

**Administrative region:** Kent

## 10. Elevation (average and/or max. & min.) (metres): 11. Area (hectares): 2169.23

| | |
|---|---|
| Min. | -1 |
| Max. | 6 |
| Mean | 0 |

## 12. General overview of the site:

Provide a short paragraph giving a summary description of the principal ecological characteristics and importance of the wetland.

A coastal site, consisting of a long stretch of rocky shore, adjoining areas of estuary, sand dune, maritime grassland, saltmarsh and grazing marsh. The wetland habitats support 15 British Red Data Book invertebrates, as well as a large number of nationally scarce species. The site attracts internationally important numbers of turnstone *Arenaria interpres*, and nationally important numbers of nationally important wintering populations of four wader species: ringed plover, golden plover, grey plover and sanderling, as well as Lapland bunting. The site is used by large numbers of migratory birds.

## 13. Ramsar Criteria:

Circle or underline each Criterion applied to the designation of the Ramsar site. See Annex II of the *Explanatory Notes and Guidelines* for the Criteria and guidelines for their application (adopted by Resolution VII.11).

**2, 6**

## 14. Justification for the application of each Criterion listed in 13 above:

Provide justification for each Criterion in turn, clearly identifying to which Criterion the justification applies (see Annex II for guidance on acceptable forms of justification).

Ramsar criterion 2

Supports 15 British Red Data Book wetland invertebrates.

**Ramsar criterion 6 – species/populations occurring at levels of international importance.**

**Qualifying Species/populations (as identified at designation):**
**Species with peak counts in winter:**

| | |
|---|---|
| Ruddy turnstone , *Arenaria interpres interpres*, NE Canada, Greenland/W Europe & NW Africa | 1007 individuals, representing an average of 1% of the population (5 year peak mean 1998/9-2002/3) |

Contemporary data and information on waterbird trends at this site and their regional (sub-national) and national contexts can be found in the Wetland Bird Survey report, which is updated annually. See www.bto.org/survey/webs/webs-alerts-index.htm.

## 15. **Biogeography** (required when Criteria 1 and/or 3 and /or certain applications of Criterion 2 are applied to the designation)**:**

Name the relevant biogeographic region that includes the Ramsar site, and identify the biogeographic regionalisation system that has been applied.

**a) biogeographic region:**
Atlantic

**b) biogeographic regionalisation scheme** (include reference citation):
Council Directive 92/43/EEC

## 16. Physical features of the site:

Describe, as appropriate, the geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; downstream area; general climate, etc.

| | |
|---|---|
| Soil & geology | basic, neutral, shingle, sand, mud, clay, alluvium, peat, nutrient-rich, nutrient-poor, sedimentary, limestone/chalk |
| Geomorphology and landscape | lowland, coastal, valley, floodplain, barrier beach, intertidal sediments (including sandflat/mudflat), open coast (including bay), estuary, cave/tunnel, lagoon, cliffs, pools |
| Nutrient status | eutrophic, highly eutrophic |
| pH | alkaline |
| Salinity | brackish / mixosaline, fresh, saline / euhaline |
| Soil | mainly mineral, mainly organic |
| Water permanence | usually permanent |
| Summary of main climatic features | Annual averages (Greenwich, 1971–2000) (www.metoffice.com/climate/uk/averages/19712000/sites/greenwich.html)<br>Max. daily temperature: 14.8° C<br>Min. daily temperature: 7.2° C<br>Days of air frost: 29.1<br>Rainfall: 583.6 mm<br>Hrs. of sunshine: 1461.0 |

**General description of the Physical Features:**

Thanet Coast and Sandwich Bay consists of a long stretch of rocky shore, adjoining areas of estuary, sand dune, maritime grassland, saltmarsh and grazing marsh.

### 17. Physical features of the catchment area:

Describe the surface area, general geology and geomorphological features, general soil types, general land use, and climate (including climate type).

Thanet Coast and Sandwich Bay consists of a long stretch of rocky shore, adjoining areas of estuary, sand dune, maritime grassland, saltmarsh and grazing marsh.

### 18. Hydrological values:

Describe the functions and values of the wetland in groundwater recharge, flood control, sediment trapping, shoreline stabilization, etc.

Shoreline stabilisation and dissipation of erosive forces

### 19. Wetland types:

Inland wetland, Marine/coastal wetland

| Code | Name | % Area |
|---|---|---|
| G | Tidal flats | 56 |
| D | Rocky shores | 15.5 |
| 4 | Seasonally flooded agricultural land | 15 |
| M | Rivers / streams / creeks: permanent | 10 |
| Xf | Freshwater, tree-dominated wetlands | 1 |
| E | Sand / shingle shores (including dune systems) | 0.9 |
| F | Estuarine waters | 0.8 |
| Tp | Freshwater marshes / pools: permanent | 0.6 |
| H | Salt marshes | 0.2 |

### 20. General ecological features:

Provide further description, as appropriate, of the main habitats, vegetation types, plant and animal communities present in the Ramsar site, and the ecosystem services of the site and the benefits derived from them.

Chalk cliffs and rocky shore: Much of the Thanet coastline consists of chalk cliffs, approx. 75% of which has been subjected to the building of sea defences. Where the cliffs are undefended they contain a large number of sea caves which are are rich in marine algae. The chalk shore platform is the most extensive such area in the UK and supports a range of characteristic biotopes.

Sand/mud flats: There are extensive areas of intertidal mud and sand flat that are attractive to waders.

Saltmarsh: The relatively small areas of saltmarsh integrate in some areas with the sand dune communities. Common species include *Puccinellia maritima*, *Atriplex portulacoides*, and *Limonium vulgare*. Scarce plants include *Inulia crithmoides*.

Shingle beach: The coastline around Sandwich and Reculver is fringed by shingle beach, mostly unvegetated. There are small areas of vegetated shingle with species such as *Glaucium flavum*, and *Crambe maritima*.

Sand dune: Part of the site includes a part of a larger area of dune grassland. Here there are small areas of young *Ammophila arenaria* dune, with large areas of fixed dune, dominated by *Festuca rubra*, *Galium verum* communities. The scarce rush *Juncus acutus* occurs here. Lizard orchid *Himantoglossum hircinum* and bedstraw broomrape *Orobanche caryophyllacea* both occur on the dune grassland.

There are extensive areas of grazing marsh located in some areas on alluvial deposits, and in other areas on thick beds of peat. The peat-dominated areas have the greatest interest, supporting the nationally scarce *Potamogeton coloratus* and *Sparganium minimum* at its only locality in south-east England; the ditches support a wide diversity of aquatic plants typical of south-eastern grazing marsh, other scarce species include *Myriophyllum verticillatum* and *Althaea officinalis*. Much of the grazing marsh has been subject to agricultural improvement. A few fields remain, however, with an unimproved turf and a relatively diverse flora.

Arable: Some areas of grazing marsh have been ploughed and drained. The ditches retain some water, but with an impoverished flora, dominated by emergents such as *Typha latifolia*, *T. angustifolia* and *Phragmites australis*.

Ecosystem services

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## 21. Noteworthy flora:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in **12**. Justification for the application of the Criteria) indicating, e.g. which species/communities are unique, rare, endangered or biogeographically important, etc. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

**Nationally important species occurring on the site.**

**Higher Plants.**

*Juncus acutus, Potamogeton coloratus, Ceratophyllum submersum, Myriophyllum verticillatum, Carex divisia, Althaea officinalis, Frankenia laevis, Inula crithmoides*

Non-wetland higher plants of importance:

Plants of sand dunes: *Himantoglossum hircinum* (90% UK population on dunes at Sandwich Bay); *Orobanche caryophyllacea*.

Plants of chalk cliffs: *Brassica oleracea* var. *oleracea*; *Matthiola incana*; *Matthiola sinuata*; *Limonium binervosum*.

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## 22. Noteworthy fauna:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in **12**. Justification for the application of the Criteria) indicating, e.g. which species/communities are unique, rare, endangered or biogeographically important, etc., including count data. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

**Birds**

**Species currently occurring at levels of national importance:**

**Species with peak counts in spring/autumn:**

| | |
|---|---|
| Ringed plover , *Charadrius hiaticula*, Europe/Northwest Africa | 649 individuals, representing an average of 2% of the GB population (5 year peak mean 1998/9-2002/3) |
| Common greenshank , *Tringa nebularia*, Europe/W Africa | 35 individuals, representing an average of 5.8% of the GB population (5 year peak mean 1998/9-2002/3) |

**Species with peak counts in winter:**

| | |
|---|---|
| Red-throated diver , *Gavia stellata*, NW Europe | 57 individuals, representing an average of 1.1% of the GB population (5 year peak mean 1998/9-2002/3) |
| Great crested grebe , *Podiceps cristatus cristatus*, NW Europe | 218 individuals, representing an average of 1.3% of the GB population (5 year peak mean 1998/9-2002/3) |

| | |
|---|---|
| European golden plover , *Pluvialis apricaria apricaria*, P. a. altifrons Iceland & Faroes/E Atlantic | 4190 individuals, representing an average of 1.6% of the GB population (5 year peak mean 1998/9-2002/3) |
| Sanderling , *Calidris alba*, Eastern Atlantic | 598 individuals, representing an average of 2.9% of the GB population (5 year peak mean 1998/9-2002/3) |

**Species Information**

**Nationally important species occurring on the site.**

Sand lizards *Lacerta agilis* are being reintroduced to the site on the Sandwich & Pegwell Bay NNR, September 2004, as part of a national programme of reintroduction to seven sites across England.

**Invertebrates.**

*Lixus vilis, Stigmella repentiella, Bagous nodulosus, Deltote bankiana, Poecilobothrus ducalis, Emblethis verbasci, Pionosomus varius, Nabis brevis, Euheptauclacus sus, Melanotus punctolineatus, Eluma purpurescens, Ectemnius ruficornis, Alysson lunicornis, Orthotylus rubidus*

Non-wetland invertebrates of importance recorded during 2004 survey:

Bees & wasps: *Cerceris quadricincta* (RDB 1; largest UK colony discovered on site in Pegwell area); *Philanthus triangulum* (RDB2, pRDB4); *Hedychrum niemelai* (RDB3); *Smicromyrme rufipes* (Notable b species); *Andrena minutuloides* (Notable a species); *Andrena pilipes* (Notable b species); *Melitta leporine* (Notable b species); *Nomada fucata* (Notable a species).

Moths found on sand dunes at Sandwich: *Idaea ochrata* (BAP priority species); *Aplasta ononaria* (RDB3); *Phibalapteryx virgata* (Nationally Scarce),

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## 23. Social and cultural values:

Describe if the site has any general social and/or cultural values e.g. fisheries production, forestry, religious importance, archaeological sites, social relations with the wetland, etc. Distinguish between historical/archaeological/religious significance and current socio-economic values.

Aesthetic
Archaeological/historical site
Environmental education/ interpretation
Livestock grazing
Non-consumptive recreation
Scientific research
Sport fishing
Sport hunting
Tourism
Transportation/navigation

**b)** Is the site considered of international importance for holding, in addition to relevant ecological values, examples of significant cultural values, whether material or non-material, linked to its origin, conservation and/or ecological functioning? No

If Yes, describe this importance under one or more of the following categories:

i) sites which provide a model of wetland wise use, demonstrating the application of traditional knowledge and methods of management and use that maintain the ecological character of the wetland:

ii) sites which have exceptional cultural traditions or records of former civilizations that have influenced the ecological character of the wetland:

iii) sites where the ecological character of the wetland depends on the interaction with local communities or indigenous peoples:

iv) sites where relevant non-material values such as sacred sites are present and their existence is strongly linked with the maintenance of the ecological character of the wetland:

## 24. Land tenure/ownership:

| Ownership category | On-site | Off-site |
|---|---|---|
| Non-governmental organisation (NGO) | + | |
| Local authority, municipality etc. | + | |
| Private | + | |
| Public/communal | + | |

## 25. Current land (including water) use:

| Activity | On-site | Off-site |
|---|---|---|
| Nature conservation | + | |
| Tourism | + | |
| Recreation | + | |
| Current scientific research | + | |
| Collection of non-timber natural products: (unspecified) | + | |
| Fishing: (unspecified) | + | |
| Fishing: commercial | + | |
| Fishing: recreational/sport | + | |
| Marine/saltwater aquaculture | | + |
| Gathering of shellfish | + | |
| Bait collection | + | |
| Arable agriculture (unspecified) | + | |
| Permanent arable agriculture | | + |
| Grazing (unspecified) | + | |
| Permanent pastoral agriculture | + | |
| Hunting: recreational/sport | + | |
| Industrial water supply | + | |
| Industry | + | |
| Sewage treatment/disposal | | + |
| Harbour/port | | + |
| Flood control | + | |
| Mineral exploration (excl. hydrocarbons) | + | |
| Transport route | | + |
| Domestic water supply | + | |
| Urban development | + | |

## 26. Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land (including water) use and development projects:

*Explanation of reporting category:*

1. *Those factors that are still operating, but it is unclear if they are under control, as there is a lag in showing the management or regulatory regime to be successful.*
2. *Those factors that are not currently being managed, or where the regulatory regime appears to have been ineffective so far.*

*NA = Not Applicable because no factors have been reported.*

| Adverse Factor Category | Reporting Category | Description of the problem (Newly reported Factors only) | On-Site | Off-Site | Major Impact? |
|---|---|---|---|---|---|
| Vegetation succession | 2 | Survey 2003 revealed problem of lack of ditch management in some areas. | + | | + |
| Water diversion for irrigation/domestic/industrial use | 1 | | + | + | + |
| Eutrophication | 1 | Subsidence in former colliery areas has created sump effect and contributed to eutrophication. | + | + | + |
| Pollution – pesticides/agricultural runoff | 2 | Runoff from agricultural fields. | + | + | + |
| Recreational/tourism disturbance (unspecified) | 1 | Disturbance of turnstones *Arenaria interpres*, especially by dog walking and kite surfing/boarding, which can result in loss of condition to birds if unmanaged. | + | | + |
| Unspecified development: urban use | 1 | Activities connected with ongoing management and new development on the coast cause significant disturbance to wintering birds if unmanaged. | + | | + |
| | | | | | |

For category 2 factors only.
What measures have been taken / are planned / regulatory processes invoked, to mitigate the effect of these factors?
Vegetation succession - Management agreements in place. It is intended that the number of these will increase when Environmental Stewardship Scheme is introduced.
Negotiation is underway with owners to reinstate ditch management in neglected areas.

Pollution – pesticides/agricultural runoff - Environment Agency currently investigating nature and extent of problem with view to implementing appropriate controls.

Is the site subject to adverse ecological change? YES

## 27. Conservation measures taken:

List national category and legal status of protected areas, including boundary relationships with the Ramsar site; management practices; whether an officially approved management plan exists and whether it is being implemented.

| Conservation measure | On-site | Off-site |
|---|---|---|
| Site/ Area of Special Scientific Interest (SSSI/ASSI) | + | |
| National Nature Reserve (NNR) | + | |
| Special Protection Area (SPA) | + | |
| Land owned by a non-governmental organisation for nature conservation | + | |
| Management agreement | + | |
| Site management statement/plan implemented | + | |
| Special Area of Conservation (SAC) | + | |

**b)** Describe any other current management practices:
The management of Ramsar sites in the UK is determined by either a formal management plan or through other management planning processes, and is overseen by the relevant statutory conservation agency. Details of the precise management practises are given in these documents.

## 28. Conservation measures proposed but not yet implemented:

e.g. management plan in preparation; official proposal as a legally protected area, etc.

No information available

## 29. Current scientific research and facilities:

e.g. details of current research projects, including biodiversity monitoring; existence of a field research station, etc.

**Fauna.**
Numbers of migratory and wintering wildfowl and waders are monitored annually as part of the national Wetland Birds Survey (WeBS) organised by the British Trust for Ornithology, Wildfowl & Wetlands Trust, the Royal Society for the Protection of Birds and the Joint Nature Conservation Committee.
A littoral and sublittoral marine life survey of the chalk cliffs, caves and reefs was undertaken by the Natural History Museum in 1997 (Tittley *et al*. 1998); the littoral element was repeated in 2001 (Tittley *et al*. 2004).
A sublittoral diving survey of the chalk reefs took place in Summer 2004.
A survey of the numbers and distribution of the golden plover population was undertaken in 2002-03.
Turnstone research was undertaken from 2001-03.
A sand dune NVC survey was undertaken in 2002 and a ditch flora survey in 2003.
Reintroduction of sand lizards *Lacerta agilis* to Sandwich & Pegwell Bay NNR, September 2004.

## 30. Current communications, education and public awareness (CEPA) activities related to or benefiting the site:

e.g. visitor centre, observation hides and nature trails, information booklets, facilities for school visits, etc.

The Thanet Coast Project was set up in 2001 and operates over most of the site. The Project implements aspects of the North East Kent European marine sites Management Scheme and works with local people, providing a wide range of coastal educational activities for adults and children as well as leaflets and other information.

Sandwich and Pegwell Bay NNR and LNR is managed by Kent Wildlife Trust. Guided walks and events are held on site throughout the year and information leaflets and interpretive boards are provided.

Sandwich Bay Bird Observatory is situated close to the site and provides information and leaflets on birds, as well as guided walks and events. It has conference and laboratory facilities as well as accommodation for visiting groups.

### 31. Current recreation and tourism:

State if the wetland is used for recreation/tourism; indicate type(s) and their frequency/intensity.

**Activities, Facilities provided and Seasonality.**

There are a number of beach resorts around this Ramsar site, and the whole coastline is heavily used for recreation. Although there is more use in summer, there are a number of recreational activities that take place year-round on the coast, such as dog walking, and it is these that have most effect on wintering birds.

The inland parts of this Ramsar Site are the only areas that are not heavily used for recreation.

Water-based recreation includes jet-skiing, power-boat use, sailing, water-skiing and kite-surfing at a number of locations around the site. These activities happen mostly in spring, summer and autumn, but there is some year-round use.

Kite-boarding has been noted at two locations and has caused bird disturbance problems. This activity happens intermittently but more often in summer.

### 32. Jurisdiction:

Include territorial, e.g. state/region, and functional/sectoral, e.g. Dept. of Agriculture/Dept. of Environment, etc.

Head, Natura 2000 and Ramsar Team, Department for Environment, Food and Rural Affairs, European Wildlife Division, Zone 1/07, Temple Quay House, 2 The Square, Temple Quay, Bristol, BS1 6EB

### 33. Management authority:

Provide the name and address of the local office(s) of the agency(ies) or organisation(s) directly responsible for managing the wetland. Wherever possible provide also the title and/or name of the person or persons in this office with responsibility for the wetland.

Site Designations Manager, English Nature, Sites and Surveillance Team, Northminster House, Northminster Road, Peterborough, PE1 1UA, UK

### 34. Bibliographical references:

Scientific/technical references only. If biogeographic regionalisation scheme applied (see **15** above), list full reference citation for the scheme.

**Site-relevant references**

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Bratton, JH (ed.) (1991) *British Red Data Books: 3. Invertebrates other than insects*. Joint Nature Conservation Committee, Peterborough

Buck, AL (ed.) (1997) *An inventory of UK estuaries. Volume 6. Southern England*. Joint Nature Conservation Committee, Peterborough

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Radley, GP (1994) *Sand dune vegetation survey of Great Britain: a national inventory. Part 1: England*. Joint Nature Conservation Committee, Peterborough

Ratcliffe, DA (ed.) (1977) *A Nature Conservation Review. The selection of biological sites of national importance to nature conservation in Britain*. Cambridge University Press (for the Natural Environment Research Council and the Nature Conservancy Council), Cambridge (2 vols.)

Shirt, DB (ed.) (1987) *British Red Data Books: 2. Insects*. Nature Conservancy Council, Peterborough

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# Joint SNCB[1] Interim Displacement Advice Note

**Advice on how to present assessment information on the extent and potential consequences of seabird displacement from Offshore Wind Farm (OWF) developments**

**January 2017**

## Summary of input requirements for displacement assessment

**Inputs required:**

- Full details of survey techniques.
- Site-based density estimates to include birds on water and in flight.
- Proportions of different age classes of birds (where possible).
- Monthly population estimates presented for minimum two years[2] pre-consent monitoring.
- Raw count data to be included in report appendices.
- Counts to be assessed as mean seasonal peaks[3] (averaged over the years of survey).
- Population estimates for the development footprint and also for the development footprint plus a standard displacement buffer. Buffer of 2km for all species with the exception of divers and sea ducks where a 4km displacement buffer is recommended.
- Full details of the development (with worst case and typical scenarios) including size of development footprint alone and size plus appropriate outer buffer – usually 2km [4]. (Abundance estimates will be required for site with and without buffer zone).

[1]SNCB – Statutory Nature Conservation Bodies in this case comprising Natural Resources Wales (NRW), Department of Agriculture, Environment and Rural Affairs / Northern Ireland Environment Agency (DAERA/NIEA), Natural England (NE), Scottish Natural Heritage (SNH) and Joint Nature Conservation Committee (JNCC)

[2]Lower level of data provision may be agreed in some cases (e.g. 18 months ensuring 2 breeding season periods covered if other baseline data available).

[3] Mean seasonal peaks – the mean of the peak counts for each season assessed. If season is April – July and monthly counts of 338, 720, 418 and 552 are recorded the season peak is 720. If three repeat seasons are assessed and the peak counts from the three seasons are 720, 979 and 501 the mean seasonal peak value is the mean of these three counts i.e. 733.

[4] 2km for most species, 4km for sensitive species (e.g. red-throated diver).

## Summary of data treatment for displacement assessment

**Data manipulation and assessment criteria:**

- A 'power analysis' should be used to identify the probability of being able to detect specified levels of change in abundance associated with varying survey effort. Surveys should provide complete seasonal coverage.
- Any count adjustment and correction to be fully documented (e.g. for availability bias, distance sampling effects).
- Species to be assessed should be selected based on sensitivity scores and local observation or empirical data.
- Breeding season[5] assessment to be done against an appropriate regional population scale, as agreed with SNCBs (but likely to cover total colony counts[6] within mean-max foraging range[7]).
- Non-breeding season assessment done against appropriate population scale (e.g. Furness 2015), as agreed with SNCBs.
- Use published indices of disturbance (e.g. Furness *et al*. 2013) to assign a range of displacement levels for each species individually. The SNCBs note that further evidence is emerging that may confirm or suggest modifications to these scores and likely displacement levels (e.g. Wade *et al. 2016).*
- Use published indices of habitat flexibility (e.g. Furness *et al*. 2013), other empirical evidence if available, and discussions with SNCBs; to agree appropriate levels of likely adult mortality associated with particular displacement levels, for each species individually (acknowledging data very limited at this time).
- Use above two metrics to compile a 'Matrix Approach' table (i.e. representing proportions of birds potentially displaced/dying as a result of OWF development). Table should be presented from 0-100%, in 10% increments for displacement levels. Percentage increments for mortality should also be presented between 0-100%, but including smaller increments at lower values (e.g. 0%, 1%, 2%, 5%, 10%, 20%…..). At this time impacts to breeding success, although plausible are not being considered, unless site specific information exists. The approach here assesses mortality of full grown individuals connected to the development site.
- Impacts to be assessed for a minimum of two seasons (i.e. breeding and non-breeding season). For some species more than two seasons may be appropriate (e.g. based on post-breeding dispersal periods for auks or migration seasons defined for species in Furness 2015), on discussion with SNCBs.
- Seasonal impacts should be summed across seasons. While acknowledged that this could result in birds being assessed in more than one season, and thus double counted, the precautionary approach is required in absence of empirical information on seasonal turnover on development sites.
- Displacement impacts and collision impacts will be added together for assessment of total impacts. This is acknowledged to involve some degree of double counting, but is adopted as a precautionary approach in the absence, at present, of being able to distinguish between birds which might be subject to collision and those that may be displaced.

[5] Potentially suitable seasons/periodicity can be found in Furness (2015), but can vary by location so should also be agreed with SNCBs.
[6] JNCC Seabird Monitoring Programme a good source of most recent UK colony count data.
[7] See Thaxter *et al.* (2012), although more recent tracking data to be used, in discussion with SNCBs, if more up-to-date.

## 1. Aim of document

This interim displacement advice note replaces an earlier NE and JNCC joint advice note from 2012 (NE and JNCC 2012). It updates the previous note to take account of potential areas of disparity in approaches that have arisen in casework since the original note was issued. It also follows on from a Displacement Workshop (6-7 May 2015), run by JNCC and the Marine Renewables Ornithology Group (MROG) and funded by The Crown Estate, which sought to make progress towards developing a more refined best practice approach to assessing displacement impacts.

Following recommendations made at the workshop, it was agreed that this Joint SNCB interim displacement advice note would contribute towards achieving one of the recommendations (i.e. the creation of a short-term SNCB advice position). This document is intended to address critical areas of clarification and SNCB positioning. It will not attempt to cover (or make progress towards) the more complex issues of displacement assessment at this time. Nor will it cover the expert elicitation recommendation that came out of the displacement workshop, as it was agreed at a meeting of the SNCBs in June 2015 that this could more realistically be produced against a medium-term objective, in a further round of SNCB guidance.

SNCB advice and positioning on displacement assessment methods and approaches will be an iterative process, with at least three stages expected (see Displacement Workshop report 'Next Steps' section, for more details).

The key changes to this document since the earlier advice note are:

- A clearer definition of displacement and barrier terms.
- Further clarity on the application of the 'Matrix Approach'.
- Further clarity on the use of sensitivity scores in relation to the 'Matrix Approach' (based on evidence obtained since the original NE and JNCC advice note (NE and JNCC 2012)).

In addition, this interim advice note aims to provide:

- Advice on how to present information to enable comparable and transparent assessment of the magnitude and potential impacts of seabird displacement from OWFs.
- A method to enable displacement impacts to be compared and potentially combined across multiple sites/projects/activities, with an eye to improving Cumulative Impact Assessment (CIA) approaches for this impact.

Future revision of this advice note is anticipated when new empirical evidence of displacement levels and associated population-level impacts (e.g. changes to productivity or mortality levels) becomes available. Currently our recommendations are aimed at capturing the full range of potential impacts, while encouraging developers to present any species-specific evidence to further refine this as part of both Habitat Regulations Assessment (HRA) and Environmental Impact Assessment (EIA) processes. It is anticipated we will be able to narrow down predicted range of impacts as more results from post-consent monitoring and other studies are produced.

## 2. Background

Individual species react differently to the construction, operation and decommissioning of OWFs (and other offshore developments). Several species groups display avoidance of operational OWFs. However, for all development types during operation, construction and decommissioning, activities such as towing, pile driving or presence of maintenance/service vessels in the vicinity may cause disturbance (Fox and Petersen 2006; Krijgsveld *et al*. 2011; Vanermen *et al*. 2014). Displacement (see definitions below) can pose a potential ecological threat to seabirds as it can result in habitat loss, in the form of foraging or rafting areas. For adaptive species this may not be a problem, but for less adaptive or constrained species/individuals (e.g. during breeding season) this may result in ecological and/or population level consequences.

## 3. Definitions of disturbance, displacement, and barrier effects

### Disturbance

Disturbance exists when a bird's normal pattern of activity is interrupted by an anthropogenic activity. Birds using a given area of sea for a range of activities e.g. feeding, resting, commuting etc. may be disturbed by the occurrence of human activities or artifacts in or near those areas. Birds may choose to avoid such sources of disturbance (e.g. by swimming or flying away during the disturbance event to continue their activity elsewhere) and may not return until sometime later. The duration of return times coupled with the frequency of disturbing events, may combine to result in longer term and potentially continual reductions of numbers in an area of impact (i.e. displacement) which may be partial or total.

### Displacement

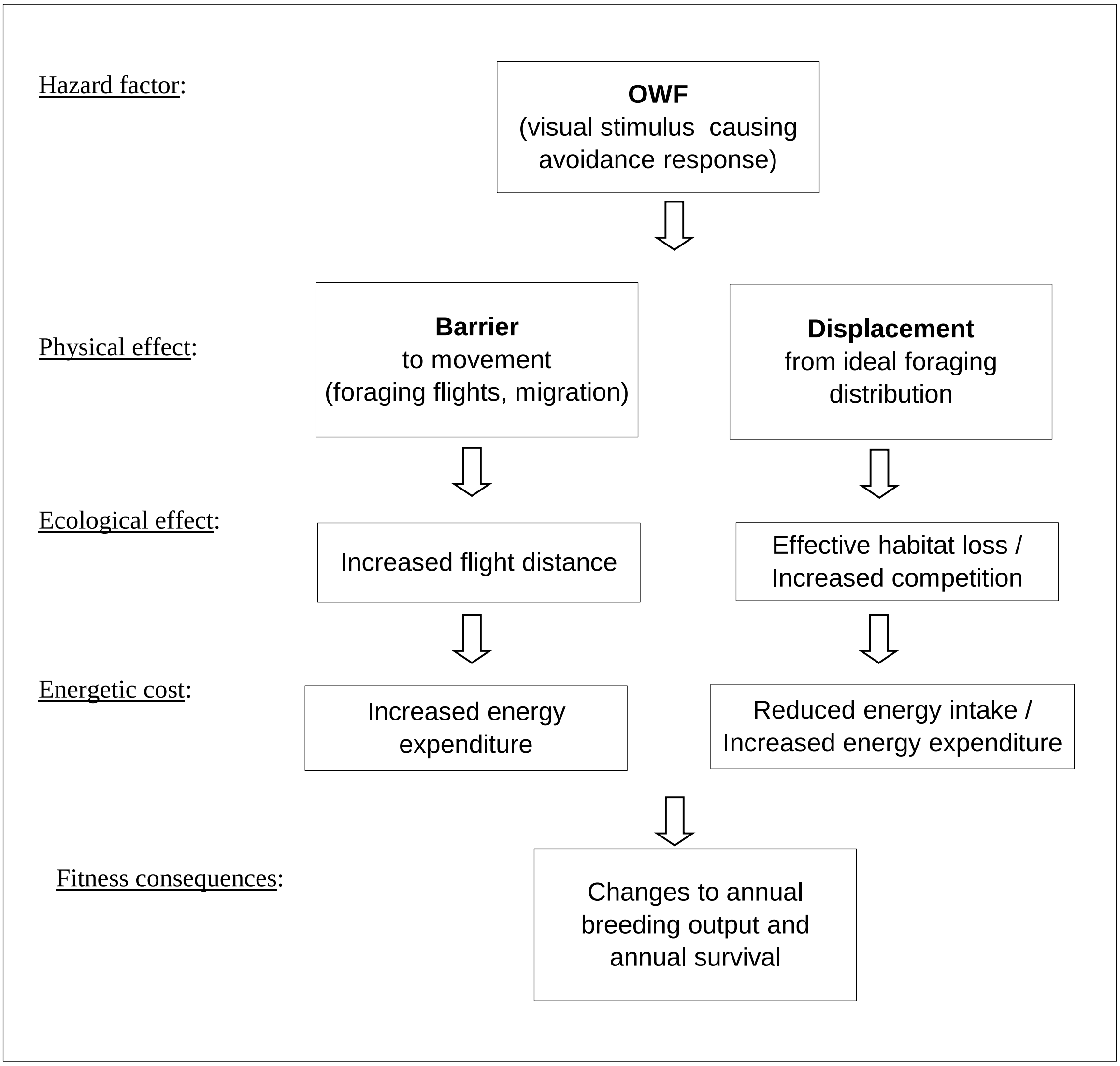
In relation to offshore wind farm development, Furness *et al*. (2013) define displacement as 'a reduced number of birds occurring within or immediately adjacent to an offshore wind farm'. Displacement, as an effect, may occur both in the area of the disturbance or development and to some distance beyond it – known as a 'buffer' (e.g. Mendel *et al*. 2014). The degree of displacement, both in terms of length of time and proportion of the original source population affected, may vary seasonally and between species. We define **displacement as affecting birds present both in the air and on the water**. This is in contrast to the definition in Cook *et al*. (2014) which included only birds on the water as capable of being displaced (birds in flight which were deterred from entering the wind farm are considered to form the component of 'macro-avoidance'), but while these birds are not at risk of collision they are potentially at risk of impacts arising from their displacement from wind farm areas. Birds that would have previously passed through the footprint of the disturbance area to a more distant feeding, resting or nesting area, but now choose either to stop short or detour around the location are said to be affected by barrier impacts (see below).

### Barrier

A barrier is a physical factor that limits the migration, or free movement of individuals or populations, thus requiring them to divert from their intended path in order to reach their original destination. This effect is expected to increase the energy expenditure of birds if they have to fly around the area in question in order to reach their goal. Birds experiencing barrier effects are typically in flight, but not necessarily always so. For the purposes of this description, however, **we interpret barrier effects to mean applying to birds in flight**. Barrier effects are more likely to result in individual/population level impacts, if they occur during the breeding season (and at colonies close to an OWF). Individuals may repeatedly deviate from their normal foraging trajectories at this crucial stage in their annual cycle. Individuals are less constrained during the non-breeding season (i.e. no longer central-placed foragers). Therefore, increases to overall flight costs due to barrier effects while on migration are likely to be very small (Topping and Petersen 2011).

A key distinction between barrier and displacement is that birds experiencing barrier effects typically travel longer distances (i.e. to some point beyond the OWF) and did not intend to forage/utilise the OWF site itself, but some area beyond it. However, it is hard to define where an individual may have intended to travel to, even using tracking data. Therefore, in this advice note we do not provide specific recommendations on the treatment/assessment of barrier effects. As and when technological advances allow for quantitative distinction between these two effects, it may be possible to separate these two impacts within future Displacement Assessment Frameworks (DAFs).

**Figure 1.** Barrier and displacement effects illustrated (adapted from Petersen *et al*. 2006).




**SNCB advice section – barrier and displacement effects**

It is recognised that a proportion of the birds recorded in wind farm areas may be transiting through the site (and therefore potentially affected by barrier effects, rather than displacement from the wind farm area) and that this is more likely to be the case for flying birds. However, at present we do not have enough evidence to separate these impacts out and apportion to the two groups. Therefore it is assumed that total numbers of birds on site (flying and on water) are subject to displacement impacts. However, as remote tracking of seabirds continues to expand our knowledge on seabird behavior it may be possible to provide further information on the relative impacts of both issues – this position will be kept under review.

## 4. Data recording and presentation

In order to address displacement impacts for offshore wind developments, developers should present the following minimum level of data collected in the manner described in guidance documents elsewhere (see Appendix 1). That information should include:

- Full details of survey techniques (platform, transects, temporal and spatial extent of surveys) and how density estimates (and derived abundance estimates) have been calculated.
- Details of if/how density estimates have been corrected to account for availability bias and detection probabilities.
- Accurate information on size of OWF area plus appropriate buffer area calculations.
- Total abundance estimates of birds on water and in flight (and summed). This should be presented separately for the OWF site plus appropriate buffer area, with the extent of buffer area clearly indicated (see Section 6).
- Age or age-class of birds (where this can be determined).

SNCBs recommend **assessing impacts of displacement based on the overall mean seasonal peak numbers of birds (averaged over the years of survey)** in the development footprint and appropriate buffer (see Section 6 on defining appropriate buffer zones). This is a combined estimate of the **number of birds on the water** (corrected for survey coverage and distance analysis/diving species availability bias, if appropriate) and of the **number of birds in flight** (corrected for survey coverage). Methods for estimating birds at sea, both on the water and in flight, have advanced dramatically in recent years. However, standard methodologies for correcting for diving species availability bias are still in development. Hence, decisions made with regards to these components of input data (both for Collision Risk Models (CRM) and displacement) should be discussed and agreed with SNCBs at the time.

Where possible, the ratio of detected age classes should be reported. Age class ratios may differ seasonally and regionally, and ratios obtained from on-site survey data are preferred (if of sufficient quality). Where site specific data on age class ratios are not available there may be other sources of evidence that can be used such as other offshore datasets, colony studies of age ratios or ratios from stable age structures generated from population models. While separation of age classes is not directly used in the 'Matrix Approach' (the matrix should include abundance figures that relate to all birds in the project area, across all age classes), it can be crucial for later stages in the assessment process (e.g. when applying appropriate biologically relevant population scales and making assessments of population-level impacts).

SNCBs advise that at least two full years of monthly survey data should be collected pre-construction. This should be considered the bare minimum for assessment purposes. However, a more appropriate approach is to initially conduct a power analysis to confirm how many years survey data are required to adequately characterise any potential changes to bird abundances (on a species-by-species basis) in response to future OWF development. The number of years survey effort is likely to vary between species, site, and data collection method (e.g. digital aerial versus boat-based observers). Ideally, survey programmes should commence at the beginning of a clearly defined biological season, such that the period of survey will provide complete seasonal coverage in terms of data collection (without the need to combine incomplete data for seasons across different years, when calculating mean seasonal peak abundance estimates).

Data should be provided in a format that allows the calculation of **mean seasonal peak population estimates based on several years data**. For example, for a species with a breeding season from April to July, this requires the average of the peak count between April and July in year one, and the peak count between April and July in a second year. This may require the counts to originate from different months in the two years (e.g. May in the first year and June in the second year). In practice this requires consistent monthly abundance estimates for each year of survey. This allows for year-to-year variation in the precise time (and magnitude) of peak abundance estimates to be taken into account in arriving at a mean peak population estimate. To allow recalculation of values, best practice requires presentation of monthly values in summary and full data from all surveys in an appendix to any report.

## 5. Selection of species for displacement assessment

Sensitivity to displacement differs considerably between seabird species. To focus impact assessment, SNCBs recommend that consideration is given to each species observed within a development site and informed by:

i) Species presence at the development site (or development sites in the case of in-combination assessments).

ii) Susceptibility to disturbance and habitat specialisation scores for species found in Scottish waters (Furness *et al.* 2013), and the expanded list for wider UK waters (Bradbury *et al.* 2014), covering additional species not previously included in Furness *et al.* (2013).

Furness *et al*. (2013) assessed seabird species occurring in Scottish waters by; 1) scoring species for sensitivity to disturbance by wind farm structures, ship and helicopter traffic, and 2) the degree of habitat specialisation. These two metrics together give an indication of which species are expected to be most susceptible to displacement impacts. The same scoring system and scores were used by Bradbury *et al*. (2014), although they expanded the species list to account for additional species that occur in English waters. Reference to these values will help developers and SNCBs determine the most relevant species for assessment at the site-specific level.

**SNCB advice section – screening species for displacement assessment**

It is recognised that, regardless of these scores, it is unlikely that cormorant and gull species will need to be routinely assessed for displacement, as a number of empirical studies have demonstrated these species can also be attracted as well as display no noticeable reaction to the presence of OWFs (e.g. Leopold *et al*. 2013; Vanermen *et al.* 2014; Petersen *et al.* 2006; Mendel *et al.* 2014). **The priority species for assessment of displacement effects will typically be diver and sea duck species, guillemot, razorbill, puffin and gannet.**
As a general guide, any species scoring 3 or more under either category (‘*Disturbance Susceptibility*’ or ‘*Habitat Specialization’*) in Table 1, and which is present in the OWF site or buffer should be progressed to the matrix stage unless there is strong empirical evidence to the contrary. Gannet, with a score of 2, is an obvious exception to this general guide as there are empirical studies demonstrating they are sensitive to displacement and barrier effects (Krijgsveld *et al*. 2011, Vanermen *et al.* 2013). The scores for this species have been revised in a recent publication by Wade *et al. (2016.)*.

**Table 1. 'Disturbance Sensitivity' and 'Habitat Specialization' scores from Bradbury *et al*. (2014) (expanded from Furness *et al.* 2013).** No 'real' value is implied by these scores, although species with higher scores are considered more sensitive to displacement. (Grey content = species with scores of 3 or higher in either category).

| Species | Scientific name | Disturbance Susceptibility | Habitat Specialization |
|---|---|---|---|
| Common scoter$ | *Melanitta nigra* | 5 | 4 |
| Red-throated diver$ | *Gavia stellata* | 5 | 4 |
| Black-throated diver$ | *Gavia arctica* | 5 | 4 |
| White-billed diver$ | *Gavia adamsii* | 5 | 4 |
| Velvet scoter$ | *Melanitta fusca* | 5 | 3 |
| Great northern diver$ | *Gavia immer* | 5 | 3 |
| Greater scaup$ | *Aythya marila* | 4 | 4 |
| Common goldeneye$ | *Bucephala clangula* | 4 | 4 |
| Goosander$ | *Mergus merganser* | 4 | 4 |
| Great cormorant† | *Phalcrocoax carbo* | 4 | 3 |
| Common eider$ | *Somateria mollisima* | 3 | 4 |
| Long-tailed duck$ | *Clangula hymalis* | 3 | 4 |
| Red-breasted merganser$ | *Mergus serrator* | 3 | 4 |
| Great-crested grebe | *Podiceps cristatus* | 3 | 4 |
| Slavonian Grebe | *Podiceps auritus* | 3 | 4 |
| Black guillemot* | *Cepphus grylle* | 3 | 4 |
| Shag | *Phalacrocorax aristoltelis* | 3 | 3 |
| Common guillemot | *Uria aalge* | 3 | 3 |
| Razorbill | *Alca torda* | 3 | 3 |
| Little tern | *Sternula albifrons* | 2 | 4 |
| Sabine's gull* | *Xena sabini* | 2 | 3 |
| Black tern | *Childonias niger* | 2 | 3 |
| Sandwich tern | *Sterna sandivicensis* | 2 | 3 |
| Roseate tern | *Sterna dougalii* | 2 | 3 |
| Arctic tern | *Sterna paradisaea* | 2 | 3 |
| Atlantic puffin | *Fratecula arctica* | 2 | 3 |
| Mediterranean gull* | *Larus melanocephalus* | 2 | 2 |
| Common gull* | *Larus canus* | 2 | 2 |
| Great black-backed gull* | *Larus marinus* | 2 | 2 |
| Black-legged kittiwake* | *Rissa tridactyla* | 2 | 2 |
| Little auk | *Alle alle* | 2 | 2 |
| Northern gannet&* | *Morus bassanas* | 2 | 1 |
| Lesser black-backed gull* | *Larus fuscus* | 2 | 1 |
| Herring gull* | *Larus argentatus* | 2 | 1 |
| Iceland gull* | *Larus glaucoides* | 2 | 1 |
| Glaucous gull* | *Larus hyperboreus* | 2 | 1 |

| Species | Scientific name | Disturbance Susceptibility | Habitat Specialization |
|---|---|---|---|
| Black-headed gull* | *Chroicocephalus ridibundus* | 1 | 3 |
| Grey phalarope | *Phalaropus fulicarius* | 1 | 2 |
| Red-necked phalarope | *Phalaropus lobatus* | 1 | 2 |
| Pomarine skua | *Stercorarius pomarinus* | 1 | 2 |
| Arctic skua | *Stercorarius parasiticus* | 1 | 2 |
| Great skua | *Stercorarius skua* | 1 | 2 |
| Long-tailed skua | *Stercorarius longicaudus* | 1 | 2 |
| Northern fulmar | *Fulmaris glacialis* | 1 | 1 |
| Cory's shearwater | *Calonectris diomedea* | 1 | 1 |
| Great shearwater | *Puffinus gravis* | 1 | 1 |
| Sooty shearwater | *Puffinus griseus* | 1 | 1 |
| Manx shearwater | *Puffinus puffinus* | 1 | 1 |
| Balearic shearwater | *Puffinus mauretanicus* | 1 | 1 |
| Wilson's storm petrel | *Oveanites oceanites* | 1 | 1 |
| European storm petrel | *Hydrobates pelagicus* | 1 | 1 |
| Leach's storm petrel | *Oceanodroma leucorhoa* | 1 | 1 |

& Species to be progressed to 'Matrix Approach' regardless of scores, due to more recent empirical data (see main text for references).
† Species not usually to be progressed to 'Matrix Approach', due to more recent empirical data demonstrating frequent attraction to OWFs (see main text for references).
* Species where some age class differentiation is expected in survey counts.
$ Species where buffer distance for assessment would be 4 km (2 km being the default for others).

In previous SNCB advice on displacement assessment (NE and JNCC 2012), a 1% threshold of regional population scales was given as a guide for species to be taken forward to quantitative displacement assessment, with the exception of those species with a significant element of turnover (i.e. passage migrants, which might be undercounted). This is no longer recommended as a suitable guide due to the potential for species to be screened out of predictive displacement impact assessments at an individual project level, which might otherwise have been flagged as an issue at the CIA level.

There is an issue with how to appropriately treat species that are more likely to be encountered in development areas as passage migrants (i.e. likely to be transiting through the area and where there may be a high degree of turnover of individuals at a particular site). For these types of species (e.g. skuas and shearwaters) it might be predicted that, as individuals are using the development area only briefly and rarely, they might be more realistically examined solely from the perspective of barrier effects. However, as there is no standardised method for examining barrier effects (albeit some developers have developed useful passage migrant models to predict impacts, largely for collision, on these types of species) we recommend that if turnover is thought to be an issue for a given species at a particular site, this be considered on a site-by-site basis.

## 6. Displacement buffers

Seabirds showing avoidance reactions to OWF areas may not only be displaced from the footprint itself, but may also be displaced (possibly to a lesser degree) from the surrounding area (or buffer zone). This additional area must be considered, alongside the OWF site footprint, and included in any displacement assessment.

SNCBs recommend for most species a **standard displacement buffer of 2 km** with the exception of the species groups of divers and sea ducks. Divers and sea ducks have been assessed as being the most sensitive species groups to offshore development and associated boat and helicopter traffic. **Therefore for divers and sea ducks a 4 km displacement buffer** is recommended. This is based on evidence of displacement distances which extend beyond 2km for those species groups (e.g. Percival 2010; Kaiser 2002; Percival 2014; Petersen *et al*. 2006; Fox & Petersen 2006; Petersen *et al.* 2013).

The SNCBs acknowledge that the evidence for displacement effects leading to reduced densities post-construction beyond 2km from operational wind farms in these sensitive species is mixed but note that there is some evidence of displacement effects up to at least 3km (Percival 2010), and even up to 13km (Petersen *et al.* 2014). Extrapolation of the evidence from Percival (2010) suggests an effect that may radiate out to 5.5km before post-construction densities match those pre-construction. While this is an extrapolation, this effect is considerably less than the extent of significant reductions in diver density reported around Horns Rev (Petersen *et al.* 2013). SNCBs acknowledge that in reality there is likely to be a gradient in the reduction of density with increasing distance from OWF site, but the evidence regarding the slope of this gradient beyond 2km is limited. Until further evidence is gathered, it is recommended that a standard displacement level (%) is applied out to 4km for these more sensitive species groups.

**SNCB advice section – use of buffer zones for Offshore Wind Farms**

All species taken forward to the matrix stage of displacement assessment should be assessed against impacts to development site plus appropriate buffer. For most species the buffer should be 2km outside the OWF footprint. Exceptions for more sensitive species (i.e. divers and sea ducks) require a 4km buffer zone be applied. In both cases no gradient of impact of displacement level should be applied to the buffer zone, as there is not sufficient evidence to underpin any such gradient application on a species-by-species basis. However, as displacement levels in some instances may exceed 4km, the SNCBs feel this flat application of displacement level across the OWF site plus buffer is sufficiently precautionary.

## 7. Displacement levels

There is a small but increasing evidence-base on species-specific displacement levels from post-construction monitoring of OWFs. However, at present the published evidence remains sparse and often contradictory. SNCBs consequently need to ensure adequate precaution while at the same time taking due account of emerging evidence. Therefore, developers are encouraged to seek and present emerging sources of empirical evidence to provide support for their displacement assessment.

In the face of limited empirical evidence regarding the percentage of individuals likely to be displaced from an OWF footprint and buffer, SNCBs recommend that the full range of potential displacement (from 0% to 100% of the mean seasonal peak bird numbers observed pre-construction) is presented within a ‘Matrix Approach’ (see Section 12 for further details). The values should be presented in 10% intervals. Matrix tables should be presented with and without appropriate buffer data included, to allow for future changes in understanding regarding buffer zones and effects.

Presentation of 0-100% displacement levels in a matrix is a necessary step for all species taken forward to this stage of the assessment, in the face of current levels of uncertainty. However, it may be appropriate to highlight particular sections within the matrix where displacement levels are most likely to fall (i.e. through interpretation of the 'Disturbance Susceptibility' scores and/or reliable empirical data for a given species). Sufficient evidence should be presented to support selection of any highlighted area within the matrix on a species-by-species basis. Moreover, presentation of the full range of figures should not be interpreted as an indication that the SNCBs will inevitably focus their attention and formulate their advice on the most precautionary scenario.

The use of the collected age class data does not occur at the matrix stage, where the total number of full-grown birds is used. Later stages of the process may use the age data to refine what the impacts to sub-sets of the development site population will be.

## 8. Translating 'Disturbance Susceptibility' scores into displacement levels for 'Matrix Approach'

The 'Disturbance Susceptibility' scores from ship and helicopter traffic (and to a lesser extent OWF) in Bradbury *et al.* (2014) (Table 1) give a possible indication of potential displacement levels that may be exhibited by each species. Without any additional evidence it is assumed that the scores give a crude, but useful, approximation of the levels of displacement that may be experienced by seabirds and can be used to inform the most likely range of displacement for a given species). However, the SNCBs would note that further evidence is emerging that may confirm or suggest future modification to these scores and likely displacement levels (e.g. Wade *et al. 2016*).

**SNCB advice section – translating 'Disturbance Susceptibility' scores**

The SNCBs intend to use 'Disturbance Susceptibility' scores as a general guide to appropriate displacement levels on a species-by-species basis, rather than to prescriptively read across to particular levels of displacement. That said, for those species lacking in empirical data on likely displacement levels resulting from OWF construction, there is potential utility in using the scores in order to maintain consistency of approach across different developments (where appropriate). For example, for auk species the SNCBs would typically advise a displacement level of 30-70% (Guillemot and Razorbill have a 'Disturbance Susceptibility' score of 3). For diver species a displacement level of 90-100% is likely to be advised (red-throated diver has a 'Disturbance Susceptibility' score of 5 and empirical studies report high levels of displacement). Some species with 'Disturbance Susceptibility' scores of 1 (e.g. northern fulmar) may not be displaced or hardly displaced. If assessment of these species is recommended in a particular case, usually a displacement level of 10% or less is assumed.

## 9. Displacement impacts - adult mortality and productivity

Displaced individuals, and other individuals with which displaced birds subsequently interact and compete, may experience fitness consequences (i.e. changes to their likelihood of survival and level of reproductive output). Individual fitness may be impacted due to immediate increases in energy expenditure and/or reduced energy intake as a result of relocating to other foraging grounds and experiencing increased competition (an indirect impact resulting from localised habitat loss). Individual fitness may thus be impacted over longer time frames due to negatively affected energy budgets if birds have to relocate to alternative habitat. This impact might operate through increased intra/inter-specific competition due to a higher density of individuals competing for the same resources and/or through a lower quality/quantity of prey (e.g. Burton *et al*. 2006; Durell *et al*. 2001, 2000). This would result in an increase in the energetic cost of average foraging bouts and consequently to a change in daily energy and time budgets (McDonald *et al.* 2012; Searle *et al.* 2014). During the breeding season this in turn could lead to reduced chick provisioning rates and therefore reduced reproductive success. Young birds fledging at lower weights may also have reduced survival. The increased stress on adult birds that are provisioning chicks means they may end the breeding season in poorer condition than they otherwise would have. This might be expected to have consequences on adult survival during the rest of the year, particularly over winter.

However, there is a lack of empirical evidence on the consequence of displacement to seabirds, in terms of both their mortality and productivity. For other types of birds, e.g. waders, it has been established that displaced individuals are more likely to die than other individuals (Burton *et al.* 2006). Behaviour-based computer simulation models of waders, geese and sea ducks have also demonstrated that displacement can, through changes to the energy budgets of individuals, lead to changes to mortality levels (Pettifor *et al.* 2000; West *et al.* 2003; Kaiser *et al.* 2002). However, Topping and Petersen's model showed no such effects on wintering divers (Topping and Petersen 2011). Searle *et al.* (2014) have recently developed a simulation model that predicts changes to seabird productivity and adult survival arising from simulated displacement and barrier effects associated with OWFs in the Forth & Tay regions of Scotland. However, whether an impact on demographic rates is predicted by such models is highly dependent upon the particulars of the case being modeled and no simple generalities can be drawn.

It seems probable that the fitness consequences of displacement (in terms of productivity and mortality) might vary between stages of the annual life cycle. However, once again, empirical data on this is lacking. Until supporting data can be collected this is considered theoretically plausible but unproven.

**SNCB advice section – productivity impacts not assessed**

Due to the large degree of uncertainty regarding the impact of displacement on different components of seabird demography (for example, impacts on chick survival arising from displacement effects experienced by adult birds) the SNCBs currently advise that only **mortality of individuals displaced from the development site (plus buffer)** be considered in the 'Matrix Approach' at this time.

## 10. Selecting appropriate mortality levels for the 'Matrix Approach'

As highlighted in Section 9, Searle *et al.* (2014) demonstrated through simulation modelling, that displacement and barrier effects could impact both breeding season productivity and adult mortality throughout the year. However, as this model operated at an individual-based and colony level, it is not possible to directly translate percentages (of productivity and mortality) from this study into useful application with the 'Matrix Approach' as the latter is based on site-based abundance estimates.

Bird species showing limited flexibility in habitat use will be expected to experience greater fitness consequences from displacement compared to those species that are more generalised (at least in non-marine habitats e.g. Colles *et al*. 2009; Duraes *et al*. 2013). Therefore, the scores of species-specific 'Habitat Specialisation' (Table 1) can be used to provide an indication of the relative scale of mortality arising from displacement for each species. Species considered less flexible in their habitat use, are likely to be more vulnerable to displacement from favoured habitats. A high score for specialisation would therefore be expected to indicate a higher level of potential mortality.

Although it appears to be a sound principle, there is very little, if any, evidence connecting 'Habitat Specialization' scores (Bradbury *et al.* 2014) of individual species with potential mortality levels as a consequence of displacement. Therefore the SNCBs do not advise a standardised translation of these scores across to mortality percentages within the matrix. **It is recommended that the presentation of 0-100% mortality of displaced birds for all species taken forward to the matrix stage. Once again, this should be presented in 10% increments.** However, in acknowledgement that for some less constrained species (e.g. shearwaters) the level of both adult mortality and reduced productivity resulting from displacement are likely to be in the lower range (i.e. 1-10%) it is appropriate to have a finer gradation of percentage mortality impacts at the lower range of the scale (see Table 3).

While the SNCBs do not recommend a direct translation of the 'Habitat Specialisation' score into a specific mortality level, this information is still useful, when combined with expert opinion, as to the likely range of possible mortality impacts resulting from particular levels of displacement.

Finally, it is important to recognise and (qualitatively) account for the quality of habitat being lost at an OWF site and its importance relative to alternative available habitat, which displaced birds may reasonably utilise instead. Expert opinion on mortality levels should take account of site-specific characteristics in coming to a judgement on likely mortality levels. In future it is hoped that, with more empirical evidence linking displacement levels to mortality/productivity consequences, a more quantitative approach can be developed.

**SNCB advice section – mortality and productivity**

At present the 'Matrix Approach' should only be applied, in relation to **predicted adult mortality levels for birds present on the site (plus buffer)** for each defined season. In other words, a separate productivity matrix is not required at this time. However, this is something which may be revised in subsequent advice should suitable methods be developed along with an improved evidence-base. Appropriate **mortality levels** should be selected based on **expert opinion and in discussion with SNCBs**. The selected mortality levels should be appropriately precautionary, given it is currently intended to (qualitatively) address the potential population level impacts of displacement on both mortality and productivity combined.

As with displacement levels, **mortality levels should be presented for the full range of 0-100%**. However, for mortality the assessment should be presented at **10% increments, as well as 1% increments from 0-5%**, with expert opinion focusing in on highlighting likely potential ranges within this complete range.

## 11. Seasonality

In addition to the complexity introduced by the uncertainty over likely impacts to different demographic parameters (i.e. mortality versus productivity), there is also the potential for displacement levels and impacts to vary according to season. Given there is currently no empirical evidence on the impacts of displacement to seabirds, the SNCBs do not view it as appropriate at this time to apply varying mortality levels by season. This is because the theoretical arguments, as highlighted in previous sections, regarding breeding versus non-breeding season impacts, could be made in either direction. Therefore, the SNCBs recommend that, for the time being, seasonality in the assessment process, in terms of predicted impacts, should be treated consistently. However, the same need not apply to the treatment of varying abundance estimates for the OWF site (plus buffer) by season.

**SNCBs recommend that mean seasonal peak abundance be used to produce, as a minimum, two seasonal matrices (breeding and non-breeding season).** However, for a number of species there may be evidence to support an additional breakdown of the non-breeding period to account for periods when distribution, activity or population mix are distinctly different (for example post-breeding aggregations of some auk and sea duck species associated with flightless periods, migration periods etc.). Furness (2015) provides a guide to suggested seasonal divisions for a range of species based on evidence for distribution and abundance of species in UK offshore waters at different times of the year.

The ecology of several species supports a need to consider additional seasons (e.g. the post-breeding season) as a distinct period in their annual cycle, during which the impact of displacement may differ from other periods. A lack of empirical evidence requires that the full range of potential mortality (0 – 100%) be presented (albeit with a selected likely range of percentages being highlighted, according to the sensitivity score proxies, for example).

The predicted mortality levels should be summed across seasons. SNCBs acknowledge that this is a precautionary approach, as it is clearly possible that the same bird may be assessed more than once. However, since a large proportion of the birds present in the non-breeding season are often predicted to be different individuals from those present in the breeding season, assessing against different populations for each season is justified. The relevant SNCB should be contacted for advice on the appropriate population scale to use for each season. Therefore, in apportioning impacts back to SPA colonies (e.g. for HRA), only a small number of mortalities in the non-breeding season will be attributed to a particular colony decreasing the likelihood that these will be the same individuals that were assessed during the breeding season. Similarly, in assessing displacement impacts at a wider population scale (e.g. in EIA), it is assumed that individuals present in the project area in the breeding season will be dispersed over a much larger area during the non-breeding season. This reduces the probability that individuals present at the project site at that time will be the same individuals present in the breeding season. Methods that do not consider mortality impacts on populations across all seasons may result in potential impacts being underestimated.

**SNCB advice section – seasonality and summing across seasons**

The ‘Matrix Approach’ should be applied to a minimum of two seasons (breeding and non-breeding season) using mean seasonal peak abundance estimates for the OWF site (plus buffer). Where appropriate, additional matrix tables should be created for other discrete seasons (e.g. post breeding and migration periods for relevant species). However, decisions regarding how to treat seasonality in any displacement assessment should be made on a site and species-specific basis, in discussion with SNCBs.

When a multi-season assessment is taking place, the predicted mortalities from these various tables should be summed across seasons, **where the relevant geographical range and population scale remains the same or where the assessment involves apportioning back to an SPA colony**. However, an alternative approach for EIA may have to be taken where the appropriate population scale varies with each season. In these instances, the assessment of potential impacts may need to be undertaken against the most appropriate population scale, for each season in turn, although the default position is to assess the summed annual mortality against the largest population scale in the annual cycle for EIA.

## 12. ‘Matrix Approach’

Data on predicted displacement of seabirds from an OWF site should be presented in the form of a gridded matrix table (or tables) as shown below (Table 3). While presenting the full range of potential displacement and mortality impacts, SNCBs encourage developers to indicate their interpretation of the most likely displacement levels and mortality scenarios by highlighting a range of cells within the matrix, and simultaneously to provide sufficient empirical/modelling evidence to support any highlighted subset of cells.

SNCBs also advise that a range of displacement values are taken through to the assessment of population impacts and not a single figure. The range of population impacts can then also be presented as a matrix so that those levels of displacement which might exceed a particular level of population impact can be easily identified and evaluated. But if only a single figure can be taken forward, this in most cases should be the more precautionary of the sub-set selected (e.g. 20% displaced, 50% mortality, in the below example).

**Table 3. Example of Matrix Approach.** Cell entries present the estimated number of birds of a given species predicted to be at risk of adult mortality following displacement during a particular season given; i) the seasonal mean peak population within the impacted area (5,000 individuals in this example) ii) the proportion of those birds assumed to be displaced from the impact area; and iii) the assumed proportion of those birds deemed to be at risk of adult mortality as a result of displacement. Cells which are considered, in the light of empirical evidence, to represent the more realistic scenarios can be colour-coded with increasing intensity (shades of green in this instance).

| Species (season) | **Mortality Level (% of displaced birds that die)** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Displacement Level (% of all birds on site)** | | 0% | 1% | 2% | 3% | 4% | 5% | 10% | 15% | 20% | 30% | 50% | 80% | 100% |
| | 0% | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 10% | 0 | 5 | 10 | 15 | 20 | 25 | 50 | 75 | 100 | 150 | 250 | 400 | 500 |
| | 20% | 0 | 10 | 20 | 30 | 40 | 50 | 100 | 150 | 200 | 300 | 500 | 800 | 1000 |
| | 30% | 0 | 15 | 30 | 45 | 60 | 75 | 150 | 225 | 300 | 450 | 750 | 1200 | 1500 |
| | 40% | 0 | 20 | 40 | 60 | 80 | 100 | 200 | 300 | 400 | 600 | 1000 | 1600 | 2000 |
| | 50% | 0 | 25 | 50 | 75 | 100 | 125 | 250 | 375 | 500 | 750 | 1250 | 2000 | 2500 |
| | 60% | 0 | 30 | 60 | 90 | 120 | 150 | 300 | 450 | 600 | 900 | 1500 | 2400 | 3000 |
| | 70% | 0 | 35 | 70 | 105 | 140 | 175 | 350 | 525 | 700 | 1050 | 1750 | 2800 | 3500 |
| | 80% | 0 | 40 | 80 | 120 | 160 | 200 | 400 | 600 | 800 | 1200 | 2000 | 3200 | 4000 |
| | 90% | 0 | 45 | 90 | 135 | 180 | 225 | 450 | 675 | 900 | 1350 | 2250 | 3600 | 4500 |
| | 100% | 0 | 50 | 100 | 150 | 200 | 250 | 500 | 750 | 1000 | 1500 | 2500 | 4000 | 5000 |

**Note:** This matrix table would need to be replicated for each screened-in species, each season, and for the OWF site with and without buffer zones included (in terms of total abundance estimates).

In order to determine whether the figures presented in tables (e.g. Table 3 above) are likely to lead to population level effects (i.e. changes to population abundance) it will be necessary to determine which reference population scale(s) (or BDMPS) it is appropriate to relate these predicted displacement impacts to. This will vary between EIA and HRA processes as well as sites and seasons and may range from the breeding population of a species at a single designated site to a north-west European biogeographic migratory or wintering population of a species, possibly even wider. Note that in the case of HRA, where displacement effects take place within areas that are known to be used or likely to be used by birds associated with particular SPAs, assessment of the overall figures must be made at the scale of the populations of each of those individual SPAs (apportioned where necessary between SPAs). The relevant SNCB should be contacted for advice on the appropriate population scale for a given season. For project proposals in English, Irish or Welsh waters the respective SNCBs recommend consideration should be given to the Natural England and JNCC advice on Habitats Regulations Assessment (HRA) screening for seabirds in the breeding season (NE & JNCC 2013) and the non-breeding season populations of seabirds in UK waters report by Furness (2015), when considering appropriate population scales for a given season, for an HRA. For project proposals in Scottish waters, advice should be sought from Scottish Natural Heritage (SNH) on the appropriate population scale to use for each season.

Therefore, unless one particular population scale can be identified as being the only one appropriate to consider for a particular species/season/site combination, the numbers presented in the tables outlined above are thereafter considered in the context of a range of possible reference populations (but see separate guidance on these elements).

## 13. Combining collision impacts and displacement impacts

The number of birds at risk of reduced individual fitness (i.e. mortality and productivity losses) as a result of displacement is based on the numbers of birds present within a development area and buffer both on the water and in flight. Assessment of the number of birds at risk of mortality as a result of collisions (e.g. with wind turbines) is based on the number of birds present within a development area that are in flight only. The mortality impacts estimated from CRM are assumed to be in addition to any mortality caused by displacement impacts. Productivity impacts due to displacement would be a further addition (but this is not currently quantitatively accounted for under existing methods/advice).

Therefore, at present, the SNCBs regard the **two impacts (collision and displacement) as additive and advise that they should be summed**. In summing the predicted mortalities that arise via these two mechanisms, there is a risk of some degree of double counting as a bird that collides with a turbine cannot be displaced and vice versa. Thus, it is acknowledged that this simplistic approach will therefore incorporate a degree of precaution. The level of precaution is difficult to gauge, but will be highest when the number of birds recorded flying at turbine height (and therefore the predicted number of collisions) is greatest.
SNCBs are seeking further evidence from ongoing and proposed studies into avoidance rates that will help clarify the relationship between collision risk, displacement and so called 'macro' avoidance. A recent review of avoidance rates has been completed by the BTO on behalf of Marine Scotland (Cook *et al.* 2014). At some point in the future it is possible that SNCB advice may revisit this additive approach, in light of more advanced techniques for discriminating between birds in flight and birds on the water (in terms of pre-construction abundance data) and between barrier, macro-avoidance and displacement effects.

## 14. Cumulative impact assessment for displacement

While there is currently no established standardised method for undertaking a CIA process for displacement (or for collision), the **SNCBs recommend that a similar approach be taken to additively combining multiple project's displacement impacts, to that undertaken for a single project.** In other words, for projects undertaking a CIA for displacement across multiple projects, provided density information and OWF site footprint data (plus appropriate buffer zones) are available, it should be feasible to standardise displacement assessment approaches across even historic projects. Ideally, historic projects will have conducted a displacement assessment along similar lines to those laid out in this interim displacement advice note. However, it is recognised that there are likely to be discrepancies, in terms of variation in displacement levels used for different species, as well as likely mortality levels, and seasons presented, etc.

Several North Sea developers have now undertaken cumulative and in-combination displacement impact assessments for a range of species. Moreover, they have also applied a method to calculate predicted displacement impacts for historic projects that did not present displacement figures for particular species – See:
http://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010051/2.%20Post-Submission/Representations/ExA%20Questions/20-11-2014%20-%20ExA%20Second%20Written%20Questions/Forewind%20-%20Final%20HRA%20In-combination%20ornithology%20tables.pdf

Use of such methods (or refinement of displacement assessments from historic projects required to feed into CIA for future OWF development applications) should be done in consultation with the SNCBs. Finally, it is not within the scope of this displacement advice note to address all aspects of cumulative assessment. Guidance is available to assist with this elsewhere (King *et al*. 2009).

**SNCB advice section – assessing cumulative displacement impacts**

In broad terms, displacement impacts from different OWF development sites (plus appropriate buffer zones) should be considered cumulatively (i.e. additively). Any differences in assumptions about species sensitivity to displacement or habitat flexibility between individual project sites should be clearly identified, explained and agreed with SNCBs prior to further analysis. All areas should be assumed to be at carrying capacity, unless there is specific evidence to the contrary. Where displacement assessments may have varied between historic and more recent projects, efforts should be made to standardise approaches. If necessary historic assessments and matrices should be revisited to re-analyse site-based abundance data and bring it into line with current thinking on likely displacement levels, mortality rates, seasons and buffer zones for relevant species.

## 15. Future development of a 'Displacement Assessment Framework '(DAF)

Several areas of displacement (and barrier) impact assessment remain problematic and there is a need for further investigation and gathering of empirical evidence to support decisions. Nearly all aspects of the assessment of displacement and barrier impacts would benefit from robust and rigorous post-consent monitoring.

The SNCBs recognise that, in several areas, the current document outlines an approach that incorporates high levels of uncertainty. As a consequence aspects of the advised method may be somewhat precautionary (although this does depend on the selection of appropriate displacement and mortality levels within the matrix tables).

Displacement assessment methods are an area of active interest for industry, SNCBs and regulators and needs to be reflected in post-consent monitoring where displacement effects remain uncertain. This joint SNCB interim displacement advice note will be reviewed and updated when new information or approaches are brought to light.

As captured in recommendations from a recent Displacement Workshop (May 2015) organised by JNCC and the MROG, this joint SNCB advice note is intended to address only a short-term gap in advice provision and standardisation of DAF methods within the OWF industry sector. It is anticipated that further steps, with regards to both medium and long-term displacement method development and advice, will follow the publication of this note. Recommendations from the Displacement Workshop are currently being progressed through MROG and SNCB discussions with industry. It is anticipated that further displacement advice revisions may be produced by the SNCBs jointly in the next year.

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This advice note was prepared by the Marine Industry Group for ornithology (MIG-Birds), with contributions from Joint Nature Conservation Committee, Natural England, Natural Resources Wales, Northern Ireland Environment Agency and Scottish Natural Heritage

JNCC
Joint Nature Conservation Committee

Cyfoeth Naturiol Cymru
Natural Resources Wales

NATURAL ENGLAND

Scottish Natural Heritage
Dualchas Nàdair na h-Alba
All of nature for all of Scotland
Nàdar air fad airson Alba air fad

NIEA Northern Ireland Environment Agency
www.daera-ni.gov.uk

An Agency within the Department of
Agriculture, Environment and Rural Affairs
www.daera-ni.gov.uk

INVESTORS IN PEOPLE

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## Appendix 1: - Links to guidance on associated topics.

### SNH Guidance

Recommendations for the presentation and content of interim marine bird, mammal and basking shark survey reports for marine renewable energy developments. **Available at <**http://www.snh.gov.uk/docs/A1325759.pdf > Accessed 23 March 2016.

Guidance on Methods for Monitoring Bird Populations at Onshore Wind Farms. Available at <http://www.snh.gov.uk/docs/C205417.pdf> Accessed 23 March 2016.

### The Crown Estate Guidance

Guide to an onshore wind farm. Available at <http://www.thecrownestate.co.uk/media/5408/ei-a-guide-to-an-offshore-wind-farm.pdf> Accessed 23 March 2016

Towards Standardised seabirds at-sea census techniques in connection with environmental impact assessments for offshore wind farms in the UK. Available at <http://www.thecrownestate.co.uk/media/6001/2004-04%20Towards%20standardised%20seabirds%20at%20sea%20census%20techniques%20in%20connection%20with%20environmental%20impact%20assessments%20for%20offshore%20wind%20farms%20in%20the%20UK.pdf> Accessed 23 March 2016

### COWRIE reports

Available at <http://www.thecrownestate.co.uk/media/5491/cowrie_reports_held_by_the_crown_estate.pdf > Accessed 23 March 2016

### RSPB Information

Offshore wind farms and birds : Round 3 zones . Available at <http://www.rspb.org.uk/Images/langston_2010_tcm9-203501.pdf> Accessed 23 March 2016

### SOSS Projects

Available at <http://www.bto.org/science/wetland-and-marine/soss/projects > Accessed 23 March 2016

# NATURA 2000 – STANDARD DATA FORM

## Special Areas of Conservation under the EC Habitats Directive (includes candidate SACs, Sites of Community Importance and designated SACs).

Each Natura 2000 site in the United Kingdom has its own Standard Data Form containing site-specific information. The data form for this site has been generated from the Natura 2000 Database submitted to the European Commission on the following date:

22/12/2015

The information provided here, follows the officially agreed site information format for Natura 2000 sites, as set out in the Official Journal of the European Union recording the Commission Implementing Decision of 11 July 2011 (2011/484/EU).

The Standard Data Forms are generated automatically for all of the UK's Natura 2000 sites using the European Environment Agency's Natura 2000 software. The structure and format of these forms is exactly as produced by the EEA's Natura 2000 software (except for the addition of this coversheet and the end notes). The content matches exactly the data submitted to the European Commission.

Please note that these forms contain a number of codes, all of which are explained either within the data forms themselves or in the end notes.

Further technical documentation may be found here
http://bd.eionet.europa.eu/activities/Natura_2000/reference_portal

As part of the December 2015 submission, several sections of the UK's previously published Standard Data Forms have been updated. For details of the approach taken by the UK in this submission please refer to the following document:
http://jncc.defra.gov.uk/pdf/Natura2000_StandardDataForm_UKApproach_Dec2015.pdf

More general information on Special Areas of Conservation (SACs) in the United Kingdom is available from the SAC home page on the JNCC website. This webpage also provides links to Standard Data Forms for all SACs in the UK.

Date form generated by the Joint Nature Conservation Committee
25 January 2016.

# NATURA 2000 - STANDARD DATA FORM

**For Special Protection Areas (SPA), Proposed Sites for Community Importance (pSCI), Sites of Community Importance (SCI) and for Special Areas of Conservation (SAC)**

SITE **UK0013107**

SITENAME **Thanet Coast**

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## 1. SITE IDENTIFICATION

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| 1.1 Type | 1.2 Site code |
|---|---|
| B | UK0013107 |

### 1.3 Site name

Thanet Coast

| 1.4 First Compilation date | 1.5 Update date |
|---|---|
| 1996-10 | 2015-12 |

### 1.6 Respondent:

| | |
|---|---|
| **Name/Organisation:** | Joint Nature Conservation Committee |
| **Address:** | Joint Nature Conservation Committee Monkstone House City Road Peterborough PE1 1JY |
| **Email:** | |

| | |
|---|---|
| **Date site proposed as SCI:** | 1996-10 |
| **Date site confirmed as SCI:** | 2004-12 |
| **Date site designated as SAC:** | 2005-04 |
| **National legal reference of SAC designation:** | Regulations 11 and 13-15 of the Conservation of Habitats and Species Regulations 2010 (http://www.legislation.gov.uk/uksi/2010/490/contents/made). |

## 2. SITE LOCATION

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### 2.1 Site-centre location [decimal degrees]:

| Longitude | Latitude |
|---|---|
| 1.375833333 | 51.39 |

| 2.2 Area [ha]: | 2.3 Marine area [%] |
|---|---|
| 2815.95 | 98.3 |

**2.4 Sitelength [km]:**

0.0

### 2.5 Administrative region code and name

| NUTS level 2 code | Region Name |
|---|---|
| UKJ4 | Kent |

### 2.6 Biogeographical Region(s)

Atlantic (100.0 %)

## 3. ECOLOGICAL INFORMATION

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### 3.1 Habitat types present on the site and assessment for them

| Annex I Habitat types | | | | | | Site assessment | | | |
|---|---|---|---|---|---|---|---|---|---|
| Code | PF | NP | Cover [ha] | Cave [number] | Data quality | A\|B\|C\|D | A\|B\|C | | |
| | | | | | | Representativity | Relative Surface | Conservation | Global |
| 1110 | | | 1633.25 | | G | D | | | |
| 1140 | | | 281.59 | | M | D | | | |
| 1170 | | | 901.1 | | M | A | C | B | B |
| 8330 | | | 28.16 | | P | A | C | A | B |

- **PF:** for the habitat types that can have a non-priority as well as a priority form (6210, 7130, 9430) enter "X" in the column PF to indicate the priority form.
- **NP:** in case that a habitat type no longer exists in the site enter: x (optional)
- **Cover:** decimal values can be entered
- **Caves:** for habitat types 8310, 8330 (caves) enter the number of caves if estimated surface is not available.
- **Data quality:** G = 'Good' (e.g. based on surveys); M = 'Moderate' (e.g. based on partial data with some extrapolation); P = 'Poor' (e.g. rough estimation)

# 4. SITE DESCRIPTION

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## 4.1 General site character

| Habitat class | % Cover |
|---|---|
| N01 | 87.0 |
| N05 | 3.0 |
| N02 | 10.0 |
| **Total Habitat Cover** | 100 |

### Other Site Characteristics

2 Terrestrial: Geomorphology and landscape: coastal 3 Marine: Geology: cobble,limestone/chalk,chert/flint,sand,mud 4 Marine: Geomorphology: subtidal rock (including rocky reefs),subtidal sediments (including sandbank/mudbank),open coast (including bay),intertidal sediments (including sandflat/mudflat),intertidal rock,cave/tunnel,cliffs

## 4.2 Quality and importance

Reefs for which this is considered to be one of the best areas in the United Kingdom. Submerged or partially submerged sea caves for which this is considered to be one of the best areas in the United Kingdom.

## 4.3 Threats, pressures and activities with impacts on the site

The most important impacts and activities with high effect on the site

| Negative Impacts | | | |
|---|---|---|---|
| Rank | Threats and pressures [code] | Pollution (optional) [code] | inside/outside [i\|o\|b] |
| H | I01 | | B |
| H | H02 | | B |
| H | G01 | | I |
| H | J02 | | B |
| H | M02 | | B |

| Positive Impacts | | | |
|---|---|---|---|
| Rank | Activities, management [code] | Pollution (optional) [code] | inside/outside [i\|o\|b] |

Rank: H = high, M = medium, L = low
Pollution: N = Nitrogen input, P = Phosphor/Phosphate input, A = Acid input/acidification,
T = toxic inorganic chemicals, O = toxic organic chemicals, X = Mixed pollutions
i = inside, o = outside, b = both

## 4.5 Documentation

Conservation Objectives - the Natural England links below provide access to the Conservation Objectives (and other site-related information) for its terrestrial and inshore Natura 2000 sites, including conservation advice packages and supporting documents for European Marine Sites within English waters and for cross-border sites. See also the 'UK Approach' document for more information (link via the JNCC website).

Link(s): http://jncc.defra.gov.uk/pdf/Natura2000_StandardDataForm_UKApproach_Dec2015.pdf

http://publications.naturalengland.org.uk/category/3212324
http://publications.naturalengland.org.uk/category/6490068894089216

# 5. SITE PROTECTION STATUS (optional)

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## 5.1 Designation types at national and regional level:

| Code | Cover [%] | Code | Cover [%] | Code | Cover [%] |
|---|---|---|---|---|---|
| UK04 | 100.0 | | | | |

## 6. SITE MANAGEMENT

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### 6.1 Body(ies) responsible for the site management:

| | |
|---|---|
| Organisation: | Natural England |
| Address: | |
| Email: | |

### 6.2 Management Plan(s):

An actual management plan does exist:

| | |
|---|---|
| [ ] | Yes |
| [ ] | No, but in preparation |
| X | No |

### 6.3 Conservation measures (optional)

For available information, including on Conservation Objectives, see Section 4.5.

# EXPLANATION OF CODES USED IN THE NATURA 2000 STANDARD DATA FORMS

The codes in the table below are also explained in the official European Union guidelines for the Standard Data Form. The relevant page is shown in the table below.

## 1.1 Site type

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| A | Designated Special Protection Area | 53 |
| B | SAC (includes candidates Special Areas of Conservation, Sites of Community Importance and designated SAC) | 53 |
| C | SAC area the same as SPA. Note in the UK Natura 2000 submission this is only used for Gibraltar | 53 |

## 3.1 Habitat representativity

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| A | Excellent | 57 |
| B | Good | 57 |
| C | Significant | 57 |
| D | Non-significant presence | 57 |

## 3.1 Habitat code

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| 1110 | Sandbanks which are slightly covered by sea water all the time | 57 |
| 1130 | Estuaries | 57 |
| 1140 | Mudflats and sandflats not covered by seawater at low tide | 57 |
| 1150 | Coastal lagoons | 57 |
| 1160 | Large shallow inlets and bays | 57 |
| 1170 | Reefs | 57 |
| 1180 | Submarine structures made by leaking gases | 57 |
| 1210 | Annual vegetation of drift lines | 57 |
| 1220 | Perennial vegetation of stony banks | 57 |
| 1230 | Vegetated sea cliffs of the Atlantic and Baltic Coasts | 57 |
| 1310 | Salicornia and other annuals colonizing mud and sand | 57 |
| 1320 | Spartina swards (Spartinion maritimae) | 57 |
| 1330 | Atlantic salt meadows (Glauco-Puccinellietalia maritimae) | 57 |
| 1340 | Inland salt meadows | 57 |
| 1420 | Mediterranean and thermo-Atlantic halophilous scrubs (Sarcocornetea fruticosi) | 57 |
| 2110 | Embryonic shifting dunes | 57 |
| 2120 | Shifting dunes along the shoreline with Ammophila arenaria ("white dunes") | 57 |
| 2130 | Fixed coastal dunes with herbaceous vegetation ("grey dunes") | 57 |
| 2140 | Decalcified fixed dunes with Empetrum nigrum | 57 |
| 2150 | Atlantic decalcified fixed dunes (Calluno-Ulicetea) | 57 |
| 2160 | Dunes with Hippopha� rhamnoides | 57 |
| 2170 | Dunes with Salix repens ssp. argentea (Salicion arenariae) | 57 |
| 2190 | Humid dune slacks | 57 |
| 21A0 | Machairs (* in Ireland) | 57 |
| 2250 | Coastal dunes with Juniperus spp. | 57 |
| 2330 | Inland dunes with open Corynephorus and Agrostis grasslands | 57 |
| 3110 | Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae) | 57 |
| 3130 | Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Isoëto-Nanojuncetea | 57 |
| 3140 | Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. | 57 |
| 3150 | Natural eutrophic lakes with Magnopotamion or Hydrocharition - type vegetation | 57 |

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| 3160 | Natural dystrophic lakes and ponds | 57 |
| 3170 | Mediterranean temporary ponds | 57 |
| 3180 | Turloughs | 57 |
| 3260 | Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation | 57 |
| 4010 | Northern Atlantic wet heaths with Erica tetralix | 57 |
| 4020 | Temperate Atlantic wet heaths with Erica ciliaris and Erica tetralix | 57 |
| 4030 | European dry heaths | 57 |
| 4040 | Dry Atlantic coastal heaths with Erica vagans | 57 |
| 4060 | Alpine and Boreal heaths | 57 |
| 4080 | Sub-Arctic Salix spp. scrub | 57 |
| 5110 | Stable xerothermophilous formations with Buxus sempervirens on rock slopes (Berberidion p.p.) | 57 |
| 5130 | Juniperus communis formations on heaths or calcareous grasslands | 57 |
| 6130 | Calaminarian grasslands of the Violetalia calaminariae | 57 |
| 6150 | Siliceous alpine and boreal grasslands | 57 |
| 6170 | Alpine and subalpine calcareous grasslands | 57 |
| 6210 | Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites) | 57 |
| 6230 | Species-rich Nardus grasslands, on silicious substrates in mountain areas (and submountain areas in Continental Europe) | 57 |
| 6410 | Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae) | 57 |
| 6430 | Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels | 57 |
| 6510 | Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis) | 57 |
| 6520 | Mountain hay meadows | 57 |
| 7110 | Active raised bogs | 57 |
| 7120 | Degraded raised bogs still capable of natural regeneration | 57 |
| 7130 | Blanket bogs (* if active bog) | 57 |
| 7140 | Transition mires and quaking bogs | 57 |
| 7150 | Depressions on peat substrates of the Rhynchosporion | 57 |
| 7210 | Calcareous fens with Cladium mariscus and species of the Caricion davallianae | 57 |
| 7220 | Petrifying springs with tufa formation (Cratoneurion) | 57 |
| 7230 | Alkaline fens | 57 |
| 7240 | Alpine pioneer formations of the Caricion bicoloris-atrofuscae | 57 |
| 8110 | Siliceous scree of the montane to snow levels (Androsacetalia alpinae and Galeopsietalia ladani) | 57 |
| 8120 | Calcareous and calcshist screes of the montane to alpine levels (Thlaspietea rotundifolii) | 57 |
| 8210 | Calcareous rocky slopes with chasmophytic vegetation | 57 |
| 8220 | Siliceous rocky slopes with chasmophytic vegetation | 57 |
| 8240 | Limestone pavements | 57 |
| 8310 | Caves not open to the public | 57 |
| 8330 | Submerged or partially submerged sea caves | 57 |
| 9120 | Atlantic acidophilous beech forests with Ilex and sometimes also Taxus in the shrublayer (Quercion robori-petraeae or Ilici-Fagenion) | 57 |
| 9130 | Asperulo-Fagetum beech forests | 57 |
| 9160 | Sub-Atlantic and medio-European oak or oak-hornbeam forests of the Carpinion betuli | 57 |
| 9180 | Tilio-Acerion forests of slopes, screes and ravines | 57 |
| 9190 | Old acidophilous oak woods with Quercus robur on sandy plains | 57 |
| 91A0 | Old sessile oak woods with Ilex and Blechnum in the British Isles | 57 |
| 91C0 | Caledonian forest | 57 |
| 91D0 | Bog woodland | 57 |
| 91E0 | Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) | 57 |
| 91J0 | Taxus baccata woods of the British Isles | 57 |

## 3.1 Relative surface

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| A | 15%-100% | 58 |
| B | 2%-15% | 58 |
| C | < 2% | 58 |

## 3.1 Conservation status habitat

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| A | Excellent conservation | 59 |
| B | Good conservation | 59 |
| C | Average or reduced conservation | 59 |

## 3.1 Global grade habitat

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| A | Excellent value | 59 |
| B | Good value | 59 |
| C | Significant value | 59 |

## 3.2 Population (abbreviated to 'Pop.' in data form)

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| A | 15%-100% | 62 |
| B | 2%-15% | 62 |
| C | < 2% | 62 |
| D | Non-significant population | 62 |

## 3.2 Conservation status species (abbreviated to 'Con.' in data form)

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| A | Excellent conservation | 63 |
| B | Good conservation | 63 |
| C | Average or reduced conservation | 63 |

## 3.2 Isolation (abbreviated to 'Iso.' in data form)

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| A | Population (almost) Isolated | 63 |
| B | Population not-isolated, but on margins of area of distribution | 63 |
| C | Population not-isolated within extended distribution range | 63 |

## 3.2 Global Grade (abbreviated to 'Glo.' Or 'G.' in data form)

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| A | Excellent value | 63 |
| B | Good value | 63 |
| C | Significant value | 63 |

## 3.3 Assemblages types

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| WATR | Non breeding waterfowl assemblage | UK specific code |
| SBA | Breeding seabird assemblage | UK specific code |
| BBA | Breeding bird assemblage (applies only to sites classified pre 2000) | UK specific code |

### 4.1 Habitat class code

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| N01 | Marine areas, Sea inlets | 65 |
| N02 | Tidal rivers, Estuaries, Mud flats, Sand flats, Lagoons (including saltwork basins) | 65 |
| N03 | Salt marshes, Salt pastures, Salt steppes | 65 |
| N04 | Coastal sand dunes, Sand beaches, Machair | 65 |
| N05 | Shingle, Sea cliffs, Islets | 65 |
| N06 | Inland water bodies (Standing water, Running water) | 65 |
| N07 | Bogs, Marshes, Water fringed vegetation, Fens | 65 |
| N08 | Heath, Scrub, Maquis and Garrigue, Phygrana | 65 |
| N09 | Dry grassland, Steppes | 65 |
| N10 | Humid grassland, Mesophile grassland | 65 |
| N11 | Alpine and sub-Alpine grassland | 65 |
| N14 | Improved grassland | 65 |
| N15 | Other arable land | 65 |
| N16 | Broad-leaved deciduous woodland | 65 |
| N17 | Coniferous woodland | 65 |
| N19 | Mixed woodland | 65 |
| N21 | Non-forest areas cultivated with woody plants (including Orchards, groves, Vineyards, Dehesas) | 65 |
| N22 | Inland rocks, Screes, Sands, Permanent Snow and ice | 65 |
| N23 | Other land (including Towns, Villages, Roads, Waste places, Mines, Industrial sites) | 65 |
| N25 | Grassland and scrub habitats (general) | 65 |
| N26 | Woodland habitats (general) | 65 |

### 4.3 Threats code

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| A01 | Cultivation | 65 |
| A02 | Modification of cultivation practices | 65 |
| A03 | Mowing / cutting of grassland | 65 |
| A04 | Grazing | 65 |
| A05 | Livestock farming and animal breeding (without grazing) | 65 |
| A06 | Annual and perennial non-timber crops | 65 |
| A07 | Use of biocides, hormones and chemicals | 65 |
| A08 | Fertilisation | 65 |
| A10 | Restructuring agricultural land holding | 65 |
| A11 | Agriculture activities not referred to above | 65 |
| B01 | Forest planting on open ground | 65 |
| B02 | Forest and Plantation management & use | 65 |
| B03 | Forest exploitation without replanting or natural regrowth | 65 |
| B04 | Use of biocides, hormones and chemicals (forestry) | 65 |
| B06 | Grazing in forests/ woodland | 65 |
| B07 | Forestry activities not referred to above | 65 |
| C01 | Mining and quarrying | 65 |
| C02 | Exploration and extraction of oil or gas | 65 |
| C03 | Renewable abiotic energy use | 65 |
| D01 | Roads, paths and railroads | 65 |
| D02 | Utility and service lines | 65 |
| D03 | Shipping lanes, ports, marine constructions | 65 |
| D04 | Airports, flightpaths | 65 |
| D05 | Improved access to site | 65 |
| E01 | Urbanised areas, human habitation | 65 |
| E02 | Industrial or commercial areas | 65 |

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| E03 | Discharges | 65 |
| E04 | Structures, buildings in the landscape | 65 |
| E06 | Other urbanisation, industrial and similar activities | 65 |
| F01 | Marine and Freshwater Aquaculture | 65 |
| F02 | Fishing and harvesting aquatic ressources | 65 |
| F03 | Hunting and collection of wild animals (terrestrial), including damage caused by game (excessive density), and taking/removal of terrestrial animals (including collection of insects, reptiles, amphibians, birds of prey, etc., trapping, poisoning, poaching, predator control, accidental capture (e.g. due to fishing gear), etc.) | 65 |
| F04 | Taking / Removal of terrestrial plants, general | 65 |
| F05 | Illegal taking/ removal of marine fauna | 65 |
| F06 | Hunting, fishing or collecting activities not referred to above | 65 |
| G01 | Outdoor sports and leisure activities, recreational activities | 65 |
| G02 | Sport and leisure structures | 65 |
| G03 | Interpretative centres | 65 |
| G04 | Military use and civil unrest | 65 |
| G05 | Other human intrusions and disturbances | 65 |
| H01 | Pollution to surface waters (limnic & terrestrial, marine & brackish) | 65 |
| H02 | Pollution to groundwater (point sources and diffuse sources) | 65 |
| H03 | Marine water pollution | 65 |
| H04 | Air pollution, air-borne pollutants | 65 |
| H05 | Soil pollution and solid waste (excluding discharges) | 65 |
| H06 | Excess energy | 65 |
| H07 | Other forms of pollution | 65 |
| I01 | Invasive non-native species | 65 |
| I02 | Problematic native species | 65 |
| I03 | Introduced genetic material, GMO | 65 |
| J01 | Fire and fire suppression | 65 |
| J02 | Human induced changes in hydraulic conditions | 65 |
| J03 | Other ecosystem modifications | 65 |
| K01 | Abiotic (slow) natural processes | 65 |
| K02 | Biocenotic evolution, succession | 65 |
| K03 | Interspecific faunal relations | 65 |
| K04 | Interspecific floral relations | 65 |
| K05 | Reduced fecundity/ genetic depression | 65 |
| L05 | Collapse of terrain, landslide | 65 |
| L07 | Storm, cyclone | 65 |
| L08 | Inundation (natural processes) | 65 |
| L10 | Other natural catastrophes | 65 |
| M01 | Changes in abiotic conditions | 65 |
| M02 | Changes in biotic conditions | 65 |
| U | Unknown threat or pressure | 65 |
| XO | Threats and pressures from outside the Member State | 65 |

## 5.1 Designation type codes

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| UK00 | No Protection Status | 67 |
| UK01 | National Nature Reserve | 67 |
| UK02 | Marine Nature Reserve | 67 |
| UK04 | Site of Special Scientific Interest (UK) | 67 |

Departmental brief:

# Outer Thames Estuary potential Special Protection Area

Natural England and JNCC

November 2015

Contents

# Summary

Outer Thames Estuary potential Special Protection Area (pSPA) detailed in this Departmental Brief is proposed to protect important areas of coast and sea used for a variety of purposes by the qualifying features. The new pSPA enlarges the existing Outer Thames Estuary SPA (classified solely for non-breeding red-throated divers *Gavia stellata*) to include three new areas identified for foraging terns breeding at other (already classified) SPAs on shore; these are parts of the Rivers Yare and Bure, a small riverine section at Minsmere, and both estuarine and marine areas around Foulness. The pSPA therefore comprises areas for foraging breeding seabirds and non-breeding waterbirds. The feature of the existing SPA is retained, and new qualifying features are added based on a review of up-to-date bird abundance information. The total area of the Outer Thames Estuary pSPA is approx. 391,910 ha (392km$^2$).

The two species of tern relevant to the pSPA are common tern *Sterna hirundo* and little tern *Sternula albifrons*. From north to south, the adjacent SPAs with these tern species as qualifying features (all little tern unless stated) are: Great Yarmouth North Denes SPA; Breydon Water SPA (common tern only); Benacre to Easton Bavents SPA; Minsmere – Walberswick SPA; Alde-Ore Estuary SPA; Foulness SPA (common tern and little tern); and Thanet Coast & Sandwich Bay SPA. In addition to these, common and little terns breeding at Scroby Sands, a sand bank completely contained within the pSPA, and other coastal nesting locations functionally linked to terrestrial SPAs, are included in determining the abundance of terns at the site.

However, Sandwich terns at the Alde-Ore Estuary and Foulness SPAs are not included in determining the details of the pSPA because the feature has been absent at these SPAs for too long to merit influencing the size and shape of the site (Wilson *et al*. 2014). Marine extensions to Hamford Water SPA are the subject of a separate Departmental Brief and do not influence the Outer Thames Estuary pSPA, whilst small numbers of little terns at Colne Estuary, Blackwater Estuary and Medway Estuary and Marshes SPAs are not expected to forage within the marine pSPA based on generic foraging models (Parsons *et al*. 2015).

This Departmental Brief makes use of the most recent available estimates of the population sizes of these species at these sites to derive the populations of birds supported by the pSPA. However, in respect of the existing classified (terrestrial) SPAs, this Departmental Brief does not make any proposal to add or remove qualifying features, amend baseline population figures, or alter site boundaries.

This Departmental Brief sets out the scientific case for the classification of the Outer Thames Estuary pSPA. This site qualifies under Article 4 of the Birds Directive (2009/147/EC) for the following reasons (summarised in Table 1):

The site regularly supports more than 1% of the Great Britain breeding populations of three species listed in Annex I of the Birds Directive. Therefore, the site qualifies for SPA classification in accordance with the UK SPA selection guidelines (stage 1.1).

**Table 1 Summary of qualifying ornithological interest in Outer Thames Estuary pSPA**

| Species | Count (period) | % of subspecies or population | Interest type | Selection criteria | Status of feature |
|---|---|---|---|---|---|
| Little tern *Sternula albifrons* (in breeding season) | 746 individuals (2011 – 2015) | 19.64% of GB population | Annex 1 | Stage 1.1 | New |
| Common tern *Sterna hirundo* (in breeding season) | 532 individuals (2011 – 2015) | 2.66% of GB population | Annex 1 | Stage 1.1 | new |
| Red-throated diver *Gavia stellata* (in non- breeding season) | 6,466 individuals (1989 – 2006/07)[1] | 38.0% of GB population | Annex 1 | Stage 1.1 | From existing SPA |

[1] Citation value from original Outer Thames Estuary SPA classification, 2010

# 1. Assessment against SPA selection guidelines

The UK SPA selection guidelines require that SPA identification should be determined in two stages (Stroud *et al*. 2001). The first stage is intended to identify areas that are likely to qualify for SPA status. The second stage further considers these areas using one or more of the judgements in Stage 2 to select the most suitable areas in number and size for SPA classification (Stroud *et al*. 2001).

## 1.1. Stage 1

Under stage 1 of the SPA selection guidelines (JNCC, 1999), sites eligible for selection as a potential SPA must demonstrate one or more of the following:

1) an area is used regularly by 1% or more of the Great Britain (or in Northern Ireland, the all-Ireland) population of a species listed in Annex I of the Birds Directive (2009/147/EC) in any season;
2) an area is used regularly by 1% or more of the biogeographical population of a regularly occurring migratory species (other than those listed in Annex I) in any season;
3) an area is used regularly by over 20,000 waterbirds (waterbirds as defined by the Ramsar Convention) or 20,000 seabirds in any season;
4) an area which meets the requirements of one or more of the Stage 2 guidelines in any season, where the application of Stage 1 guidelines 1, 2 or 3 for a species does not identify an adequate suite of most suitable sites for the conservation of that species.

Outer Thames Estuary pSPA qualifies under stage 1(1) because it regularly supports greater than 1% of the GB population of three Annex I species; two in the breeding season (little tern, common tern) and one in the non-breeding season (red-throated diver).

## 1.2. Stage 2

Outer Thames Estuary pSPA is assessed against Stage 2 of the SPA selection guidelines in Table 2. It should be noted that in applying the SPA selection guidelines, Stroud *et al.* (2001) note that a site which meets only one of these Stage 2 judgments is not considered any less preferable than a site which meets several of them, as the factors operate independently as indicators of the various different kinds of importance that a site may have. The pSPA meets most of the Stage 2 criteria indicating the different kinds of importance the site holds.

**Table 2.** Assessment of the bird interest against stage 2 of the SPA selection guidelines.

| Feature | Qualification | Assessment |
|---|---|---|
| 1. Population size & density | ✓ | The site supports comfortably the largest aggregation of red-throated divers in the UK (O'Brien *et al*. 2008). It also supports foraging areas for nearly 20% of the GB population of little terns, and nearly 3% of the GB population of common terns. |
| 2. Species range | ✓ | The pSPA is the main non-breeding area for red-throated divers in the UK, and is the most south-easterly of sites classified or under consideration. Similarly, south east England supports the bulk of the UK's breeding little terns (Mitchell *et al*. 2004) and the pSPA provides for foraging in this crucial part of their range. |
| 3. Breeding success | ✓ | Little tern productivity at some colonies contributing to the pSPA has exceeded the UK average of 0.51 chicks per pair (Cook & Robinson 2010) occasionally (e.g. Winterton 2012, 2013; Benacre to Easton Bavents 2014: RSPB data). Common tern productivity is estimated to fluctuate nationally between an average 0.7 and 0.3 (Wilson *et al.* 2014); productivity at Breydon Water SPA exceeds this average in most years (RSPB data) and is likely to be especially high |

| | | |
|---|---|---|
| | | (perhaps 1.7 chicks per pair) at Foulness SPA. The pSPA directly contributes to productivity, as food resources are contained within it. |
| 4. History of occupancy | ✓ | Large aggregations of red-throated divers began to be discovered through a programme of aerial surveys between 2001 and 2006 (O'Brien *et al*. 2008). Therefore there is a history of occupancy dating back almost 15 years, although it is highly likely divers were present before our knowledge developed. Breeding little terns and common terns have bred at locations adjacent to the pSPA for many years, meaning several sites were classified as SPAs from the early 1990s. There is every reason to believe the foraging areas within the pSPA would have been used for an equal period, given the foraging ranges of the relevant terns are unlikely to have changed significantly. |
| 5. Multi-species area | ✓ | Three features qualify in total. |
| 6. Naturalness | N/A | No longer applicable, following ruling from the SPA & Ramsar Scientific Working Group. |
| 7. Severe weather refuge | **?** | No data are available to determine whether the pSPA acts as a severe weather refuge for red-throated divers. Numbers of divers within the pSPA do fluctuate, but the reasons are imperfectly understood. |

## 2. Rationale and data underpinning site classification

In 1979, the European Community adopted Council Directive 79/409/EC on the conservation of wild birds (EEC, 1979) known as the 'Birds Directive'. This has been amended subsequently as Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds. This provides for protection, management and control of naturally occurring wild birds within the European Union through a range of mechanisms. One of the key provisions is the establishment of an ecologically coherent network of protected areas. Member States are required to identify and classify the most suitable territories in size and number for rare or vulnerable species listed in Annex I (Article 4.1) and for 'regularly occurring migratory species' under Article 4.2 of the Directive. These sites are known as Special Protection Areas (SPAs) in the UK. Guidelines for selecting SPAs in the UK were derived from knowledge of common international practice and based on scientific criteria (JNCC, 1999).

According to Stroud *et al.* (2001), the task of identifying a coherent network of terrestrial sites in the UK is largely complete, comprising of 243 sites of which some include areas used by inshore non-breeding waterbirds, for example in estuaries. However, the JNCC's SPA Selection Guidelines do not review requirements of birds using the wholly offshore environment in which many birds access resources that are critical for their survival and reproduction. Johnston *et al*. (2002) describe a process consisting of three strands by which SPAs might be identified for marine birds under the Birds Directive *i.e*. the identification of:

Strand 1: seaward extensions of existing seabird breeding colony SPAs beyond the low water mark;
Strand 2: inshore feeding areas used by concentrations of birds (e.g. seaduck, grebes and divers) in the non-breeding season; and
Strand 3: offshore areas used by marine birds, probably for feeding but also for other purposes.

Since then, a fourth strand was added to the work conducted by the Joint Nature Conservation Committee (JNCC) to address the need for:

Strand 4: other types of SPA (JNCC, 2011) that would identify some important areas for marine birds that may not be included within the above three categories and will be considered individually

To implement conservation measures under **Strand 1**, the JNCC produced generic guidance (McSorley *et* *al.* 2003, 2005, 2006; Reid & Webb 2005) to extend the seaward extent of SPA boundaries from seabird colonies. The seaward extensions of existing boundaries in these cases include waters vital for ensuring that some of the essential ecological requirements of the breeding seabird populations are met (e.g. preening, bathing, displaying and potentially local foraging). The distance of the extension is dependent upon the qualifying species breeding within the SPA. However, these generic boundary extensions are not influenced by or meant to encompass the principal foraging areas used by the species for which they are identified or any other species at the colonies concerned. Generic seaward extensions to the boundaries of existing SPAs have been implemented at 31 sites in Scotland and are under consideration at the Flamborough and Filey Coast pSPA (Natural England 2014). However, in line with the recommendations of Reid & Webb (2005), generic extensions have only been implemented at sites holding certain seabird species, none of which occur as breeding birds within the existing SPAs which border the Outer Thames Estuary pSPA. Reid & Webb (2005) note that no evidence has been found that any of the five species of tern which breed regularly in Great Britain make significant use of waters around their colony for maintenance activity (McSorley *et al.* 2003) and conclude that generic guidance for extension of colony SPAs for this purpose is not appropriate in the case of terns.

The original Outer Thames Estuary SPA was classified under **Strand 2** in 2010. Classification was for the marine area supporting a peak mean value of 6,466 red-throated divers in the non-breeding season (JNCC, 2011). As no boundary changes are proposed for this species, and as insufficient contemporary data are available to revise the citation value, this Departmental Brief will not focus on the scientific case for inclusion of this species. The starting position is that this original feature is retained, and all further justification relates to tern foraging areas (which mainly overlap red-throated diver non-breeding areas).

All five species of tern that regularly breed in the UK (Arctic tern *Sterna paradisaea*, common tern *S. hirundo,* Sandwich tern *S. sandvicensis,* roseate tern *S. dougallii* and little tern *Sternula albifrons*) are listed on Annex I of the EU Birds Directive and thus are subject to special conservation measures including the classification of Special Protection Areas (SPAs). Within the UK there are currently 57 breeding colony SPAs for which at least one species of tern is protected. However, additional important areas for terns foraging at sea have yet to be identified and classified as marine SPAs to complement the existing terrestrial suite. Since 2007, the JNCC has been working with the four Statutory Nature Conservation Bodies (SNCBs) towards the identification of such areas under **Strand 4** as, given the likely extent of these areas, these cannot be addressed by application of the generic maintenance extensions approach and are not covered by the work on identifying inshore non-breeding aggregations or important offshore areas due to difficulties in identification of terns and to limited survey coverage closer to shore (terns have limited foraging ranges compared to other seabird species).

In the process by which a site becomes fully classified as an SPA, Ministerial approval has to be given to undertake formal consultation on the proposal to classify the site. At this stage in the process a site becomes known as a potential SPA (pSPA). Within this Departmental Brief, and others being prepared at the same time, sites currently under consideration include both new sites (such as Solent & Dorset Coast pSPA) and existing sites (such as Hamford Water SPA) which are being extended and/or having new features added. For the purpose of clarity in this and other Departmental Briefs, sites are referred to as SPAs when referring to existing classified sites. Where reference is made to an entirely new site, or to an extended site, or to a site including new features being proposed (such as Outer Thames Estuary), it will be referred to as pSPA since the site (if new), or any additional extent or feature is not yet fully classified.

This Departmental Brief sets out information supporting the identification of the qualifying features of the Outer Thames Estuary pSPA and definition of its proposed boundaries. This is based upon the areas of sea identified as being most important to the tern populations that comprise the qualifying features of this new marine SPA, i.e. terns breeding at the existing Great Yarmouth North Denes, Breydon Water, Benacre to Easton Bavents, Minsmere – Walberswick, Alde-Ore Estuary, Foulness and Thanet Coast & Sandwich Bay SPAs, as well as some functionally linked nesting locations.

SPA site selection guidelines have been applied to the most up to date data for the site.

## 2.1. Data collection – defining the suite of breeding features and numbers supported by the Outer Thames Estuary pSPA

The size of each of the populations of terns supported by the Outer Thames Estuary pSPA, and which exceed the SPA qualifying thresholds, have been derived as the sum of the numbers of those species at each of the existing SPAs from which the individuals recorded at sea within the pSPA are most likely to originate. Citation figures from existing SPAs have not been used to calculate the Outer Thames Estuary pSPA population. These figures are considered out of date and therefore inappropriate for use in defining the sizes of the populations of these species supported by the entirely new pSPA. Therefore, for each of the source SPAs, the numbers are the most recently available from the Seabird Monitoring Programme (SMP) database (i.e. within the last five years), unless otherwise indicated. Where necessary and possible, this dataset has been augmented by information requested directly from colony managers, from relevant reports (Parsons *et al*. 2015; Norfolk Bird & Mammal Reports), from the national bird ringing scheme, and from the LIFE+ little tern project.

The pSPA population calculation excluded: i) numbers of any terns that may forage within Outer Thames Estuary pSPA, but derive from breeding colonies that are situated outside of existing SPAs, apart from those with strong evidence of functional linkage between SPAs and alternate nesting locations; ii) numbers of terns at existing SPAs which are not qualifying features of these sites and not currently present in numbers exceeding SPA selection criteria thresholds at those sites; iii) numbers of terns at existing SPAs which, although qualifying features of those sites are no longer present in such numbers at those particular sites, and do not meet selection criteria when summed across all source SPAs that might contribute to the pSPA (e.g. Sandwich tern). These exclusions were made to ensure that the size and shape of the pSPA were determined by the foraging requirements of the large numbers of birds originating from the principal source colonies and not unduly influenced by the inclusion of areas of sea that might be used only by relatively small numbers of birds from colonies that do not meet SPA selection criteria thresholds.

### 2.2. Defining the boundary of Outer Thames Estuary pSPA

The overall boundary of the Outer Thames Estuary pSPA is largely unchanged from the existing SPA, defined according to the distribution of non-breeding red-throated divers (O'Brien *et al*. 2012). However, some additional nearshore areas are proposed to allow for tern foraging requirements. The work done to identify important areas for little and larger tern species differed and was conducted separately (Wilson *et al*. 2014; Parsons *et al*. 2015). These separate pieces of work are described in brief in the following two sub-sections. The overall site boundary was drawn as a composite of the separate species-specific boundaries and this is described in section 3.4.

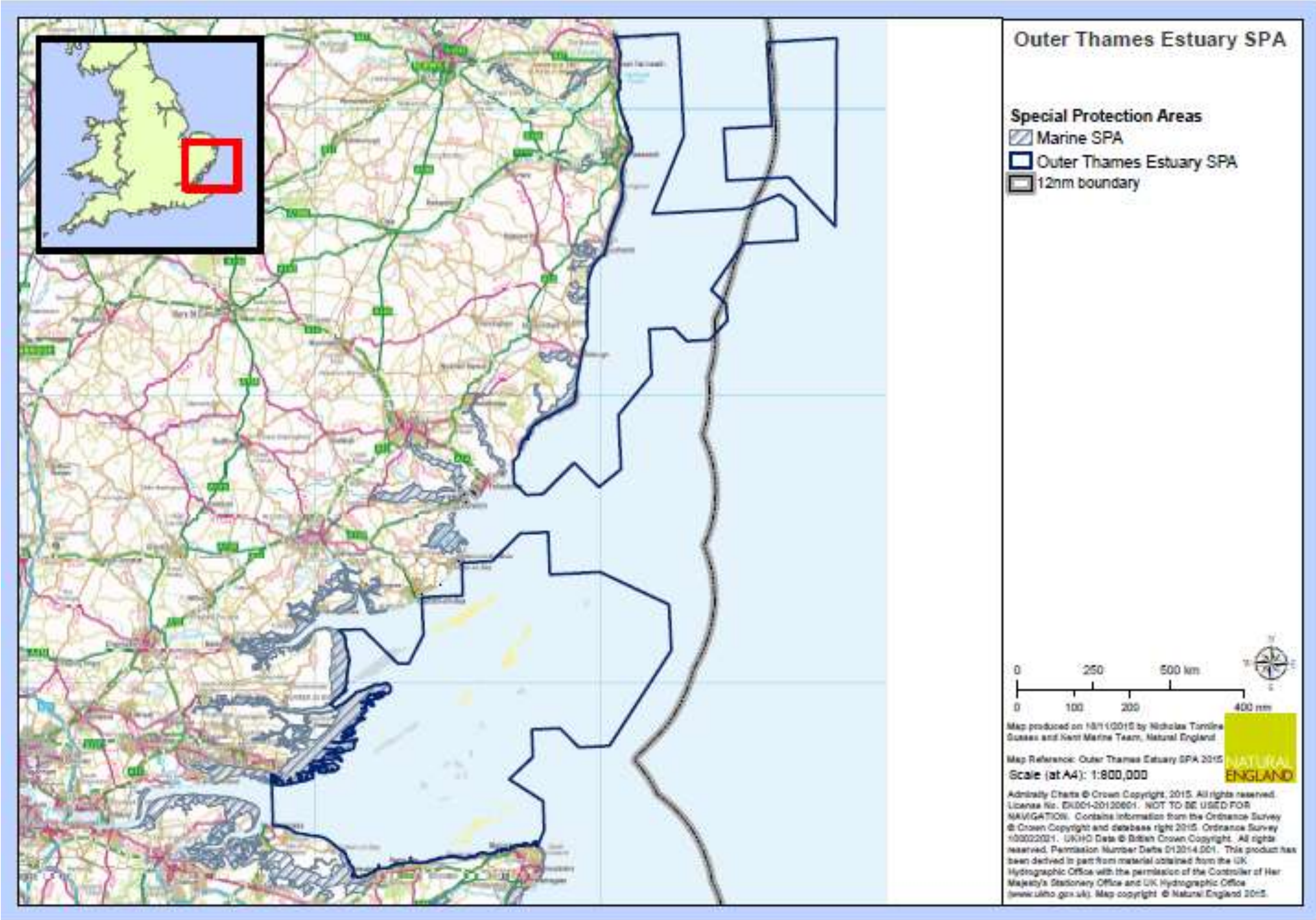
## 3. Site Status and Boundary

### 3.1. Existing Boundary

The total area of the existing Outer Thames Estuary SPA is approx. 379,268 ha (379km$^2$).and is divided into three main areas (refer to Figure 1):

- The outer estuary (east of a line north from Sheerness, Kent to Shoebury Ness, Essex);
- A separate area extending south along the coast from East Norfolk (from Caister-on-Sea) to Woodbridge, Suffolk; and
- An area lying offshore slightly further north.

**Figure 1**. Existing Outer Thames Estuary SPA boundary



Generally, the landward boundary of the existing SPA follows the Mean Low Water (MLW) mark or the seaward boundaries of existing coastal SPAs along most of its length (whichever is the further seaward). The coastal SPAs which directly abut the site from north to south are:

- Great Yarmouth North Denes SPA
- Benacre to Easton Bavents SPA
- Minsmere-Walberswick SPA
- Alde-Ore Estuary SPA
- Crouch and Roach Estuaries SPA
- Dengie SPA
- Foulness SPA
- Southend and Benfleet Marshes SPA
- Thames Estuary and Marshes SPA
- Medway Estuary and Marshes SPA
- The Swale SPA, and
- Thanet Coast and Sandwich Bay SPA

Intertidal mudflats and sandbanks separated from the mainland coast by subtidal areas at MLW are within the existing SPA boundary, except where they are within the boundaries of existing coastal SPAs.

The offshore boundary of the site is largely within the 12 nautical mile (nm) zone; however a significant component of the northern section does extend beyond the 12 nm limit. The total area of the existing Outer Thames Estuary SPA is currently approx.. 379,268 ha (379km$^2$).

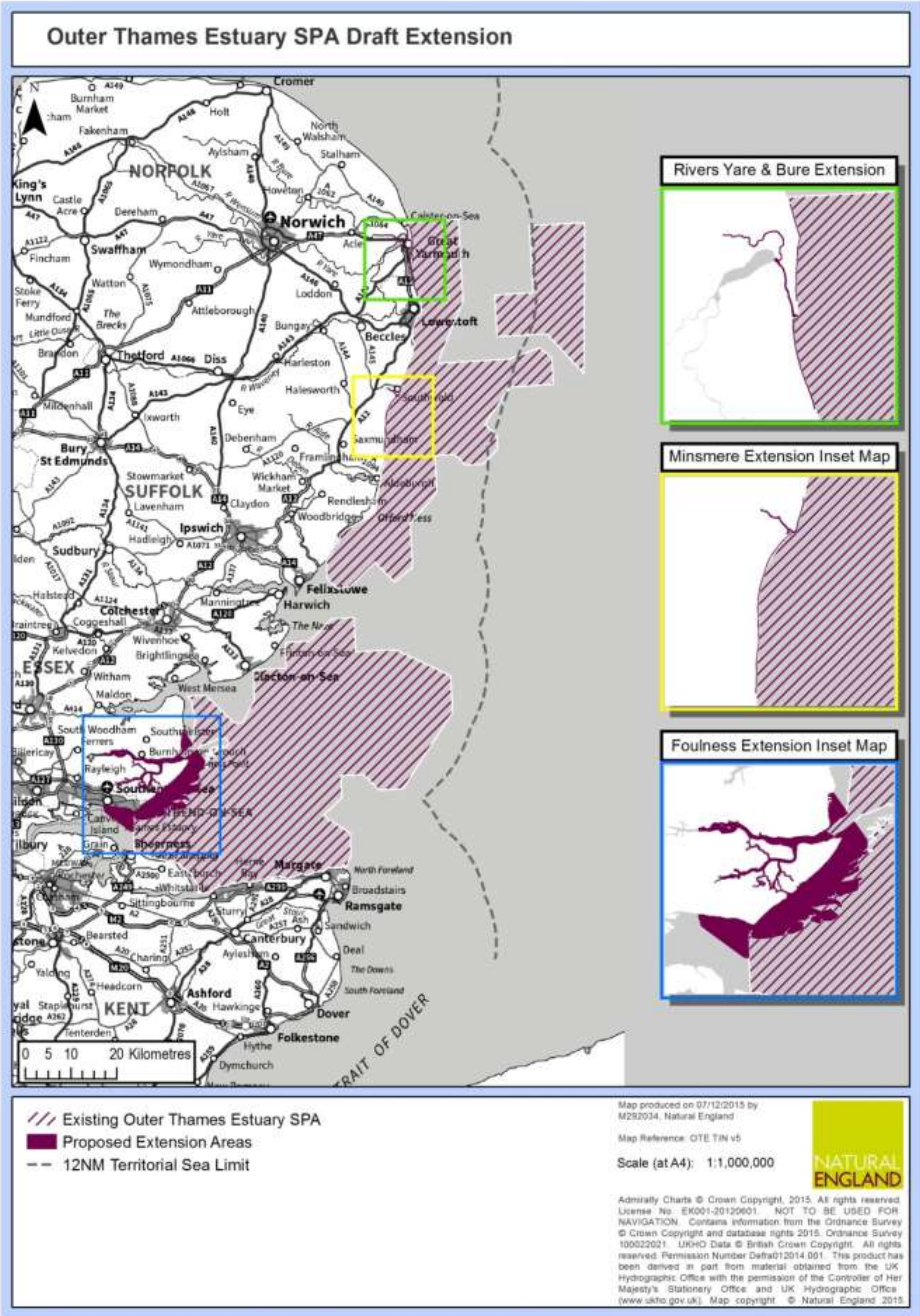
## 3.2. Outer Thames Estuary pSPA boundary

The total area of the Outer Thames Estuary pSPA is approx.391,909 ha (392km$^2$) - refer to Figure 1a.

The proposed boundary changes to the existing Outer Thames Estuary SPA are based upon projected foraging areas of common terns and little terns breeding within several qualifying coastal SPAs.

The proposed boundary change has been drawn to encompass the qualifying foraging areas of tern species overlaid with maximum curvature derived limits, and has excluded areas that do not support qualifying densities.

**Figure 1a -** map showing the existing Outer Thames Estuary and the three proposed extensions



## 3.3. Seaward boundary of the pSPA

There will be no changes to the existing eastern seaward boundary of the Outer Thames Estuary SPA in proposing the boundary extension. The boundary is proposed to extend seaward southwards from the Southend coast driven by the distribution of common terns (Annex 1a). Further information on the extension will be discussed below in section 3.4.

## 3.4. Landward boundary of the pSPA

The proposed landward boundary of the pSPA is driven by the distribution of both common and little terns which extends in places into the inter-tidal zone (Annex 1a).

Further information on the extension locations are discussed below.

### 3.4.1. Identification of important marine areas for little terns

Of the five species of tern which regularly breed in Great Britain, little tern is the smallest and has the most limited foraging range: mean range of 2.1 km, mean of recorded maxima of 6.3 km and maximum ever recorded in the literature being 11 km (Thaxter *et al.* 2012). In light of this evidence, JNCC, in agreement with all of the Statutory Nature Conservation Bodies (SNCBs), decided that the most effective method to determine the extent of the area's most heavily used for foraging by breeding little terns would be to undertake a programme of shore based observations and of boat-based transects around colonies and to use the resultant distribution data directly in setting the alongshore and seaward boundaries respectively.

Accordingly, between 2009 and 2013 JNCC coordinated a programme of survey work to identify important foraging areas for little terns at a number of UK little tern colonies. These surveys were conducted during the chick rearing period in each year and comprised repeated shore-based counts of little terns seen at a series of observation stations at increasing distances from the colony locations, and repeated boat based surveys along transects across the waters around colonies. These surveys sought to establish the distances both alongshore and offshore that little terns were travelling to feed.

In total, 70 shore-based surveys were undertaken at 14 little tern colonies around the UK with a total of 7,006 little tern observations. Twenty three boat-based transect surveys were undertaken across waters near eight colonies around the UK with a total of 781 little tern observations.

The following sub-sections summarise survey work and boundaries identified at little tern colonies that are qualifying features of SPAs located adjacent to the Outer Thames Estuary pSPA. Further general information on the little tern survey programme is presented in Parsons *et al*. (2015) and Annex 4.

#### 3.4.1.1. Great Yarmouth North Denes SPA

Three shore-based surveys were undertaken in 2013 which collected 937 little tern observations. Two boat-based surveys were also completed in 2013 and recorded 202 little tern observations. These data were supplemented by radio-tracking data collected at the site in preceding years (Perrow & Skeate 2010; Parsons *et al*. 2015). The total number of observations for both shore and boat-based surveys was judged to be sufficient to justify a site-specific approach to boundary definition. The alongshore foraging extent for this colony was set to be 5 km to the north and 4 km to the south. The mean of maximum seaward foraging extents for this colony of little terns was 2.43 km (Figure 2; Parsons *et al*. 2015).

The little tern foraging area is mostly contained within the existing Outer Thames Estuary SPA boundary with the exception of the coastal areas up to Mean High Water (MHW) and therefore the proposed pSPA boundary will be extended to incorporate this area (Annex 1b). However, the northern extent of the foraging areas from Great Yarmouth North Denes SPA overlaps with the proposed Greater Wash pSPA. Because of the tendency for little terns to switch nesting preferences between two colonies within the Great Yarmouth North Denes SPA (at Winterton and North Denes), and because it is not possible to definitively assign foraging areas exclusively to one pSPA, birds at this colony contribute to totals for both pSPAs. This recognises that they could be foraging in either marine pSPA area at any given time.

3.4.1.2. Minsmere - Walberswick SPA

No data were collected for this SPA, as breeding terns were absent during the study period (Parsons *et al*. 2015). It was therefore not possible to apply a site-specific foraging boundary, and instead a generic approach was applied. The alongshore and seaward foraging extents for this colony were set to be the generic values derived from all of the surveys at all of the colonies, i.e. 3.9 km alongshore and 2.18 km seaward (Figure 3). This generic foraging area is mostly contained by the existing Outer Thames Estuary SPA boundary, although the pSPA boundary is proposed to extend inland along the River Blyth to encompass Blythburgh Water, a tidal lagoon directly adjacent to northern parts of the Minsmere – Walberswick SPA. A further expansion along the coast to MHW northwards to Southwold and southwards to Leiston is proposed to incorporate the foraging area (Annex 1c).

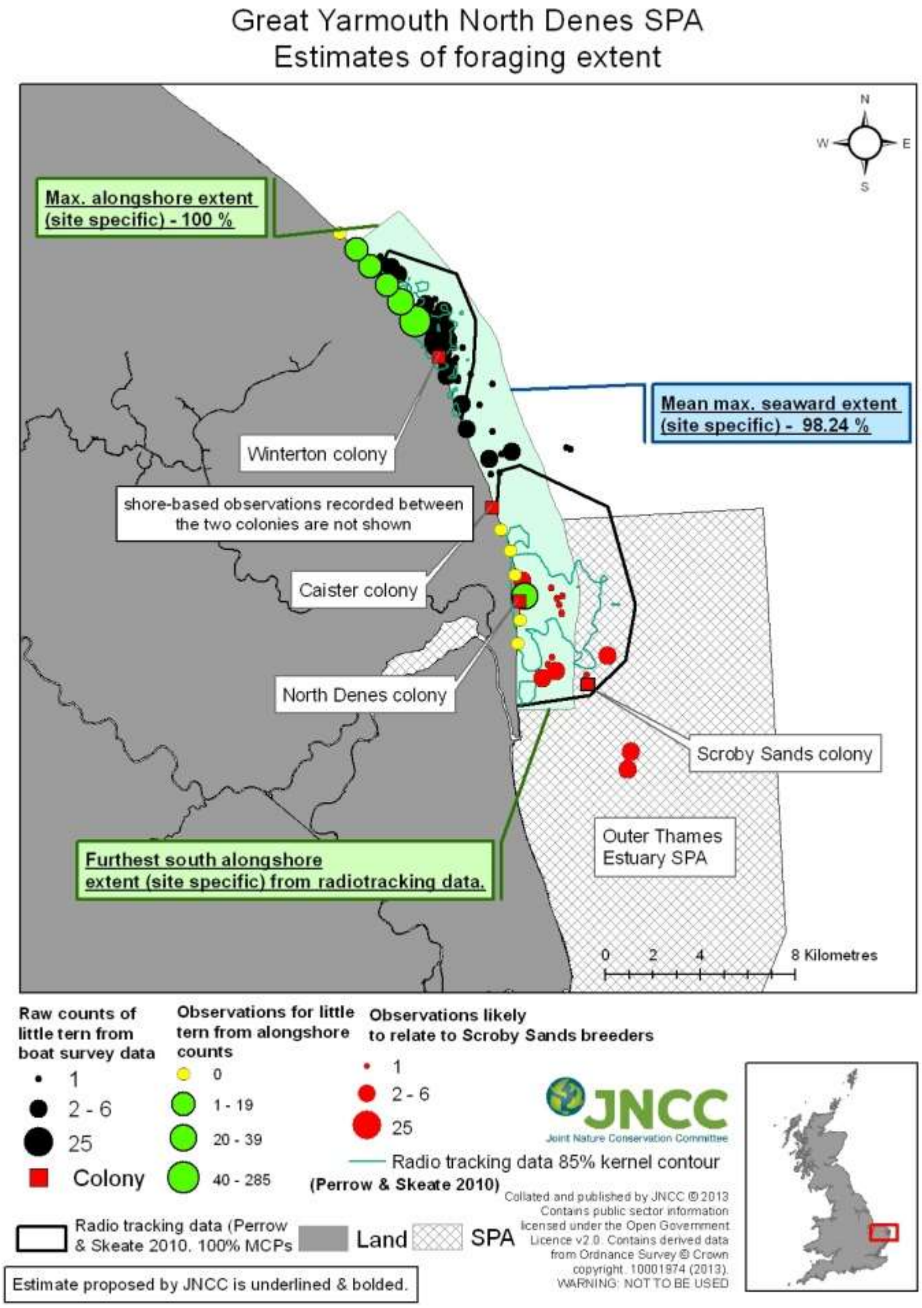



**Figure 2**. Application of site-specific alongshore and seaward extents to define boundaries for little tern foraging areas around colonies within Great Yarmouth North Denes SPA

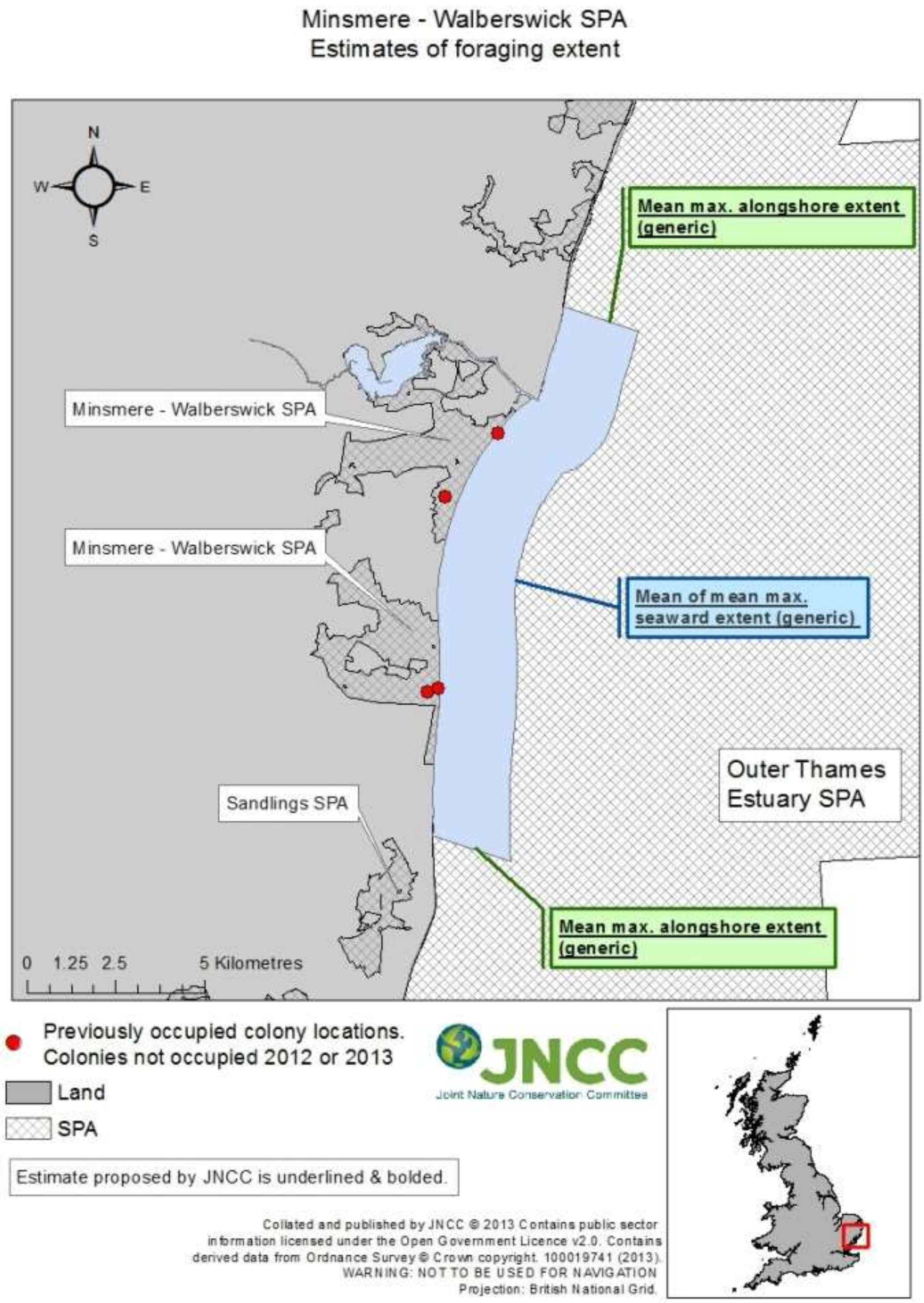



**Figure 3**. Application of generic alongshore and seaward extents for Minsmere – Walberswick SPA.

3.4.1.3. Alde-Ore Estuary, Benacre to Easton Bavents, Foulness and Thanet Coast & Sandwich Bay SPAs

The Alde-Ore Estuary, Benacre to Easton Bavents, Foulness and Thanet Coast & Sandwich Bay SPAs were amongst a group of sites listed as not regularly occupied (defined as supporting an average of 1% of the GB population in the most recent five year period: Parsons *et al*. 2015). Consequently, no attempt was made to collect data at these sites, or to fit models of expected foraging areas. However, the Outer Thames Estuary pSPA boundary directly abuts these existing SPAs, and therefore the foraging areas of little terns at these sites are by default within the pSPA. Thus, whilst tern foraging areas do not alter the boundary of the pSPA, any terns breeding at these sites do contribute to the abundance total within the site.

3.4.1.4. Scroby Sands

In addition to the above SPAs, the Outer Thames Estuary pSPA contains a breeding colony not currently protected within any SPA citation; Scroby Sands. This is an exposed sand bank lying approximately 6 km offshore from Great Yarmouth, south of the Scroby Sands Offshore Wind Farm, in an area known as South Scroby. There is some evidence that breeding little terns interchange between Great Yarmouth North Denes SPA and South Scroby (section 5.2), meaning Scroby Sands may be considered functionally linked land, and justifying the extension of protection to the Outer Thames Estuary pSPA. When breeding at this offshore site, the foraging area used by little terns is highly likely to be entirely contained within the Outer Thames Estuary pSPA, based on foraging range (Thaxter *et al*. 2012; Parsons *et al*. 2015).

The proposal is that terns at this colony should contribute to the Outer Thames Estuary pSPA abundance total and be recognised as part of the pSPA, because it is contained entirely within the existing SPA boundary and because of the likely connectivity with Great Yarmouth North Denes SPA.

3.4.1.5. Hamford Water, Blackwater Estuary, Colne Estuary and Medway Estuary & Marshes SPAs

Parsons *et al*. (2015) identified Hamford Water SPA as supporting enough terns (between 30 and 45 pairs) to include in their survey programme. Five boat-based surveys took place over 2012 and 2013, with three shore-based surveys also in 2013. Sufficient data were collected to derive a site-specific foraging tern boundary around the SPA, and this is the subject of a separate Departmental Brief.

The Blackwater Estuary, Colne Estuary and Medway Estuary & Marshes SPAs were amongst the group of sites listed as not regularly occupied (Parsons *et al*. 2015). Consequently, no attempt was made to collect data at these sites, or to fit models of expected foraging areas.

When applying the maximum extent of the generic models (3.9 km) in an arc around the location of tern colonies within these SPAs (Old Hall Marshes / Tollesbury Wick; Colne Point; and Deadman's Island, respectively), there is either no overlap or only negligible overlap with the Outer Thames Estuary pSPA boundary. Little terns at these sites are thus not expected to routinely forage within the Outer Thames Estuary pSPA boundary and therefore do not contribute to the abundance total of the pSPA.

### 3.4.2. Identification of important marine areas for larger terns

The four larger species of tern (common, Arctic, Sandwich and roseate) which breed regularly in Great Britain have recorded mean foraging ranges between 4.5 km and 12.2 km and maximum recorded foraging ranges between 15.2 km and 49 km (Thaxter *et al*. 2012). JNCC, in agreement with all of the SNCBs, decided that the most effective method to determine the extent of the area's most heavily used by larger breeding terns would be different to that employed for little terns. In this case, the approach was to undertake a programme of boat-based visual tracking of foraging birds. The resultant information on foraging locations chosen by the birds was combined with information on the habitat characteristics of those locations relative to other areas available to construct habitat association models of tern usage. These models were used to predict species specific tern usage patterns around breeding colony SPAs. Usage predictions were made out to the maximum recorded foraging range from each colony. This process of producing usage predictions around colonies for which tracking data had been gathered had colony (and species) specific analysis which produced a smoothed map of foraging usage around the colony. In Phase 2, analysis of pooled data across colonies (species specific) produced generic models which allowed production of maps of smoothed foraging usage around colonies for which no (or insufficient) data were available.

In order to draw a boundary around the most important foraging areas for terns from each colony of interest, a cut-off or threshold value of usage has to be found and only those areas in which usage exceeds that cut-off value included within a possible SPA boundary. An objective and repeatable method to identifying a threshold value, based on the law of diminishing returns, is maximum curvature (O'Brien *et al.* 2012). This method identifies a threshold value below which disproportionately large areas would have to be included within the boundary to accommodate any more increase in, in this case, foraging tern usage. Further details of this work are given in Annex 5.

To gather the empirical data necessary for the modelling, JNCC coordinated a programme of visual tracking work between 2009 and 2011 to identify important foraging areas at a number of UK colonies. These surveys were conducted during the chick rearing period in each year and comprised repeated days of observations of individual terns whose tracks were followed by boat as they left the colony to forage.

Visual tracking was carried out or commissioned by JNCC at 10 of 32 colony SPAs which were deemed to be recently regularly occupied (Wilson *et al.* 2014). Survey effort was prioritised at these 10 sites on the basis of several considerations including: maximising geographical coverage across each species' range, logistical ease of boat-based work, and maximising likely sample sizes (e.g. larger/multi-species colonies with recent successful breeding seasons). As a result no boat-based tracking work was undertaken on the south coast of England.

The total number of tracks obtained was 1,004 including 55 tracks (6%) for roseate tern (2 SPAs), 184 tracks (18%) for arctic tern (6 SPAs, 1 non-SPA), 381 tracks (38%) for common tern (7 SPAs, 1 non-SPA) and 384 tracks (38%) for Sandwich tern (5 SPAs, 1 non-SPA), with multiple years of data collected at five of the ten JNCC study colony SPAs. In addition, visual tracking data were obtained through a data-sharing agreement with ECON Ecological Consultancy Ltd for two SPAs: Ynys Feurig, Cemlyn Bay and The Skerries SPA (136 Sandwich, 2 common and 1 Arctic tern tracks, all collected in 2009) and North Norfolk Coast SPA (108 Sandwich and 24 common tern tracks collected 2006-2008). This gave a total of 1,275 tracks available to the project, although not all data were used in the modelling; incomplete tracks or those which recorded no foraging behaviour were excluded.

The following three sub-sections summarise the application of generic boundaries, derived from the modelling of tracking data at other UK tern colonies, to each of the two relevant larger tern colonies within the Outer Thames Estuary pSPA. Further general information on these surveys is presented in Annex 5.

#### 3.4.2.1. Breydon Water SPA

Breeding common terns are qualifying features of Breydon Water SPA. Generic models of foraging behaviour, generated from pooled data obtained from surveys of tern colonies across the UK as described in section 3.4.2, were used to generate boundaries around the SPA. The predictor variables used in the generic models to generate usage patterns of common tern at this SPA were: i) distance to colony, ii) distance to shore, and iii) bathymetry. These variables predicted highest usage around the colony, generally decreasing with increasing distance from it. This means that for the common tern nesting colony located at Breydon Water, only the lower River Yare and part of the River Bure are predicted by the model to be used for foraging by the terns.

The model-generated predictions of relative usage by common terns, together with the boundary drawn around all of the areas in which predicted usage exceeded the threshold identified by application of the maximum curvature approach (to define a limit to the extent of the most important areas) are shown in Figures 4 and 5. The extent of the area of prediction was defined by the limit of the dark blue circles shown (Fig. 4). This reflects the constraint imposed on the modelling by use of a radius the size of the global mean maximum foraging distance from colony derived from tracking data held by JNCC, ECON Ecological Consultancy Ltd (for Scolt Head, Blakeney Point and Cemlyn Bay only) and Thaxter *et al.* (2012). It can be seen in every case that very substantial areas of sea within that wider area which are distant to the colony and/or distant from the shore are predicted to have very little or no usage by foraging terns.

The predicted usage boundaries largely sit within the existing boundaries of the Outer Thames Estuary pSPA, and thus do not influence it greatly, except along the coast northward to Caister-on-Sea and southward to South of Corton, where the boundary is extended to incorporate the gap between MLW (where the existing Outer Thames Estuary SPA boundary is currently drawn to) and MHW. Also, the Outer Thames Estuary pSPA boundary will be extended inland along the River Yare to meet the existing Breydon Water SPA boundary, and along the lower part of the River Bure approximately to Runham, thus providing no gap in protection across the predicted usage area (Annex 1b).

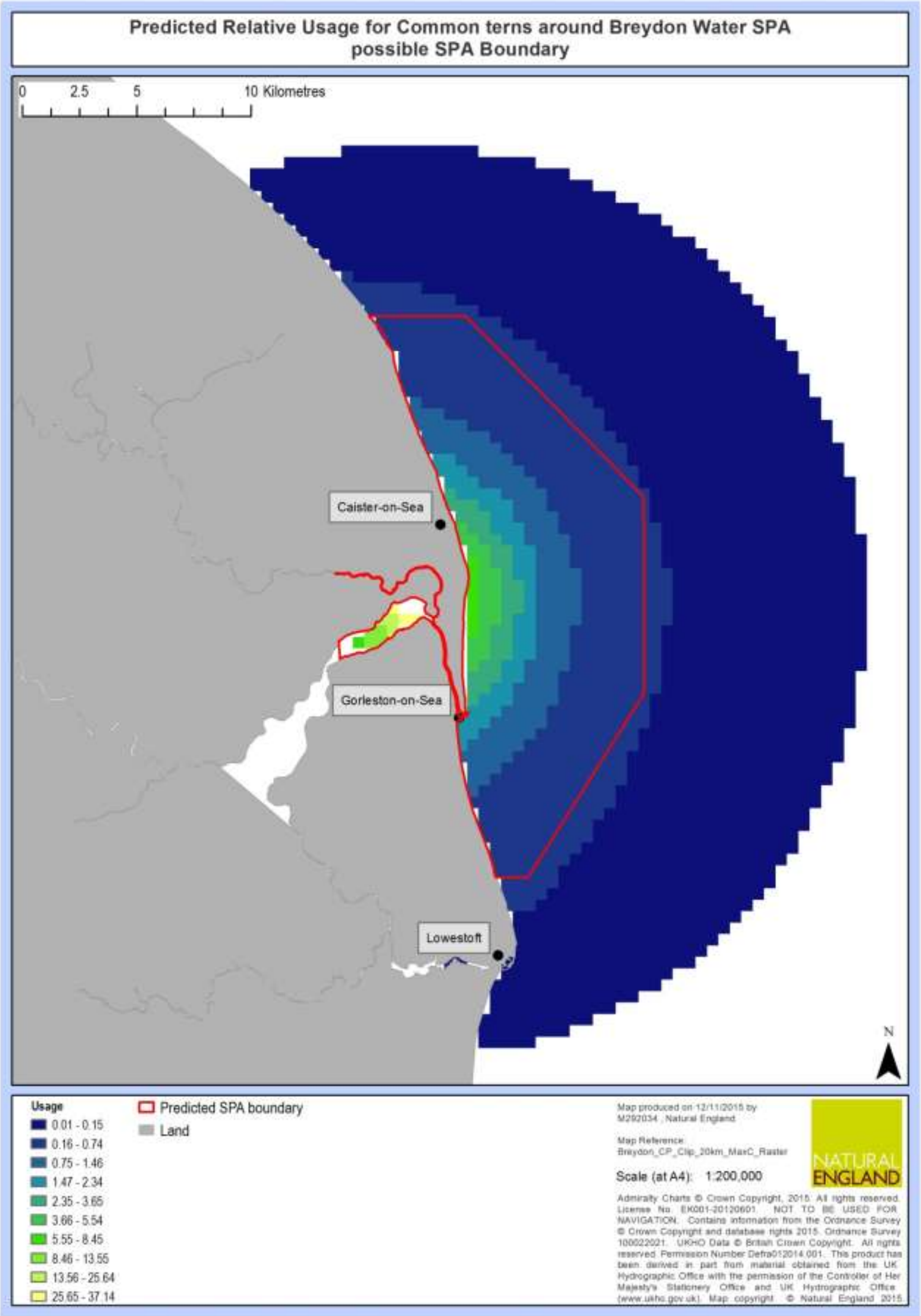



**Figure 4**. Model predictions of common tern usage overlaid with maximum curvature derived limits to areas of most importance around the Breydon Water SPA. Source: Win *et al.* (2015).

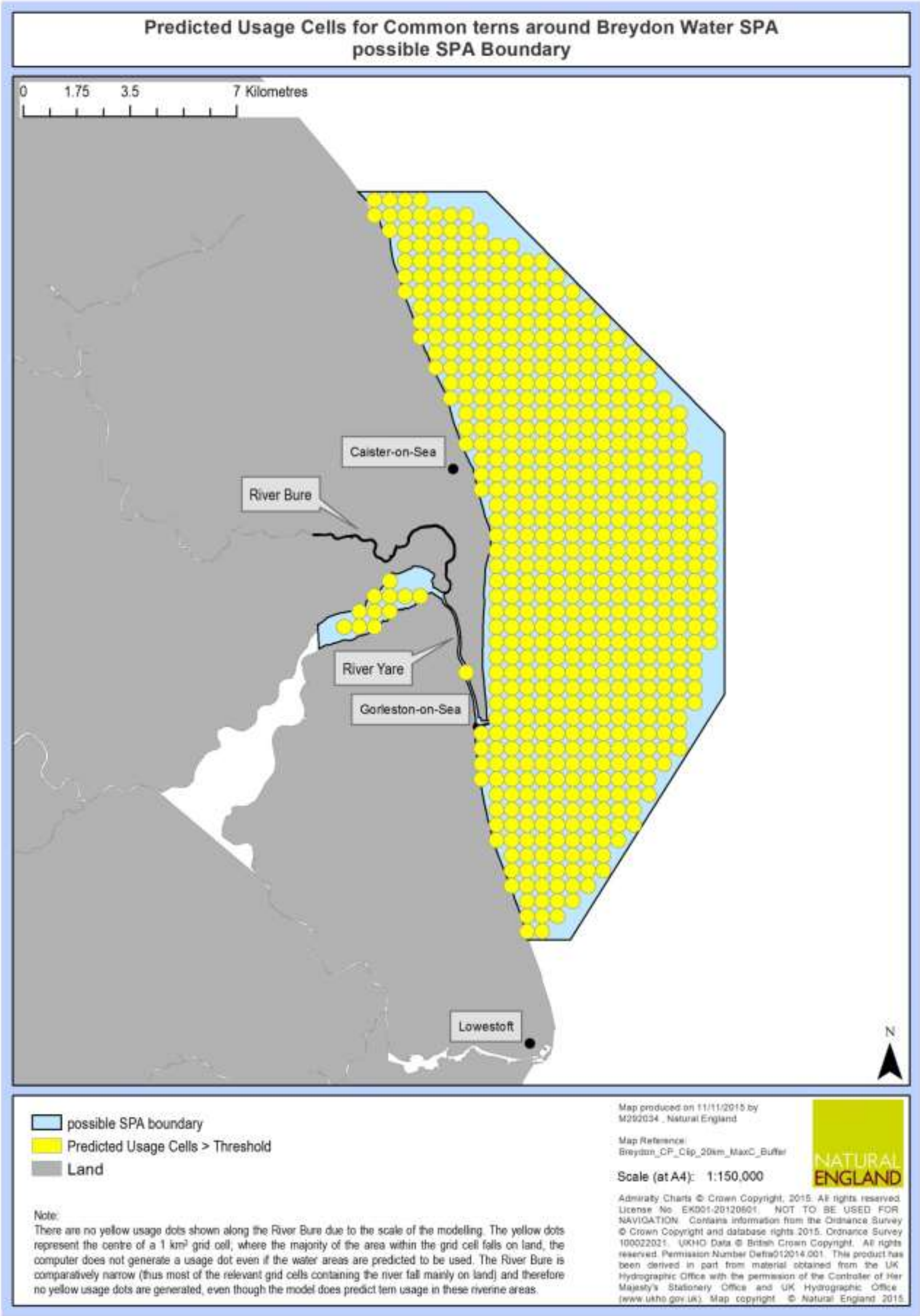



**Figure 5** Proposed boundary drawn around the cells within which predicted usage levels by common terns, exceeded the threshold level identified by application of the maximum curvature methodology to the predicted usage surfaces (see Annex 5). Source: Win *et al.* (2015).

#### 3.4.2.2. Foulness SPA

Breeding common terns are qualifying features of Foulness SPA. Generic models of foraging behaviour, generated from pooled data obtained from surveys of tern colonies across the UK, were used to generate boundaries around the SPA. The predictor variables used in the generic models to generate usage patterns of both species of tern at this SPA were: i) distance to colony, ii) distance to shore, and iii) bathymetry. Predicted usage levels for both species were highest around the colony, generally decreasing with increasing distance from each colony.

The model-generated predictions of relative usage by common terns, together with the boundary drawn around all of the areas in which predicted usage exceeded the threshold identified by application of the maximum curvature approach (to define a limit to the extent of the most important areas), are shown in Figures 6 and 7. The extent of the area of prediction was defined by the limit of the dark blue circles shown (Figure 6). This reflects the constraint imposed on the modelling by use of a radius the size of the global mean maximum foraging distance from colony derived from tracking data held by JNCC, ECON Ecological Consultancy Ltd (for Scolt Head, Blakeney Point and Cemlyn Bay only) and Thaxter *et al.* (2012). It can be seen in every case that very substantial areas of sea which are distant to the colony and/or distant from the shore are predicted to have very little or no usage by foraging terns, therefore these areas have not been included in the proposed boundary.

The predicted usage boundaries largely sit within the existing boundaries of the Outer Thames Estuary SPA, but the pSPA boundary is influenced by the new predicted foraging area. Firstly, it includes the estuarine areas (up to Mean High Water) of the Crouch and Roach Estuaries SPA, approximately as far inland as South Fambridge. As common terns are not a feature of this SPA, which extends down to MLW, the Outer Thames Estuary pSPA will overlap with the Crouch and Roach Estuaries SPA in the relevant intertidal areas (Figure 6). Additionally, the Outer Thames Estuary pSPA boundary will extend seaward to the south and west, overlapping with part of Benfleet & Southend Marshes SPA and then northwards where it will overlap Dengie SPA (none have common terns as a qualifying feature) and also parts of Foulness SPA itself (which does have common terns as a qualifying feature); this is necessary to provide protection in all of the predicted foraging usage areas. Finally, the predicted usage model extends the existing Outer Thames Estuary SPA boundary to the west as far as Westcliffe-on-sea along the Southend coast (Annex 1d).

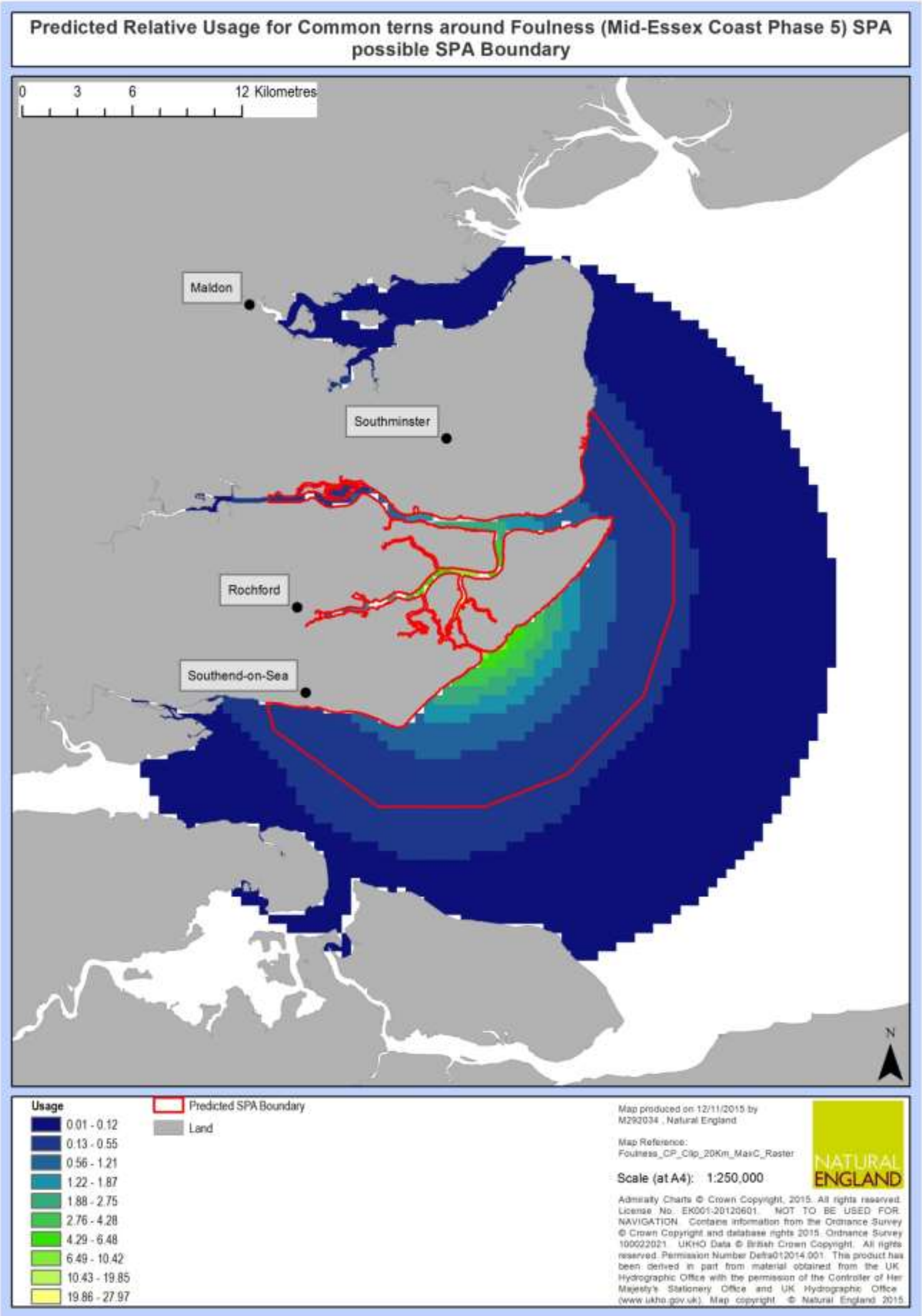



**Figure 6**. Model predictions of common tern usage overlaid with maximum curvature derived limits to areas of most importance around Foulness SPA. Source: Win *et al.* (2015).

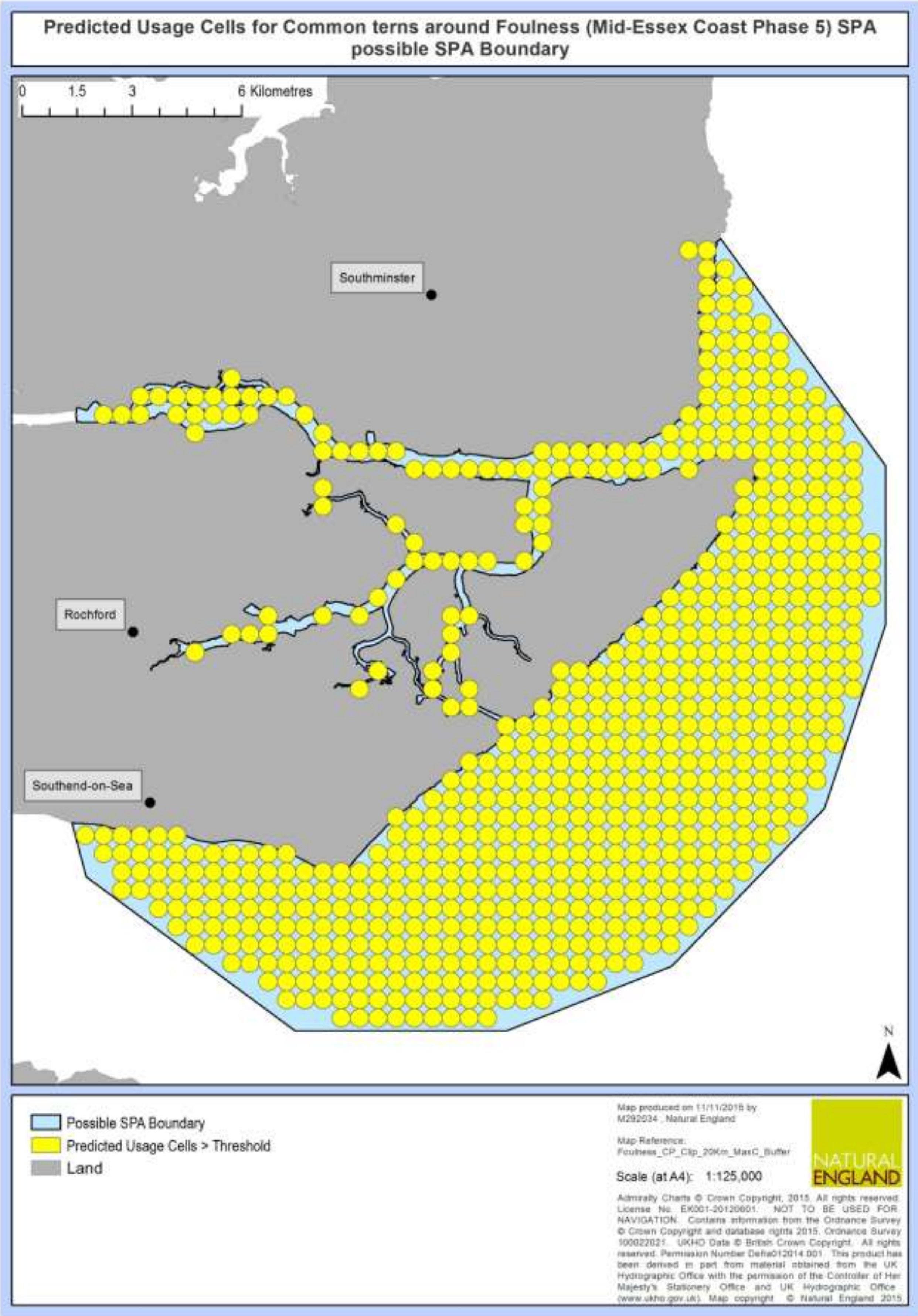



**Figure 7**. Proposed boundary drawn around the cells within which predicted usage levels by common terns, centred on the source colony, exceeded the threshold level identified by application of the maximum curvature methodology to the predicted usage surfaces (see Annex 5). Source: Win *et al.* (2015).

#### 3.4.2.3. Sandwich terns – Alde-Ore Estuary and Foulness SPAs

Breeding Sandwich terns are a feature of these SPAs, but they are not considered to be regularly occupied in recent years (Wilson *et al*. 2014). Generic foraging models have not been applied to their parent SPA colonies, and so they do not influence the pSPA boundary; likewise they do not contribute to the total number of terns which the pSPA is expected to support; neither do the Sandwich terns sporadically breeding at Scroby Sands.

### 3.4.3. Composite boundary of Outer Thames Estuary pSPA

The seaward and alongshore extent of the Outer Thames Estuary pSPA (Annex 1a) is almost entirely determined by the boundaries of the existing Outer Thames Estuary SPA, defined according to the distribution of non-breeding red-throated divers (O'Brien *et al*. 2012). The new areas are:

a. The inclusion of the River Blyth to encompass Blythburgh Water, a tidal lagoon directly adjacent to the northern parts of Minsmere-Walberswick SPA in addition to include MHW areas up the coast (to Southwold) and down the coast (to Leiston) to provide continuous coverage for little terns foraging from this SPA.
b. The inclusion of the River Yare channel, to abut the eastern boundary of the existing Breydon Water SPA, and the lower River Bure, to provide continuous SPA coverage for common terns foraging from this SPA;
c. The inclusion of coastal areas up to MHW up the coast (to Caister-on-Sea) to provide coverage for little terns from Great Yarmouth North Denes foraging from this SPA, and common terns foraging from Breydon Water SPA.
d. The inclusion of coastal areas up to MHW down the coast (to just south of Corton) to provide coverage for common terns from Breydon Water foraging from this SPA.
e. The inclusion of the estuarine areas up to Mean High Water within the Crouch and Roach Estuaries, overlapping the existing Crouch and Roach Estuaries SPA in the intertidal area, to provide SPA coverage for common terns foraging from the existing Foulness SPA;
f. The inclusion of a small additional marine area along the south Essex coast and overlapping part of the Foulness SPA, to the west of the existing Outer Thames Estuary SPA boundary, to provide coverage for common terns foraging from the existing Foulness SPA.

In total, the additional area encompasses 12,642 ha, an increase of 3.3% from the existing SPA area.

Given that the parts of the proposed boundary of the pSPA listed above are determined on the basis of predictions of common tern usage patterns generated by a generic model, rather than a model based on observations of common terns in the Outer Thames Estuary, it is appropriate to consider the reliability of that evidence base. Annex 5 describes the process of cross-validation by which the robustness of each generic model was assessed using standard statistical criteria. This assessment involved assessing the ability of each species-specific, generic model to predict the observed distribution of terns of the species of interest at colonies which were (in the cross-validation process) excluded in turn from building the model. This demonstrated that of the three species-specific, generic models, the Sandwich tern model was the most reliable, with an average test statistic for this cross-validation process that was classed as indicative of the model being "excellent". By the same measure, the generic common tern model was judged to be "good" i.e. better than other possible classes of "moderate", "poor" or "unsuccessful". This analysis indicated that there is reasonable consistency between colonies around the UK in the characteristics of sea areas which hold the highest relative densities of foraging common terns. Accordingly, there is a correspondingly high degree of confidence that the boundary of this pSPA, being partly dependent upon the predicted usage patterns of common terns, is founded on a reliable evidence base, albeit not one derived directly from birds at the colonies in question.

## 4. Location and habitats

The Thames Estuary is located in the southern part of the North Sea on the east coast of England, between the counties of Essex (on the north side) and Kent (on the south) and extends as a broad opening into the North Sea. The Outer Thames Estuary extends northwards to Caister-on-Sea in Norfolk.

The Outer Thames Estuary pSPA consists of areas of shallow and deeper water (ranging from 0-50 m below sea level), high tidal current streams and a range of mobile sediments. Large areas of mud, silt and gravelly sediments form the deeper water channels, the main ones representing the approach route to the ports of London and as such being continually disturbed by shipping and maintenance dredging. Sand in the form of sandbanks separated by troughs predominates in the remaining areas and the crests of some of the banks are exposed at MLW; Cross Sand, Scroby Sands, Helm Sand, Newcombe Sand, Aldeburgh Napes, Aldeburgh Ridge, North Ship Head and Bawdsey Bank; in the southern part of the site the main sandbanks are Kentish Flats, West and East Barrow, Ray Sand, Foulness Sands, Maplin Sands, Chapman Sands, Southend Sands and Yantlet Flats, Long Sand, Margate Sand and Kentish Knock.

The proposed boundary overlaps various other sites which have been notified or designated under either British or European conservation legislation, such as SSSIs and SPAs. The proposed boundary will overlap with the following coastal SPAs;

- Crouch and Roach Estuaries SPA;
- Dengie SPA;
- Foulness SPA; and
- Benfleet & Southend Marshes SPA

These overlapping areas comprise of inter-tidal mud, sand and saltmarsh in addition to creeks which are key areas where the terns forage. The Outer Thames Estuary pSPA also overlaps with several existing SACs including from north to south;

- Essex Estuaries SAC: designated for a wide range of characteristic marine and estuarine sediment communities; subtidal areas have rich invert fauna.The SAC also has extensive mudflats and sandflats with extensive growths of eelgrass *Zostera spp.* on the open coast.
- Thanet Coast SAC: designated for chalk, having the longest continuous stretch of coastal chalk in the UK with subtidal chalk reefs which extend into the intertidal zone.

Furthermore, the boundary overlaps the following MCZs:

- Blackwater, Crouch, Roach and Colne Estuaries MCZ which is primarily designated for native oyster and native oyster beds.
- Thames Estuary rMCZ which is recommended for designation of the intertidal and subtidal sediments as well as species such as tentacle lagoon worm, European eel and Smelt.
- Medway Estuaries MCZ, which is primarily designated for intertidal and subtidal mud.
- Swale Estuary pMCZ; which is subject to public consultation by Defra. The pMCZ is primarily being recommended for subtidal habitats (mud and mixed sediments).
- Thanet Coast MCZ which is primarily designated for further extensions of chalk reef, intertidal *Sabellaria spinulosa* and also the stalked jellyfish (*Lucernoriopsis cruxmelitensis*).

The seabed in the area of the Norfolk and Suffolk coast is of a similar composition to that in the main estuary with large shallow areas of mud, sand, silt and gravely sediments but, in the absence of main port areas with approaches inside the SPA, there are consequently fewer disturbances through shipping or dredging.

# 5. Assessment of ornithological interest

## 5.1. Survey Information and summary

SPA site selection guidelines have been applied to the most up to date information for the site.

Counts of breeding seabirds (and / or young) at the colonies within the existing SPAs (which are also those most likely to be the origin of birds within the marine foraging areas of the pSPA) are from the national Seabird Monitoring Programme (SMP). This dataset has been augmented by information from colony managers and the LIFE+ little tern project (all through RSPB), the Foulness Area Bird Survey Group, data collected for the national bird ringing scheme (administered by the British Trust for Ornithology) by the ringing group at Foulness, and relevant editions of the Norfolk Bird & Mammal Report.

Parameters adopted in transforming numbers of young common terns ringed into numbers of breeding adult pairs at Foulness SPA are outlined in Annex 7.

Details of the work carried out to characterise the foraging areas used by breeding adult terns within the Outer Thames Estuary pSPA are above in sections 2 and 3 and in Annexes 4 and 5.

Data on non-breeding red-throated divers are unchanged from the Outer Thames Estuary SPA citation and the N2K standard data form (JNCC, 2011), outlined in O'Brien *et al*. (2012).

## 5.2. Annex I species

### 5.2.1. Breeding season

5.2.1.1. Little tern *Sternula albifrons*

The breeding population of little terns in Great Britain is estimated to be 1,900 pairs (Musgrove *et al*. 2013), representing about 10.3% of the Eastern Atlantic breeding population (18,500 pairs derived by division by 3 of the upper estimate of 55,500 individuals: AEWA 2012). Breeding occurs in scattered colonies along much of the east and west coasts of Britain, from the north of Scotland to (and including) the south coast of England (Mitchell *et al.* 2004). The greater part of the population occurs in south and east England from Dorset to Norfolk (Mitchell *et al.* 2004). All British little terns nest on the coast, utilising sand and shingle beaches and spits, as well as tiny islets of sand or rock close inshore (Mitchell *et al.* 2004).

Little terns are a qualifying feature of Great Yarmouth North Denes, Benacre to Easton Bavents, Minsmere – Walberswick, Alde-Ore Estuary, Foulness and Thanet Coast and Sandwich Bay SPAs. Little terns are notoriously transitory in their nesting habits (Brown & Grice 2005) and may move between different colonies in response to factors including disturbance and predation. Because of this habit, the estimates for Great Yarmouth North Denes SPA include figures from Caister (< 1 km from the SPA boundary), Eccles and Scroby Sands (both approximately 6 km from the SPA boundary), all of which are thought to be functionally linked to colonies protected within the Great Yarmouth North Denes SPA. This view is supported on the basis of little variation between the summed totals from year to year (Figure 5.2a), particularly between 2011 and 2014, when little terns were all but absent from North Denes, instead breeding predominantly at Winterton and Scroby Sands. If the Benacre – Easton Bavents SPA is also considered, including an apparently functionally linked site at nearby (< 1 km from SPA boundary) Kessingland, the collective number of little tern pairs averages 392, with a standard deviation of just 40 pairs (2009 – 2015). This provides strong evidence of functional linkage between this group of sites, and provides justification for including data from each of them within the total number of little terns expected to use the Outer Thames Estuary pSPA. Recent shifts to Benacre and Kessingland may reflect a response to targeted site management here, and possibly beach accretion.

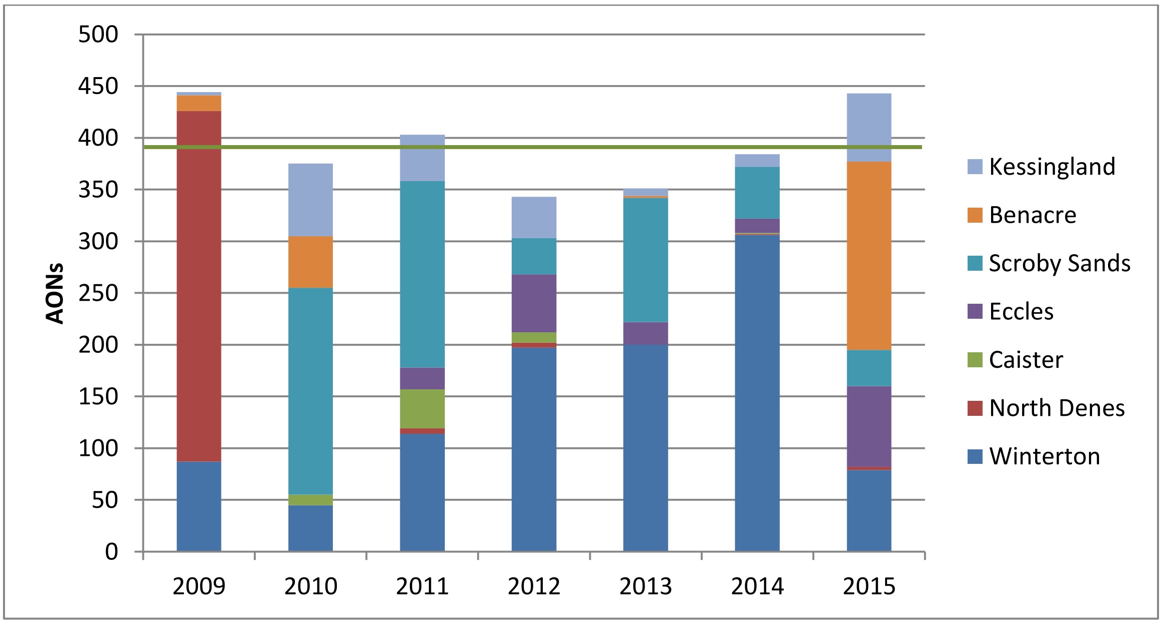



**Figure 8**. Little tern numbers (Apparently Occupied Nests, AONs, equivalent to adult pairs) at five locations either within or thought to be functionally linked to the Great Yarmouth North Denes SPA (Winterton, North Denes, Caister, Eccles and Scorby Sands) and two either within or thought to be functionally linked to the

Benacre to Easton Bavents SPA (Benacre, Kessingland). Green horizontal line shows average for period 2009 – 2015.

Although there is a suggestion of similar functional linkage between little terns breeding within the Alde-Ore Estuary SPA and the sandbanks at the mouth of the River Deben (known as the Deben Knolls), current data suggest only sporadic breeding and do not allow comparable demonstration of linkage with sufficient confidence.

Combined, the SPAs listed and their associated functionally linked nesting sites currently contribute a five year average of 373 pairs (Table 3). This represents 19.64% of the GB population. The pSPA will thus offer protection of foraging areas to a very significant proportion of little terns breeding in Great Britain.

5.2.1.2. Common tern *Sterna hirundo*

The breeding population of common terns in Great Britain is estimated to be 10,000 pairs (Musgrove *et al.* 2013), representing at least 15% of the Southern & Western European breeding population (67,000 pairs derived by division by 3 of the upper estimate of 200,000 individuals and rounded to nearest 1,000: AEWA 2012). A significant proportion of the British population breeds in Scotland. Coastal colonies in England are concentrated in the north-east, East Anglia, at a few localities along the south coast, and in the north-west (Mitchell *et al*. 2004). Common terns breed not only around coasts but, unlike the other tern species which breed in the UK, also breed frequently beside inland freshwater bodies.

Common terns are a qualifying feature of Foulness and Breydon Water SPAs. The species still nests at both sites. At Foulness SPA, the five year mean (2011 – 2015) of 17.5 pairs derives from counts of adult pairs and counts of ringed young breeding at New England Creek (Annex 7). The five year mean at Breydon Water SPA for the same period is 104 pairs.

Common terns also breed on the sandbanks at Scroby Sands, along with little terns. It is likely that the common terns nesting here are functionally linked to the Breydon Water SPA population; as numbers at Breydon Water have declined since Scroby Sands has become exposed, numbers at Scroby Sands have generally increased (Figure 9). The average number of common tern pairs for the two areas combined is 235, with a standard deviation of 54.5 pairs (2009 – 2015). This suggests annual variation is limited, especially with the apparently anomalous large count in 2013, and provides evidence of functional linkage between Breydon Water SPA and Scroby Sands. This provides justification for including data from each of them within the total number of common terns expected to use the Outer Thames Estuary pSPA.

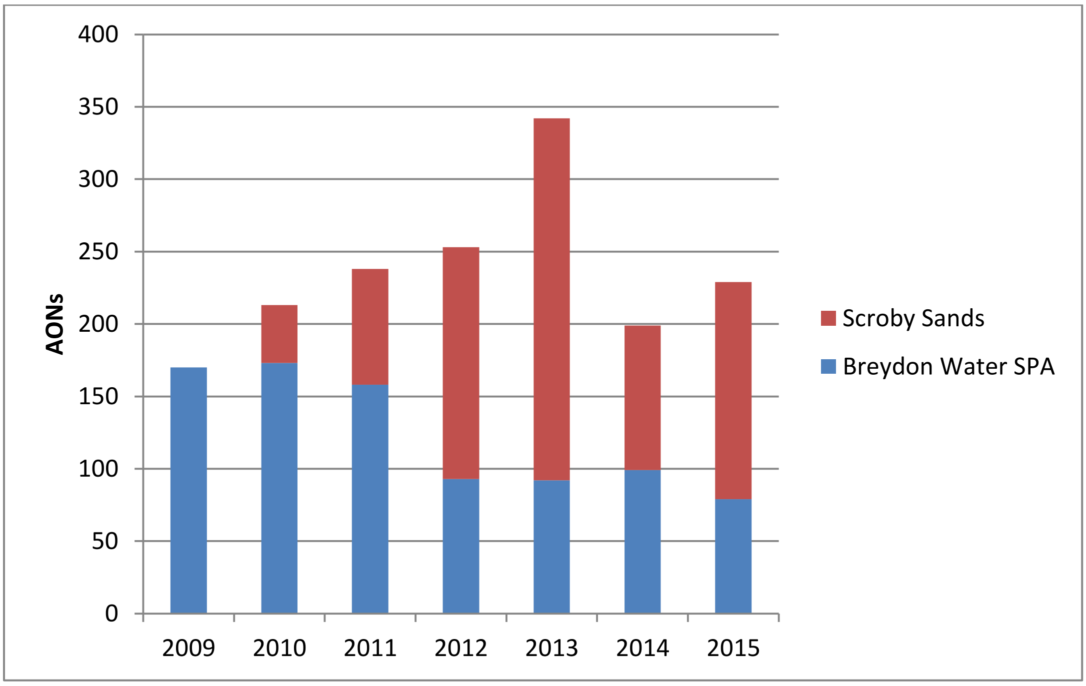



**Figure 9** Common tern numbers (Apparently Occupied Nests, AONs) at Scroby Sands and Breydon Water SPA 2009 – 2015.

Combined, Foulness SPA, Breydon Water SPA, and the associated functionally linked nesting site at Scroby Sands currently contribute a five year average of 266 pairs (Table 5.2). This represents 2.66% of the GB population. The pSPA will thus offer protection of foraging areas to a significant proportion of common terns breeding in Great Britain.

### 5.2.2. Comparison of counts for breeding sites

Current data used for the pSPA total are presented here, alongside values from SPA citation forms and N2K Standard Data Forms (Table 3). These are for comparison purposes within this Brief; it is the current data that informs the classification of the site.

**Table 3**. Counts of terns (pairs) contributing to the Outer Thames Estuary pSPA total, and current five-year means (2011 – 2015), including likely functionally linked breeding sites within SPA totals. Sandwich terns presented for information only (see section 4.2.4). Grey cells indicate where the species is not a feature of the SPA.

| | **Little tern** | | | **Common tern** | | | **Sandwich tern** | | |
|---|---|---|---|---|---|---|---|---|---|
| **SPA** | *Current* | *SPA citation* | *N2K data form* | *Current* | *SPA citation* | *N2K data form* | *Current* | *SPA citation* | *N2K data form* |
| **Great Yarmouth North Denes** | 314 | 277 | 220 | | | | | | |
| **Breydon Water** | | | | 252.2 | 155 | 155 | | | |
| **Benacre to Easton Bavents** | 57.6 | 39 | 21 | | | | | | |
| **Minsmere-Walberswick** | 0.8 | 32 | 28 | | | | | | |
| **Alde-Ore Estuary** | 0.8 | No data | 48 | | | | No data | No data | 170 |
| **Foulness** | 0 | 73 | >24 | 17.5 | 186 | 220 | 0 | 267 | 320 |
| **Thanet Coast and Sandwich Bay** | 0 | 30 | 6 | | | | | | |
| **Current five-year mean (sum)** | 373.2 | | | 266.2 | | | | | |

### 5.2.3. Non-breeding season

#### *5.2.3.1.* Red-throated diver *Gavia stellata*

The non-breeding population of red-throated divers in Great Britain is estimated to be 17,000 individuals (Musgrove *et al.* 2013), mostly distributed in marine areas in the south east of England (O'Brien *et al*. 2008). The original Outer Thames Estuary SPA boundary was determined for red-throated divers, using visual aerial survey data, Kernel Density Estimation and Maximum Curvature Analysis (Natural England 2010 (http://publications.naturalengland.org.uk/publication/3233957); O'Brien *et al*. 2012).

The Outer Thames Estuary pSPA boundary remains largely unchanged from the original SPA classification, and the peak mean value of 6,466 individuals is also unchanged.

### 5.2.4. Species not currently meeting SPA selection guidelines

Although Sandwich terns are a breeding feature of the existing Alde-Ore Estuary and Foulness SPAs, their continued absence at these sites means their foraging requirements were neither directly measured nor modelled, and they make no contribution to the Outer Thames Estuary pSPA total. Although Sandwich terns are recorded sporadically on Scroby Sands, the species is not present regularly in abundances exceeding the stage 1.1 selection guideline (four year peak mean 70.5 pairs *cf*. 1% GB population threshold of 110 pairs (Musgrove *et al*. 2013); derived from counts of 0 (2012), 2 (2013), 250 (2014) and 30 (2015): data source – RSPB). Thus Sandwich terns are not currently a feature of the Outer Thames Estuary pSPA. This may require review in future if populations recover at the terrestrial breeding sites.

## 6. Comparison with other sites in the UK

*Breeding season*

A comparison of the numbers of terns within the Outer Thames Estuary pSPA, derived by summing the most recent five year colony counts from the source colonies, with the most recent populations supported by other SPAs in the UK which also have these same species as named qualifying features in their own right, is presented in Table 6. As the source colony SPAs continue to exist in their own right, they are included in this table. This leads to duplication of numbers of birds with those tabulated for Outer Thames Estuary pSPA (acknowledging the difference in time periods between derivation of these numbers).

**Table 6**. Comparison of the average numbers of individuals (and pairs) of each of the features of the Outer Thames Estuary pSPA (2011 – 2015) with those at other SPAs identified (Stroud *et al*. 2001) as supporting those features.

| Species | Site | Individuals (pairs)[2] | Rank[3][4] | Comments |
|---|---|---|---|---|
| Common tern *Sterna hirundo* | Dungeness to Pett Level SPA | 532 (266) | =11th of 23 | |
| | Outer Thames Estuary pSPA | 532 (266) | =11th of 23 | |
| | Ythan Estuary, Sands of Forvie and Meikle Loch SPA | 530 (265) | 13th of 23 | |
| Little tern *Sternula albifrons* | Outer Thames Estuary pSPA | 779 (389) | 1st of 28 | |
| | North Norfolk Coast | 754 (377) | 2nd of 28 | |
| | Great Yarmouth North Denes | 440 (220) | 3rd of 28 | |

*Non-breeding season*

The Outer Thames Estuary SPA, when classified, supported 38% of the GB population (five year peak mean of 6,466 birds); the only other classified SPA in the UK (Liverpool Bay SPA) supported 5.4% (five year peak mean of 922 birds). The only other SPA for the species in the UK is the Firth of Forth SPA, supporting 90 individuals.

The Outer Thames Estuary pSPA is therefore the highest ranked site in the UK.

## 7. Conclusion

The evidence presented in this Departmental Brief sets out the scientific case for SPA classification, based on peer-reviewed models of tern foraging requirements and red-throated diver distributional data. The proposed boundary changes only slightly in comparison to the original Outer Thames Estuary SPA, and is still largely determined by aggregations of red-throated divers.

[2] Stroud *et al. (2001)* notes: Data from the JNCC/RSPB/ Seabird Group's Seabird Colony Register have been used. These comprised the best available, whole colony counts for the period 1993-1997 or earlier. These data have been supplemented with additional census data for some sites provided by country agencies (especially in Scotland) and/or as a result of more recent surveys of particular species.

[3] Note that these rankings should only be considered indicative of the relative importance of the pSPA as they are based on comparison of the sum of the most recent 5 year mean populations of each species at the source SPAs with the historical populations of each species at each SPA in the UK as listed in Stroud *et al.* (2001). The number of sites ranked is based on the number of sites listed for each species in Stroud *et al*. (2001) and included from that list are SPAs contributing to the total presented for the Outer Thames Estuary pSPA, and adding one site to account for the pSPA itself.

[4] These rank orders to not take account of numbers currently being considered in the context of other pSPAs in the United Kingdom.

The pSPA is internationally important for three species. It will remain the most abundant site in the UK for red-throated divers, and will provide foraging habitat for a combined total of little terns exceeding the single most abundant breeding colony total (being comprised of birds from six source SPA colonies). Also, it will support internationally important numbers of foraging common terns from two source SPA colonies.

In conclusion, the site qualifies as per the original Outer Thames Estuary SPA, with the addition of little tern and common tern features to protect the marine foraging areas used by birds breeding along the adjacent coastline.

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# Annex 1 Site Citation

## EC Directive 79/409 on the Conservation of Wild Birds

## potential Special Protection Area (SPA)

**Name:** Outer Thames Estuary pSPA

**Counties/Unitary Authorities**:

Norfolk, Suffolk, Essex, Kent

**Boundary of the pSPA**:

The pSPA is divided into three main areas: the main part of the site is the outer part of the estuary, located between a line eastwards just north of Walton on the Naze, Essex in the north, to approximately Foreness Point seaward in the south, reflecting the existing SPA boundary. This area however extends inland to Westcliffe-on-sea along the Southend coast and down the River Roach and as far west as South Fambridge on the River Crouch. A separate area extends south along the coast of east Norfolk from Caister-on Sea in the north to offshore Felixstowe, Suffolk reflecting the existing SPA boundary. However the site extends down the River Bure to approximately Runham, and the River Blythe to encompass Blythburgh Water in the west. This area lies mainly within the 12 nautical mile (nm) zone, except for two small areas which extend slightly into the 12nm zone offshore from about Lowestoft, and a third area lying slightly further north and partly within 12nm, but also with a larger area extending well beyond the 12nm zone.

The landward boundary of the pSPA will mainly follow the existing Outer Thames Estuary SPA boundary which was drawn to Mean Low Water (MLW) or the seaward boundaries of existing SPAs, whichever is furthest seaward and based on red-throated diver survey data. The boundary is extending to Mean High Water (MHW) in places to encompass the foraging areas for little tern (*Sternula albifrons*) and common tern (*Sterna hirundo*) identified from qualifying SPAs.

The seaward boundary lies partly within the 20 m depth contour and marginally (along the outer eastern edge) within the 20-50 m depth contour.

**Size of pSPA:** The pSPA covers an area of 391,909.65 ha.

**Site description**:

The Outer Thames Estuary pSPA is located on the east coast of England between the counties of Norfolk (on the north side) and Kent (on the south side) and extends into the North Sea. The site comprises areas of shallow and deeper water, high tidal current streams and a range of mobile mud, sand, silt and gravely sediments extending into the marine environment, incorporating areas of sand banks often exposed at low tide. Intertidal mud and sand flats are found further towards the coast and within creeks and inlets inland down the River Yare, Bure, Blyth and Roach and Crouch estuaries. The diversity of marine habitats and associated species is reflected in existing statutory protected area designations, some of which overlap or abut the pSPA.

**Qualifying species:**

SPA site selection guidelines have been applied to the most up to date information for the site. Red-throated divers were a feature of the existing Outer Thames Estuary SPA and remain as part of the new pSPA.

The site qualifies under **article 4.1** of the Directive (2009/147/EC) as it is used regularly by 1% or more of the Great Britain populations of the following species listed in Annex I in any season:

| Species | Season | Count (Period) | % of population |
|---|---|---|---|
| Red-throated diver *Gavia stellata* | Non-breeding | 6,466 individuals (1989 – 2006/07)[5] | 38.0% of GB population |
| Little tern *Sternula albifrons* | Breeding | 746 individuals (2011 – 2015) | 19.64% of GB population |
| Common tern *Sterna hirundo* | Breeding | 532 individuals (2011 – 2015) | 2.66% of GB population |

**Assemblage qualification:**

The site does not qualify under SPA selection stage 1.3.

**Principal bird data sources:**

Colony counts from JNCC Seabird Monitoring Programme, Norfolk Bird & Mammal Reports, Foulness Area Bird Survey Group and contributed by colony managers from RSPB. Data on ringed common terns from national bird ringing scheme. Red-throated diver data from aerial surveys 1989 – 2006/07, as per Natural England (2010) and O'Brien *et al*. (2012).

[5] Value retained from original Outer Thames Estuary SPA standard data form (http://publications.naturalengland.org.uk/publication/3233957)

## Annex 2 Sources of bird data

| Source of Data | Data provider | Subject | Date produced | Method of data collection | Verification |
|---|---|---|---|---|---|
| JNCC larger tern survey report | JNCC | Empirical survey data on the foraging locations of breeding terns tracked from several UK colonies and the identification of important foraging areas around colonies using habitat association models | 2009-2011 | Visual tracking of individual terns from boat-based survey platform | Verification by JNCC and external peer review of final report |
| JNCC little tern survey report | JNCC | Empirical survey data on the sightings of little terns along the shore and at sea at several UK colonies and definition of alongshore and seaward limits to important foraging areas around colonies | 2009-2013 | Shore-based counts from fixed vantage points and boat-based transects at sea | Verification by JNCC and external peer review of final report |
| Seabird Monitoring Programme | JNCC and site managers | Breeding seabird data for relevant colonies contributing to Outer Thames Estuary pSPA | 2011-2014 | Standard methodology | Verified by site manager and JNCC and published on website |
| Norfolk Bird & Mammal Report | | Breeding seabird data for relevant colonies contributing to Outer Thames Estuary pSPA | 2010 - 2013 | Standard methodology | Published document undergoing editorial scrutiny |
| Data from RSPB | RSPB | Breeding seabird data for relevant colonies contributing to Outer Thames Estuary pSPA | 2011 - 2015 | Standard methodology | Data collected and agreed by site managers |
| Data from Foulness Area Bird Survey Group | FABSG | Breeding seabird data Foulness contributing to Outer Thames Estuary pSPA | 2011 - 2015 | Standard methodology | Data collected by group, scrutinised by group leader and published on website |
| National bird ringing scheme | BTO / Foulness ringing group | Counts of young common terns ringed at Foulness SPA | 2011 | Counts of ringed birds | Contributed to national ringing scheme |
| JNCC red-throated diver report | JNCC | Data on red-throated diver distribution and abundance from aerial surveys; summarised by Webb *et al*. (2009), Natural England (2010), O'Brien *et al*. (2012) | 1989 – 2006/07 | Visual aerial surveys, Kernel Density Estimation, Maximum Curvature analysis | Published in peer-reviewed journal (O'Brien *et al*. 2012) |

# Annex 3 Defining little tern foraging areas and seaward boundary

## 1. Background and overview

All five species of tern that breed in the UK (Arctic *Sterna paradisaea*, common *S. hirundo,* Sandwich *S. sandvicensis,* roseate *S. dougallii* and little tern *Sternula albifrons*) are listed as rare and vulnerable on Annex I of the EU Birds Directive and thus are subject to special conservation measures including the classification of Special Protection Areas (SPAs). Little terns nest on sand or shingle beaches, islets and spits, often very close to the high water mark and are among the rarest seabird species breeding in the UK. There are currently 28 breeding colony SPAs designated within which little terns are protected. The marine areas they use while foraging to provide their young have not yet been identified and classified as SPAs to complement the existing terrestrial suite. Since 2009, the JNCC has been working with the four Statutory Nature Conservation Bodies (SNCBs) towards the identification of such areas.

This annex gives an overview of the survey and analytical work carried out by and on behalf of JNCC between 2009 and 2013 for the little tern. This work focussed on those colony SPAs which have been regularly occupied[6] by significant numbers of little tern pairs over the last 5-10 years (13 colony SPAs). Shore based and boat based survey work was undertaken which allowed characterisation of the distances that little terns fly from their colony in order to forage. Boundaries of important foraging areas were drawn based on the distances which little terns fly along the coast, and distances which they fly out to sea. A full and detailed description of the analysis can be found in the JNCC report on this work (http://jncc.defra.gov.uk/pdf/Report_548_web.pdf). A different approach was deemed appropriate for large terns as they search for food over a much wider area and further from the coast and breeding colony than little terns. An overview of that work is described in Annex 6 and a full and detailed description of that analysis can be found in the JNCC report on that work (http://jncc.defra.gov.uk/page-6644).

## 1. Data collection

The study aimed to provide three years of colony specific data for all regularly occupied breeding SPAs of little terns. However logistics, colony failure, and other factors meant the data coverage for each colony varied. Surveys were timed to coincide as far as possible with chick rearing, which is the period of greatest energetic demand to the species during the breeding season and therefore critical to the maintenance of the population.

Two types of survey (boat- and shore-based observations) were applied in order to estimate both seaward as well as alongshore (coastal) extent of little tern foraging areas.

### 1.1. Seaward extent of little tern distribution (boat-based survey)

Boat-based surveys were carried out to assess how far out at sea foraging little terns would range (*i.e*. to confirm their maximum seaward foraging extent). Surveys involved the boats travelling along a series of parallel lines through a survey area around each colony. These surveys extended to 6 km from the coast to approximate the mean maximum foraging range as revealed from the literature (e.g. Thaxter *et al.* 2012) and preliminary JNCC observations. Two methods of recording little terns along a transect line were employed: (i) Instantaneous counts undertaken systematically at pre-determined points (between 300 m and 1800 m apart). The instantaneous count area was an 180º arc either ahead of, or off one side of, the boat depending on viewing conditions. All birds seen within this arc (out to a maximum estimated distance of 300 m) were recorded, along with the distance and bearing of the sighting and information on behaviour; (ii) Continuous counts of any little terns observed between the instantaneous points were also recorded to provide an[7] index of

[6] 'Regularly occupied' was defined where the mean peak breeding numbers of the most recent five years at the time of assessment equalled or exceeded the 1% of the national population. Colony counts were provided by the Seabird Monitoring Programme (www.jncc.defra. gov.uk/page-1550) and direct from site managers.

relative abundance. Although observers recorded behaviour (foraging/flying), restricting the analysis to just foraging observations would have limited the sample size. Therefore, all records (foraging and not foraging) were included in the analyses.

### 1.2. Alongshore extent of little tern distribution (shore-based surveys)

Shore-based observations aimed to assess to what extent little terns forage away from their colony along the coastal strip. Observation points were chosen at 1 km intervals to either side of the colony, up to a distance of 6 km along the coast, according to the mean maximum foraging range indicated by the literature. If preliminary observations found birds going further than 6 km, more observation points were added at successive 1 km intervals. Birds were counted within a distance of 300 m to either side of the observation point (resulting in a 180° arc). The shore based counts recorded passage rate and foraging use and if possible snapshot counts at one minute or two minute intervals were also recorded. The aim of the snapshot counts was to provide information on the intensity of foraging at each observation point. Ideally, counts at different observation points were done concurrently, lasting at least 30 minutes at each observation point. This time is based on the mean foraging trip duration for little terns lasting 16–29 minutes according to Perrow *et al.* (2006). However, in some cases this was not possible due to time constraints and/or logistical difficulties. In order to account for this difference in effort between observation points the shore-based count data were standardised to the number of birds observed per minute at each observation point. Care was taken to cover a range of tidal states, as variations in water levels between the times of high and low water are likely to play a significant role in determining the foraging locations of terns.

To ensure that the data were comparable between sites the samples were analysed as a proportion of the total birds counted (per minute) at the first count point (usually 1 km) in either direction alongshore from the colony. Each side of the colony was analysed as a separate sample. This approach assumes that 100% of birds leaving the colony in a particular direction reach the first count point, and that all birds reaching subsequent count points have passed through (and had been counted at) point one on their way.

## 2. Data analysis

The density of little terns within each survey area was relatively small, leading to small numbers of observations within boat transects and shore based count points. This was particularly evident at the colonies with fewer breeding pairs. Given this, techniques successfully used for defining boundaries to areas of importance for other seabird and waterfowl species i.e. interpolation based on analyses of transect data to yield density maps (e.g. O'Brien *et al.* 2012) could not be used in this case. Furthermore, the small foraging range of the little terns precluded application of the habitat association modelling approach used in the case of the work on larger terns (Annex 6). Accordingly, JNCC developed a method for boundary delineation which would work with this type of data.

The approach developed to boundary setting was based on use of simple metrics that could be derived from the boat-based and shore-based survey data collected at each site. At colonies where sufficient data were available, site-specific survey data were used to determine the values of these metrics. Analysis found that colony size and density had only a weak effect on the extent of little tern foraging ranges, so in the case of colonies where there were insufficient or no data, averages of all the colony specific values were used to define seaward and alongshore boundaries. These options are set out in more detail below.

### 2.1 Site-specific options

For colonies with sufficient data to describe either or both seaward and alongshore extents, the following site-specific metrics were used to define boundaries:

A) Seaward extent

The **site-specific seaward** extent of foraging areas was determined by the **mean of the maximum extents** of little tern observations from repeated surveys at that site.

Using the mean of the maximum seaward observations across repeated surveys aims to represent the maximum foraging distance used by an average little tern on an average day. Within a given survey day maximum extent is used because there were relatively few survey data available and additional sampling effort would likely extend the observed maximum range. The mean of these maximum extents was used in order to express the variability of extents between samples. This approach avoids the risk of outliers dictating the extent, as would be the case if the 'maximum extent' ever observed at a site was used.

B) Alongshore extent

The **site-specific alongshore** extent of foraging areas was determined by the **maximum extent** of alongshore distribution at a site.

Using the maximum alongshore observation was considered appropriate to avoid a potential bias towards underestimation of the distances travelled alongshore that would have arisen from use of any other metric because there were: i) relatively few survey data available at each site, ii) a tendency for count points furthest away from the colony to receive slightly less counting effort, and iii) instances in which little terns were observed at the furthermost observation point alongshore. Furthermore, there appeared to be very few outliers in these datasets such that there was a lower risk of the alongshore extent being unduly influenced by outliers than in the case of the defining the seaward extent.

## 2.2 Generic options

For colonies with insufficient or missing data, generic options were applied to define either or both seaward and alongshore extents, based on the averages of the relevant values derived at each of the colonies for which sufficient data were available to determine site-specific values.

A) Seaward extent

The **generic seaward** extent of foraging areas was determined by the **mean** of the **mean maximum extent** obtained from site-specific datasets.

B) Alongshore extent

The **generic alongshore** extent of foraging areas was determined by the **mean** of the **maximum alongshore extent** obtained from site-specific datasets.

The validity of using these averages across sites to define the generic values for both seaward and alongshore extent at colonies with insufficient or missing data was explored by examination of the relationships between the cumulative numbers of little tern observations and increasing distance out to sea and alongshore, pooled across all sites (see next section).

## 2.3 Derivation of site specific and generic seaward and alongshore extents

A summary of the seaward extents as estimated from boat-based transect surveys at each colony, together with the generic seaward foraging extent derived from these values is set out in Table 1.

Table 1. Values of the maximum seaward observation of little terns on each survey at each SPA surveyed. The number of values in the 2$^{nd}$ column indicates the number of boat-based surveys yielding independent estimates of maximum seaward extent of occurrence at each colony. The values in the 3$^{rd}$ column are the site specific average of the values in the 2$^{nd}$ column. The value in the final row is the average of the site specific mean values.

| SPA colony | Maximum seaward observation per survey (m) | Mean of maximum seaward observations (m) |
|---|---|---|

| | | |
|---|---|---|
| Teesmouth and Cleveland Coast | 1564,5661,4504,1357,4153 | 3448 |
| Solent & Southampton water | 492, 1620 | 1056 |
| North Norfolk Coast | 2077, 2129, 1946 | 2051 |
| Hamford Water | 2487, 1065 | 1776 |
| Great Yarmouth and North Denes | 800[1], 3120[1], 3770[1], 1390[2], 1730[2], 3780[2] | 2430 |
| Northumbria Coast | 2185, 3011 | 2598 |
| Dee estuary | 1674, 2070 | 1872 |
| Generic (mean value) applied to sites with insufficient data | - | 2176 |

1. Derived from birds breeding at the North Denes colony; 85% kernel contours.
2. Derived from bird breeding (radio-tracking; 85% kernel contours) or assumed to be breeding (boat transects) at
Winterton colony.

A summary of the alongshore extents as estimated from shore-based surveys at each colony, together with the generic alongshore foraging extent derived from these values is set out in Table 2.

Table 2. Values of the distance of the observation point furthest alongshore (in each direction) from each colony at which little terns were observed on any survey at that colony in any year. The value in the final row is the average of the site specific values.

| SPA colony | Maximum alongshore extent from the colony in each direction (km) |
|---|---|
| Ythan Estuary, Sands of Forvie and Meikle Loch | 2, 5.35 |
| Dee Estuary | 3, 3 |
| Northumbria Coast | 5, 6 |
| Humber Estuary | 6, 6 |
| North Norfolk Coast | 7, 7 |
| Teesmouth & Cleveland Coast | 5, 5 |
| Gibraltar Point | 2, N/A |
| Great Yarmouth North Denes | 5, 4 |
| Hamford Water | 4, 3 |
| Solent & Southampton water | 1, N/A |
| Morecambe Bay | 7, 2 |
| Lindisfarne | 3, 4 |
| Chesil Beach and The Fleet | 1, 0.5, 1 |
| Generic (mean value) applied to sites with insufficient data | 3.9 |

The relationships between the cumulative numbers of little tern observations with increasing distance out to sea and alongshore, pooled across all sites are presented in Figures 1 and 2. These have been used to assess the appropriateness and degree of precaution associated with the use of the generic values of 2.2 km offshore and 3.9 km alongshore to define the boundaries in the case of colonies with insufficient or missing data.

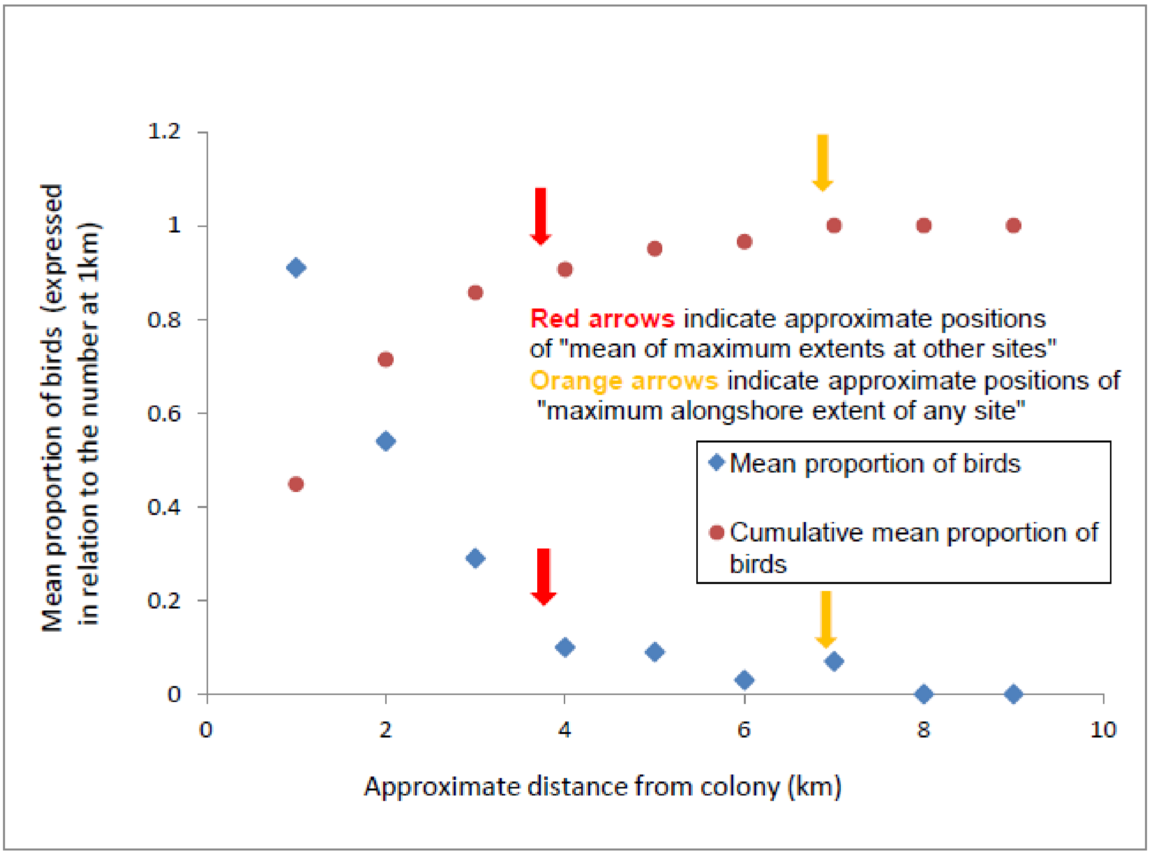


**Figure 1:** Mean proportion (blue dots) and cumulative mean proportion (red dots) of little terns at increasing distances alongshore from the colony. Each blue point represents the mean proportional usage at each distance band from the colony averaged across colonies. The proportion at each distance (blue dots) is expressed relative to the number at the 1 km mark. The mean proportion of birds at 1 km is less than 1.0 because, in a few cases, no birds were observed at 1 km. The red arrows indicate the values at the generic mean of the maximum site-specific alongshore extent (3.9 km) whereas the yellow arrows indicate the values at the greatest site-specific maximum alongshore extent recorded (7 km at North Norfolk Coast and Morecambe Bay). Source: Parsons *et al.* (2015).

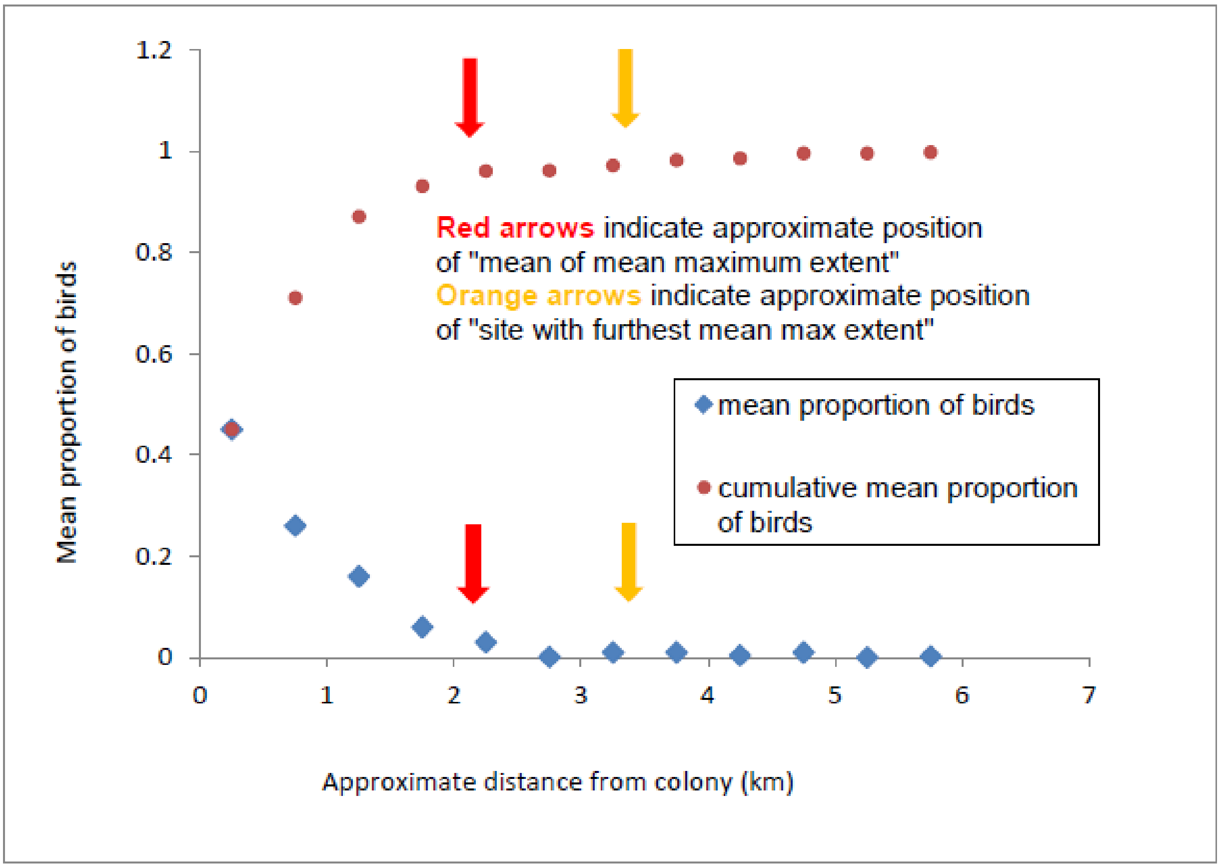


**Figure 2:** Mean proportion (blue dots) and cumulative mean proportion (red dots) of little terns at increasing seaward distances from mean high water mark. Each blue point represents the mean proportional usage at each distance band from mean high water mark averaged across colonies. The red arrows indicate the values at the generic mean of the mean maximum site-specific seaward extent (2.2 km) whereas the yellow arrows indicate the values at the greatest of the site specific mean maximum seaward extents (3.4 km at Teesmouth and Cleveland Coast). Source: Parsons *et al.* (2015).

These figures demonstrate the nature of the relationship of increasing cumulative usage with increasing distance from colony. For alongshore (Figure 1) approximately 0.86 of all recorded usage occurred within 3.9 km from the colony, this being the mean of maximum extents at other sites and used as the generic value to define alongshore boundaries at colonies with insufficient or missing data. In comparison, at 7 km from the colony (i.e. the maximum distance of any observation station from any colony) all recorded usage was encompassed. For offshore extent (Figure 2), approximately 0.97 of all recorded usage occurred within 2.18 km of the coast, this being the "mean of the site specific mean maximum extents" at other sites and used as the generic value to define seaward boundaries at colonies with insufficient or missing data. In comparison, at 3.4 km which is the greatest of the site specific mean maximum seaward extents, 0.99 of all recorded usage at all sites was encompassed.

From these analyses it can be seen that in order to capture all recorded usage in an alongshore direction (1.0 at 7 km) and almost all recorded usage in a seaward direction (0.99 at 3.4 km) there would need to be a considerable increase in the distances being considered for defining the generic boundaries over those proposed (i.e. a further 3.1 km alongshore in each direction and a further 1.2 km offshore). On the simplifying assumption that alongshore and seaward limits define a rectangle lying parallel to the coast and with the landward edge centred on the colony, the sea area encompassed by these greater limits would be approximately 2.8 times that encompassed by the narrower limits proposed. The analyses suggest, however, that the gain in terms of the inclusion of additional areas of significant little tern activity would be relatively modest as the proportion of bird observations included within the narrower generic boundaries proposed already capture 0.86 and 0.97 of recorded usage alongshore and offshore respectively. It would seem to be overly precautionary for an estimate of foraging extent to encompass all or nearly all observations, given that at any one site this would probably result in significant areas of very low tern usage being included in the estimate. Therefore, the average of the site specific maximum alongshore extents (3.9 km) and the average of the site specific mean maximum seaward extents (2.2 km) have been adopted for a generic estimation of foraging extent at colonies with insufficient or missing data. Use of these values is, on the basis of the analyses, likely to encompass areas of high to moderate use by breeding adult little terns during chick-rearing while excluding areas which are likely to have very low usage at that stage of the season.

# 3 Boundary delineation

At each colony SPA, an assessment was made on the quality and quantity of data available for defining seaward extent and alongshore extent. If the quality or quantity was felt to be insufficient (eg no data or low numbers of birds observed, or few surveys, or data from only one year), then the generic option was applied at that colony. Judgement was applied rather than strict adherence to numerical thresholds for quantity of data. If the data at a site was felt to be sufficient, then the site-specific options, as described above, were applied at that colony.

Alongshore boundaries for little tern foraging areas were simply drawn as straight lines perpendicular to the coast at the distances of the site specific or generic alongshore extent on each side of the colony. Site specific alongshore boundaries were allowed to differ between the shores on either side of a colony if the data indicated this to be appropriate, whereas generic alongshore boundaries were drawn equidistant on both sides of a colony. These lines were then joined up using a line parallel to the coast and drawn at a distance defined either by the site specific or generic seaward extent. Observations indicated that little terns forage both in the intertidal zone and subtidal zone, so the landward limit of foraging extents has been taken to Mean High Water.

An example of a potential boundary around little tern foraging areas based on the approach described above is shown in Figure 3.

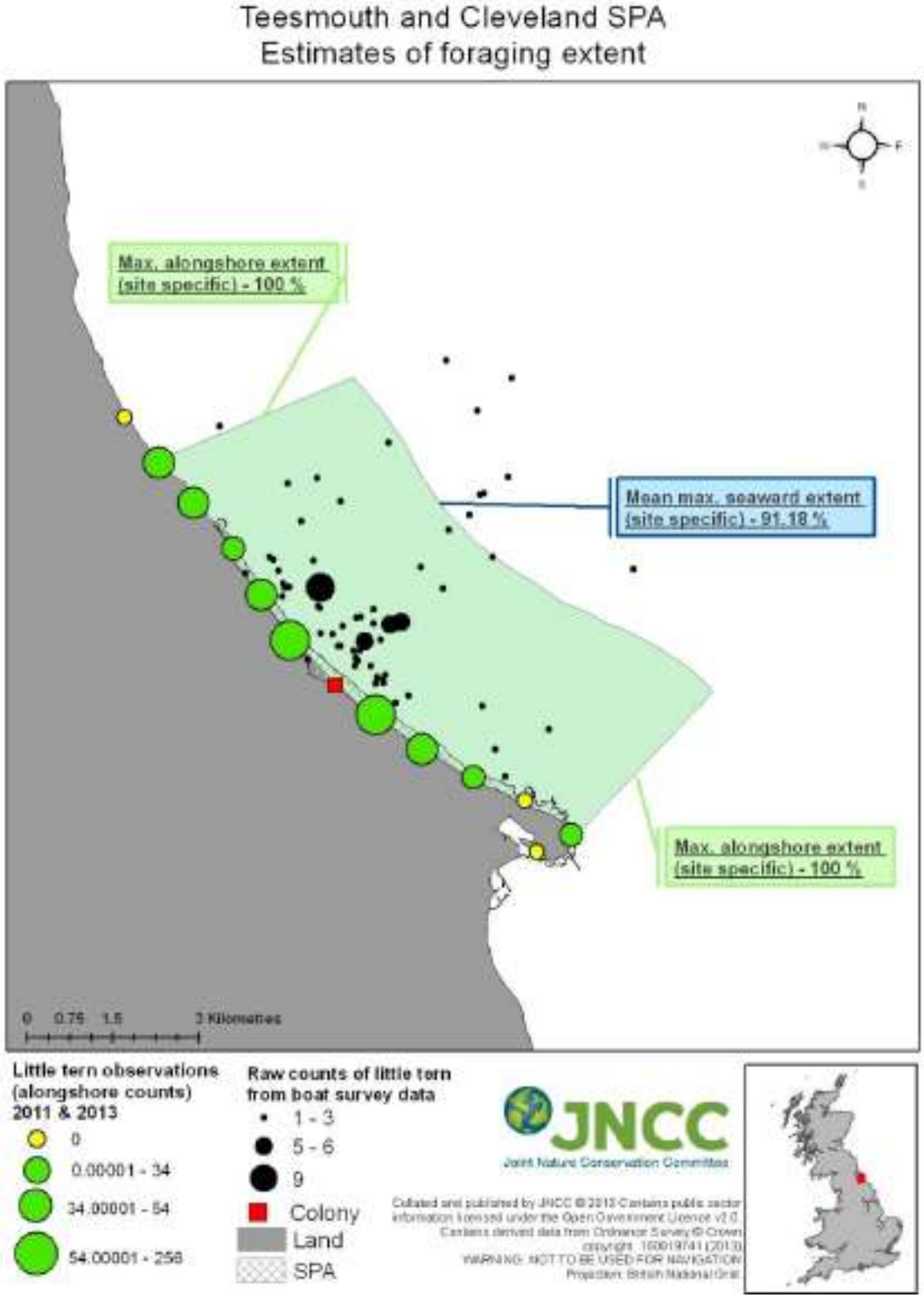


Figure 3. An example of the application of site specific alongshore and site specific seaward extents to define the boundaries to little tern foraging areas at the Teesmouth and Cleveland SPA. The % values given in the labels indicate the site specific % of little tern observations within the shore-based (alongshore) dataset and boat-based (seaward) dataset captured within the alongshore and seaward boundaries.

## 4 Conclusion

The aim of this work was to quantify usage of the marine environment by little terns around their breeding colony SPAs in the UK. The foraging extents identified by this study derive from information gathered over multiple years using site-specific information where possible. Most information derives from data collected between 2009 and 2013, a combination of shore-based observation (to determine the alongshore extent of use) and boat-based transect surveys (to establish the seaward extent). At one SPA - Great Yarmouth North Denes – these data were supplemented by information from radio tracking, collected in 2003-6 (Perrow and Skeate 2010).

Collection of site-specific data was attempted at most currently occupied SPAs, though in many cases data on seaward or alongshore extent could not be collected, and at others, no or few usable data were collected, either due to colony failure (caused by tidal inundation, predation or disturbance) or simply too few breeding pairs for sufficient observations to be detected by surveys.

Therefore, methods were required which aim to quantify foraging extent under a range of cases of data availability: i) where there are good data for both parameters; ii) where there are no site-specific survey data; iii) where data on seaward and/or alongshore extent are deficient.

For colonies with sufficient data on seaward extent, the mean of the maximum seaward extent of little tern observations from repeat surveys at that site has been used. Using the mean of repeat surveys aims to represent average usage and is therefore moderately conservative, and avoids the risk of outliers having a large influence on extent, as would be the case if the alternative – maximum distance offshore at which a single little tern was ever observed at a site – were used. For colonies with sufficient data on alongshore extent, the maximum distance alongshore at which terns were observed has been used, on the basis that because there are relatively few survey data at each site, and the tendency for furthest count points to have received slightly less effort on average, further survey would probably have extended the estimates of range. Because of this, it was judged that choosing the maximum extent at a site would not be excessively precautionary nor would the influence of outliers pose significant risk of over-estimation of extent.

For colonies with no or insufficient data, a method to derive generic extents was developed, based on data collected at other colonies. This aimed to weigh the risks of being overly precautionary (over-estimate foraging extent) or overly conservative (under-estimate foraging extent). Analyses indicated that use of the average across sites of the site specific means of the maximum recorded seaward extents captured 0.97 of all recorded tern observations, while use of the average across sites of the site specific maximum recorded alongshore extent captured 0.86 of all recorded tern observations. This suggested that use of these values at colonies with insufficient data to derive site-specific boundaries to little tern foraging areas would be likely to encompass areas of high to moderate use while excluding areas which are likely to have very low usage during the chick-rearing period.

The colony SPAs selected for study were those assessed to be currently occupied. This, however leaves a number of SPAs where little tern is a feature, where it was judged that little terns are no longer regularly breeding in significant numbers (as well as those currently occupied SPAs where no or few data could be collected). The assessment of occupation of such sites may change with time. This study has provided generic extents that could be applied following changed assessments.

The methods to estimate foraging extents are derived from field surveys and analyses of a nature appropriate to the data and the ecology of the little tern. Habitat modelling, such as that undertaken for the larger tern species (Annex 6) is not appropriate for the little tern, due to the combined effects of their more restricted inherent foraging range and the limited availability of habitat data at a suitable resolution or inshore locations.

The foraging extents of little tern estimated in this study fall within the range identified for little tern in a recent review of foraging ranges (Thaxter *et al.* 2012). That study identified the mean extent of the three studies included in the review as 2.1 km, with the mean of maxima across studies as 6.3 km. The work by JNCC, on a larger number of colonies, gave a mean maximum extent of 2.2 km, with a range of 1.1-3.4 km (for seaward extent) and a mean maximum of 3.9 km, with a range of 0.5-7 km (for alongshore extent). Eglington (2013), in a literature review of foraging ecology of terns, concluded that most studies, including those citing anecdotal information, reported a foraging radius less than 4 km from the colony, which accords with the results of JNCC's work.

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*Abstract available at:* http://www.researchgate.net/publication/236034521_Seabird_foraging_ranges_as_a_preliminary_tool_for_identifying_candidate_Marine_Protected_Areas/file/3deec515ec5e3a2218.pdf

# Annex 4 Defining larger tern foraging areas and seaward boundary

## 1. Background and overview

All five species of tern that breed in the UK (Arctic *Sterna paradisaea*, common *S. hirundo,* Sandwich *S. sandvicensis,* roseate *S. dougallii* and little tern *Sternula albifrons*) are listed as rare and vulnerable on Annex I of the EU Birds Directive and thus are subject to special conservation measures including the classification of Special Protection Areas (SPAs). Within the UK there are currently 57 breeding colony SPAs for which at least one species of tern is protected. However, additional important areas for terns at sea have yet to be identified and classified as marine SPAs to complement the existing terrestrial suite. Since 2007, the JNCC has been working with the four Statutory Nature Conservation Bodies (SNCBs) towards the identification of such areas.

The work described here aimed to detect and characterise marine feeding areas used by terns breeding within colony SPAs. Given that at least one of five species of terns occur as an interest feature within 57 colony SPAs spread across the UK, it was recognised that resource and time constraints would preclude the detailed site-specific surveys at all colony SPAs over several years that, in an ideal world, would provide the most robust empirically based characterisation of marine feeding areas used by terns breeding within every colony SPA. Accordingly a statistical modelling approach was adopted which used data collected from a sub-sample of colonies to a) characterise the types of marine environment that are used by foraging terns, and b) use this information to identify potential feeding areas around all colony SPAs.

This annex gives an overview of the survey and analytical work carried out by and on behalf of JNCC between 2009 and 2013 for the four larger tern species (*Sterna* species). A full and detailed description of the analysis can be found in the JNCC report on this work (http://jncc.defra.gov.uk/page-6644). A different approach was deemed appropriate for little terns as they search for food in a much more restricted area closer to the coast and to the breeding colony. An overview of that work is described in Annex 5 and a full and detailed description of that analysis can be found in the JNCC report on that work (http://jncc.defra.gov.uk/pdf/Report_548_web.pdf). For the modelling analysis aspect of the project, JNCC worked collaboratively with Biomathematics and Statistics Scotland (BioSS)[8].

## 2. Data collection

To acquire information on the at-sea foraging distributions of breeding terns, three years of targeted data collection were carried out or commissioned by JNCC around selected tern colonies from 2009 to 2011, using the visual-tracking technique[9] (see BOX 1 for details). The majority of the data were collected during the chick-rearing period (June to early July), a highly demanding period for breeding adult terns due to food gathering for chick feeding and rearing. The need to regularly return to the colony results in a higher number of foraging trips within a generally more restricted foraging range. Accordingly, areas used during this period are considered as crucial for overall survival and are thus high priority for site-based conservation.

[8] BioSS are one of the Main Research Providers for strategic research in environmental, agricultural and biological science funded by the Scottish Government's Rural and Environment Science and Analytical Services Division.

[9] PERROW, M. R., SKEATE, E. R. and GILROY, J. J. (2011). Visual tracking from a rigid-hulled inflatable boat to determine foraging movements of breeding terns. *Journal of Field Ornithology*, 82(1), 68-79.

BOX 1.
Observers on-board a rigid-hulled inflatable boat (RIB) followed individual terns during their foraging trips. An on-board GPS recorded the boat's track, which was used to represent the track of the bird. Observations commenced immediately adjacent to the SPA colony. The actual starting position was varied to capture the full range of departure directions of the birds. Observers maintained constant visual contact with the bird (by maintaining the RIB c.50-200 m from the bird*) and recorded any incidence of foraging behaviours, along with their associated timings. Behaviours could then be assigned to a distinct location within the GPS track by matching the timings.
* This distance was found to be optimal in terms of maintaining visual contact whilst minimising disturbance to the bird

Existing information on tern foraging ranges (Thaxter *et al.* 2012) suggest that the larger terns are capable of foraging as far as 30 km (Arctic, common and roseate terns) or 54 km (Sandwich terns) from their colonies. Accordingly, models were used to generate predicted distributions out to these maximum foraging ranges around the colonies of interest. To do so, information on habitat conditions across these areas was gathered from various sources to be fed into the habitat models as environmental covariates (information on environmental conditions at an appropriate scale and extent). Such environmental covariates were chosen for their potential to explain the observed tern distribution data. Due to a lack of information on actual prey distributions (e.g. sandeels, clupeids such as herring and sardine, zooplankton), environmental covariates which could relate to the occurrence or availability of these prey species such as water depth, temperature, salinity, current and wave energy, frontal features, chlorophyll concentrations, seabed slope and type of sediment as well as distance to colony (as a proxy for energetic costs) were used instead.

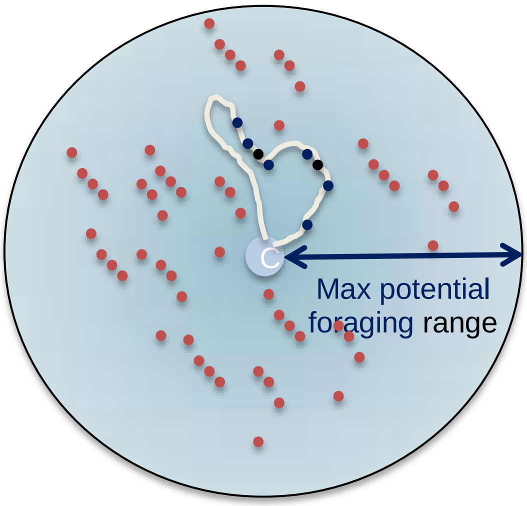
## 3. Data preparation and analysis

Prior to analysis within the habitat models, data had to be prepared and processed into a suitable format. Each track of a tern comprised periods of time when the bird was clearly not engaged in either actively searching for prey or in active foraging but appeared to be in transit to or from the colony or between areas of search at sea. As the aim of this work was to characterise important foraging areas and inclusion in the modelling of locations passed over in transit would dilute the power of the analysis to identify important habitat relationships and therefore foraging areas. In addition, because terns are central place foragers (meaning they must travel to and from their nest site on each trip), it would almost certainly lead to a bias towards high usage of areas close to the colony, data from commuting periods (i.e. parts of the bird track where no foraging behaviour[10] was recorded) were removed from the modelling analysis.

In order to identify the preferred type of area used for feeding, the environmental conditions found at foraging locations had to be compared with conditions found at locations which were not used for foraging. The analysis therefore compared observed foraging presence locations with foraging absence locations (see Box 2 for more detail on how these were defined) to characterise the kind of environment used for foraging by the terns.

[10] Foraging behaviour was defined as an instance of circling slowly actively searching for food in the water below, diving into the water, or dipping into the water surface.

Box 2.
Given that the data is collected by tracking individual birds rather than from transect surveys, we do not have a comprehensive picture of where the terns did not forage, but instead we do know where a particular bird did forage throughout a feeding trip. During that trip, it did not (choose to) feed anywhere else. There is an infinite number of possible 'non-foraging locations' where that tern could have gone to forage, so to provide something meaningful for the comparison analysis, we took a sample of non-foraging locations to which that individual might have gone from within the maximum published foraging range of each species.




The figure shows an example of the observed foraging locations (blue) along one bird track. Although an individual can (choose to) conduct a foraging trip to anywhere within the maximum foraging range, each location at which it forages on a given trip (i.e. the blue dots) is at least partly dependent upon the locations at which it has already foraged while on that trip i.e. one location follows another – the bird does not move about at random across the entire foraging range between successive foraging events on any given trip. Accordingly, to retain this within trip structure in the comparison of "presence " locations with "absence" locations, for each trip, matching sets of "absence " locations (red dots) were generated at random starting points within the maximum published foraging range of each species[11], These matching tracks therefore retained the number and spatial structure of observed foraging locations within each bird's track. 'Absence' locations represented areas available to the foraging bird but where the bird was absent at the time of recording. Twelve replicate "absence tracks" were generated for each actual trip. Subsequently, the resulting data sets to be used in the habitat models consisted of both 'foraging' and matching sets of 'absence' points for each individual foraging trip, as well as respective X and Y co-ordinates and values of the environmental covariates associated with each point

The environment that the terns use for foraging was characterised by analysis of the presence and matching absence data in relation to a suite of environmental covariates (see BOX 3 for details). This analysis was then 'reversed' and the modelled relationships between tern usage and the environmental covariates used, in conjunction with maps of environmental conditions or habitats around tern colonies, to identify those areas with characteristics suggesting that they are likely to be used for foraging, either by other terns at the same colony, or by terns at other colonies (see Figure 1).

[11] Species specific maximum foraging range from our own data and those identified in THAXTER, C.B., LASCELLES, B., SUGAR, K., COOK, A.S.C.P., ROOS, S., BOLTON, M., LANGSTON, R.H.W. & BURTON, N.H.K. 2012. Seabird foraging ranges as a preliminary tool for identifying candidate Marine Protected Areas. *Biological Conservation*, **156**: 53-61.

Box 3.

Extensive investigative analysis showed that logistic Generalised Linear Models (GLMs) were the appropriate statistical tool to identify habitat preferences of foraging terns based on observational data, and to generate predicted foraging distributions around colonies where data were missing. GLMs quantify the relationship between environmental covariates and tern foraging locations within a defined area, and by simply reversing this relationship, they are able to calculate the relative likelihood of a tern foraging (or not) at any location based on the values of the environmental covariates at that location.

As part of the development of the final GLMs used in the analysis, we ascertained that the relationship between tern foraging usage and environmental covariates was consistent between years, warranting the combination of data from all years of the study in the final models. Moreover, environmental covariates were ranked based on their biological meaningfulness, while also taking into account of the suitability and robustness of the data sets for making predictions of foraging use. Selection of which environmental covariates were included in the final model was based on this ranking combined with a standard statistical approach which trades off model complexity with goodness-of-fit to the underlying data.

In order to make a smoothed map of predicted foraging distribution, a 500 m by 500 m grid was created to cover the published foraging range for each colony of interest. Predictions of foraging likelihood were then made to each grid-cell based on the environmental conditions at the centre points of each cell. These predictions were then rescaled to provide a measure of relative foraging density within each grid-cell.

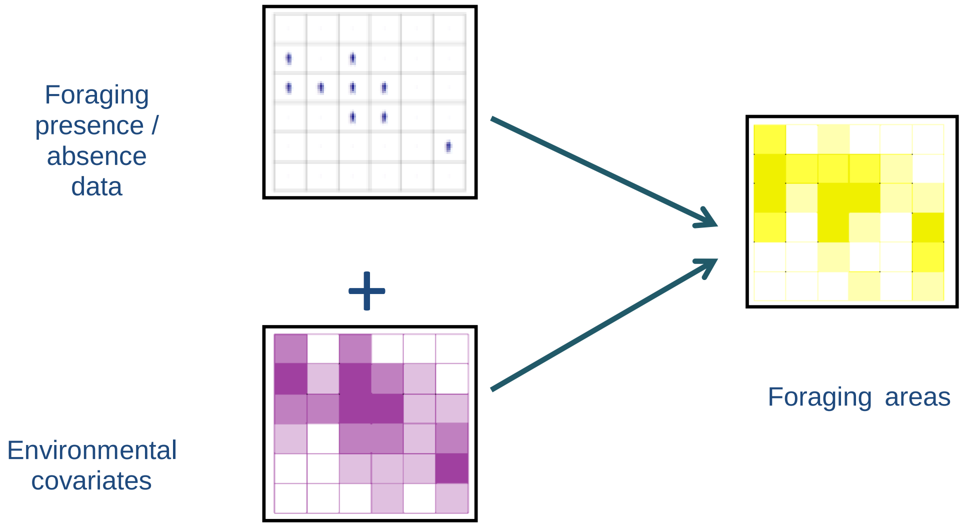


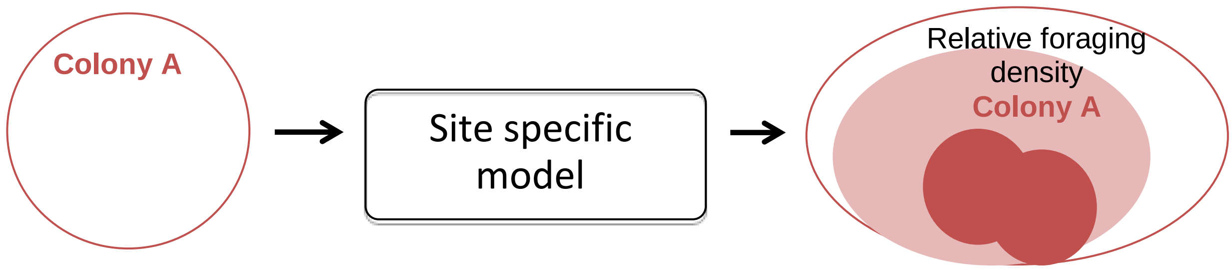

Figure 1. Simplified, schematic representation of the process of modelling distributions based on environmental information, using a single covariate distribution map in the example.

For each species of tern, there were two types of analysis: for colonies where we had collected sufficient data, the data from that colony only was used in the analysis, providing a colony-specific relative foraging density map (phase 1 analysis in Figure 2).

For colonies where we had insufficient data to produce a colony-specific relative foraging density map, all data for that species was combined to produce a UK wide analysis which could be used to produce foraging density maps around any tern colony in the UK, based on the environment and habitat conditions around those colonies (phase 2 analysis in Figure 2).

The process of analysis in this way involves creating a statistical model, and it is this model which characterises the environment that the terns use for foraging.

PHASE 1: colony specific bird data




PHASE 2: no colony specific bird data

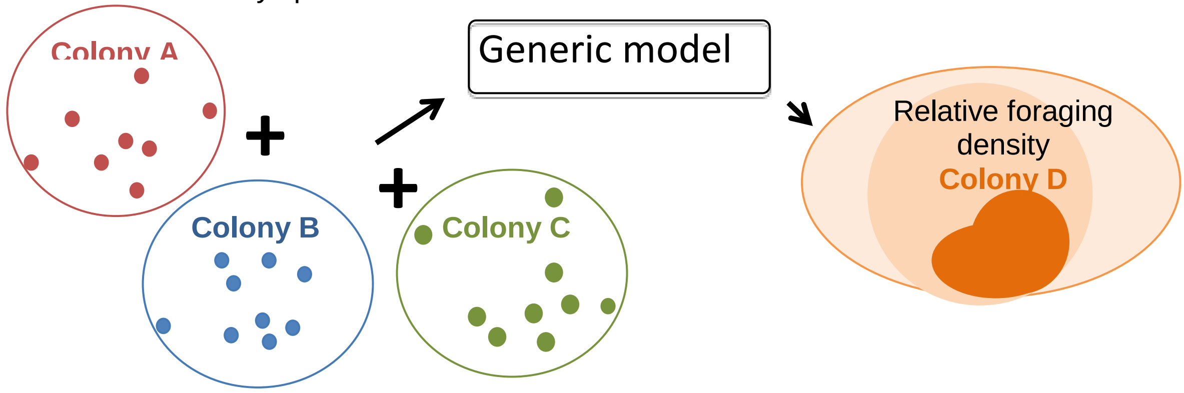



Figure 2. Simplified, schematic representation of the process whereby empirical observations of tern foraging locations around a colony were either: used to build predictive, site-specific models of tern usage that generated relative foraging density maps around that colony (phase 1 analyses); or combined with observations of tern foraging locations around other study colonies to build predictive, generic models of tern usage that generated relative foraging density maps around poorly studied or unstudied colonies (phase 2 analyses).

In order to have confidence in the robustness of the habitat association model predictions of tern usage, which are based on samples of tern tracks, it is important to consider the degree to which the sample datasets on which the models are based can be considered representative of all of the foraging locations which would have been visited across all foraging trips by all birds from a colony across an entire chick-rearing period.

Accordingly, an analysis was carried out to assess whether sufficient birds had been tracked to capture the foraging areas of the populations at individual colonies (although as discussed below this was not the primary objective of the tracking work). This analysis was conducted on data derived from three years of tracking from the Coquet Island colony of Arctic, Sandwich and roseate terns and two years of tracking from the common tern colony at the Imperial Dock (Leith). A recently published and peer-reviewed method for assessing the sufficiency of tracking sample size was used for the analysis (see Soanes *et al*. 2013). This method takes subsamples of the available data to examine how sample size influences estimates of the home range (the size of the area used) by the whole colony, based on the time spent in individual predefined grid cells. All of the cells within a home range represent the total area of use, whilst other fractions of the total area of use, determined by ranking the cells within the home range in order of the amount of time spent within them were also examined i.e. the area of active use (95%) and the core foraging area (50%).

These areas are derived for samples of the pooled track data to produce results based on the use by 1 individual, 2 individuals, 3 individuals, etc… randomly sampled from the pool of available tracks in the dataset. Models are then fitted to the resulting data to examine the relationship between sample size and the total area of use, area of active use and the core foraging area. Parameters derived from these models can then be used to estimate the numbers of tracks required to capture different percentages of the area of interest (e.g. 50%, 75% and 95% of the total, active and core areas of use) given a specific colony size, thus providing an indication of how sufficient the sampling is.

The full details of the analyses are presented in Harwood & Perrow (2013). In summary, the analyses revealed that the available samples of tracks described between 45% and 68% of the total area of use, 50% and 73% of the area of active use and between 72% and 83% of the core foraging area for the four species (Table 1).

Table 1. Percentages of the predicted total (100%), active (95%) and core foraging (50%) areas based on colony size, resulting from the actual sample sizes achieved. Source: Harwood & Perrow (2013)

| Tern species | Sample size (number of tracks) | % of total area of use (CI) | % of area of active use (CI) | % of core foraging area (CI) |
|---|---|---|---|---|
| Common (Leith) | 121 | 68.1 (66.4-69.8) | 72.7 (71.1-74.3) | 73.8 (72.0-75.6) |
| Arctic (Coquet) | 91 | 44.8 (40.3-49.2) | 49.9 (45.5-54.0) | 72.4 (68.6-75.9) |
| Sandwich (Coquet) | 117 | 51.4 (48.3-54.4) | 54.8 (51.7-57.7) | 71.9 (69.1-74.6) |
| Roseate (Coquet) | 50 | 67.9 (62.8-72.5) | 72.2 (67.4-76.5) | 83.3 (78.4-87.5) |

Thus, although the sampling effort captured no more than 68.1% of the total area of use in any case, it should be noted that the total area of use is unlikely to be described fully by any reasonable amount of tracking effort; as this would require every movement of every individual in a colony to be constantly monitored. However, the surveys did provide sufficient data to account for a large proportion of the core foraging area, which is a key metric for investigating habitat association. This provides reassurance that, even when a relatively small proportion of the colony population is sampled, the data are likely to represent well the core foraging areas of the colony population as a whole.

Furthermore, it should be borne in mind that the objective of the tracking work was not to gather a comprehensive body of tracks from which to determine directly a potential boundary around important foraging locations. Rather, the goal was to gather a representative sample of tracks from which to construct a habitat association model to identify areas with the characteristics of important foraging locations i.e. to identify not just those locations where foraging was observed within the necessarily limited empirical dataset on which the models were based, but also to identify other locations (including at other colonies where it was not possible to sample) where relatively high levels of usage by foraging terns might be expected based on their characteristics. In other words, the habitat models allow us to fill gaps in sampling effort, both at sampled colonies and at unsampled colonies.

With that in mind, for each model produced, an assessment was made of how good this model would be at making predictions of tern foraging around the same colony (for colony specific analysis) or around other colonies (for UK wide analysis). This assessment was made using a technique called cross-validation.

Cross-validation involves omitting a sub-set of data (the validation set), and refitting the chosen model to the remaining data (the training set). Predictions, in this case of tern foraging locations, generated by models based on each training set are then compared with the validation set – which in this case comprises the actual tern foraging locations not used in building the model. Comparisons can be done by various scoring methods; three were used to avoid reliance on a single method, but for simplicity only one of these i.e. the Area Under the Curve (AUC) score, is presented in this annex. The AUC score represents the discriminatory ability of a model as follows: > 0.9, excellent; 0.8-0.9, good; 0.7-0.8, moderate; 0.6-0.7, poor; and 0.5-0.6, unsuccessful (Swets 1988).

Phase 1 model performance was assessed in two ways: by investigating how well each site and species specific model predicted: (i) validation data for omitted individuals and (ii) validation data for omitted years. The former analyses were conducted for any species/colonies with at least 50 tracks that could be sub-sampled while the latter analyses were conducted for any species/colonies with more than one year of data with at least five tracks in each.

The main concern regarding the use of Phase 2 models was ensuring the models performed well when extrapolated to new areas. Therefore, model selection for Phase 2 was based on the ability of models to predict data from new colonies. The predictive ability of models consisting of all combinations of the candidate covariates was tested using cross-validation, by omitting each colony in turn and developing a model using data from the remaining colonies. Using a UK wide analysis based on data from three tern colonies (such as colonies A, B and C in Figure 2) as an example: The cross validation analysis is undertaken, creating a model which predicts tern foraging locations, based on data from only two of the three colonies, which is then used to make predictions of tern foraging locations around the third colony. Those model predictions are compared with the data that were actually collected around the third colony to see how similar they are; how well does the prediction match what the data tells us (Figure 3). This process is repeated with all possible combinations of two colonies going into the analysis, and testing the output on the third, or ‘left-out’, colony, to give an overall estimate of how well the model performs when making predictions to a ‘new’ colony.

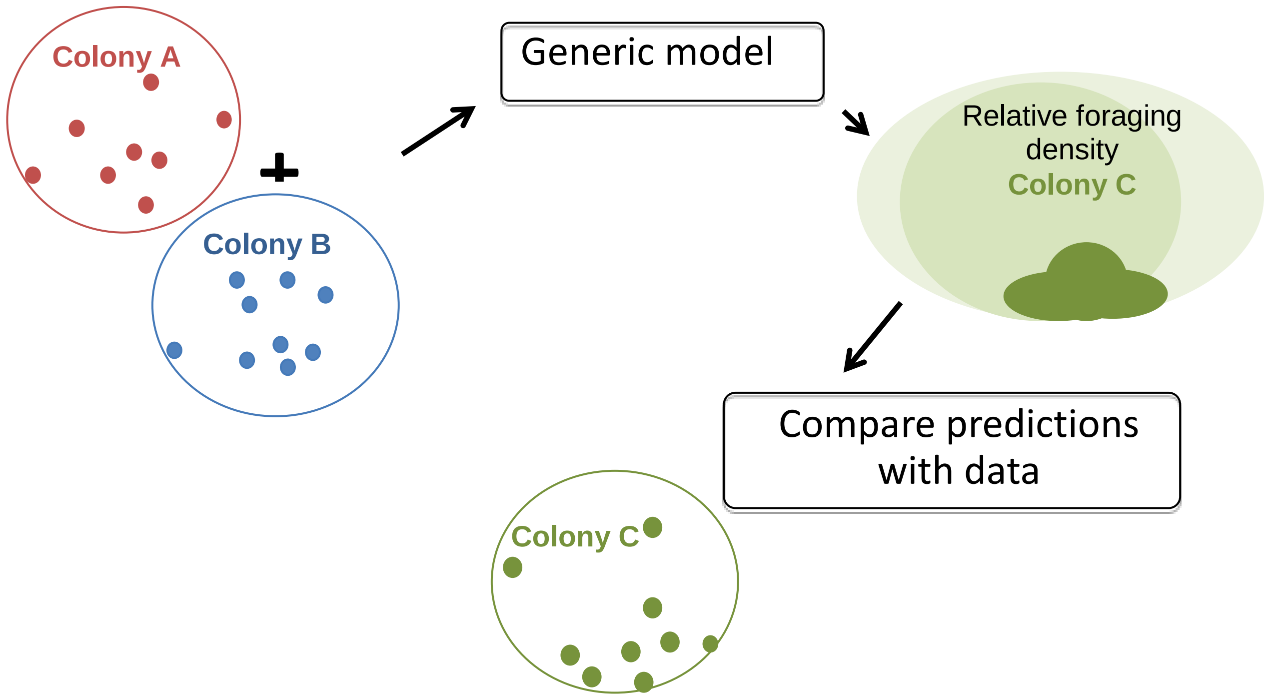



Figure 3. Schematic representation of the cross-validation process, using an example where we have data for three colonies A, B and C, of which data from two at a time (A and B in this diagram) are used to build a predictive model, the predictions of which are then tested by comparison with empirical data from the other colony (C in this case).

The cross-validation results for testing the ability of the Phase 1 models to predict validation data from individuals omitted from the models are shown in Table 2, while the results for testing the ability of the models to predict validation data from omitted years are shown in Table 3. On the basis of the average AUC scores of the Phase 1 models tested, two models performed moderately well, two were good and two were excellent in their ability to predict validation data for omitted individuals (Table 2). Of those tested for their ability to predict validation data for omitted years, based on the average AUC score, one performed poorly, two performed moderately well, three were good and two were excellent (Table 3). The cross-validation results for the Phase 2 models are summarised in Table 4. They showed that, when predicting data from new colonies, the final Arctic tern generic models performed moderately well, common tern generic models were good, and Sandwich tern generic models were excellent. For all species, the final Phase 2 models performed better than simple models containing only distance to colony.

Table 2. The results of cross-validation of Phase 1 models, testing the ability of the models to predict validation data from omitted individuals tracked at the same colony.

| Species | SPA Colony | Average AUC score |
|---|---|---|
| Arctic tern | Coquet Island | 0.796 |
| Common tern | Coquet Island | 0.845 |
| | Imperial Dock Lock | 0.741 |
| Sandwich tern | Coquet Island | 0.915 |
| | North Norfolk | 0.884 |
| | Ynys Feurig, Cemlyn Bay and The Skerries | 0.939 |
| | Ythan Estuary, Sands of Forvie and Meikle Loch | 0.990 |

Table 3 The results of cross-validation of Phase 1 models, testing the ability of the models to predict validation data from a different year of survey omitted from the model building phase.

| Species | SPA colony | Number of combinations of years that comprised either training or test datasets | Average AUC score |
|---|---|---|---|
| Arctic tern | Coquet Island | 9 (2009, 2010 & 2011) | 0.71 |
| | Outer Ards | 4[1] (2009, 2010 & 2011) | 0.72 |
| Common tern | Coquet Island | 9 (2009, 2010 & 2011) | 0.84 |
| | Imperial Dock Lock | 2 (2009 & 2010) | 0.68 |
| | Larne Lough | 4[1] (2009, 2010 & 2011) | 0.87 |
| Roseate tern | Coquet Island | 4[1] (2009, 2010 & 2011) | 0.84 |
| Sandwich tern | Coquet Island | 9 (2009, 2010 & 2011) | 0.92 |
| | Larne Lough | 9 (2009, 2010 & 2011) | 0.98 |

[1] In these cases there were insufficient tracks in 2010 for this year to be used as a test dataset or as a training dataset on its own.

Table 4. The results of cross-validation of Phase 2 models based on the AUC score for (a) Arctic, (b) common and (c) Sandwich terns. For each species the final model chosen (based on all three different cross-validation scores, rather than just the AUC score) is shown in bold. In addition, a model containing only distance to colony and the model which maximised the AUC score are shown for comparison. Note that the selection of the final models was based not just on these relative AUC scores but also their performance when judged using two alternative metrics. For the full cross-validation results for all the other models tested, and for all three scores, see Potts *et al*. 2013c.

(a)

| Arctic terns | AUC score for each test colony | | | |
|---|---|---|---|---|
| Model | Coquet Island | Farne Islands | Outer Ards | Average AUC |
| Distance to colony | 0.790 | 0.753 | 0.700 | 0.747 |
| **Distance to colony, bathymetry** | **0.789** | **0.762** | **0.713** | **0.755** |
| Distance to colony, bathymetry, shear stress current | 0.786 | 0.774 | 0.713 | 0.758 |

(b)

| Common terns | AUC score for each test colony | | | | | | |
|---|---|---|---|---|---|---|---|
| Model | North Norfolk | Coquet Island | Cemlyn | Larne Lough | Imperial Dock Lock | Glas Eileanan | Average AUC |
| Distance to colony | 0.923 | 0.801 | 0.916 | 0.819 | 0.655 | 0.746 | 0.810 |
| **Distance to colony, bathymetry, distance to shore** | **0.931** | **0.813** | **0.913** | **0.788** | **0.665** | **0.761** | **0.812** |
| Distance to colony, slope | 0.930 | 0.805 | 0.908 | 0.853 | 0.670 | 0.749 | 0.819 |

(c)

| Sandwich terns | AUC score for each test colony | | | | | | |
|---|---|---|---|---|---|---|---|
| Model | North Norfolk | Coquet Island | Larne Lough | Sands of Forvie | Farne Islands | Cemlyn | Average AUC |
| Distance to colony | 0.877 | 0.850 | 0.963 | 0.898 | 0.889 | 0.866 | 0.884 |
| Distance to colony, bathymetry | 0.878 | 0.899 | 0.979 | 0.962 | 0.956 | 0.907 | 0.920 |
| **Distance to colony, bathymetry, distance to shore** | **0.821** | **0.911** | **0.979** | **0.973** | **0.970** | **0.907** | **0.916** |

## 4. Boundary Delineation

The maps created from outputs of the GLM models in Phases 1 and 2 are essentially a series of grid squares, each with an associated measure of relative foraging density, and indicates how likely the area within that square is to be used by feeding terns compared to other squares. There is no clear threshold in these relative density values to distinguish between 'important' and 'not important'. This kind of problem occurs in most of the marine SPA analysis JNCC has undertaken and details on how this problem has been tackled is in http://jncc.defra.gov.uk/pdf/SAS_Defining_SPA_boundaries_at_sea. In order to identify important foraging areas for terns and draw a boundary around them, a cut-off or threshold value has to be found and only those grid squares with a usage value above this cut-off would be included within an SPA boundary. One well established way of doing this is to generate a list of every grid cell within an area of interest, ranked in decreasing order by its predicted level of usage and from that list generate a cumulative relationship between the level of bird usage captured within an area and the size of that area as, starting with the most heavily used grid cell each one in turn is added. This process invariably leads to a cumulative curve which, provided a sufficient area has been surveyed and includes some areas of relatively limited usage, gradually approaches an asymptote *i.e.* exhibits gradually diminishing returns in terms of levels of bird usage captured as the area considered increases. An objective and repeatable method to identifying a threshold value of diminishing returns on such cumulative curves is called maximum curvature (O'Brien *et al.* 2012). This method identifies at what point on the cumulative curve disproportionately large areas would have to be included within the boundary to accommodate any more increase in, in this case, foraging tern usage.

As the maximum curvature technique is sensitive to the size of the area to which it is applied, the analysis was based on a common area unit for each species. A species-specific mean maximum foraging range (*i.e.* the furthest that an average individual forages from a colony) was determined using all available data[12], resulting in 30km for Arctic, 20km for common, 32km for Sandwich and 21 km for roseate tern. Any grid cells outside the mean maximum foraging ranges were excluded prior to maximum curvature analysis.

An example of a maximum curvature boundary drawn tightly around the modelled usage distribution of common terns from Foulness SPA is shown in Figure 4.

[12] The global mean maximum foraging range was calculated using all available tracking data (those collated for Thaxter *et al*. 2012, JNCC's tern project data, and data collected by Econ Ecological Consultancy Ltd). THAXTER, C.B., LASCELLES, B., SUGAR, K., COOK, A.S.C.P., ROOS, S., BOLTON, M., LANGSTON, R.H.W. & BURTON, N.H.K. 2012. Seabird foraging ranges as a preliminary tool for identifying candidate Marine Protected Areas. *Biological Conservation*. **156**: 53-61.

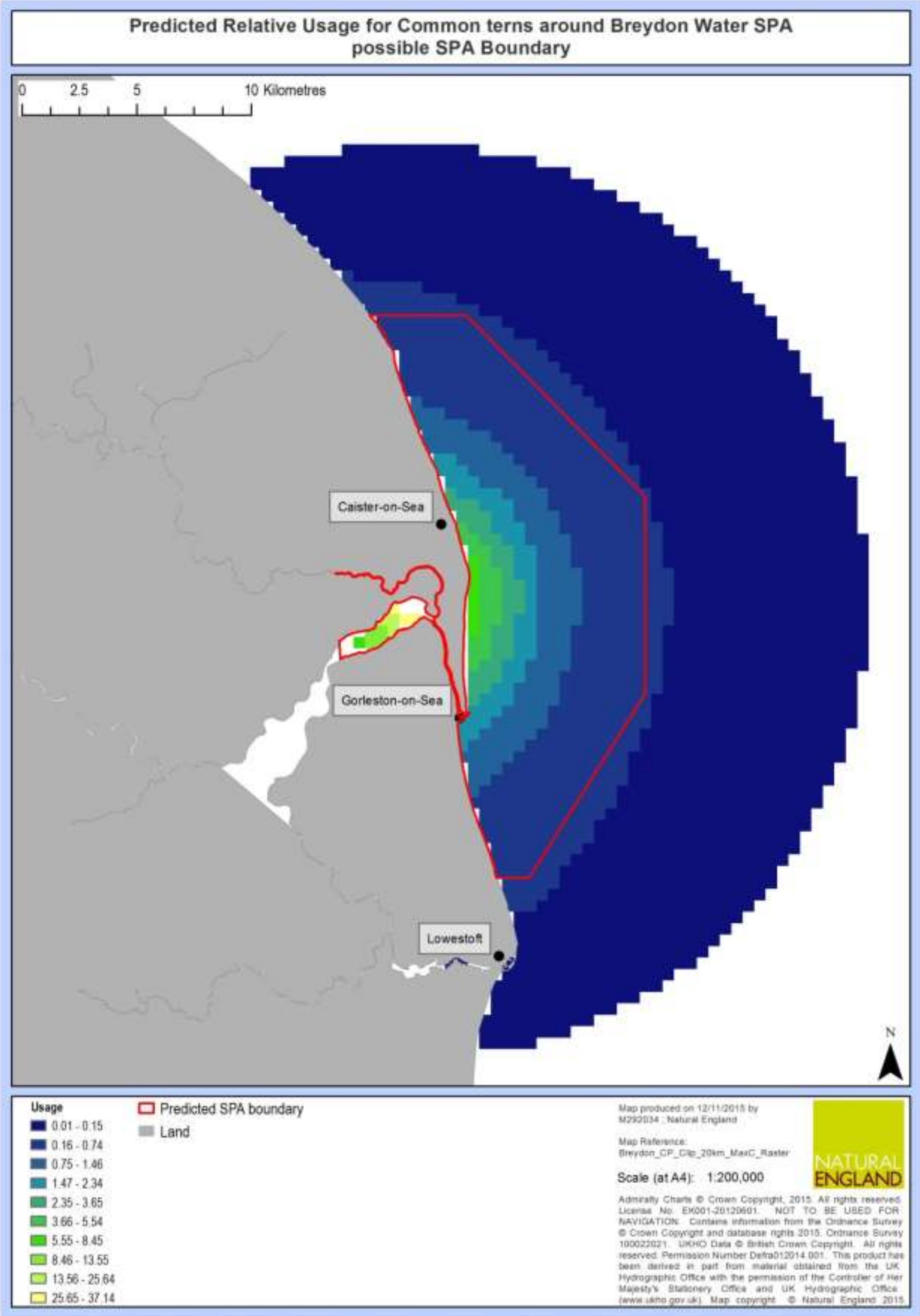



Figure 4 Maximum curvature derived boundary (red line) overlaid on map of model predictions of usage by common terns around Foulness SPA. The extent of the dark blue circle of model

predictions of usage is 20 km - the global mean maximum distance to colony, calculated using tracking data held by JNCC; ECON Ecological Consultancy Ltd and Thaxter *et al.* 2012. These values were used to constrain the usage data used before Maximum curvature analysis was applied. Source: Win et al (2015).

Finally, boundaries were then drawn, in as simple a way as possible, around all the cells within which tern usage exceeded the maximum curvature threshold, as described in http://jncc.defra.gov.uk/pdf/SAS_Defining_SPA_boundaries_at_sea..

In several pSPAs, boundaries are composites derived by application of maximum curvature methods to model predictions of usage of several interest features. In such cases, the composite boundary to the pSPA is derived by the combination of those stretches of the feature specific boundaries which together ensure that all of the important areas identified within the feature-specific boundaries are included within the whole.

## 5. Conclusion

Delineation of the boundaries around areas of sea that are most heavily used by seabirds have, in several existing marine SPAs, been based on maps of the relative density of birds derived directly from empirical at sea surveys of bird distribution. However, such an approach was not followed in the current project for a number of reasons. First, with tern foraging being predominantly close to shore and with the need to consider colonies all around the United Kingdom, existing data sources eg the European Seabirds at Sea (ESAS) database (http://jncc.defra.gov.uk/page-1547) were not fit for purpose. For this approach to have been followed, a significant programme of bespoke, near-shore at sea transect surveys around the UK would have been required. Furthermore, as the objective of the work was to identify foraging areas of importance to birds originating from existing SPA colonies it was necessary that survey methods could identify the origin of each bird seen at sea. Conventional at sea transect surveys cannot provide this information with any certainty, particularly when considering sightings of birds in sea areas that may be many kilometers from possible source colonies. Accordingly, a programme of boat-based tracking of breeding terns was identified as being the most suitable approach to gathering the necessary information on at sea tern foraging distributions. In an ideal world, such tracking would have been carried out on each species at every colony of interest around the UK with the intention of collating sufficiently large numbers of tracks to allow delineation of a boundary to important areas of use of each species at each colony directly from maps of relative intensity of occurrence. However, given the scale of the task (41 breeding colony SPAs have one or more of the larger tern *Sterna* species as a feature) and the inevitable limitations to survey effort that could be deployed, it was recognized that a targeted survey programme leading to development of predictive models would be the most pragmatic, cost-effective and indeed reliable approach to this project.

This project collected and collated a substantial amount of data on the distributions of terns at sea and to our knowledge represents the largest available resource of tracking data for breeding terns. The data collected/collated consisted of up to three years of survey around eleven colony SPAs and a total of almost 1300 tracks were available to the project across the four species. Geographical coverage across the UK was maximised within the constraints of the time available, logistics and resources. This ensured that data were obtained across a large range of covariate values, and that inter-colony variation could be captured as much as possible for the generic models.

The datasets collected and modelling carried out within this project allowed the development of site-specific models for 16 species/SPAs as well as generic models for each species that were used to extrapolate geographically for 30 species/SPAs. Thus the project delivered predictions of relative distributions of the larger tern species around the full complement of 32 colony SPAs in the UK which were deemed to be recently regularly occupied (46 species/SPA models in total).

Distributions predicted by the Phase 1 models generally matched the underlying data well, but also occasionally identified areas of use which were not captured by the tracking data. This is one of the key advantages of using a habitat modelling approach as it allows extrapolation into areas which were not sampled, but which are predicted to be used based on the suitability of the environment. Interpolation based only on raw data would risk overlooking the potential importance of some areas if they had not happened to be used at the time of tracking by the individuals that were sampled. A habitat modelling approach also allowed us to apply generic models which benefit from pooling data across multiple colonies, gaining strength from increased sample sizes which are able to identify broad, consistent preference relationships across multiple colonies.

All of our models predicted highest usage around the colony, with usage generally declining with increasing distance from the colony. This pattern accords well with what we might expect from central place foragers. For Arctic and common terns, the pattern of usage generally radiated out from the colony in all directions out to sea. For Sandwich terns, usage was in most cases confined to a relatively narrow coastal area either side of the colony. In all cases, there was negligible use of areas distant from the colony; more than half of the maximum potential foraging range was predicted to be virtually unused. The majority of usage was also confined to an area less than that encompassed by the mean maximum foraging ranges (as recorded in this study as well as those in Thaxter *et al.* (2012)). So although a simple approach such as applying a mean maximum foraging range radius around the colony, would correctly identify areas being used (and be a simpler method to explain) and could have been used in boundary setting, it would also include large areas of relatively low importance. The habitat modelling approach, although relatively complex, provides more realistic estimates of the relative importance of the areas within the maximum and mean maximum foraging ranges.

It might be considered that boundaries determined directly from empirically derived maps of the distributions of terns around each colony would have had a smaller degree of uncertainty associated with them than ones derived, as in this project, on the basis of model predictions of bird usage patterns, which in the case of some species and colonies are derived entirely from models of the association between bird usage and environmental covariates which have been derived elsewhere. However, this need not be the case. As noted above, the modelling approach has the advantage of allowing extrapolation of predicted usage levels into sea areas which may not be seen to be sampled (by the birds) in what will always be a necessarily limited sample dataset. Furthermore, the cross-validation of both site specific and generic models has indicated that the pooling of data across years and colonies has allowed models of tern usage to be built which are relatively robust to variations in tern foraging behaviour in time and space. For these reasons it is considered that this project has generated proposed boundaries which have degrees of uncertainty that are acceptable, and certainly need not be considered to be any worse than if it had been possible to apply more conventional approaches.

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# Annex 5 Implementation of Natural England Evidence Standards

Decision-making processes within Natural England are evidence driven and the Natural England strategic evidence standard, and supporting guidance were followed. In particular, the four principles for the analysis of evidence set out in the Natural England Standard *Analysis of Evidence* have been adhered to. These two standards documents can be downloaded from the following web-links:

Strategic Evidence Standard:
http://publications.naturalengland.org.uk/publication/7699291?category=3769710

Analysis of Evidence Standard:
http://publications.naturalengland.org.uk/publication/7850003?category=3769710

An explanation follows as to how the principles within the *Analysis of Evidence* standard have been applied in defining the set of qualifying features and boundary of the Outer Thames Estuary pSPA.

***1.) The evidence used is of a quality and relevance appropriate to the research question or issue requiring advice or decision***

**Quantification of qualifying feature population sizes**

In order to determine the suite of species present within the pSPA which meet the SPA selection guidelines (JNCC 1999), most relevant bird count data were used, either pertaining to the current five year period (2011-2015 for breeding terns; 1989 - 2006/07 for non-breeding red-throated divers, as per the original SPA citation (Natural England 2010, O'Brien *et al*. 2012).

1. Data from JNCC's Seabird Monitoring Programme (SMP) (http://jncc.defra.gov.uk/smp/) Count data for breeding terns were taken from the national database wherever possible.

2. Data from colony managers and local expert groups (Foulness Area Bird Survey Group, Foulness ringing group) supplemented the SMP data where this was not available, for both little and common terns.

3. The Norfolk Bird & Mammal Report was used to provide data where neither SMP nor RSPB data were available.

The count data taken from the SMP database is the best available information. In addition, the 2013 SMP data has been checked by JNCC. The count data which were obtained directly from the colony managers is source information that will in due course become part of the SMP database. As such, it too is the best available information. Ringing data is submitted to the national ringing scheme, again providing most suitable available information.

**Establishment of extent of marine pSPAs using tern tracking data**

Webb & Reid (2004) provide a series of guidelines for the selection of marine SPAs for aggregations of inshore non-breeding waterbirds. This guidance does not directly consider the evidence requirements for the selection of marine SPAs focussed on the principal foraging areas used by breeding seabirds. However, a number of the issues and principles covered in Webb & Reid (2004) nonetheless have some relevance in this context. Accordingly, the following section describes in broad terms a comparison of the quality and relevance of the tern evidence base with the guidelines produced by Webb & Reid (2004).

Webb & Reid (2004) note that the guidelines for selecting SPAs in the United Kingdom are described in Stroud *et al*. (2001), and are adequate and competent for application to site selection in the inshore environment for inshore non-breeding waterbird aggregations. However, given that the type and quality of data which underpins the Outer Thames Estuary pSPA differs from those used in identifying sites for terrestrial birds and aggregations of non-breeding waterbirds, it is necessary to consider their adequacy and relevance.

Webb & Reid (2004) set out seven criteria to assess the adequacy of count data. Although not all of direct relevance in the current case these criteria are set out in Table 1 with accompanying comments regarding the tern tracking and modelling work.

Table 1 Criteria for inshore SPA data adequacy.

| Criterion | Adequacy of JNCC led larger tern surveys | Adequacy of JNCC led little tern surveys |
|---|---|---|
| Experience of observers | All tracking of terns was undertaken either by JNCC staff or experienced contractors commissioned by JNCC to do the work. | All observations of terns was undertaken either by JNCC staff or experienced contractors commissioned by JNCC or volunteer counters who received training in the shore-based observation techniques. |
| Systematic surveys | Tern tracking was conducted in as systematic a way as possible. Tracking at each colony was carried out during well-defined periods of the breeding season (chick-rearing) in one or more years. Tracking was undertaken in accordance with a field protocol established by JNCC. In the context of tern tracking, the movements of birds is an essential component of the technique and not a source of systematic bias in the survey results as it may be in conventional transect surveys. | Boat-based survey work followed systematic transect survey designs that were appropriate to each colony and were followed on repeated surveys. Shore based survey work used systematic series of observation stations and a standard recording protocol which was used repeatedly at each colony. |
| Completeness | The aim of the tracking survey method was not to cover all of the areas sea to consider for inclusion in the pSPA, but to ensure that the tracking effort was sufficient to capture tern usage across a representative proportion of that area on the basis of which reliable habitat association models could be constructed and used to predict tern usage patterns across the wider area – including those areas in which no direct observations of terns were made. | Boat-based transects extended up to 6km offshore and alongshore survey stations were positioned at 1km intervals up to at least 6km in either direction from the colony (and where necessary, further). With the mean maximum foraging range reported to be 6.3km, the survey areas gave virtual complete coverage of the likely areas of greatest importance. |
| Counting method | The larger tern tracking work did not involve counting of birds or use of such information to derive population estimates for the pSPA. However, the modelling is based on samples of tracks of relatively few individual terns from each colony rather than surveys of the distribution of terns (of unknown origin) around the colony. Cross-validation tests of the models' predictions and analysis of sample adequacy both suggest that the results of the models, although based on the samples of tracks, are robust. | At sea observations included instantaneous counts at predetermined distances along transects at which all terns in flight within 300 m in an 180º arc of the boat were recorded. Between these points, continuous records of all little terns seen were also made to provide an index of relative abundance.<br>During shore-based observations, terns recorded within 300 m of the observation point were recorded during timed observation periods. Counts at each station were standardised to birds/minute and expressed as proportions of the value recorded at the 1 km observation station to standardise across sites. |
| Quality of sampling | Cross-validation tests of the models' predictions and analysis of sample size adequacy both suggest that the results of the models based on the samples of tracks are robust. | This was affected by the low numbers of birds at many colonies and the frequent breeding failures. At colonies with 5 or more shore-based surveys yielding records of 200 or more terns, this was deemed sufficient to derive site-specific along shore boundaries. At colonies with at least 2 boat-based surveys yielding at least 20 tern sightings this was deemed sufficient to derive site-specific |

| | | |
|---|---|---|
| | | seaward boundaries. At colonies where these criteria were not met, a generic approach was used by pooling sample data across sites to yield better-evidence based estimates of limits. |
| Robustness of population estimate | Not applicable as the tern tracking work was not used to generate a population estimate | Not applicable as the tern observation work was not used to generate a population estimate |
| External factors affecting the survey | Tracking was constrained by weather, e.g. tracking could not take place with sea state ≥3 and during rain. Thus, tracking data were gathered only under favourable weather conditions. | Although the aim was to collect data from most currently occupied SPAs, in many cases data on seaward or alongshore extent could not be collected due to colony failure (caused by tidal inundation, predation or disturbance) or simply too few breeding pairs for sufficient observations to be detected by surveys. Accessibility to count points in all parts of the possible extent of a foraging area limited the ability to provide site-specific alongshore extents in some cases. |

Webb & Reid (2004) also discuss the issue of establishing sufficient evidence in the case of marine SPAs to establish regularity of use, which is a key element of the SPA selection guidelines. The tern tracking work was never intended to establish regularity of use of certain sea areas by particular species around particular colonies. The aim of that work was simply to capture sufficient representative information on tern foraging behaviour to allow reliable habitat association models to be constructed and used to generate maps of areas of principal usage. The results of the cross validation of those models' predictions, in which data from different years were used as test datasets, suggests a relatively high degree of consistency in usage patterns between years i.e. regularity of use of those most important areas (Wilson *et al.* 2015). However, no formal tests of the regularity of use of the sea areas within the pSPA boundary have been made. Regularity of use of the pSPA has been reasonably inferred from the continued existence of the site's named features in qualifying numbers in each of the existing coastal SPAs from which birds within the marine SPA are most likely to originate.

Webb & Reid (2004) discuss the issue of boundary placement. They note that the principles for defining boundaries for terrestrial SPAs in the UK are described in Stroud *et al.* (2001) thus (emphasis added):

*"The first stage of boundary determination involves* ***defining the extent of area required by the qualifying species concerned****. These scientific judgements are made in the light of the ecological requirements of the relevant species that may be delivered by that particular site, and the extent to which the site can fulfil these requirements. This follows a* ***rigorous assessment of the best-available local information regarding distribution, abundance and movements of the qualifying species****. It may also involve the* ***commissioning of special surveys*** *where the information base is weak. Following this stage, every attempt is made to define a boundary that is identifiable on the ground and can be recognised by those responsible for the management of the site. This* ***boundary will include the most suitable areas for the qualifying species*** *identified in the first stage……"*

The larger tern tracking and little tern observations were conducted to define the extent of the area required by these species on the basis of specially commissioned surveys that generated the best available local information regarding distribution, abundance and movements of these qualifying species.

Webb & Reid (2004) discuss the principles of setting both landward and seaward boundaries of marine SPAs.

In regard of setting landward boundaries they note that "*Where the distribution of birds at a site is likely to meet land, a boundary should usually be set at the mean high water mark (MHW)…….*

*unless there is evidence that the qualifying species make no use of the intertidal region at high water*."

The landward boundary of the pSPA has been drawn at MHW along the River Yare, Bure, and Crouch and Roach Estuaries, Benfleet and Southened SPA in the light of model predictions of the usage of such areas by foraging common terns from Foulness SPA. Additionally, the landward boundary of the pSPA has been drawn to MHW along the Blythe River in light of the model predictions of the usage of such areas by foraging little terns from Minsmere-Walberswick SPA.

Webb & Reid (2004) set out a recommended method for defining the seaward boundary of SPAs for inshore non-breeding waterbirds on the basis of analysing bird data from aerial or boat-based sample surveys using spatial interpolation combined with spatial analysis. They note exceptions to this method which include the case in which "*habitat data are also used in combination with bird distribution data to determine boundaries*". A combination of these approaches have been used in determining the seaward boundary of this pSPA; the former for parts of the boundary drawn for red-throated diver distribution, and the latter for areas added for foraging terns.

Webb & Reid (2004) describe spatial interpolation methods by which survey sample data can be used to generate maps of species probability of occurrence or abundance. This involves use of a "….*suite of modelling techniques in which the probability of bird occurrence or the total number of birds present is estimated at unsampled locations (usually in grid cells) using information on the presence or absence, or the number of birds recorded at sampled locations*". This is the principle underlying the modelling of the tern tracking data, albeit that the nature of the statistical models used is somewhat different to those considered by Webb & Reid (2004). As such, the principle of the method which has been used to define the seaward boundary of the pSPA is entirely in line with the recommendation of Webb & Reid (2004).

Webb & Reid (2004) conclude by discussing the method by which a boundary should be drawn around the parts of a site identified as being most important. They refer to Webb *et al.* (2003) which sets out a method for classifying grid cells so that the most important ones for a species on any given survey are highlighted. In that method, the grid cells are ranked from lowest predicted bird abundance to highest, and the cumulative population calculated from lowest ranked grid cell to highest. The highest ranking grid cells were selected such that they comprised 95% of the total population. The analytical approach which has been applied to the grid-based, modelled predictions of tern usage to define the most important areas to include within the pSPA boundary (Win *et al.* 2015) follows the basic ranking principle outlined by Webb *et al.* (2003). However, the application of the maximum curvature technique to such cumulative usage curves in the current case (Win *et al*. 2015) reflects the advances in the details of this analytical method by JNCC since then (O'Brien *et al.* 2012).

Thus, in summary, although Webb & Reid (2004) does not directly address the issue of data requirements in regard of establishing marine SPAs for breeding seabirds, many aspects of the collection and analysis of the tern tracking work which has been used to define the location and extent of the Outer Thames Estuary pSPA can be seen to be in accord with the guidelines set out in that document.

## Establishment of the extent of Outer Thames Estuary pSPA

The extent of the pSPA boundary is determined almost entirely by the distribution of red-throated divers as per the classification of the Outer Thames Estuary SPA. The smaller new part of the extent is based on model-generated predictions of which areas of sea are most heavily used by foraging terns originating from two source colonies. The boundary of the pSPA is a composite of non-breeding feature distribution and breeding feature predicted foraging areas.

All species and colony-specific areas of use have been derived from models based on at-sea records of the foraging locations of the particular species but at other colonies around the UK i.e. generic models (e.g. Sandwich terns at the Farne Islands). The quality and relevance of the evidence provided in both of these ways is discussed in the following section.

The adequacy and relevance of these various models and of the modelling approach in general, was addressed by JNCC in three ways (Wilson *et al.* 2015):

i) Cross-validation of site specific models
ii) Cross-validation of generic models
iii) Adequacy of sample size data

A summary of the results of the cross-validation of both site specific and generic models of larger tern usage is presented in Annex 5, as is a summary of the analysis addressing the adequacy of the sample sizes.

***2.) The Analysis carried out is appropriate to the evidence available and the question or issue under consideration***

The other major analyses which underpin the pSPA are: i) the boat-based and shore-based observations of little terns, ii) the habitat-association based modelling of larger tern usage patterns and ii) identification of threshold levels of predicted larger tern usage which were used to define the site boundary.

The very restricted foraging range of little terns precluded the use of the predictive habitat association modelling approach that was used for the larger terns. Accordingly, it was appropriate to gather empirical evidence on little tern distributions from which to determine directly the boundaries to the areas of greatest usage by foraging birds at each colony. At colonies where evidence was lacking or insufficient it was considered appropriate to make use of data gathered at other colonies to determine "generic" boundaries which, comparison with all available data indicated, would capture a very significant proportion of total usage (see Annex 4).

The habitat association modelling approach is a novel one which has not been used in defining the extent or boundaries of any marine SPA to date. However, the decision to adopt a habitat association modelling approach was the subject of discussion between JNCC and all other statutory nature conservation bodies over many years and agreement to follow this approach informed the design of the survey programme coordinated by JNCC since 2009. For the modelling analysis part of the project JNCC worked collaboratively with their statistical advisors Biomathematics and Statistics Scotland (BioSS).

Although the method by which the grid-cell based maps of predicted bird distribution were drawn up in this case differed in detail from more conventional spatial interpolation and spatial analysis considered by Webb & Reid (2004), the way in which the resultant maps of predicted bird distribution were analysed to determine threshold levels of predicted tern usage, and hence to define the site boundary, (i.e. maximum curvature analysis) represents application of an established method used at other marine SPAs (O'Brien *et al.* 2012) and is thus entirely appropriate to the evidence available.

Following completion of the work on both larger terns and little terns, JNCC commissioned external peer review of both pieces of work. Those peer reviews did not highlight any significant issues with the appropriateness of the analyses which were not resolved by subsequent discussion between the reviewers and JNCC. Further details of the external peer review are provided in section 5 of this Annex.

Analysis of non-breeding red-throated diver distribution has been published in a peer-reviewed journal (O'Brien *et al*. 2012)

*3.)* ***Conclusions are drawn which clearly relate to the evidence and analysis***

The conclusions regarding the list of features and their reference population sizes within the pSPA are based on application of the SPA selection guidelines issued by JNCC (JNCC 1999) to the best and most recent count data, or to count data originating from the time of original classification. As such the conclusions in this respect clearly relate to the best available evidence.

The conclusions regarding the drawing of parts of the landward boundary of the pSPA inland at MHW are based upon the evidence provided in the form of a model of predicted usage by foraging common tern. In this instance, the generic model was used which included distance from shore as a significant covariate with a negative coefficient indicative of highest use being closest to shore and therefore in many instances inclusive of intertidal areas. That the use of such areas by larger tern species is also likely is supported by information in the scientific literature. A review of tern foraging ecology (Eglington 2013) notes that larger tern species including Sandwich tern routinely forage in areas of shallow water. There is no reason on the basis of that review to consider it likely that common terns will not forage over intertidal areas. Accordingly, in this respect too, the conclusions clearly relate to the best available evidence.

The conclusions regarding the drawing of the seaward boundary of the pSPA are based upon the evidence provided in the form of models of predicted usage by foraging larger tern species and non-breeding divers through the application of a standard analytical method, already well-established for use in marine SPA boundary setting i.e. maximum curvature (O'Brien *et al*. 2012), to the models' outputs. The validity and robustness of the outputs of the site specific and generic models used to underpin the boundary analysis of the pSPA have been established by the process of cross-validation described in Annex 5. Thus, the conclusions in this respect clearly relate to the best available analysis of the best available evidence.

Since the modelling work was completed by JNCC, the Department of the Environment, Northern Ireland (DoENI) commissioned in 2014 a programme of land-based and at-sea surveys to verify the extents of tern foraging activity at three sites in Northern Ireland i.e. Larne Lough, Strangford Lough and Carlingford Lough. At each of these sites, the same generic predictive models, as already described in this Departmental Brief, had also been used to generate relative usage maps for at least one species of larger tern ( and in some cases for all species) and hence to determine proposed site boundaries. In summary, this work (Allen & Mellon Environmental Ltd 2015) confirmed the presence of terns (mainly Sandwich) to the furthermost alongshore limits of the areas searched and in one case beyond the limit of the modelled alongshore boundaries. The work provided some evidence that the larger terns do feed further out to sea than the limits of the modelled boundaries. However, the use of the threshold setting approach to the predicted relative usage maps does not deny that terns may forage beyond that limit. The work also provided some evidence that the very intense use of localised hotspots of activity recorded in or close to the entrances to the loughs were not as clearly identified as such by the models. However, the proposed boundaries in each of the three sites did contain the hotspots within the lough entrances. Thus, these verification surveys provide: confirmation that hotspots of usage near colonies are contained within modelled boundaries, some evidence that proposed boundaries, based on model predictions, may be somewhat conservative in regard of their seaward limits, and no evidence that their alongshore or seaward extents are in any way excessive.

4.) ***Uncertainty arising due to the nature of the evidence and analysis is clearly identified, explained and recorded.***

*Count data*

The UK SMP is an internationally recognised monitoring scheme coordinated by JNCC in partnership with others (e.g. statutory nature conservation bodies, the RSPB and other colony managers as data providers, etc.). It collects data according to standardised field methods (Walsh *et al.* 1995). SMP data are verified by the JNCC seabird team. Therefore, there is high confidence in SMP data. The majority of the data which has been used in determining the size of the populations of each of the species considered for inclusion as features of the pSPA is based on counts which are on the SMP database and so justify high confidence.

RSPB survey data are verified and quality assured by the RSPB count coordinator and site manager. RSPB is a professional organisation with long-standing experience of seabird monitoring, and surveys are conducted by trained surveyors. There is therefore high confidence in RSPB survey data. Accordingly, such data referred to in this Departmental Brief can be considered to justify high confidence . Similarly, the Foulness Area Bird Survey Group are an organised collective with unrivalled local ornithological knowledge and experience. The data collected by the group also justify high confidence.

Ringing data (counts of numbers of birds ringed) are not subject to uncertainty. However, the method applied to estimate numbers of adult pairs will be. To account for this, several scenarios are presented, with selection of the scenario considered to be realistic (based on conversations with local site experts) informing the calculations of numbers of pairs of common terns breeding at Foulness SPA (Annex 7).

Any uncertainties with aerial survey data collected for red-throated divers are assumed to have been adequately addressed in classifying the original Outer Thames Estuary SPA.

*Landward boundary*

The issue regarding the confidence in the evidence base upon which the decision to draw the landward boundary of the pSPA to MHW along parts of the coast has been made, is discussed in the previous section.

*Seaward boundary*

The position of the seaward boundary of the pSPA has largely been quality assured to the highest level (O'Brien *et al*. 2012). The position of the small additional extension to the seaward boundary has been determined on the basis of outputs of statistical models which are based on tern behaviour at colonies in other parts of the UK. Accordingly, it is almost inevitable that there is a greater degree of uncertainty regarding the robustness of the boundary location than if it had been derived directly from a comprehensive site-specific set of observations of tern foraging locations. However, provided the models are empirically evidence based, and shown to be robust via cross validation, the modelling approach brings with it a robustness which may exceed that which might be achieved from reliance on a limited empirical dataset of tern foraging locations. It is considered that the cross-validation analyses and sample-size sufficiency analyses indicate that proposed boundaries generated by the modelling approach have degrees of uncertainty that are acceptable, and certainly need not be considered to be any worse than if it had been possible to apply more conventional approaches. This issue is discussed fully in Annex 5.

### 5.) Independent expert review and internal quality assurance processes

*Independent expert review*

Natural England's standard in quality assurance of use of evidence, including peer review, (http://www.naturalengland.org.uk/images/operationalstandardsforevidence_tcm6-28588.pdf) has been followed in determining the level of independent expert review and internal quality assurance required in relation to Natural England's analysis of the evidence for this site and the way that the boundary has been drawn up. Independent expert review is to be adopted where there is a high novelty or technical difficulty to the analysis.

O'Brien *et al*. (2012) describes the process of boundary setting for red-throated divers, which determines the vast majority of the pSPA boundary. As a peer-reviewed publication in a scientific journal, this work was subject to the highest level of independent review.

The derivation of the alongshore extent and seaward boundary to the pSPA is based on a novel approach, never used before in SPA designation, and has entailed considerable technical difficulty in the analyses. In recognition of this, JNCC commissioned independent expert review of both the larger tern and little tern programmes of work. A representative of Natural England, along with those of all other country statutory nature conservation bodies, was involved by JNCC in setting the terms of reference for the review work, in nominating potential reviewers for JNCC to consider approaching, and in the selection of those who carried out the reviews.

The larger tern modelling work was reviewed by two independent scientists (Dr Mark Bolton of the British Trust for Ornithology and Dr Norman Ratcliffe of the British Antarctic Survey). In summary, both reviewers raised two primary issues with the data collection and its analyses. These related to: i) the focus of the tern tracking work during the chick-rearing phase of the breeding season and ii) to the details of the way in which control points denoting tern absence were generated to match track locations where terns were recorded and the use of that information to determine terns' preference for each location and the conversion of that preference pattern into a pattern of tern usage. In regard to the first issue, JNCC acknowledged that the focus of the tracking work was only on the chick-rearing period, partly in order to ensure that sufficient data were gathered during that one period, but also in recognition of the need to focus attention on the identification and protection of those sea areas which are of most importance to the birds when their ability to buffer themselves against adverse environmental conditions by foraging further from the colony is most limited by time and energy constraints and their need to provision their chicks. The report (Wilson *et al*. 2015) was amended to acknowledge the fact that the modelled boundaries are unlikely to fully capture areas of importance during the incubation phase of the breeding cycle. The second point of concern raised by the reviewers led to extended discussion between the reviewers, JNCC and BiOSS. As part of this process, independent advice was sought from Dr Geert Aarts (AEW Wageningen University). In summary, the conclusion of those discussions, agreed by all, was that the methods used by JNCC and BioSS were sound and appropriate, but that further clarification was needed in the text of the report. As a result of these discussions, the relevant section of the report (Box 1 in Wilson *et al.* 2015) was amended.

The reports on the little tern field work methodology and results and subsequent boundary setting work were also put out to independent peer review by JNCC. One main point made by the peer reviewer(s) was that the boat and shore-based observations should have been corroborated more extensively with data from radio tracking or even habitat modelling. JNCC did in fact use radio tracking, at one site, where it confirmed the results of their techniques. JNCC did not consider it to be necessary or even practicable to apply this approach more widely. JNCC considered that habitat modelling was not possible, given the small range of the species and the limited availability of environmental data over that range. JNCC noted that it would have been prohibitively expensive to collect their own environmental data, even at a few sites, and with unknown chance of "success". The other main point made by the peer reviewers (in accord with the same suggestion made by the peer reviewers of the larger tern work) was for data to have also been collected during the incubation period. However, as noted above in regard of work on larger terns, it was decided at the outset of the work that the priority should be on the chick-rearing period, because it is probably at this time when little terns face the greatest energetic demands. The focus was on chick-rearing for biological reasons but also logistical ones; JNCC noted that there would have been a risk of obtaining too few data during both incubation and chick-rearing if both periods were studied. One reviewer asked for greater reference to the findings of other studies but JNCC considered this aspect to be sufficient. A number of improvements were made to text, tables and figures by JNCC, on the recommendation of the reviewer, and some additional text was included in the Discussion to serve as a Conclusion to the report.

In the light of Natural England's involvement with the review process conducted by JNCC and in the light of its outcomes, Natural England did not consider it necessary to initiate its own independent expert review of the reports prepared by JNCC.

*Internal peer review and quality assurance*

A representative of Natural England has been involved in the entire history of the larger and little tern monitoring and modelling work programme since its inception. Since late 2009, this role was fulfilled by Dr Richard Caldow (Senior Environmental Specialist: Marine Ornithology). Accordingly, Natural England has, in conjunction with Scottish Natural Heritage (SNH), Natural Resources Wales (NRW) and Department of the Environment Northern Ireland (DoENI), been in a position to review and provide quality assurance of the programme of JNCCs work and its findings from start to finish as detailed below.

JNCC evidence reports relating to marine SPA identification go through an extensive internal and external QA process. This has applied to all of the main strands of analysis (ESAS analyses to identify offshore hotspots of usage, inshore wintering waterbird work, larger tern work, and little tern work).

The general approach and survey methods are subject to internal and external discussion, often in workshop format. External discussion can involve organisations such as SNCBs who will use the outputs, academics and other researchers in the field. Once an approach and survey method has been agreed and data collection has started, interim reports are prepared which are subject to internal and SNCB review. Analysis of data is subject to discussions (and workshops if appropriate) internally and with academics and statistical contractors if appropriate. For particularly challenging analyses (such as larger tern modelling work) statistical contractors may undertake significant portions of exploration and development work, and/or of final analysis. Finally, once all the data has been collected and analysed, JNCC prepare an extensive report which has contributions from several JNCC staff, undergoes several rounds of JNCC and SNCB comment, and is finally signed off at JNCC Grade 7 level. At this stage it goes to SNCBs for use in their own work in parallel with going to external peer review, where a minimum of 2 reviewers are sought. Reviewers are usually sought with knowledge of the species ecologies and/or statistical and technical understanding, with reviewers sought to complement each other (for example with differing expertise, from differing types of organisation). JNCC then respond to peer reviews, making changes to 'final' reports if appropriate. Only if peer review comments are significant and fundamental is further grade 7 sign off sought before publishing as part of the JNCC report series.

The first version of this Departmental Brief was drawn up by Alex Banks (Marine Ornithologist) and with input from Catherine Laverick.

Departmental Briefs are drafted by an ornithologist with support from the site lead who provides the local site specific detail. This document is then quality assured by the marine N2K National Project Management team as well as selected members of the Project Board. The brief is then circulated for external comments from Defra Marine Policy Officer, JNCC senior seabird ecologists, Marine Protected Area Technical Group (MPATG) and UK Marine Biodiversity Policy Steering Group (UKMBPSG). The briefs are also sent to Natural England Board members for early sight of SPA proposals. The amended briefs are then reviewed and approved by the Marine N2K Project Board, Marine Director and relevant Area Managers and subsequently by the Natural England Chief Scientist in accordance with our Quality Management Standard. The brief is then signed off as required by our Non-Financial Scheme of Delegation by a representative of the Senior Leadership Team with delegated authority before being submitted to Defra.

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# Annex 6 Common terns breeding at Foulness SPA

This annex presents relevant data for common terns breeding at Foulness SPA. Data are kindly supplied by Foulness Area Bird Survey Group and the Foulness ringing group. Treatment of data focuses on the main breeding area (New England Creek) within the SPA, and does not include the handful of pairs known to usually or occasionally breed at other scattered locations within the SPA, largely because of the patchy nature of available data on these locations.

Available data for the past six years are displayed in Table 1 below.

**Table 1**: count data for common terns at Foulness SPA in pairs / AON. Brackets show juveniles ringed. NC = No Count.

| | New England raft | East Newlands |
|---|---|---|
| 2010 | Bred (72) | |
| 2011 | Bred (58) | |
| 2012 | 25 | |
| 2013 | NC | |
| 2014 | 9 | |
| 2015 | 2 | 2-3 |

From Table 1, the past six years of data for Foulness (using data from New England Creek and ignoring small numbers of pairs elsewhere within the SPA) gives two years in which common terns 'bred', one with no count, and three years with counts of adults totalling 25, 9 and 2 pairs. Common tern numbers are thought to fluctuate partly in response to black-headed gull *Chroicocephalus ridibundus* abundance at the breeding location, with lower numbers likely reflecting lack of management intervention to discourage gull nesting. In years when this is possible (e.g. 2010, 2011), common terns numbers increase. We expect future management to lead to the same increases in commn tern nesting numbers.

*Estimating adults from ringed young*

In 2010 and 2011, the number of juvenile birds ringed suggests that numbers of adult common tern pairs were likely to have been greater than the value of 25 pairs used by JNCC to prioritise sites supporting regular breeding (as common terns produce two eggs per pair and numbers of young exceeded 50). In some other years, figures suggest that adult pairs may be underestimated (or that some years birds are extremely productive); for example, 134 pairs and 102 young in 2000; 33 pairs and 56 young in 2007.

No ringing data for 2012, 2014 or 2015 are available and so counts of adults are all that can be used, accepting that they may be undercounted. There are no data for 2013 of any type.

In order to estimate the number of adult pairs from juveniles, we can make some assumptions about productivity and thus calculate the number of pairs that are likely to have been present to produce the resulting number of young. Two ways to do this are to use national (UK) average productivity levels across time, or average productivity levels (for England) in the years in question (2010 and 2011) as a proxy for productivity at Foulness SPA. We assume that terns with fledged chicks do not make repeat attempts to breed within the same breeding season, likely a fair assumption based on tern ecology.

Horswill & Robinson (2015)[13] provide demographic rates for seabirds breeding in the UK. For common terns, 24 colonies in the UK (16 in England) are analysed and a mean is derived from these. This value is 0.764 chicks per pair (standard deviation = 0.470), assessed as a 'good' quality estimate (the highest category available). As the mean is provided with the standard deviation, it is possible to calculate an upper estimate of productivity, based on mean productivity plus two standard deviations. Within a normal distribution, 95% of individual colony productivity average values should lie within two standard deviations of the mean. The upper 95% value derived in this way equates to a productivity level that is seldom exceeded and so provides a very conservative estimate of the number of pairs that might produce a certain number of fledged young.

JNCC also provide information on annual seabird productivity, with plots summarising this by country within the UK. In England, estimated average common tern productivity in 2010 and 2011 was 0.57 and 0.45 chicks per pair respectively (JNCC 2014: http://jncc.defra.gov.uk/page-3201).

Table 2 displays the various estimated numbers of adult common terns. Five year means are shown relating to these estimated and counted totals of adult pairs. When using the most optimistic estimate of productivity (national average plus two standard deviations) to estimate the numbers of pairs present in 2010 and 2011, the five year mean 2010 – 2014 is 27.6 pairs and 17.5 pairs 2011 - 2015. Using alternative assumptions regarding productivity to estimate numbers of pairs in 2010 and 2011 gives greater five year means; 51.0 and 28.0 pairs (using national average productivity over the two five year periods) and 71.0 and 41.2 pairs (using average productivity in England 2010 and 2011).

In the opinion of the Foulness ringing group, based on casual observations of adult pairs at the time of ringing and observations of productivity, the most realistic estimates of adults are those based on the national average plus two standard deviations (42 pairs in 2010 and 34 in 2011). Foulness SPA is thus a very productive colony for common terns, when manangement intervention discourages black-headed gull nesting and allows the terns to breed.

**Table 2**: Five year mean population size for common terns at Foulness SPA based on estimated and actual counts of adult pairs. 2010 and 2011 values estimated according to: national average productivity, upper estimates of national productivity, and estimated average productivity in England in 2010 and 2011.

| | **National average** | **Upper national** | **England** |
|---|---|---|---|
| 2010 | *94* | *42* | *126* |
| 2011 | *76* | *34* | *129* |
| 2012 | | 25 | |
| 2013 | | No data | |
| 2014 | | 9 | |
| 2015 | | 2 | |
| Five year mean (2010 – 2014) | 51.0 | 27.6 | 71.0 |
| Five year mean (2011 – 2015) | 28.0 | 17.5 | 41.2 |

[13] Horswill, C. & Robinson R. A. 2015. Review of seabird demographic rates and density dependence. *JNCC Report No. 552*. Joint Nature Conservation Committee, Peterborough.

# Outer Thames Estuary
# Special Protection Area

# Draft advice under Regulation 35(3) of The Conservation of Habitats and Species Regulations 2010 (as amended) and Regulation 18 of The Offshore Marine Conservation (Natural Habitats, & c.) Regulations 2007 (as amended)


Cover photograph illustrates red-throated diver in winter.

Version 3.7 (March 2013)

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| Thames SPA Cons Obs AOO 190509 .doc | Changes to tables 2.1 and 2.4; additions of Bas-corbiere ruling; changes to sensitivity assessment section; changes to physical loss and physical damage sections; changes to toxic contamination and biological disturbance sections | Internal draft for comment July 3rd 2009 |
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| Thames SPA Cons Obs AOO 090909 | Final (draft) version 2009 | Issued for consultation September 2009 |
| Thames SPA Cons Obs CWversion forRAs | Draft version 2011 for QA from Evidence Team, stakeholders comments not included as comments within the text | Final draft version 2011 |
| Thames SPA Cons Obs CWMARCH2011 | Final revision post workshop, standardised approach which mirrors Liverpool Bay SPA COs, following discussions with R Caldow and JNCC | Final version March 2011 |
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| ThamesSPAConsObsVersion 3.2 FINAL | Final version for circulation to relevant authorities | Final version August 2011 |
| TamesSPAConsObsVersion 3.3 | Further amendments following JNCC discussions and internal advice. Removal of section 3.2.1 and re-ordering of pagination following this – M | Final Version April 2012 |

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|---|---|---|
| | Knollys | |
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| ThamesSPAConsObsVersion 3.6 FINAL FOR WEB | Final draft document incorporating all comments | Jan 2013 |
| ThamesSPAConsObsVersion 3.7 FINAL FOR WEB | Final document for NE and JNCC website | March 2013 |



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## Summary of draft Conservation Objectives and Advice on Operations for the Outer Thames Estuary Special Protection Area (SPA)

This advice is based on information on the Special Protection Area (SPA) presented in Natural England's and the Joint Nature Conservation Committee's (JNCC) 'Departmental Brief: Outer Thames Estuary SPA document (Version May 2010)[1]. Natural England and JNCC's conservation objectives and advice on operations is site and feature specific, and has been developed using the best available scientific information and expert interpretation as at July 2012. The advice is generated through a coarse grading of sensitivity and exposure of the site's interest feature and its supporting habitat to physical, chemical and biological pressures associated with human activity. Sensitivity and exposure have been combined to provide a measure of the vulnerability of the interest feature to operations which may cause damage or deterioration, and therefore may require management.

The exact impact of any operation will be dependent upon the nature, scale, location and timing of events. This advice on operations for the Outer Thames Estuary SPA site will be kept under review and will be periodically updated to reflect changes in both sensitivity and exposure.

**The conservation objective for the Outer Thames Estuary Special Protection Area is, subject to natural change[2], maintain[3] or enhance the red-throated diver population (*Gavia stellata*) and its supporting habitats in favourable condition[4]**

The interest feature red-throated diver will be considered to be in favourable condition only when both of the following two conditions are met:

(i) The size of the red-throated diver population is at, or shows only non-significant fluctuation around the mean population at the time of designation of the SPA to account for natural change;

(ii) The extent of the supporting habitat within the site is maintained.
Management actions should enable the **Annex I feature *Gavia stellata* (wintering red-throated diver) and its supporting habitat in the Outer Thames Estuary** to

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1 http://www.naturalengland.org.uk/Images/Thames-brief_tcm6-21728.pdf

2 Natural change‟ means changes in the species or habitat which are not a result of human influences. Human influence on the red-throated diver population is acceptable provided that it is proved to be/can be established to be compatible with the achievement of the conditions set out under the definition of favourable condition. A failure to meet these conditions, which is entirely a result of natural process will not constitute unfavourable condition, but may trigger a review of the definition of favourable condition.

3 Maintain‟ is used here because existing evidence suggests the feature to be in favourable condition, and the objective is for it to remain so. Existing activities are deemed to be compatible with the conservation objectives if current practices are continued at current levels and in the absence of evidence that current activities are significantly affecting the red-throated diver population or its habitat. However, it must be borne in mind that gradually damaging activities can take time to show their effects. If evidence later shows an activity to be undermining the achievement of the conservation objectives, then the red-throated diver population will be deemed to be in unfavourable condition.

4 Favourable Condition **–** Relates to the maintenance of the structure, function, and typical species for that feature within the site.

maintain or enhance its population and extent of supporting habitat for the foreseeable future. This will require assessment and management of human activities likely to affect these adversely, and of activities likely to impact the functioning of natural processes upon which the feature is dependent.

To fulfil the conservation objectives for the **Annex I feature *Gavia stellata* and its supporting habitat**, the relevant and competent authorities for this area are advised to manage human activities within their remit such that they do not result in deterioration or disturbance, or impede the restoration of this feature through any of the following:

i) **Physical loss** of habitat by removal (e.g. capital dredging, harvesting, coastal and marine development)

ii) **Physical damage** by physical disturbance or abrasion of habitat (e.g. extraction)

iii) **Non-physical disturbance** through noise or visual disturbance (e.g. shipping, wind turbines)

iv) **Toxic contamination** by introduction of synthetic and/or non-synthetic compounds (e.g. polychlorinated biphenyls (PCBs), pollution from oil and gas industry, shipping);

v) **Non-toxic contamination** to prey species only by changes in e.g. turbidity (e.g. capital and maintenance dredging);

vi) **Biological disturbance** by selective extraction of species (e.g. commercial fisheries) and non selective extraction (eg entanglement with netting and wind turbine strike)

The advice describes the above impacts and activities for both the habitat and prey species of the red-throated divers and on the red-throated divers themselves.

During 2011/12 Government instigated a review of the implementation of the Habitats and Wild Birds Directive. The review concluded that all conservation objectives (marine and terrestrial) should be up-to date, accessible and allow applicants to assess the impact of their proposed development against them. The report[5] requested Natural England with JNCC to develop a new approach to improve the information contained in conservation objectives. Natural England and JNCC published their intended approach in June 2012. Natural England has committed to review and update its conservation objectives for all European Marine Sites to make them more definitive and explicit from 2013 onwards, on a prioritised basis. We will use this review to update the advice contained within this document, to take account of new evidence that subsequently becomes available, and improved scientific understanding.



5 http://www.defra.gov.uk/publications/2012/03/22/pb13724-habitats-wild-birds-directives/

**Outer Thames Estuary Special Protection Area**

**Draft advice under Regulation 35(3) of The Conservation of Habitats and Species Regulations 2010 and Regulation 18 of The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (as amended)**

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## 1. Introduction

The Outer Thames Estuary has been classified by the UK Government as a Special Protection Area (SPA) and the European Commission has been notified. The site now forms part of the Natura 2000[6] network. The Outer Thames Estuary SPA lies across both English territorial waters and UK offshore waters.

The Outer Thames Estuary SPA is subject to full protection under the Habitats and Birds Directive[7] (transposed through The Conservation of Habitats and Species Regulations 2010 (as amended)[8] and The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (as amended)[9] (referred to in this document respectively as the 'Habitats Regulations' and the 'Offshore Regulations'). Amongst other things, the Habitats Regulations and the Offshore Regulations place an obligation on relevant authorities and competent authorities respectively to put in place measures to protect the sites from damage or deterioration.

This advice is given in fulfilment of the duty of Natural England and JNCC under Regulations 35(3)[10], and 18[11] of the respective Habitats Regulations (referred to in this document as "Regulation 35/18 advice"), to provide relevant and competent authorities as to (a) the conservation objectives for the Outer Thames Estuary SPA: and (b) any operations which may cause deterioration of natural habitats or the habitats of species, or disturbance of species, for which the Outer Thames Estuary SPA has been designated.

This advice constitutes one element of NE's/JNCC's advisory role in relation to this site. The current information must be used by relevant authorities[12] to explore and put in place management measures (if required), and by competent authorities[13] to fulfil their duties under the Habitats Regulations in making the necessary determinations on the impact of activities on the site. Developers may also use this advice when operating within a site, and when providing information to relevant/competent authorities as part of an application for new plans and projects. However, should relevant or competent authorities or others require any further advice, they are not limited to taking account of the conservation advice contained here, and would be expected to make further enquiries as required in order to make determinations or implement management measures. Further information/reference should be made to the Departmental Brief for the Outer Thames Special Protection Area[14].

An independent review of Natural England's marine SAC selection process carried out in 2011 made a number of recommendations as to how Defra and Natural England should modify their approach to future evidence based work[15]. This resulted

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[6] as defined under Regulation 3 of The Conservation of Habitats and Species Regulations 2010
[7] Council Directive 79/409/EEC on the conservation of wild birds
[8] http://www.legislation.gov.uk/uksi/2010/490/contents/made
[9] http://www.legislation.gov.uk/uksi/2010/491/contents/made
[10] http://www.legislation.gov.uk/uksi/2010/490/regulation/35/made
[11] http://www.legislation.gov.uk/uksi/2007/1842/regulation/18/made
[12] as defined under Regulation 7 of The Conservation of Habitats and Species Regulations 2010
[13] http://www.legislation.gov.uk/uksi/2007/1842/regulation/23/made
[14] http://www.naturalengland.org.uk/Images/Thames-brief_tcm6-21728.pdf

[15] http://www.defra.gov.uk/publications/files/pb13598-graham-bryce-independent-review-marine-sacs-110713.pdf

in Natural England adopting the Government Chief Scientific Adviser‟s (GCSA) guidelines on using evidence[16] through the development of a suite of Evidence Standards[17]. Implementation of these standards has included Natural England working with JNCC to develop a protocol[18], which has been subject to independent expert review, setting out the processes and requirements for the development of conservation advice packages, to ensure that these fully comply with the GCSA's guidelines. Whilst the conservation advice provided here was developed prior to the finalisation of the protocol, it has been assessed for compliance with the protocol and a detailed report can be found on the Natural England website[19]

During 2011/12 Government instigated a review of the implementation of the Habitats and Wild Birds Directive. The review concluded that all conservation objectives (marine and terrestrial) should be up-to date, accessible and allow applicants to assess the impact of their proposed development against them. The report[20] requested Natural England with JNCC to develop a new approach to improve the information contained in conservation objectives. Natural England and JNCC published their intended approach in June 2012, with Natural England committing to review and update its conservation objectives for all European Marine Sites to make them more definitive and explicit. We will be consulting with stakeholders on the approach, as well as how we can make our Regulation 35/18 advice more accessible and easier to use. The review of conservation advice will then begin in 2013 on a prioritised basis. We will use this review to update the advice contained within this document, to take account of new evidence that subsequently becomes available, and improved scientific understanding.

## 2. Roles and Responsibilities

### 2.1 The role of Natural England and JNCC

The Conservation of Habitats and Species Regulations 2010 (as amended) transpose the Habitats Directive into law on land and in territorial waters of Great Britain (out to 12 nautical miles from the baseline). The Regulations give Natural England a statutory responsibility to advise relevant and competent authorities on the conservation objectives and operations which may cause deterioration of natural habitats or the habitats of species, or disturbance of species for which the sites have been designated, for European marine sites in England.

The Offshore Marine Conservation (Natural Habitats &c.) Regulations 2007 (as amended) transpose the Habitats Directive into law for UK offshore waters (from 12 nautical miles from the coast out to 200 nm or the UK Continental Shelf). These Regulations give JNCC a statutory responsibility to advise competent authorities of the conservation objectives for offshore Special Areas of Conservation and to advise them of operations which may adversely affect the integrity of the site.

[16] http://www.bis.gov.uk/assets/goscience/docs/g/10-669-gcsa-guidelines-scientific-engineering-advice-policy-making.pdf
[17] http://www.naturalengland.org.uk/ourwork/research/default.aspx
[18] http://www.naturalengland.org.uk/ourwork/marine/sacconsultation/default.aspx
[19] http://publications.naturalengland.org.uk/publication/3233957?category=3212324

This advice is also required under the Offshore Petroleum Activities 2001 (Conservation of Habitats) Regulations (as amended); and the Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended).

Natural England and JNCC will provide additional advice for each site to Relevant and competent authorities in order for them to fulfil their duties under the Habitats Regulations, for example when a Competent Authority wishes to assess the implications of any plans or projects on a candidate Special Area of Conservation (cSAC), Special Area of Conservation (SAC), or Special Protection Area (SPA).

## 2.2 The role of relevant and competent authorities

### 2.2.1 Inshore (0 – 12 nautical miles):

The Habitats Regulations require relevant and competent authorities to exercise their functions so as to secure compliance with the Habitats Directive. Under Regulation 36[21] of the Habitats Regulations relevant authorities may use this advice to draw up a management scheme for the SPArelevant authorities must, within their areas of competence, have regard to both direct and indirect effects on interest features of the site. This may include consideration of issues outside the boundary of the site.

### 2.2.2 Offshore (12 – 200 nautical miles):

Regulations 22, 23, 25 and 27[22] of the Offshore Marine Conservation (Natural Habitats &c.) Regulations 2007 (as amended) outline the responsibilities of competent authorities to ensure compliance with the Habitats Directive. Regulation 22 requires competent authorities to consider appropriate conservation measures for Annex I habitats and Annex II species present within the SAC. Regulation 23 requires competent authorities to take appropriate steps to avoid the deterioration or disturbance of interest features for which the Offshore SAC is designated. Regulation 25 requires competent authorities to consider if a plan or project could be likely to have a significant effect on a European Offshore Marine Site and, if necessary, undertake an appropriate assessment for the plan or project. Regulation 27 requires competent authorities to review existing consents, permissions or authorisations and if necessary, affirm, modify or revoke them, undertaking an appropriate assessment where necessary. Competent authorities must, within their areas of competence, have regard to both direct and indirect effects on interest features of the site. This may include consideration of issues outside the boundary of the SAC.

### 2.2.3 Activity outside the control of relevant/competent authorities

Nothing within Regulation 35/18 advice will require relevant authorities to undertake any actions or ameliorate changes in the condition of interest features if it is shown that the changes result wholly from natural causes. Having issued Regulation 35/18 advice for this site, Natural England and JNCC will work with relevant and competent authorities and others to agree, within a defined time frame, a protocol for evaluating observed changes in the site's condition and to develop an understanding of natural change and provide further guidance as appropriate and possible. This does not, however, preclude relevant and competent authorities from taking any appropriate action to prevent deterioration to the interest features, and indeed such actions should be undertaken when required.

[21] http://www.legislation.gov.uk/uksi/2010/490/regulation/36/made
[22] http://www.legislation.gov.uk/uksi/2007/1842/contents/made

## 2.3 The role of conservation objectives

The conservation objectives set out what needs to be achieved for the site to make the appropriate contribution to the conservation status of the features for which the site is designated and thus deliver the aims of the Habitats and Birds Directives.

Conservation objectives are the starting point from which management schemes and monitoring programmes may be developed as they provide the basis for determining what is currently or may cause a significant effect, and they inform the scope of appropriate assessments.

In addition to providing such advice, this advice will inform the scope and nature of any ‘appropriate assessment’ which the Directive requires to be undertaken for plans and projects (Regulations 61 and 63 and by Natural England under Regulation 21 of the Habitats Regulations).

## 2.4 The role of advice on operations

The advice on operations set out in Section 4 of this document provides the basis for discussion about the nature and extent of the operations taking place within or sufficiently close to have an impact on the site and which may have an impact on its interest features. The advice should also be used to help identify the extent to which existing measures of control, management and forms of use are, or can be made, consistent with the conservation objectives, and thereby focus the attention of relevant authorities and surveillance to areas that may need management measures.

This advice on operations may need to be supplemented through further discussions with the relevant authorities and any advisory groups formed for the site.

## 2.5 Precautionary principle

All forms of environmental risk should be tested against the precautionary principle which means that where there are real risks to the site, lack of full scientific certainty should not be used as a reason for postponing measures that are likely to be cost effective in preventing such damage. It does not however imply that the suggested cause of such damage must be eradicated unless proved to be harmless and it cannot be used as a licence to invent hypothetical consequences. Moreover, it is important, when considering whether the information available is sufficient, to take account of the associated balance of likely costs, including environmental costs, and benefits (DETR & the Welsh Office, 1998).

## 3. Conservation objectives

### 3.1 Background to conservation objectives

The conservation objectives and definitions of favourable condition for features on the site may inform the scope and nature of any ‘appropriate assessment’ under the Habitats Regulations[23,24]. An appropriate assessment will also require consideration of issues specific to the individual plan or project.

The scope and content of an appropriate assessment will depend upon the location, size and significance of the proposed project. Natural England and JNCC will advise on a case by case basis.

Following an appropriate assessment, competent authorities are required to ascertain the effect on the integrity of the site. The integrity of the site is defined in paragraph 20 of ODPM (Office of the Deputy Prime Minister) Circular 06/2005 (DEFRA Circular 01/2005)[25] as the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified. The determination of favourable condition is separate from the judgement of effect upon integrity. For example, there may be a time-lag between a plan or project being initiated and a consequent adverse effect upon integrity becoming manifest in the condition assessment. In such cases, a plan or project may have an adverse effect upon integrity even though the site remains in favourable condition, at least in the short term.

The conservation objectives for this site are provided in accordance with paragraph 17 of ODPM Circular 06/2005 (DEFRA Circular 01/2005) which outlines the appropriate assessment process. The entry on the Register of European Sites gives the reasons for which a site was classified or designated.

The target for population size is set to take account of the way in which populations fluctuate naturally and the degree of uncertainty in estimating population size. This is done so that in future condition monitoring, a population size estimate that falls within the known natural fluctuations in population size, or has a degree of uncertainty around it that renders it indistinct from the estimate of population size at the time of classification (i.e. the baseline population), can be distinguished from one that does not. This distinction serves to identify those circumstances in which the evidence is consistent with an interpretation that any apparent decline in a population below that at classification is simply a reflection of margins of error in measurement and/or due to a natural fluctuation which is part of a normal and established pattern which can be attributed to natural phenomena such a food availability, weather conditions etc.. In such circumstances it would be inappropriate to trigger further investigation into the causes of the apparent decline or the implementation of remedial actions to reverse it. In contrast, where the decline is of a magnitude that takes it beyond these limits then it is quite possible that, being beyond “expected variation”, there is a non-natural cause. Classification of the feature as being in unfavourable condition would then trigger investigation of the cause of the population decline and perhaps trigger

[23] The Conservation of Habitats and Species Regulations 2010: Regulation 61 and 63 by a competent authority and Regulation 21 by Natural England.
[24] Offshore Marine Conservation (Natural Habitats &c.) Regulations 2007 (as amended): Regulation 25 and 27 by a competent authority.
[25] http://www.communities.gov.uk/documents/planningandbuilding/pdf/147570.pdf

remedial management actions if the decline can be attributed to a particular cause (or causes) that can be managed so as to reduce their impact in the future.

This assessment is distinct from that carried out when considering the significance of a specific anthropogenic impact which can be shown to (or is predicted to) reduce a population from its baseline value to a new lower level.

### 3.2 Outer Thames Estuary SPA conservation objectives

The formal conservation objectives (as at July 2011) for Outer Thames Estuary SPA interest features are provided below. These are high-level objectives for the site features, and Natural England and JNCC may refine them in the future as our understanding of the features improves and further information becomes available, such as survey work.

They should be read in the context of other advice given, particularly:

(i) the Departmental Brief[26] which provides more detailed information about the site and evaluates its interest features according to the Birds Directives selection criteria and guiding principles;
(ii) the favourable condition table (Appendix A) providing information on how to recognise favourable condition for each of the features and which will act as a basis from which the monitoring programme will be developed; and

(iii) the attached maps (Appendix B) which show the known locations of the interest features

#### 3.2.1 Red-throated diver – *Gavia stellata*

Red-throated diver is listed in Annex I to the Birds Directive and is assessed against stage 1(1) of the SPA selection guidelines (Stroud *et al.* 2001)[27]; using the relevant national population estimate the wintering population of red-throated divers in Great Britain is estimated to be 17,116 individuals (O'Brien et al. 2008), representing between 10-19% (depending on the areas included) of the NW Europe non-breeding population. The Great Britain population estimate is derived from shore-based observations together with more specific aerial surveys. Surveys from aeroplanes (and boats) have been responsible for identifying much larger numbers wintering in British coastal waters than previously known (O'Brien *et al*. 2008). Recent evolution of aerial survey methods, using both High Resolution still photography and High Definition video, has revealed that previous estimates of red-throated diver numbers are likely to be under-estimates (APEM 2010).

In the UK, wintering red-throated divers are associated with inshore waters, often occurring within sandy bays, firths and sea lochs, although open coastline is also frequently used (Skov *et al*., 1995; Stone *et al.*, 1995). Knowledge of red-throated diver distribution in the UK was transformed during the 2000s following the advent of aerial and boat surveys for offshore development, particularly renewables development (e.g. Percival *et al.*, 2004; O'Brien *et al*. 2008). The bulk of the UK distribution is in east England, the area between Kent and North Yorkshire supporting 59% of the UK total estimate; 44% of the UK total is in the Greater Thames alone (O'Brien *et al.* 2008), with variable distribution between surveyed sites (APEM 2011).

[26] http://publications.naturalengland.org.uk/file/3264082
[27] http://jncc.defra.gov.uk/page-1405

Liverpool Bay is currently the only other marine area in the UK classified as a SPA for red-throated divers.

Red-throated divers use the Outer Thames Estuary SPA in wintering numbers of European importance (6,466 individuals, 38% of the GB population, 1989 – 2006/07).

**Table 3.1 The conservation objectives for the Outer Thames Estuary SPA interest feature: internationally important population of the regularly occurring Birds Directive Annex I species: red-throated diver (*Gavia stellata*)**

| |
|---|
| Subject to natural change[28], maintain[29] or enhance the red-throated diver population and its supporting habitats in favourable condition[30]<br><br>Relevant habitats include shallow coastal waters and areas in the vicinity of sub-tidal sandbanks<br><br>The number of red-throated diver using these habitats is given in Table 3.2 below. |

The interest feature red-throated diver will be considered to be in favourable condition only when both of the following two conditions are met:

(i) The size of the red-throated diver population is at, or shows only non-significant fluctuation around the mean population at the time of designation of the SPA to account for natural change;

(ii) The extent of the supporting habitat within the site is maintained.

The favourable condition table (Appendix A) further defines favourable condition for the interest features of the site.

[28] Natural change" means changes in the species or habitat which are not a result of human influences. Human influence on the red-throated diver population is acceptable provided that it is proved to be/can be established to be compatible with the achievement of the conditions set out under the definition of favourable condition. A failure to meet these conditions, which is entirely a result of natural process will not constitute unfavourable condition, but may trigger a review of the definition of favourable condition.

[29] Maintain" is used here because existing evidence suggests the feature to be in favourable condition, and the objective is for it to remain so. Existing activities are deemed to be compatible with the conservation objectives if current practices are continued at current levels and in the absence of evidence that current activities are significantly affecting the red-throated diver population or its habitat. However, it must be borne in mind that gradually damaging activities can take time to show their effects. If evidence later shows an activity to be undermining the achievement of the conservation objectives, then the red-throated diver population will be deemed to be in unfavourable condition.

[30] Favourable Condition – Relates to the maintenance of the structure, function, and typical species for that feature within the site.

**Table 3.2 Information on the population of red-throated diver that qualifies the Outer Thames Estuary as an SPA under the Birds Directive.**

| Internationally important populations of regularly occurring Birds Directive Annex 1 species | |
|---|---|
| **Species** | **Wintering population** |
| Red-throated diver<br>*Gavia stellata* | 6,466 individuals[31] |

### 3.2.2 Explanatory information for the red-throated diver conservation objectives

#### Key supporting habitats and distribution

In the UK, wintering red-throated divers are associated with shallow inshore waters (between 0-20m deep and less frequently in depths of around 30m), often occurring within sandy bays, firths and sea lochs, although open coastline is also frequently used (Skov *et al*., 1995; Stone *et al.*, 1995). There is some evidence of association with areas of salinity change (e.g. where low salinity river water meets higher salinity sea water: Skov & Prins 2001; Skov *et al.* 2011). Such areas tend to fluctuate with state of tide, volume of river flow and wind conditions.

Other physical and hydrographic factors determining the distribution of red-throated divers have been established for part of the Outer Thames Estuary SPA (Skov *et al.* 2011). This modelling work identified different areas of high habitat quality at different tidal flow phases with variables including current velocity, water levels, eddies, upwellings and shipping found to be important at different tidal stages. As an active fish-feeder (Guse *et al.* 2009 and references therein), the distribution and concentrations of red-throated divers will at least partly be determined by the presence, abundance, and availability of their prey species, which is likely to be linked to at least some of the environmental parameters tested by Skov *et al.* (2011).

#### Key food

The red-throated diver is considered to be an opportunistic feeder and dietary studies have revealed several different fish species are consumed depending upon the area studied, including members of the cod family, herring, gobies and sand eels (Guse *et al*. 2009 and references therein). The sandbanks of the Outer Thames Estuary

[31] The wintering population estimate was generated from aerial survey data, collected mainly by WWT (Wildfowl and Wetlands Trust) Consulting, commissioned by a number of organisations including UK Government and a consortium of wind energy companies. Other data were collected by the JNCC Marine SPA Team, and by the Natural Environmental Research Institute, Denmark. Data were collected between the months of October to March in 1988/89, and 2002-2007. **JNCC has absolute confidence in the integrity of the data provided.** Population estimates within the boundary are calculated using spatial analysis to estimate RTD density in 1km grid squares. This is the revised figure following the re-drawing (shrinking) of the boundary as a result of the public consultation.

support the nursery and feeding grounds for many fish species, including the small fish that red-throated divers feed on.

## Behaviour and Impacts

In a review of the sensitivity of 26 species of ‘seabird’ to the development of offshore windfarms, Garthe & Huppop (2004) found that red-throated divers had the second highest species sensitivity index score. Furness & Wade (2012) similarly ranked the species of primary concern with regard to disturbance /displacement from offshore wind farms. There is evidence that red-throated divers are displaced from the footprint of offshore windfarms and surrounding sea areas up to 2km distant from the outermost turbines due most likely to the presence of the turbines and the activities of maintenance vessels. Petersen *et al*. (2006) showed a marked post construction avoidance of the Horns Rev offshore windfarm, including also the 2km and 4km zones around it.  A similar, though less pronounced avoidance response to the Nysted offshore windfarm by red-throated divers was also recorded (Petersen *et al.* 2006), and emerging data from Kentish Flats offshore wind farm suggest a decreasing displacement effect with distance from the turbine footprints (Percival 2010). Inappropriately sited developments could displace significant numbers of the GB wintering population.  Other forms of renewable energy, such as tidal barrages, could also impact on the species’ wintering numbers and distribution for disturbance and habitat loss reasons.

Red-throated divers are especially sensitive to disturbance at sea (Garthe & Huppop 2004; Furness & Wade 2012) and usually avoid boats (Schwemmer *et al.* 2011).

Red-throated divers are highly sensitive to the effects of disturbance associated both directly with marine aggregate extraction, and also the resultant increases in shipping activity. As Red-throated divers are highly exposed to marine aggregate extraction areas, they have been assessed as being highly vulnerable to changes to turbidity, sedimentation and impacts to the benthos or associated fish communities (Cook & Burton 2010).

Red-throated divers moult their flight feathers during September and October when they may become flightless for a short period and are vulnerable to oil pollution at this time (Camphuysen, C.J. 1989, Williams et al 1994).

Red-throated diver populations are vulnerable to increased adult mortality as it is a long-lived species with low breeding productivity. Studies have shown entanglement in various types of static fishing gear, netting and marine litter as one of the most frequently identified causes of death in NW European and GB waters (Okill 2002, Erdmann *et al.* 2005, Weston & Caldow 2010). However early indications from a 2011/12 study by Natural England and the Kent and Essex IFCA in the Outer Thames Estuary SPA suggest that occurrence of red-throated diver entanglement in fishing gear is low. Further data is being collected over the 2012/13 winter. At a broader geographic scale,  bycatch of red-throated divers in the Baltic Sea and North Sea is estimated to be of the order of ‘hundreds’ from a population of >100,000 (Zydelis *et al.* 2009).

Herring are key prey species for the red-throated diver (Guse *et al.* 2009). The species may thus also be sensitive to aspects of dredging activity that negatively impact on herring populations, such as increases in sediment deposition (Cook & Burton 2010).

Commercial extraction of the red-throated diver's main fish prey species, as target and/or bycatch species, could impact the birds, but again the extent of this in the Outer Thames Estuary SPA is not well understood.

### 3.3 Background to favourable condition table

The favourable condition table is the principle source of information that Natural England and JNCC will use to monitor and assess the condition of an interest feature and as such comprises indicators of condition. The favourable condition table can be found at Appendix A.

On many terrestrial European sites, we know sufficient information about the required condition of qualifying habitats to be able to define favourable condition with confidence. In contrast, understanding the functioning of large, varied, dynamic marine and estuarine sites, which experience a variety of pressures resulting from historic and current activities, is much more difficult, consequently it is much harder to define favourable condition so precisely in such sites. In general the conservation objectives provided are based on a *working* assumption that the *current* condition of the features is favourable for most attributes.

Where there are more than one year's observations on the condition of marine features, all available information will need to be analysed to determine, where possible, any natural environmental trends at the site. This will provide the basis for judgements of favourable condition to be determined in the context of natural change. Where it becomes clear that certain attributes may indicate a cause for concern, and if further investigation indicates this is justified, restorative management actions will need to be taken. The aim of such action would be to return the interest feature to favourable condition from any unfavourable state. Future editions of the advice within this document will revise the current assumptions about feature condition in light of ongoing and future monitoring. This will be linked with any developments in our understanding of the structure and functioning of features and the pressures they are exposed to.

This advice also provides the basis for discussions with relevant authorities, and as such the attributes and associated measures and targets may be modified over time. The aim is to have a single agreed set of attributes that will be used as a basis for monitoring in order to report on the condition of features. Condition monitoring of the attributes may be of fairly coarse methodology, underpinned by more rigorous methods on specific areas within the site. Common Standards Monitoring (JNCC 2004) requires mandatory monitoring of some attributes of a designated feature, while other attributes are considered discretionary (or site-specific) and are incorporated to highlight local distinctiveness. Monitoring of both bird populations and the extent of habitats are fundamental to assessing the condition of bird features (JNCC 2004), and are therefore identified as "**mandatory attributes"** in the Favourable Condition Tables (Appendix A). It is not possible to make a robust assessment of the condition of a feature without assessing the mandatory attributes. **For bird features the general rule is that all mandatory attributes must meet their targets for the feature to be in favourable condition**. Priority will be given to measuring attributes that are at risk from anthropogenic pressure and for which changes in management may be necessary. This information may be generated by Natural England/JNCC or collected by other organisations through agreements.

The condition monitoring programme will be developed through discussion with the relevant / competent authorities and other interested parties, ideally as part of the management scheme process. Natural England and JNCC will be responsible for collating the information required to assess condition, and will form a judgement on the condition of each feature within the site.

Targeted monitoring of the attributes identified in the favourable condition table will be an important, but not the only, basis for assessing the condition of the features. Additional sources of information may also be selected to inform our view about the integrity and condition of the site. For example, a part of risk based monitoring activity data (as collected by the relevant/competent authorities and their statutory advisers) could give an indication as to the levels of pressure that may impact on the site features. Any other relevant data, such as data on site integrity, results from compliance monitoring, (for example assessing the conduct of activities in relation to regulations and licence conditions), together with data obtained to inform appropriate assessments, licence applications etc. will also have an important role in informing assessments of feature condition.

Information about the size of the red-throated diver population on the site will also need to be interpreted in the context of any wider changes in the population of this species at a national or biogeographic region level.

## 4. Advice on operations

### 4.1 Background

Natural England and JNCC have a duty under Regulation 35(3)(b) of the Habitats Regulations and 18 of the Offshore Marine Conservation Regulations to advise other relevant authorities as to any operations which may cause deterioration of natural habitats or the habitats of species, or disturbance of species, for which the site has been designated.

The process of deriving and scoring relative vulnerability is provided at Appendix C. A summary of the operations which may cause deterioration or disturbance is given at Appendix D, and detailed in Appendix E. Further explanation of the sensitivity of the interest features follows with examples of their exposure and therefore their vulnerability to damage or disturbance from the listed categories of operations. This enables links to be made between the categories of operation and the ecological requirements of the features.

### 4.2 Purpose of advice

The aim of this advice is to enable all relevant authorities to direct and prioritise their work on the management of activities that pose the greatest potential threat to the favourable condition of interest features at Outer Thames Estuary SPA. The advice is linked to the conservation objectives for interest features and will help provide the basis for detailed discussions between relevant authorities enabling them to formulate and agree a management scheme for the site should one be deemed necessary.

The advice given here will inform, but is given without prejudice to, any advice provided under Regulation 61 or Regulation 63 on operations that qualify as plans or projects within the meaning of Article 6 of the Habitats Directive.

## 4.3 Methods for assessment

To develop this advice on operations Natural England has used a three step process involving:

- an assessment of the **sensitivity** of the interest features or their component sub-features to operations;

- an assessment of the **exposure** of each interest feature or their component sub-features to operations; and

- a final assessment of **current vulnerability** of interest features or their component sub-features to operations.

This three step process builds up a level of information necessary to manage activities in and around the site in an effective manner. Through a consistent approach, this process enables Natural England to both explain the reasoning behind our advice and identify to competent and relevant authorities those operations which pose the most current threats to the favourable condition of the interest features on the site.

All the scores of relative sensitivity, exposure and vulnerability are derived using best available scientific information and informed scientific interpretation and judgement. The process uses sufficiently coarse categorisation to minimise uncertainty in information, reflecting the current state of our knowledge and understanding of the marine environment.

Six broad Pressure 'Categories of Operation' which may cause i) deterioration of natural habitats or the habitats of species, or ii) disturbance of species, (either alone or in-combination), are considered in this document:

- Physical Loss
- Physical Damage
- Non-physical disturbance
- Toxic contamination
- Non-toxic contamination
- Biological disturbance

Example sources of pressures are provided (Appendix D), although these examples are not inclusive of all potentially detrimental activities.

### 4.3.1. Sensitivity assessment

The sensitivity assessment used is an assessment of the relative sensitivity of the interest features and their supporting habitat in the Outer Thames Estuary SPA to the effects of six broad categories of human activities.

In relation to this assessment, sensitivity has been defined as the "intolerance of a habitat, community or individual (or individual colony) of a species to damage, or death, from an external factor and the time taken for its subsequent recovery" (Hiscock 1996, MarLIN, 2003). For example, a very sensitive species or habitat is one that is very adversely affected by an external factor arising from human activities or natural events (killed/destroyed, 'high' intolerance) and is expected to recover only over a very long period of time, i.e. >10 or up to 25 years ('low' recoverability). In the case of the SPA, this assessment considers the sensitivity of the red-throated diver population as well as the species and habitats on which that population depends. This includes its prey species and supporting habitats e.g. the condition of the sandbanks is important because they support the food chain on which the divers depend.

The sensitivity assessments are based on current information but may develop with improvements in scientific knowledge and understanding. The sensitivity of interest features or sub-features (and scientific understanding of sensitivity) may change over time; hence an operation that is not currently considered to have a negative effect may be identified as having one in the future. For example the dependence on a particular prey species may change if that species' abundance declines and the birds switch prey species. The subsequent shift may mean dependence on another prey species not previously assessed.

#### 4.3.2. Exposure assessment

This has been undertaken for the Outer Thames Estuary SPA by assessing the relative exposure of the interest features and their supporting habitat on the site to the effects of broad categories of human activities currently occurring on the site (as at July 2012). These assessments were made on the best available information and advice but should be reviewed in light of additional information on activities in the area.

#### 4.3.3. Vulnerability assessment

The third step in the process is to determine the vulnerability of interest features or their component sub-features to operations. This is an integration of sensitivity and exposure. Only if a feature is both sensitive *and* exposed to a human activity is it considered vulnerable (see Appendix C). In this context, therefore, 'vulnerability' has been defined as the exposure of the habitat, community or individual (or individual colony) of a species to an external factor to which it is sensitive (Hiscock, 1996). An assessment of the interest feature's vulnerability (Appendix E) helps to guide site management decisions by highlighting potentially detrimental activities that may need to be managed (or continue to be managed) by the competent authorities.

The vulnerability of the SPA Annex I feature to climate change is not considered in the annexes below, given the uncertainties surrounding the effects of global change on the oceans.

### 4.4 Format of advice

The advice is provided within six broad categories of operations that may cause deterioration of natural habitats or the habitats of species, or disturbance of species. This approach therefore:

- enables links to be made between human activities and the ecological requirements of the habitats or species, as required under Article 6 of the Habitats Directive;[32]

[32] For full a background summary to the Natura 2000 see http://necmsstage/ourwork/marine/sacconsultation/default.aspx and

- provides a consistent framework to enable relevant authorities to assess the effects of activities and identify priorities for management within their areas of responsibility; and

- is appropriately robust to take into account the development of novel activities or operations which may cause deterioration or disturbance to the interest features of the site and should have sufficient stability to need only infrequent review and updating by Natural England and JNCC.

These broad categories provide a clear framework against which relevant and competent authorities can assess activities under their responsibility.

### 4.5 Update and review of advice

Information as to the operations which may cause deterioration of natural habitats or the habitats of species, or disturbance of species, for which the site has been designated, is provided in light of what Natural England knows about current and recent activities and patterns of usage at Outer Thames Estuary SPA. Natural England and JNCC expects that the information on activities and patterns of usage will be refined as part of the process of developing the management scheme and through discussion with the relevant and competent authorities. As part of this process the option of identifying a number of spatial zones with different activity levels may be appropriate. It is important that future consideration of this advice by relevant authorities and others takes account of changes in the usage patterns that have occurred at the site, over the intervening period, since the information was gathered. In contrast, the information provided in this advice on the sensitivity of interest features or sub-features is relatively stable and will only change as a result of an improvement in our scientific knowledge, which will be a relatively long term process. Advice for sites will be kept under review and will be periodically updated through discussions with relevant and competent authorities and others to reflect significant changes in our understanding of sensitivity together with the potential effects of plans and projects on the marine environment.



## 5. Specific advice on operations for the Outer Thames Estuary SPA

The following sections provide information to help relate general advice regarding the sensitivity and exposure of the specific interest feature (the overwintering population of red-throated diver, *Gavia stellata*) and its supporting habitat to operations and activities within and adjacent to the Outer Thames Estuary SPA.

This advice relates to the vulnerability of the interest features and sub-features of the Outer Thames SPA to current levels of human usage, as summarised in Appendix D and detailed in Appendix E.

Further explanation of the sensitivity of the interest feature and supporting habitats follows, with examples of its exposure and therefore its vulnerability to damage or disturbance from the listed categories of pressures. This enables links to be made between the categories of operation and the ecological requirements of the features.

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the Departmental brief: http://www.naturalengland.org.uk/Images/Thames-brief_tcm6-11044.pdf

Information regarding the current commercial activities in and around the SPA can be found in the Departmental Brief[33] for the Outer Thames Estuary SPA.

### 5.1. Detailed advice for the Outer Thames Estuary SPA features

#### 5.1.1. Physical loss of supporting habitat

In the UK, wintering red-throated divers are associated with shallow (between 0-20m deep (less frequently in depths of around 30m)) inshore waters, often occurring within sandy bays, firths and sea lochs, although open coastline is also frequently used (Skov *et al*., 1995; Stone *et al*., 1995). Red-throated divers are known to be associated with sandbank features, although the exact use of different habitats within the Outer Thames Estuary is complex, and related to both physical and hydrographic variables (Skov *et al.* 2011).

The link between the birds and benthic habitats is not well understood but it probably reflects the association between some of their prey species (small fish such as gadoids, sprat, herring and sandeel between approximately 10 and 25 cm in length; Guse *et al 2009.*, and references therein) and sandbanks (Kaiser *et al*. 2004). Sandbanks may have a functional role (as nursery, spawning, or feeding grounds or in providing shelter) in supporting these fish species. Eddies and upwellings, perhaps reflecting biologically productive components of the marine environment and thus attractive to fish, have been shown to be important on certain tidal phases for explaining red-throated diver distribution in the Outer Thames Estuary (Skov *et al.* 2011).

Physical loss by removal or by smothering of any of the habitats on which red-throated divers depend may result in the loss of foraging sites and therefore the reduction of the food resource for the overwintering population. This would consequently be detrimental to the favourable condition of the interest feature. **Thus the overwintering population is considered to be highly sensitive to physical removal of habitat and moderately sensitive to smothering.** The sensitivity for smothering is considered moderate rather than high because habitats can recover after time with smothering whereas physical removal is likely to destroy the habitat.

Offshore development construction, marine aggregates extraction, capital and maintenance dredging of shipping channels all undertake physical removal of sand from within the SPA boundary. The northernmost extent of the SPA boundary (Norfolk) crosses the 12nm zone and contains some aggregates licences (from 2008) and prospecting areas. The environmental statement for the London Array Windfarm located in the southern area of the SPA (partially overlapping Margate & Long Sands SAC) considered that the resulting habitat loss from the development is very small, and is not considered significant in the context of habitat availability for divers within the SPA and the Thames Estuary as a whole (RPS Group PLC 2005).

The Round 3 development programme for offshore wind farms includes an area overlapping with the northern extent of the SPA. The Crown Estate has awarded a lease to develop the Norfolk Zone (Zone 5) to a consortium known as East Anglia Offshore Wind. This consortium will be required to undertake a zonal assessment of their combined proposals followed by an environmental impact assessment and make an application through the Planning Inspectorate for each windfarm proposal.

[33] http://www.naturalengland.org.uk/Images/Thames-brief_tcm6-11044.pdf

An approximate calculation of turbine base diameter relative to the entire extent of the SPA, indicates that direct physical loss of habitat due to the footprint of windfarm turbines (taking into account Kentish Flats, Gunfleet Sands, Scroby Sands, London Array and the Round 3 zone off Suffolk) would be substantially less than 0.01% of the total SPA area.  Whilst this figure does not take into account habitat loss due to scour protection around the turbines or over inter-array and grid connection cables, in the context of the SPA area the total figure for direct habitat loss due to turbine footprints and scour protection is still likely to fall below 1% of the total SPA area (the total area of the Outer Thames Estuary SPA is 379,268.14 ha). Direct loss due to the turbine footprint must be considered alongside ‘effective’ or indirect loss of habitat (which could be temporary), due to divers avoiding the windfarm area. This is addressed under non physical disturbance in section 5.1.3.

Furthermore, although net habitat loss may be small, it is important to recognise that some habitat areas will be of more importance to red-throated divers than others. Within the Outer Thames Estuary area, Kentish Flats and London Array offshore wind farms are situated in habitat typically described as being of ‘high’ or ‘very high’ quality (Skov *et al.* 2011). Displacement from such habitat may lead to density-dependent effects (e.g. increased feeding competition) elsewhere within the SPA.

Black Deep and Fisherman’s Gat have never been dredged; the Princes Channel was dredged in 2008 for the first time in 40 years and there will be an ongoing maintenance dredging requirement.  Maintenance and / or capital dredging is likely to increase if shipping activity and ship sizes increases. Capital dredging within the site is planned for Shellhaven, a new container port that is being developed on the site of a former oil refinery.  In addition planned capital dredging of the Medway Approach Channel will fall partly within the site.

Based on the overall extent of supporting sandbank habitat and the distribution and extent of activities the overall exposure to physical loss due to removal can be considered to be low. This is because although the impacts described above may be relatively geographically dispersed, when considered cumulatively they represent only a small area of the SPA habitat. However, the quality of supporting habitat, as determined by modelling of environmental predictor variables against known diver distributions, is a key consideration in the ultimate effect of such habitat removal (Skov *et al.* 2011). The existing and prospective aggregate extraction areas within the site as well as ongoing maintenance dredging requirements of shipping lanes and potential future capital dredging means that **exposure to physical loss due to smothering can be considered to be moderate.**

Overall the **vulnerability of the Annex I species** within the Outer Thames Estuary SPA and associated habitats to **physical loss** due to both physical removal and smothering is considered to be **low to moderate**.

### 5.1.2. Physical damage to their supporting habitat

Benthic sandbank communities are in general relatively resilient to physical damage. However, repeated damage to the habitats (through changes in suspended sediment or physical disturbance caused by selective extraction, anchoring or bottom-towed fishing gear) could adversely affect the ability of the habitats to recover, leading to permanent damage and ultimately to loss of prey species. This may result in a reduction in the value of sandbank habitats as foraging sites for the overwintering population of red-throated diver. Therefore, **the overall sensitivity of the red-throated divers to damage to their supporting habitat is considered to be moderate**.

Few ships anchor in the Outer Thames. Marine aggregate extraction activities are mostly in the northern extent of the SPA with some new licence areas in the northerly part of the southern section. Activities are not expected to significantly reduce habitat availability for divers as the areas worked are typically limited spatially and temporally. Commercial fishing activity within the SPA includes: suction dredging for cockles, set and drift-net trammelling, otter trawling, drift gill netting, potting, long-lining and a limited amount of beam trawling for demersal species. While the capacity for the majority of these gear types to cause physical damage to the seabed habitat is low, the interaction between suction dredging, beam trawling and to a lesser extent demersal otter trawling gear components and the seafloor can result in physical disturbance and potentially damage, depending on the intensity of the activity and sediment composition of the habitat (JNCC and Natural England 2011). Significant long-term changes in bathymetry caused by bottom-towed fishing gear that could render habitat unavailable for foraging divers are not anticipated. **The site is therefore considered to have low exposure to physical damage.**

Overall the **vulnerability of the Annex I species** within the Outer Thames Estuary SPA and associated habitats to physical damage is considered to be **low** for siltation, abrasion and selective extraction.

### 5.1.3. Non physical disturbance of red-throated diver

Red-throated divers are highly sensitive to non-physical disturbance by noise and visual presence during the winter (Garthe & Huppop 2004). They can be disturbed by wind turbine rotors, boat movements, and general activity. Disturbance can cause birds to reduce or cease feeding in a given area or to fly away from an area (i.e. be displaced). Either response could decrease their energy intake rate at their present (disturbed) feeding site or alternative feeding site, which may be less favoured. The latter response would also increase energy expenditure during flight and perhaps during subsequent foraging in less favourable habitat (or favourable habitat with greater intra-specific competition). Both disturbance and displacement can in principle affect the energy budgets and possibly survival of birds. Stillman *et al*. (2007) note that the impacts of disturbance during the non-breeding season on migratory wildfowl should be measured in terms of its effects on two factors: i) the storage of fat reserves needed to fuel migration in spring and to breed successfully after the birds have reached the breeding grounds; and ii) the number of birds that die during the non-breeding season. Impacts on both factors are likely to be a particular problem for diving birds which engage in an energetically expensive mode of foraging (de Leeuw 1997). **Sensitivity can be considered high.**

Disturbance and displacement of prey species arising from construction noise from wind farms could cause disruption to their lifecycles, as herring and sprat are thought to be a prey resource and are sensitive to noise. Benthopelagic fish species have some sensitivity to both construction and operational noise from windfarms. However, the level of certainty regarding the zone of impact and precise response is limited, with estimates of physiological responses, injury and death reported at varying distances from construction/operation. These appear to be more significant as a result of construction noise than operation, within 150m of the source, although impacts may occur up to 1000m away.[34]

[34] http://www.offshorewindfarms.co.uk/Assets/BIOLAReport06072006FINAL.pdf

Locally, significant disturbance and displacement effects are predicted to arise from noise and visual impacts from wind farm construction, maintenance traffic and visually or aurally from the turbines themselves. The calculation for the areas of the consented windfarm footprints relative to the area of the SPA shows that 3.5% of the SPA area could be made unavailable through displacement.[35] If the entire consented London Array development is included this increases to 282.5 $km^2$ or 7.2% of the SPA area which could potentially be unavailable to red-throated diver. The development of London Array beyond phase 1 is subject to the satisfactory outcome of an ornithological review process demonstrating that there would be no adverse effect on the red-throated diver population from the second phase of the development. Red-throated divers may habituate to wind turbines and therefore any habitat loss due to displacement may diminish over time. However, as yet, survey work has provided little or no evidence of habituation by divers (Petersen & Fox 2007; Percival 2010).

Disturbance and displacement effects may also arise from shipping (including recreational boating) and boat movements associated with marine aggregate and fishing activities (Cook & Burton 2010). Marine aggregates activities tend to be temporary and localised. Dredging and shipping activities are expected to be confined to existing shipping channels, which are already known to be avoided by divers. In the majority of cases it is expected that activity will be lowest during the winter months (when the birds are present) due to the limitations imposed by poor weather conditions (RPS Group PLC 2005). Prince's Channel (which runs through the southern area of the Outer Thames Estuary SPA) carries a significant amount of vessel traffic in and out of ports in the inner Thames Estuary. Fisherman's Gat is also an active commercial shipping channel. In addition, smaller vessels use the shallower inshore channels across the site.

**Overall current exposure is considered to be medium.**

Overall the **vulnerability of the Annex I species** within the Outer Thames Estuary SPA to **non-physical disturbance** is considered to be **high**.

### 5.1.4. Toxic contamination of red-throated diver and their supporting habitats

Synthetic compounds such as PCBs can bioaccumulate/ biomagnify through the food chain in the tissues of marine organisms and concentrations could be considerable once they reach the fish on which red-throated divers feed. Thus, **sensitivity to synthetic chemicals such as PCBs is considered moderate.**

Hotspots for synthetic compounds include industrial estuaries and sandy environments offshore, but **as PCBs are currently banned, exposure can be considered low.** If marine pollution were to occur there is the potential for exposure to PCBs to change.

Large oil and chemical spills affecting shallow sandbank habitats can have a detrimental effect on bird populations. Deterioration of invertebrate and small fish populations can have a significant impact on important food sources. Oil on the surface and in the water column would present a direct threat to diving and feeding seabirds particularly during their moulting times, when they are less mobile and

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[35] Scroby Sands, Kentish Flats, Gunfleet Sands 1 & 2 plus London Array Phase 1 occupy a total area of 137.5 $km^2$ equivalent to 3.5% of SPA area

remain at sea. Oil on the feathers of birds could lead to loss of insulation, reduced buoyancy and possible drowning. Consequently red-throated divers may suffer the inability to feed, resulting in starvation and death. Dispersants used to disperse the oil may also be harmful to the species. **Sensitivity to non-synthetic compounds is therefore considered to be high.**

Prince's Channel (which runs through the southern area of the Outer Thames Estuary SPA) carries a significant amount of vessel traffic in and out of ports in the inner Thames Estuary. Fisherman's Gat is also an active commercial shipping channel. In addition, smaller vessels use the shallower inshore channels across the site. This additional small vessel activity means that the risk of contamination by accidental spillages of fuel or cargo is increased, and a small level of contamination will exist as a result of normal shipping activities. Large ports in the area also increase the risk of exposure.

Although the *risk* of a catastrophic event due to vessel traffic (oil tankers, ships with toxic contaminants, etc.) exists, the probability of such an event occurring as a result of "normal" vessel traffic is considered to be very low; in addition the 'background level' of toxic contamination to which the site is exposed in also considered to be low.

However, there are ship-to-ship oil transfers occurring just off Southwold within 12nm. Ship-to-ship (s-t-s) transfers consist of a transfer of a cargo of oil (heavy fuel oil or crude oil, etc.) from one vessel to another. Large tankers are unable to gain access to the Russian/Baltic states and hence smaller tankers bring oil from the region and transfer this oil to larger tankers. From here the large tankers ship the oil internationally. Approximately 15-20 of these s-t-s operations occur annually. Although the Maritime and Coastguard Agency manage the s-t-s operations very well, accidental oil spills can happen at any time and due to the proximity of the s-t-s operations to the SPA it may be considered that there is an elevated risk from an oil spill at this location.

Overall the **vulnerability of the Annex I species (red-throated diver)** within the Outer Thames Estuary SPA to **toxic contamination** is considered to be **low-moderate**.

### 5.1.5. Non-toxic contamination of red-throated divers and their supporting habitats

Non-toxic contamination through nutrient loading, organic loading and changes to the thermal regime could impact on prey species and distribution. **The sensitivity** of the prey species of red-throated diver, and therefore of the divers themselves**, to non-toxic contamination is considered moderate.**

The dilution effect for this form of contamination (which could also include increased turbidity and changes to the salinity) may reduce the **exposure, which is considered low.**

Overall the **vulnerability** of the prey species and **of the Annex I species (red-throated diver)** within the Outer Thames SPA to non-toxic contamination is considered to be **low**.

### 5.1.6. Biological disturbance

**Introduction of microbial pathogens and non-native species**

Sensitivity to the introduction of microbial pathogens and non-native species is considered to be low for red-throated divers, as is their exposure to them in the Outer Thames Estuary SPA. **Vulnerability is therefore low.**

**Selective extraction of prey species**

Within the site, a variety of fishing gears are used with variable intensity to harvest different quota and non-quota species (CEFAS 2006; des Clers 2010; MMO 2012). Fishing activities include: suction dredging for cockles, set and drift-net trammelling, drift gill netting, potting, and a limited amount of beam and otter trawling for demersal species (mainly in troughs). Limited long-lining and pair-trawling also occurs within the site. Removal of fish species and larger molluscs can have significant impacts on the structure and functioning of benthic communities over and above the physical effects of fishing methods on the seabed, particularly as some fish species fill upper roles in the trophic web (Jennings & Kaiser 1998; Kaiser *et al*. 2006). Moreover, certain types of fishing have the potential to directly remove divers' prey species, either as target species or as bycatch. Thus, the mechanisms for these pressures to impact on red-throated divers may be an indirect or direct reduction in food availability for the overwintering population. **Red-throated divers are judged to be moderately sensitive to biological disturbance through selective extraction of prey species,** as they are known to be 'opportunistic feeders' taking a broad range of fish species, and their diet compositions seem to depend on availability rather than on food specialisation (Guse *et al*., 2009).

**The exposure to selective extraction of red-throated divers' prey species by fishing** (i.e. the amount of their prey species taken by fishing vessels as target or bycatch) is not clearly understood but **in general is considered low** due to differences in the average size composition of the fish eaten by divers and caught in commercial quantities by fishers, making **vulnerability to selective extraction low.**

**Non-selective extraction of red-throated divers**

The primary potential causes of non-selective extraction of divers are entanglement in static fishing gear or wind turbine strike.

Entanglement in static nets, fishing lines and general marine litter (of a wide variety) is a major cause of known mortality of red-throated divers (Okill 2002; Schirmeister 2003; Camphuysen 2008). In a study by Okill (2002), the mortality of 35.7% of all recovered ringed red-throated divers could be related to a particular cause of death: 53% of these 'attributable' deaths were caused by accidental capture in fishing nets (fish farms, discarded netting and static nets set for a variety of fish including herring, salmon and skate). It was concluded that 18.9% of all deaths of ringed red-throated divers were attributable to entanglement. Although the sample sizes on which these percentages were based are small, these figures, coupled with the relatively frequent occurrence of red-throated divers amongst netting casualties in other studies (Manville 2005) suggests that their **sensitivity to entanglement can be considered high.**

The three principal fishing methods for the inshore fishery within the SPA are suction dredging, single and multi-rig otter trawling and static netting. Static/passive fishing gear methods (such as set gill nets and drift netting), which are used throughout the estuary therefore pose the most serious risk to the birds themselves.

Kent and Essex IFCA in partnership with Natural England have been carrying out observations on red-throated diver bycatch within the Outer Thames Estuary SPA. Results from the first winter of monitoring (2011/12) showed that drift netting in the area was not a significant source of mortality for red-throated divers; zero bycatch of the species was recorded. IFCA observations showed that fishing effort for drift netting was low over winter and that fixed netting was not common practice in the area. Further observations are to be carried out over the 2012/13 winter period to increase the evidence base on bycatch and fishing methods within the area.

Information from other sources (e.g. CEFAS 2006; des Clers 2010) indicates that most netting activity, which is widespread across sandbanks, occurs in the summer and autumn, beginning in June and extending into December. In contrast, the wintering red-throated divers are most prevalent from November to March, with peak numbers occurring in January and February[36]. In light of current evidence, **exposure, and subsequently vulnerability, of red-throated divers within the site to non-selective extraction by fishing gear is therefore considered low**

There are many studies which have documented that birds which collide with rotating wind turbine blades are highly likely to be severely injured or killed (reviewed in Drewitt & Langston 2008). Red-throated diver populations are sensitive to increased adult mortality as it is a long-lived species with relatively low annual adult mortality and low breeding productivity. Thus, **sensitivity to non selective extraction through wind turbine strike can be considered high.**

Impacts to red-throated diver may result from collision with wind turbines, if they fly at a height above 20m. It has been observed, however, that they generally fly below the height at which they would be at risk of colliding with rotating turbine blades (Garthe & Huppop, 2004; RPS GROUP PLC 2005; Environmentally Sustainable Systems Ltd, 2008). Cook *et al.* (2012) modelled red-throated diver altitudes from 19 study sites, concluding only 2% of birds in flight were at collision risk height, with high confidence in the result.

In addition, exposure to collision risks is likely to be lowered due to the displacement of red-throated divers from windfarm footprints due to non-physical disturbance (section 5.1.3). These studies, coupled with the current size of the windfarm footprint areas in comparison to the area of the SPA, indicate that the **exposure to non-selective extraction through wind turbine strike is currently low. Vulnerability is therefore moderate.** Any habituation of divers to offshore windfarms in the future or further expansion of such developments may alter this assessment.

Overall the **vulnerability of the Annex I species (red-throated diver)** within the Outer Thames Estuary SPA to **biological disturbance** is considered to be **low-moderate.**

[36] They can be high in December too but tend to be lower in October and November (see Webb et al 2009, JNCC report on the Outer Thames http://www.jncc.gov.uk/page-4923 )

## 6. Risk Assessment

JNCC and Natural England consider ‘risk’ to be the likelihood of deterioration of the feature due to an activity. It is the vulnerability of the feature to an activity, assessed against the level of management of that activity.

High-risk activities are those to which the feature is highly or moderately vulnerable, and for which there is insufficient management. For example, industries or activities which are not location specific and not subject to prior consent procedures or reliable enforcement are more likely to cause damage/disturbance to the interest feature. These industries include fishing. However, clearly not all activities associated with these industries are detrimental to interest features.

Low-risk activities will be those where there is no feature vulnerability (i.e. the activity does not interact with the feature) or where the moderate or high vulnerability is mitigated by management measures. For example, industries that are location specific are always subject to prior consent (often including explicit environmental impact assessment) and have clear reliable methods of enforcement; there is generally a lower likelihood of causing damage or disturbance to interest features.

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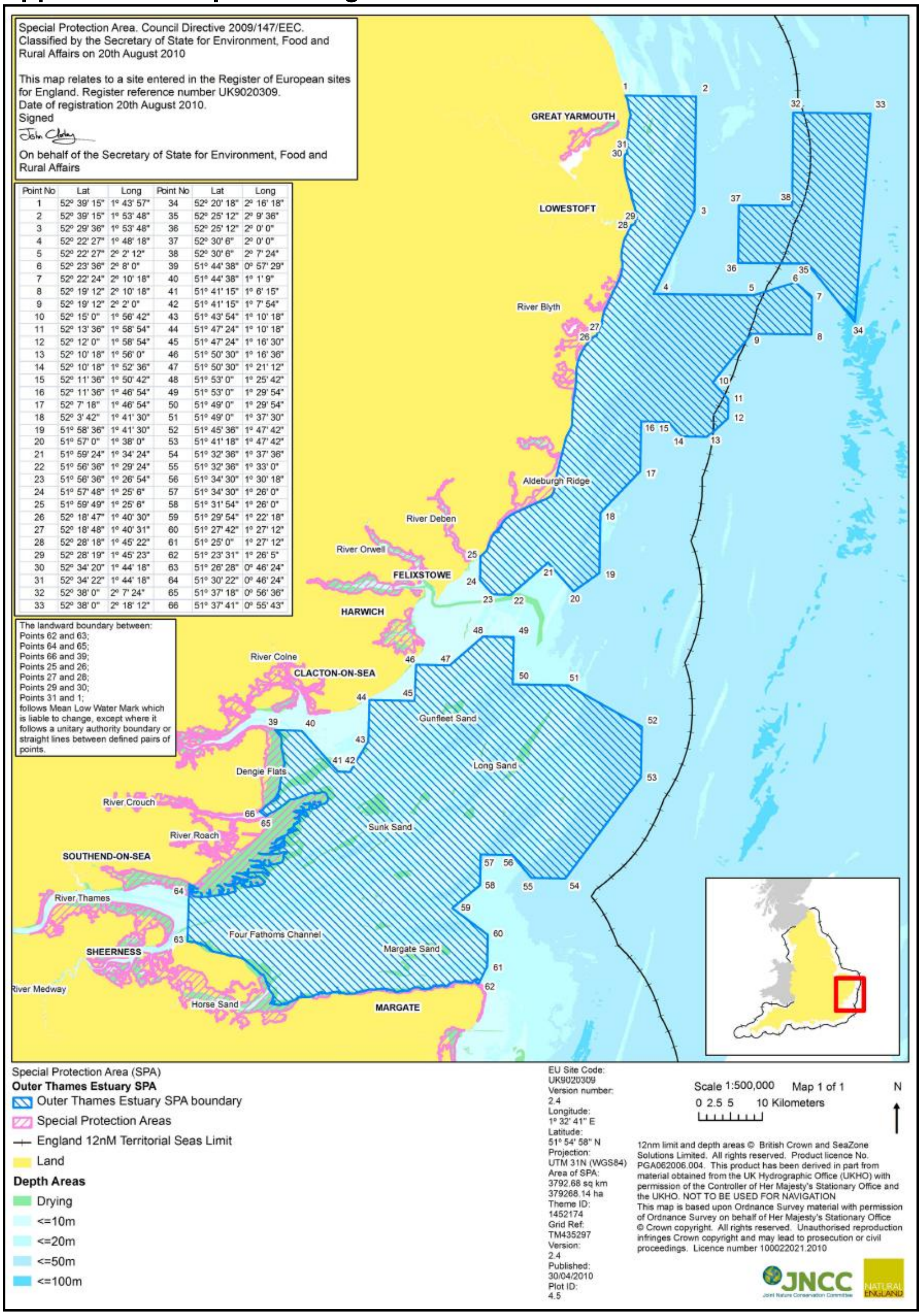
**Appendix A**
**Favourable Condition Table (FCT) for Outer Thames Estuary SPA**

| Attributes | Measure | Targets | Comments |
|---|---|---|---|
| Red-throated diver population size<br>(Mandatory attribute) | Estimated population size derived from standardised site condition monitoring programme | Maintain population on the site subject to natural fluctuations. There should be no permanent decline, only non-significant fluctuation around the mean to account for natural change: where the limits of natural fluctuations are not well known maintain the population above 50% of that at designation; loss of 50% or more is unacceptable | Survey data used as the basis for deriving the SPA population comprised many incomplete surveys covering different sections of the final SPA boundary in different winters between the months of October to March in 1988/89, and 2002-2007. Derivation of the SPA population size required these partial datasets to be combined. Accordingly, there is limited understanding of the magnitude of inter-annual natural variation in population size across the entire SPA. In the absence of good knowledge of natural fluctuation in population size, the threshold for favourable condition is set, in line with standard practice, as being a population that exceeds 50% of the designated wintering population size. This target will be used to inform future assessments of favourable condition. Improved understanding of the natural dynamics of this population over time will be used to refine the target population size. |
| Habitat extent (Mandatory attribute) | Area of supporting habitat | No significant decrease in the extent of supporting habitat available for red-throated diver. | Changes in extent will need to take account of the dynamic nature of the sandbank, but a trend of reduction in extent may indicate long-term changes in the physical conditions influencing the feature, whether it be natural processes or anthropogenically driven. Further studies of diver distribution within the site, building on Skov *et al.* (2011) will inform understanding of the habitat usage by the species and help refine the measure and target in future. |

## Appendix B : Maps showing interest features of the Outer Thames Estuary SPA



## Appendix C: Methods deriving vulnerability.

| Sensitivity | |
|---|---|
| None | - |
| Low | • |
| Moderate | •• |
| High | ••• |

| Exposure | |
|---|---|
| None | - |
| Low | + |
| Medium | ++ |
| High | +++ |

| Vulnerability |
|---|
| None detectable |
| Low |
| Moderate |
| High |

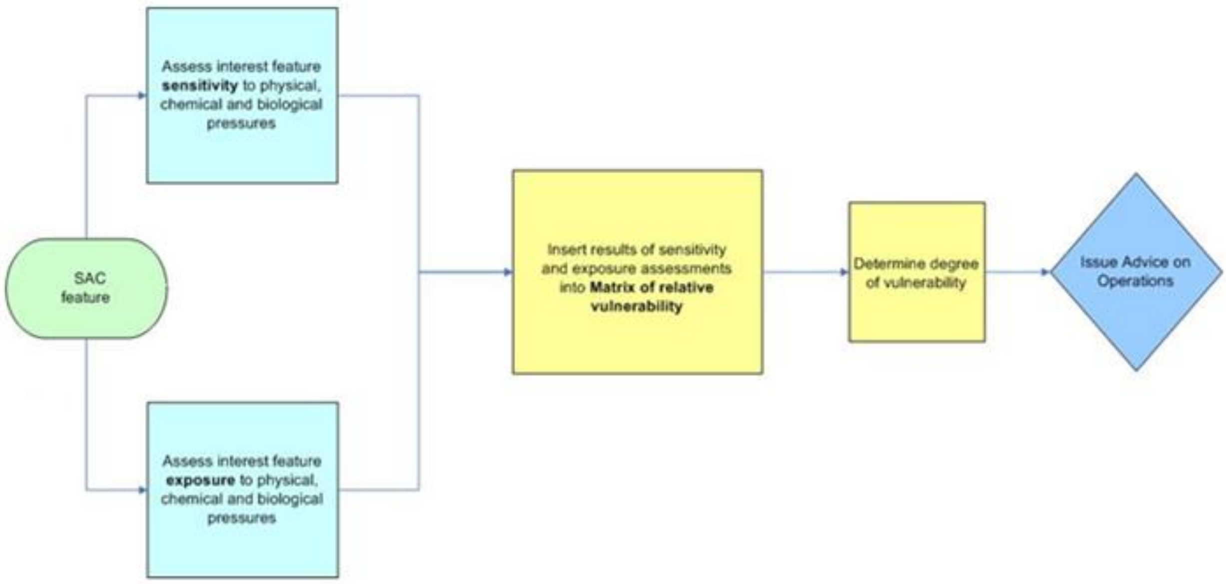
**Additional Category for insufficient information = DD (Data Deficient)**

The relative vulnerability of an interest feature or sub-feature is determined by multiplying the scores for relative sensitivity and exposure, and classifying that total into categories of relative vulnerability.

| Relative exposure of the interest feature | | Relative sensitivity of the interest feature | | | |
|---|---|---|---|---|---|
| | | **High (3)** | **Moderate (2)** | **Low (1)** | **None detectable (0)** |
| | **High (3)** | 9 | 6 | 3 | 0 |
| | **Medium (2)** | 6 | 4 | 2 | 0 |
| | **Low (1)** | 3 | 2 | 1 | 0 |
| | **None (0)** | 0 | 0 | 0 | 0 |

| Categories of relative vulnerability | |
|---|---|
| High | 6-9 |
| Moderate | 3-5 |
| Low | 1-2 |
| None detectable | 0 |

An assessment of interest features' vulnerability helps to guide site management decisions by highlighting potentially detrimental activities that may need to be managed (or continue to be managed) by the relevant authorities.



**Appendix D. Summary of operations/pressures that may cause deterioration or disturbance of red-throated diver s and their supporting habitat and prey species in the Outer Thames Estuary SPA at current levels of use**

The advice below is not a list of prohibitions but rather a checklist for operations/pressures that may need to be subject to some form of management measure(s) or further measures where actions are already in force. Examples of activities under relevant authority jurisdiction are also provided. Operations marked with a ✓ indicate those to which red throated divers are considered to be **vulnerable** either directly or indirectly as a result of effects on their prey species and supporting habitat.

| Operations (pressures) which may cause deterioration or disturbance with example activities | red-throated diver - Outer Thames Estuary SPA | Supporting habitats and prey species - Outer Thames Estuary SPA |
|---|---|---|
| **Physical loss of supporting habitat** | | |
| Removal of habitat feature (e.g. offshore development, capital dredging, 'active dredging zones') | | ✓ |
| Smothering (e.g. by artificial structures, disposal of dredge spoil) | | ✓ |
| **Physical damage to their habitats** | | |
| Siltation (e.g. run-off, channel dredging, outfalls) | | ✓ |
| Abrasion (e.g. anchoring, cables ) | | ✓ |
| Selective extraction (e.g. aggregate dredging) | | ✓ |

| Operations (pressures) which may cause deterioration or disturbance with example activities | red-throated diver - Outer Thames Estuary SPA | Supporting habitats and prey species - Outer Thames Estuary SPA |
|---|---|---|
| **Non-physical disturbance** | | |
| Noise (e.g. boat activity) | ✓ | ✓ |
| Visual (e.g. recreational activity) | ✓ | |
| **Toxic contamination** | | |
| Introduction of synthetic compounds (e.g. pesticides, TBT, PCBs) | ✓ | ✓ |
| Introduction of non-synthetic compounds (e.g. heavy metals, hydrocarbons) | ✓ | ✓ |
| Introduction of radionuclides | ✓ | ✓ |
| **Non-toxic contamination** | | |
| Changes in nutrient loading (e.g. agricultural run-off, outfalls) | | ✓ |
| Changes in organic loading (e.g. mariculture, outfalls) | | ✓ |
| Changes in thermal regime (e.g. power stations) | | ✓ |

| Operations (pressures) which may cause deterioration or disturbance with example activities | red-throated diver - Outer Thames Estuary SPA | Supporting habitats and prey species - Outer Thames Estuary SPA |
|---|---|---|
| Changes in turbidity (e.g. run-off, dredging) | | ✓ |
| Changes in salinity (e.g. water abstraction, outfalls) | | ✓ |
| **Biological disturbance** | | |
| Introduction of microbial pathogens | | |
| Introduction of non-native species and translocation | | ✓ |
| Non-selective extraction / removal of bird species (e.g. accidental turbine strike) | ✓ | |
| Non-selective extraction / removal of bird species (e.g. entanglement or bycatch) | ✓ | |
| Selective extraction and removal of prey species (e.g. commercial and recreational fishing) | | ✓ |

**Appendix E** Assessment of the relative vulnerability of interest features / Annex I Species and its supporting habitat for the Outer Thames Estuary SPA to different categories of operation (for key see appendix C). This aims to provide a 'high level' view of the operations which occur in the Outer Thames SPA and the likely vulnerability of the site's features to these activities. A more detailed assessment of each activity that is likely to occur in the site is provided in the Outer Thames SPA risk review.

| **Operations which may cause deterioration or disturbance** | **internationally important populations of the Annex I species and their supporting habitat and prey species** | | |
|---|---|---|---|
| | red-throated diver (Gavia stellata) | | |
| | Sensitivity | Exposure | Vulnerability |
| **Physical loss of supporting habitat** | | | |
| Removal (e.g. harvesting,offshore development) | ••• | + | Moderate |
| Smothering (e.g. by artificial structures, disposal of dredge spoil) | •• | ++ | Moderate |
| **Physical damage to habitat** | | | |
| Siltation (e.g. run-off, channel dredging, outfalls) | •• | + | Low |
| Abrasion (e.g. boating, anchoring,) | •• | + | Low |
| Selective extraction (e.g. aggregate dredging) | •• | + | Low |
| **Non-physical disturbance** | | | |
| Noise (e.g. boat activity) | ••• | ++ | High |
| Visual (e.g. recreational activity) | ••• | ++ | High |
| **Toxic contamination** | | | |
| Introduction of synthetic compounds (e.g. pesticides, TBT, PCBs) | •• | + | Low |
| Introduction of non-synthetic compounds (e.g. heavy metals, hydrocarbons) | ••• | + | Moderate |
| Introduction of radionuclides | **DD** | **DD** | **DD** |

| Operations which may cause deterioration or disturbance | internationally important populations of the Annex I species and their supporting habitat and prey species | | |
|---|---|---|---|
| **Non-toxic contamination** | | | |
| Changes in nutrient loading (e.g. agricultural run-off, outfalls) | •• | + | Low |
| Changes in organic loading (e.g. mariculture, outfalls) | •• | + | Low |
| Changes in thermal regime (e.g. power stations) | •• | + | Low |
| Changes in turbidity (e.g. run-off, dredging) | •• | + | Low |
| Changes in salinity (e.g. water abstraction, outfalls) | •• | + | Low |
| **Biological disturbance** | | | |
| Introduction of non-native species and translocations | • | + | Low |
| Selective extraction of prey species (e.g. commercial & recreational fishing) | •• | + | Low |
| Non-selective extraction (through entanglement with static gear) | ••• | + | Moderate |
| Non-selective extraction (through wind-turbine strike) | ••• | + | Moderate |
| Introduction of microbial pathogens | • | + | Low |

## 78. Thanet Coast and Sandwich Bay

| | | | |
|---|---|---|---|
| **Geographical Coordinates:** | 51°19'N 1°23'E | **Area:** | 2,183ha |

**Location:** The site includes the majority of the coastline between the towns of Whitstable, Margate, Ramsgate and Deal, on the north and east coasts of the county of Kent, south-east England.

**Date of Ramsar Designation:** 28 July 1994

**Other International Designations:** European Union Special Protection Area

**National Designations:** Site of special scientific interest

**Principal Features:** The Thanet Coast and Sandwich Bay Ramsar site includes a wide variety of coastal habitats including areas of chalk cliff, rocky shore, shingle, sand and mudflats, saltmarsh and sand dunes. As well as its value for breeding and wintering birds, the site supports outstanding communities of terrestrial and marine plant species, a significant number of rare invertebrate species, and is of considerable geological importance. The site supports a very large number of rare species of wetland invertebrates. A total of at least 15 Red Data Book species associated with wetlands have been recorded. These comprise three species listed as endangered: *Lixus vilis*, *Stigmella repentiella*, *Bagous nodulosus*. Two species listed as vulnerable: the moth *Deltote bankiana*, the dancefly *Poecilobothrus ducalis*. Ten species listed as rare: *Emblethis verasci, Pionosomus varius, Nabis brevis, Euheptaulacus sus, Melanotus punctolineatus*, *Pelosia muscerda*, the only British population of *Eluma purpurescens*, *Ectemnius ruficornis, Alysson lunicornis, Orthotylus rubidus*. A significant number of non-wetland Red Data Book invertebrates occur, as well as a large number of other notable and scarce wetland invertebrate species. Thanet Coast and Sandwich Bay also regularly supports an internationally important wintering population of *Arenaria interpres*. In the five year period 1986/87 - 1990/91, an average peak count of 1,340 *Arenaria interpres* was recorded, representing 2% of the east Atlantic flyway population. Notable also are nationally important breeding populations of *Sterna albifrons* and nationally important wintering populations of the following species: *Charadrius hiaticula*, *Pluvialis squatarola* and *Calidris alba*. In addition, large numbers of passerine birds pass through the site during the spring and autumn migration periods. (Criteria 2a,3c).

**Conservation Issues:** Migratory birds have been monitored since 1952 by the Sandwich Bay Bird Observatory. Other land uses include harbour facilities, sewage treatment and disposal, tourism, recreational fishing, and birdwatching. Sandwich Bay and Hacklinge Marsh SSSI has been identified as a high priority site for a water level management plan. Parts of the site have been identified within a proposed European Union Special Area of Conservation.

COUNTY: KENT SITE NAME: SANDWICH BAY AND HACKLINGE MARSHES

DISTRICTS: THANET/DOVER

Status: Site of Special Scientific Interest (SSSI) notified under Section 28 of the Wildlife and Countryside Act 1981

Local Planning Authority: THANET DISTRICT COUNCIL/DOVER DISTRICT COUNCIL

| | |
|---|---|
| National Grid Reference: TR 353585 | Area: 1756.5 (ha.) 4338.6 (ac.) |
| Ordnance Survey Sheet 1:50,000: 179 | 1:10,000: TR 35 NE, NW, SE, SW; TR 36 SW, SE |
| Date Notified (Under 1949 Act): 1951 | Date of Last Revision: 1981 |
| Date Notified (Under 1981 Act): 1984 (part) 1985 (part) 1990 | Date of Last Revision: 1994 |

Other Information:
Parts of the site are listed in 'A Nature Conservation Review' and in 'A Geological Conservation Review'[2]. The nature reserve at Sandwich Bay is owned jointly by the Kent Trust for Nature Conservation, National Trust and Royal Society for the Protection of Birds. The site has been extended to include a Kent Trust designated Site of Nature Conservation Interest known as Richborough Pasture and there are several other small amendments.

Reasons for Notification:
This site contains the most important sand dune system and sandy coastal grassland in South East England and also includes a wide range of other habitats such as mudflats, saltmarsh, chalk cliffs, freshwater grazing marsh, scrub and woodland. Associated with the various constituent habitats of the site are outstanding assemblages of both terrestrial and marine plants with over 30 nationally rare and nationally scarce species, having been recorded. Invertebrates are also of interest with recent records including 19 nationally rare[3], and 149 nationally scarce[4] species. These areas provide an important landfall for migrating birds and also support large wintering populations of waders, some of which regularly reach levels of national importance[5]. The cliffs at Pegwell Bay are also of geological interest.

Biological Interest
The sand dunes which stretch from the mouth of the River Stour to Deal comprise the most outstanding botanical habitat within the site. The dunes and associated dune slacks and coastal grassland support a distinctive flora with species including crown garlic *Allium vineale*, viper's bugloss *Echium vulgare*, sea holly *Eryngium maritimum* and restharrow *Ononis repens*, whilst the nationally

rare[3] lizard orchid *Himantoglossum hircinum* and bedstraw broomrape *Orobanche caryophyllacea* have their largest British colonies here. Many continental species have been recorded from the dunes and the dune grassland also support a high diversity of clover *Trifolium* species and many other leguninous plants.

The dunes support a diversity of invertebrates many of which are associated with warm dry conditions and include the nationally rare[3] carthusian snail *Monacha cartusiana* and the nationally scarce[4] grey bush cricket *Platycleis albopunctata.* The nationally rare[3] moths restharrow *Aplasta ononaria*, pygmy footman *Eilema pygmaeola pygmaeola* and brightwave *Idaea ochrata* have also been recorded, whilst one of the damp hollows supports the only British colony of the moth *Stigmella zelleriella*, the larvae of which mine in leaves of creeping willow *Salix repens var. argentea*.

The chalk coastline around Pegwell Bay comprises a considerable diversity of cliff and cave habitats which support a range of marine algal communities. The area is the type locality for one algal genus and three species new to science *Chrysonema*, *C. littorale*; *Chrysotila lamellosa*, *Chrysotila stipitata* and is one of the sites where Anand (1937) undertook pioneer ecological investigations. Typical chalk-cliff zonation comprises a 'Chrysophyte' zone (mainly *Apistonema carterae*) at supralittoral levels. *Enteromorpha* spp. and other green algae and the lichen *Arthropyrenia halodites* at upper littoral levels; a turf of small filamentous red, brown and green algae is predominant at lower levels. The caves contain 'Chrysophyte' communities with species such as *Chrysonema litorale* and *Thallochrysis littoralis*, together with other typical cave species such as *Pilinia rimosa* and *Pseudendoclonium submarinum*.

Foreshore algal communities are typical of wave-washed shores, low in species diversity, although a unique feature (not seen on other chalk platforms in southeast England) of lower littoral levels is the dense population (zone-forming) of the Sand-Mason worm *Lanice conchilega* forming a bank extending for 100 m by the Ramsgate Western Esplanade.

The saltmarsh comprises a diversity of characteristic plants dominated by salt-marsh grasses such as *Puccinellia maritima* and common cord-grass *Spartina anglica.* Other abundant species include sea purslane *Halimione portulacoides*, sea aster *Aster tripolium*, sea lavender *Limonium vulgare* and the nationally scarce[4] golden samphire *Inula crithmoides.* South of the River Stour saltmarsh grades into the sand dune system; this is the only Kent site for the long-bracted sedge *Carex extensa*, and also provides suitable conditions for a dense growth of the nationally scarce[4] sharp rush *Juncus acutus.* Below the cliff at Cliffsend Point, where freshwater springs emerge at the foot of the cliff, the saltmarsh grades into a swampy type of vegetation where common reed *Phragmites australis* and common reedmace *Typha latifolia* predominate.

Further inland, the grazing marsh and associated dykes provide suitable conditions for a wide range of plants and animals. The grassland is dominated by grasses such as meadow barley *Hordeum secalinum*, meadow foxtail *Alopecurus pratensis* and crested dog's tail *Cynosurus cristatus*. Some of the more uncommon broadleaved herbs that have been recorded, especially narrow leave bird's-foot-trefoil *Lotus tenuis*, adder's tongue *Ophioglossum vulgatum*, strawberry clover *Trifolium fragiferum* and divided sedge *Carex divisa*[4]. A more unusual vegetation type found within the site is the relict fen vegetation. This is found in and around the dykes of the farmland and in the marshes at Hacklinge. Fen plants such as ragged robin *Lychnis flos-cuculi*, bog pimpernel *Anagallis tenella* and greater spearwort *Ranunculus lingua* occur here, most of these are now scarce in Kent. In addition the dykes contain a number of scarce aquatic plants including whorled water-milfoil *Myriophyllum verticillatum*[4], fen pondweed *Potamogeton coloratus*[4] and river water-dropwort *Oenanthe fluviatilis*[4]. This area is also the only known locality in SE England for least bur-reed *Sparganium minimum.* The wet alder wood at Ham Brooks also contains uncommon plants including great fen-sedge *Cladium mariscus*.

The ornithological interest of Sandwich Bay and Hacklinge Marshes is centred on the large numbers of waders and wildfowl which use the area in winter and during the Spring and Autumn migrations. Dunlin *Calidris alpina* is usually the most common wader present, found particularly on the mudflats where the rich invertebrate fauna also attracts a wide range of other common species such as oystercatcher *Haematopus ostralegus*, curlew *Numenius arquata*, and redshank *Tringa totanus.* Grey plover *Plurialis squatarola* and sanderling *Calidris alba* both overwinter in nationally important numbers[5], whilst ringed plover *Charadrius hiaticula* also occurs in nationally important numbers[5] during migration. Wildfowl that occur on the site include mallard *Anas platyrhynchos*, shelduck *Tadorna tadorna* and occasionally brent goose *Branta bernicla*.

Many of the birds use more than one habitat, some for example feed on the mudflats at low tide and then move up to roost on the saltmarsh or grazing marsh.

Breeding birds include ringed plover, oystercatcher and little tern *Sterna albifrons*, a species specially protected by law and listed on Schedule 1 of the Wildlife and Countryside Act 1981. Inland areas are also of interest supporting two nationally rare species of breeding birds.

Geological Interest
Parts of the site are also of geological interest. The 16" shell bed at the base of the Reculver Silts (Thanet Formation) contains an important fish fauna. This is preserved as disarticulated fish debris, including a diversity of identifiable shark teeth. There is no other Thanetian site in Western Europe with this diversity of fauna which includes many, as yet, undescribed species plus the earliest records of other known Tertiary forms. The outcrop has very great significance because it is the only outcrop which shows the bottom living fish assemblage which was subsequently destroyed by the North Sea volcanicity, for the ash falls by these volcanoes brought about an extinction event. Interesting conclusions can be drawn from this local extinction and the later recolonisation of the area; for example unspecialised, bottom living sharks survive across the event, presumably because

a stock that was living elsewhere at the time was able to migrate back to this part of the basin and recolonise.

At Pegwell Bay the Upper Chalk is overlain by the basal Tertiary beds of the Thanet Sands. The junction is marked by the celebrated ‘Bull-head Bed’, an *in situ* weathering residue of unabraded flint nodules. This is a key section showing a demonstrable and regionally significant unconformity. Pegwell Bay is also the most important site for loess studies in Britain. The section shows up to 4 m of Devensian loess overlying Upper Chalk and Thanet Beds. The loess, an accumulation of wind-blown dust produced under periglacial conditions during the Ice Age is probably thicker here than at any other site in Britain, and is certainly the most closely studied example. Although leached in its upper part, the loess is calcareous below, with rootlet tubes and small concretions. Where the loess rests on the Chalk, there is often a highly frost-shattered zone with well developed involutions. In one part of the section where an infilled channel is cut into the frost-shattered chalk, the loess overlies chalky-flinty gravels and loams produced by solifluction. Pegwell Bay provides the best exposures of true loess deposits in Britain. They are exceptional in having escaped modification by solifluction; no other site provides such useful sections in highly calcareous loess that has not been reworked.

[1] ‘*A Nature Conservation Review’*: edited by D A Ratcliffe. Cambridge University Press 1979.

[2] *A Geological Conservation Review*: in preparation.

[3] Species regarded as ‘rare’ in Britain (recorded from 1–15 10 × 10 km squares) and listed in *British Red Data Books*.

[4] Species regarded as ‘scarce’ in Britain (recorded from 16–100 10 × 10km squares).

[5] *Wildfowl and Wader Counts* 1988–1989. D G Salmon et al, Wildfowl Trust 1989.


# Harbour Porpoise (*Phocoena phocoena)* possible Special Area of Conservation:

# Southern North Sea

## <u>Draft</u> Conservation Objectives and Advice on Activities

January 2016

Advice under Regulation 18 of The Offshore Marine Conservation (Natural Habitats, *etc*.) Regulations 2007 (as amended), and Regulation 35(3) of The Conservation of Habitats and Species Regulations 2010 (as amended).

## Further information

This document is available as a pdf file on the JNCC website for download if required (www.jncc.defra.gov.uk).

## Please return comments or queries to:

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## Summary of Conservation Objectives and Advice on Activities

The Conservation Objectives and Advice on Activities are set out for the Southern North Sea possible SAC (pSAC) for the Annex II species harbour porpoise (*Phocoena phocoena*). The site covers both inshore (within 12 nautical miles of coast) and offshore (beyond 12 nautical miles of coast) waters where Natural England (NE) and the Joint Nature Conservation Committee (JNCC) have respective advisory responsibilities.

The general objective of achieving or maintaining Favourable Conservation Status (FCS) for all species and habitat types listed in Annexes I and II of the Habitats Directive needs to be translated into site-level Conservation Objectives. These describe the condition to be achieved by species and habitat types within the sites in order for the site to contribute in the best possible way to achieving FCS at the national, bio-geographical and European level. The Conservation Objectives have been developed for the feature (harbour porpoise) throughout the recommended possible SAC network to ensure coherence across the network. This is also appropriate for a wide ranging, mobile and continuous population. The Advice on Activities is site-specific but based on a broad assessment of the sensitivity of the harbour porpoise to man-made pressures at a UK scale. The advice has been developed using the best-available scientific information and expert interpretation as at November2015. The advice provided here will be subject to change as our knowledge about the site and the impacts of human activities improve.

The site should be managed in a way that ensures that its contribution to the maintenance of the harbour porpoise population at FCS is optimised. This may require management of human activities occurring in or around the site if they are likely to have an adverse impact on the site's Conservation Objectives either directly or indirectly identified through the assessment process. Management of activities that may affect processes on which the harbour porpoise is dependent, e.g. recruitment of prey species from supporting habitats, cannot be considered at present due to insufficient (often no) evidence linking habitat characteristics to prey of the harbour porpoise. There is some information on the prey of harbour porpoises, but their prey preferences whilst within the sites are not well known. It should be noted that as European Protected Species under Annex IV of the Habitats Directive, harbour porpoise are already strictly protected wherever they are in European waters. As such several management measures are already in place in the UK.

To fulfil the Conservation Objectives for the Southern North Sea harbour porpoise site, the relevant[1] and competent[2] authorities should consider human activities within their remit which might affect the integrity of the site.

[1] Relevant authorities are those who are already involved in some form of relevant marine regulatory function and would therefore be directly involved in the management of a marine site.

[2] A competent authority is any Minister, government department, public or statutory undertaker, public body of any description or person holding a public office.

# Contents

# 1 Introduction

## 1.1 Background

A potential network of eight sites was identified within UK waters for harbour porpoise (*Phocoena phocoena*). Sites were identified within the UK portions of Management Units (MUs) defined for the species (ICES, 2014; IAMMWG, 2015a). The Welsh and Northern Ireland Governments, along with Defra on behalf of England and offshore waters, gave approval for sites within their areas of jurisdiction to proceed to consultation. The resulting five sites are shown in Figure 1.

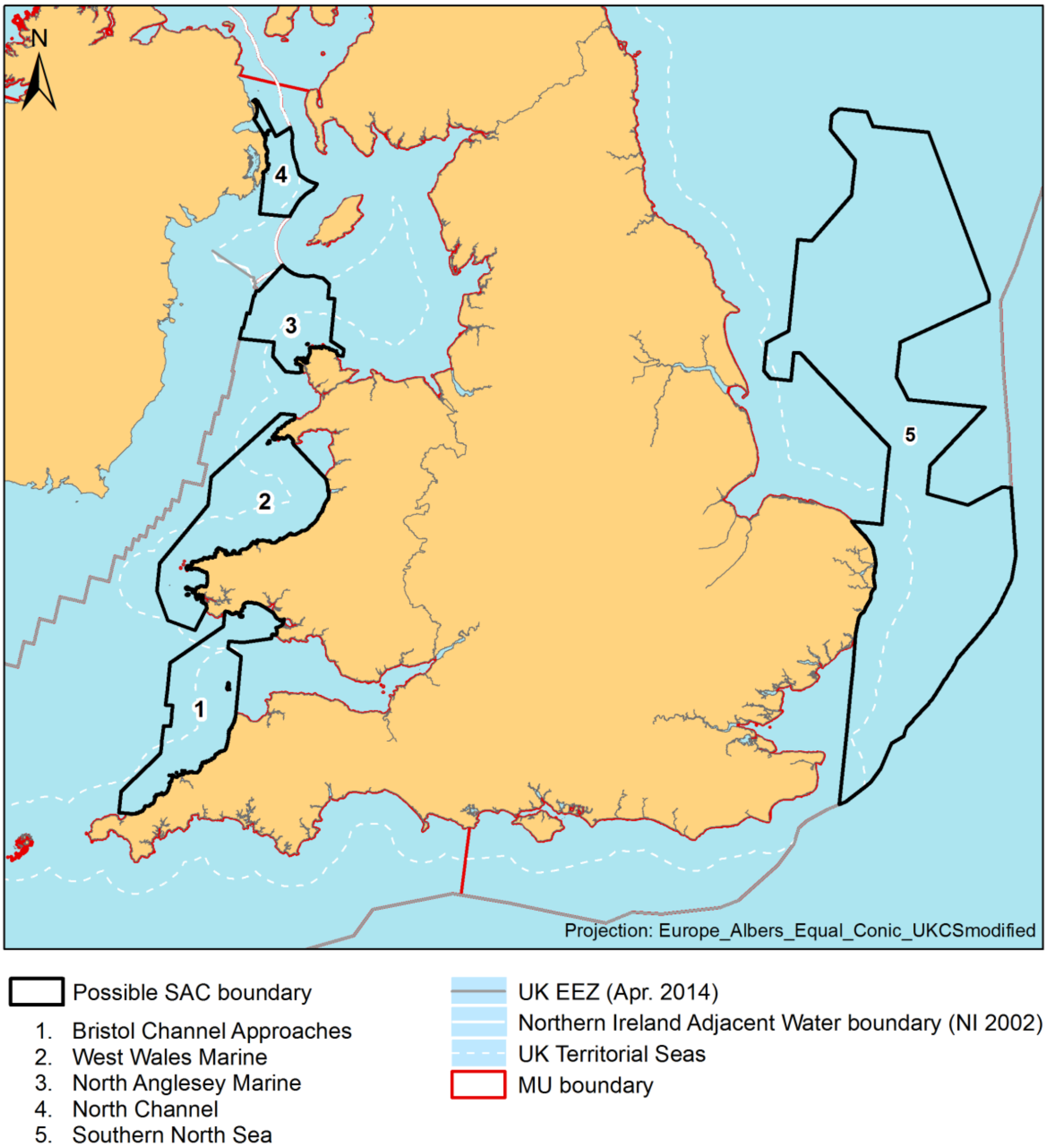





**Figure 1:** Possible Special Areas of Conservation for the harbour porpoise, *Phocoena phocoena* identified in Northern Ireland, England, Wales and offshore waters. The MU boundary refers to management units North Sea and Celtic and Irish Seas.

This advice is for the Southern North Sea site (Figure 2) which is subject to protection under the Habitats Directive as transposed by the Conservation of Habitats and Species Regulations 2010[3] and the Offshore Marine Conservation Regulations (Natural Habitats, *etc*.) Regulations 2007[4] (as amended). The advice is given in fulfilment of the duty of the Statutory Nature Conservation Bodies (SNCBs) under the Habitats Regulations to inform Relevant and Competent Authorities as to (a) the Conservation Objectives for the site; and (b) any activities which may negatively impact the feature [harbour porpoise] for which the site is designated. The SNCBs aim to ensure that the Conservation Objectives are up-to-date, accessible and allow the assessment of the impact of proposed developments against them.

# 2 Responsibilities of Relevant and Competent Authorities

The Habitats Regulations require Relevant and Competent Authorities to exercise their functions so as to secure compliance with the Habitats Directive. Competent Authorities must, within their areas of jurisdiction, have regard to both direct and indirect effects on the site. This may include consideration of issues outside the boundary of the SAC, if the impact of these occurs within the site boundaries. Relevant and Competent Authorities are not required to undertake any actions or ameliorate changes in the condition of the site if it is shown that the changes result wholly from natural causes.

The natural variability of harbour porpoise distribution and abundance within sites is likely to be large due to the mobility and wide ranging nature of this species. Apparent deterioration of harbour porpoise presence at the site must be contextualised in terms of the natural variability in abundance and distribution patterns at the population level (i.e. Management Unit level). SNCBs will work with Relevant and Competent Authorities and others to agree a protocol to guide assessments, and this will require consideration for the population at the wider scale MU population.  It is essential that any assessment for the site reflect the natural variation of the species, including assessments in the condition of the site.

# 3 Conservation Objectives for harbour porpoise SACs

## 3.1 The role of Conservation Objectives

Site level Conservation Objectives are a set of specified objectives that must be met to ensure that the site contributes to maintaining or achieving Favourable Conservation Status (FCS) of the designated site feature(s) at the national and biogeographic level (EC, 2012). Conservation Objectives constitute a necessary reference for identifying site-based conservation measures and for carrying out Habitat Regulations Assessments of the implications of plans or projects. The purpose of the Habitat Regulations Assessment is to determine whether a plan or project adversely affects a site's integrity. The critical consideration in relation to site integrity is not the extent or degree of an impact, or whether an impact is direct or indirect, but whether the implications of any activities affecting a site, either individually or in combination with other plans or projects, affect the site's ability to achieve its conservation objectives and favourable conservation status.

Harbour porpoise are protected everywhere in European waters under the provisions of Annex IV and Article 12 of the Habitats Directive. The harbour porpoise in UK waters is considered part of a wider European population and the mobile nature of this species means that the concept of a 'site population' may not be appropriate for this species. Site based

[3] http://www.legislation.gov.uk/uksi/2010/490/pdfs/uksi_20100490_en.pdf
[4] http://www.legislation.gov.uk/uksi/2007/1842/pdfs/uksi_20071842_en.pdf

conservation measures will complement wider ranging measures that are in place for the harbour porpoise.

### 3.2 Background to Conservation Objectives

The Conservation Objectives are designed to ensure that the obligations of the Habitats Directive can be met. Article 6(2) of the Directive requires that there should be no deterioration or significant disturbance of the qualifying species or to the habitats upon which they rely. Therefore, the focus of the Conservation Objectives for harbour porpoise sites is on addressing pressures that affect site integrity and would include:

- killing or injuring significant numbers of harbour porpoise (directly or indirectly);
- preventing their use of significant parts of the site (disturbance / displacement);
- significantly damaging relevant habitats; or
- significantly reducing the prey base.

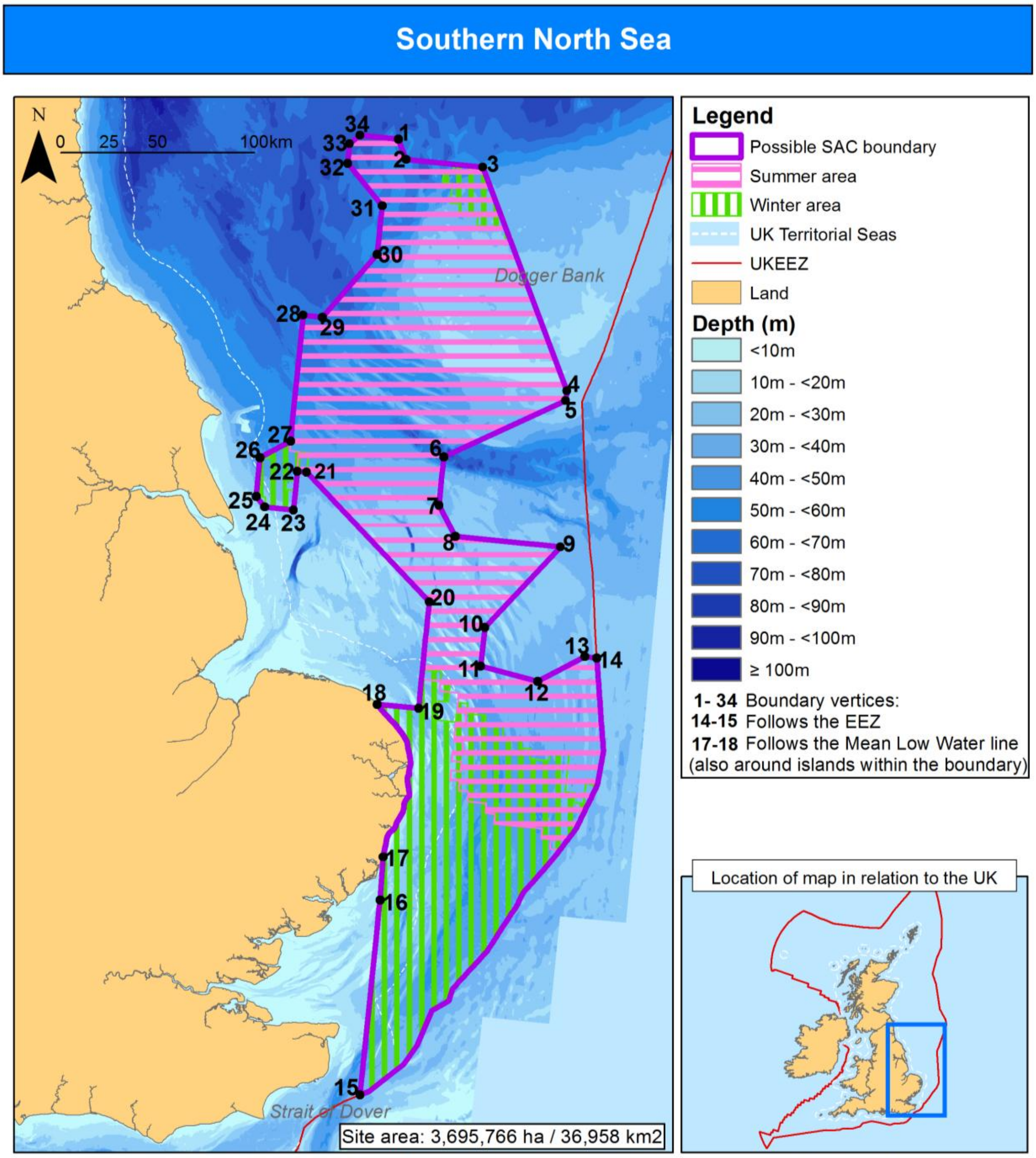
This Conservation Objectives document includes both a statement of the actual Conservation Objectives and supplementary advice with regard their intent and interpretation specific to the site. The Objectives have been set taking account of European Commission guidance (EC, 2012). Further guidance on their specific application to certain casework will also be provided at a later stage.

### 3.3 The Southern North Sea pSAC Conservation Objectives

The Southern North Sea pSAC is the largest of the possible SACs proposed for the conservation of harbour porpoise (Figure 2). The qualifying feature of the site is the Habitats Directive Annex II species:

- harbour porpoise (*Phocoena phocoena*)

Seasonal differences in the relative use of the site have been identified based on the analyses of Heinänen and Skov (2015) which shows that harbour porpoise occur in elevated densities in some parts of the site compared to others during summer and winter (Figure 2).The seasonality in porpoise distribution should be considered in the assessment of impacts and proposed management.






| ID | Latitude | Longitude | ID | Latitude | Longitude | ID | Latitude | Longitude | ID | Latitude | Longitude |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 55° 28' 53.1'' N | 01° 02' 24.8'' E | 10 | 53° 17' 32.9'' N | 02° 11' 31.6'' E | 19 | 52° 53' 06.4'' N | 01° 45' 21.9'' E | 28 | 54° 37' 0.5'' N | 00° 27' 44.8'' E |
| 2 | 55° 23' 34.2'' N | 01° 07' 24.8'' E | 11 | 53° 06' 45.7'' N | 02° 11' 43.8'' E | 20 | 53° 22' 42.4'' N | 01° 44' 22.2'' E | 29 | 54° 37' 11.8'' N | 00° 37' 01.8'' E |
| 3 | 55° 24' 03.2'' N | 01° 45' 17.6'' E | 12 | 53° 04' 11.8'' N | 02° 38' 38.6'' E | 21 | 53° 54' 05.6'' N | 00° 39' 29.7'' E | 30 | 54° 56' 28.6'' N | 00° 59' 18.7'' E |
| 4 | 54° 25' 05.4'' N | 02° 37' 56.9'' E | 13 | 53° 12' 19.1'' N | 02° 59' 22.3'' E | 22 | 53° 54' 0.3'' N | 00° 35' 04.2'' E | 31 | 55° 09' 56.9'' N | 00° 58' 38.1'' E |
| 5 | 54° 22' 23.6'' N | 02° 37' 58.3'' E | 14 | 53° 12' 19.0'' N | 03° 04' 57.1'' E | 23 | 53° 43' 17.2'' N | 00° 35' 41.1'' E | 32 | 55° 20' 23.2'' N | 00° 39' 10.7'' E |
| 6 | 54° 03' 07.5'' N | 01° 43' 06.7'' E | 15 | 51° 04' 38.9'' N | 01° 39' 44.1'' E | 24 | 53° 42' 60.0'' N | 00° 22' 03.6'' E | 33 | 55° 25' 46.4'' N | 00° 38' 51.5'' E |
| 7 | 53° 49' 40.4'' N | 01° 43' 32.5'' E | 16 | 51° 59' 04.9'' N | 01° 38' 08.0'' E | 25 | 53° 45' 35.5'' N | 00° 17' 20.7'' E | 34 | 55° 28' 33.4'' N | 00° 43' 26.4'' E |
| 8 | 53° 41' 38.9'' N | 01° 52' 54.2'' E | 17 | 52° 10' 54.3'' N | 01° 37' 11.0'' E | 26 | 53° 56' 22.0'' N | 00° 16' 38.8'' E | | | |
| 9 | 53° 41' 57.7'' N | 02° 42' 50.7'' E | 18 | 52° 52' 51.4'' N | 01° 26' 06.8'' E | 27 | 54° 02' 03.1'' N | 00° 30' 01.3'' E | | | |

**Figure 2:** The Southern North Sea possible Special Area of Conservation for harbour porpoise showing summer and winter areas.

The Conservation Objectives for the site are:

**To avoid deterioration of the habitats of the harbour porpoise or significant disturbance to the harbour porpoise, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to maintaining Favourable Conservation Status (FCS) for the UK harbour porpoise.**

To ensure for harbour porpoise that, subject to natural change, the following attributes are maintained or restored in the long term:

1. The species is a viable component of the site.

2. There is no significant disturbance of the species.

3. The supporting habitats and processes relevant to harbour porpoises and their prey are maintained.

These Conservation Objectives are common across all sites proposed for this species to ensure coherence across the network (EC, 2012). These Conservation Objectives are based on considerations of the ecological requirements of the species within the site, yet their interpretation is contextualised in their contribution to maintaining FCS at a wider scale (EC, 2012). With regard the Southern North Sea site, harbour porpoise need to be maintained rather than restored. Maintain implies that, based on our existing understanding, the feature is regarded as being in favourable condition and will, subject to natural change, remain in this condition after designation.

**1. The species is a viable component of the site:**

Harbour porpoises are considered to be a 'viable component' of the site if they are able to survive and live successfully within it. The Southern North Sea site has been selected primarily on the basis of its long-term, preferential use by harbour porpoise in contrast to other areas of the North Sea. The implication is that this site provides good foraging habitat and it may also be used for breeding and calving. However, because the number of harbour porpoise using the site naturally varies, there is not an exact number of animals within the site above which the species is viable or below which it will become unviable.

For that reason, the intent of this objective is to minimise the risk posed by activities within the site to the species viability. Activities that kill, injure or significantly disturb harbour porpoise have the potential to affect species viability within the site.

The harbour porpoise is a European Protected Species (EPS) listed on Annex IV of the Habitats Directive and as such is protected under Article 12 from deliberate killing (or injury), capture and disturbance throughout its range. However, the relevant/competent authorities are reminded of these provisions and their application to the site as an integral part of the species' range. The Habitats Directive Article 12 guidance[5] proposes the following definition of deliberate: "*deliberate actions are to be understood as actions by a person who knows, in the light of the relevant legislation that applies to the species involved, and the general information delivered to the public, that his action will most likely lead to an offence against a species, but intends this offence or, if not, consciously accepts the foreseeable results of his action*".

The meaning of 'deliberately injure' should be taken from the definition under regulations 41(1)(a) and 39(1)(a) of the Conservation (Natural Habitats *etc*.) Regulations 1994 and its

[5] http://ec.europa.eu/environment/nature/conservation/species/guidance/pdf/guidance_en.pdf

amendments consolidated in The Conservation of Habitats and Species Regulations 2010 for England and Wales

The disturbance under Article 12(1)(b) must be deliberate and not accidental. The definition of ‘deliberate disturbance’ is given in 39(1)(b) of Offshore Marine Conservation (Natural Habitats, *etc*.) Regulations 2007 (Offshore Marine Regulations, OMR, as amended in 2009 and 2010). It is an offence under these Regulations to deliberately disturb EPS in such a way as to: a) impair their ability to survive, to breed or reproduce, or to rear or nurture their young or b) to affect significantly the local distribution or abundance of that species. Further guidance as to the interpretation of and what constitutes ‘deliberate’ and ‘significant disturbance’ is given in the JNCC EPS guidance[6]. These definitions of types of disturbance are for the purposes of assessing the need for an EPS licence and apply throughout UK waters.

Bycatch of harbour porpoise in fishing nets is not deliberate but incidental killing. Article 12 (4) of the Habitats Directive applies and states that Member States ‘*shall establish a system to monitor the incidental capture and killing of the species listed on Annex IV (all cetaceans). In the light of the information gathered, Member States shall take further research or conservation measures as required to ensure that incidental capture and killing does not have a significant negative impact on the species concerned*’. Consideration must be given to the effect of bycatch on the conservation status of harbour porpoise at the population level. The impacts of bycatch within a site contribute to impacts from bycatch outside the site and thus may affect the conservation status of harbour porpoise. Bycatch, therefore, poses a risk to the viability of the population and therefore could be deemed to affect the integrity of the site. Measures may be needed to minimise the risk of bycatch to porpoises using the site.

### 2. There is no significant disturbance of the species within the site

Disturbance of harbour porpoise generally, but not exclusively, originates from activities that cause underwater noise (section 4). Responses to noise can be physiological and/or behavioural. JNCC has produced guidelines to minimise the risk of physical injury to cetaceans from various sources of loud, underwater noise[7]. However, disturbance is a behavioural (non-injurious) response to noise and may lead to harbour porpoises being displaced from the area affected.

Within sites, the immediate effects of disturbance are in the loss (usually temporary) of habitat available to harbour porpoise. The Southern North Sea site has been identified on the basis of having persistent higher densities of harbour porpoises (Heinänen and Skov 2015) when compared to other areas of the UK’s North Sea continental shelf which is linked to the habitats within the site that likely promote good feeding opportunities. Therefore, activities within the site should be managed to ensure access to the site; any disturbance should not lead to the exclusion of harbour porpoise from a significant portion of the site for a significant period of time. Case Work Advice Guidance in relation to various activities is being developed and expands this supplementary advice to define ‘significant portion and period’ in the context of impacting site integrity.

This Conservation Objective aims to ensure that the site contributes, as best it can, to maintaining the Favourable Conservation Status of the wider harbour porpoise population. As such, how the impacts within the site translate into effects on the North Sea Management Unit population are of greatest concern.

[6] http://jncc.defra.gov.uk/PDF/consultation_epsGuidanceDisturbance_all.pdf
[7] http://jncc.defra.gov.uk/page-4273

3. **The supporting habitats and processes relevant to harbour porpoises and their prey are maintained.**

The harbour porpoise is a species that is highly dependent on a year-round proximity to food sources and its distribution and condition may strongly reflect the availability and energy density of its prey (Brodie 1995 in Santos & Pierce, 2003). The densities of porpoise using the site are likely linked to the availability (and density) of prey within this site. Porpoise eat a variety of prey including gobies, sandeel, whiting, herring and sprat (which all have spawning grounds within the Southern North Sea site). However, the diet of porpoises specifically when using the site is unknown. The activity which potentially risks the achievement of this CO is commercial fishing; although environmental variability also plays a role in determining the status of fish stocks. However, currently there is no evidence to suggest that competition for prey species with commercial fisheries is having an impact on the conservation status of the harbour porpoise.

The delineation of the Southern North Sea site is based on the prediction of 'harbour porpoise habitat' within the North Sea (Heinänen and Skov 2015). Habitat, in this context, means the characteristics of the seabed and water column. Peaks in density of harbour porpoise in the Southern North Sea site vary seasonally (Figure 2). At the Management Unit scale, for both the summer and winter seasons the distribution of harbour porpoise is related to water depth and variables within the water column (Heinänen & Skov 2015). Harbour porpoise density peaked in stable stratified waters (based on vertical differences in temperature) with lower gradients of eddy activity (turbulence); higher densities were also found in areas with current speeds of 0.4-0.6m/s. The analysis indicated a preference for water depths between 30 and 50m throughout the year. In general, in both seasons, harbour porpoise preferred coarser seabed sediments (sand/gravel). How these environmental characteristics of the site influence the prey of harbour porpoise or other aspects of their life directly (e.g. breeding/calving) is currently unknown.

# 4 Advice on Activities

## 4.1 Purpose of advice

This section details the advice on human activities specifically occurring within or close to the Southern North Sea pSAC that would be expected to impact the site. Initial assessments were done at UK scale, with subsequent site level assessment detailing our understanding of impacts occurring with potential to affect harbour porpoise when using the site (Section 5 & 6). Advice is only given where pressures[8] may act at the site level and therefore, may require management if the Conservation Objectives are to be met. Wide-spread pressures may also act to affect the overall status of harbour porpoise, but such effects are not restricted to specific sites. Such pressures are best dealt with through broader measures. Alongside and in addition to the identification of the network of harbour porpoise sites, an overarching conservation strategy (DETR, 2000) has been in place for harbour porpoise since 2000. In light of a recent conservation literature review (IAMMWG *et al* 2015b), this strategy will be reviewed and updated where necessary.

The advice identifies activities with potential to affect harbour porpoise using the site (site level impacts) as well as (where possible) its supporting habitats in UK waters which may impact the species' capacity to maintain FCS. This advice should also be used to help identify the extent to which existing activities are, or can be made, consistent with the conservation objectives, and thereby focus the attention of Relevant and Competent Authorities and surveillance programmes to areas that may need management measures.

[8] See Annex A for definition of key terms

This draft advice on activities will be updated and supplemented through further discussions with the Relevant and Competent Authorities and any advisory groups formed for the site.

### 4.2 Background

In compiling this advice on activities, the SNCBs have considered the pressures that may be caused by human activities and the sensitivity of the qualifying feature, harbour porpoise, to those pressures. The advice is generated through a broad grading of sensitivity and exposure of the harbour porpoise to pressures associated with activities in order to gain an understanding of how vulnerable the species is to each activity at a UK level. The activities and their associated pressures to which the harbour porpoise is deemed vulnerable at UK level are then considered at site level in order to inform possible management needs necessary for the site to meet the conservation objectives. Annex A details the approach taken to identify the significant impacts on harbour porpoise from pressures, and the relative sensitivity and current exposure of harbour porpoise to those pressures at a UK wide scale.

This document is guidance only and activities and their management will be considered in the context of Habitats Regulations Assessments/Appropriate Assessment and where applicable through other environmental assessment processes (e.g. EIA).

## 5 Activity assessments at UK scale

The assessments have been carried out using all available evidence as of November 2015. As further information becomes available, assessments may be subject to alteration in line with the new evidence to support the change, and further improving the understanding of the vulnerability of harbour porpoise to activities occurring in UK waters. This advice is made without prejudice to any assessment that may be required for specific proposals to be considered by a Relevant Authority. The level of any impact will depend on the location, timing and intensity of the relevant activity. This advice is provided to assist and focus the Relevant Authorities in their consideration of the management of these activities.

The harbour porpoise is a wide-ranging species and occurs throughout the UK Continental Shelf area (JNCC, 2013). It does occur in deeper waters but in very low densities, and perhaps only seasonally. As a predominantly shelf species, it is exposed to a wide range of pressures, that are both ubiquitous (e.g. pollution) and patchy (e.g. bycatch) in nature, and the list of anthropogenic activities leading to these pressures is long. Based on current available information, the activities with the most notable impact on UK harbour porpoise are shown in Table 1.

The definitions of the pressures as applied within harbour porpoise SAC advice can be found in Annex B

Activities which currently pose a low risk to porpoises at the UK level (Annex A, Table A2) have not been considered in this advice. The exposure to the pressures associated with these activities is currently very limited and poses no significant threat to the maintenance of harbour porpoise FCS. Non-anthropogenic impacts are also not considered, such as attack and predation from other marine mammal species, that have the potential to impact harbour porpoise populations.

The full list of assessed activities and key references can be found in Annex A, Table A3. Updates to the assessments will occur as more evidence becomes available.

**Table 1:** Key activities and the relative risk of impacts on harbour porpoise throughout UK waters. Those pressures ranked 'high' are known to have the greatest impact relative to other pressures on the population of UK harbour porpoises.

| Activities | Pressures | Impacts | Current relative level of impact |
|---|---|---|---|
| Commercial fisheries with bycatch of harbour porpoise (predominantly static nets) | **Removal of non-target species** | • Mortality through entanglement/bycatch | High |
| Discharge/run-off from land-fill, terrestrial and offshore industries | **Contaminants** | • Affects on water and prey quality<br>• Bioaccumulation through contaminated prey ingestion<br>• Health issues (e.g. on reproduction) | High |
| Shipping, drilling, dredging and disposal, aggregate extraction, pile driving, acoustic surveys, underwater explosion, military activity, acoustic deterrent devices and recreational boating activity | **Anthropogenic underwater sound** | • Mortality<br>• Internal injury<br>• Disturbance leading to physical and acoustic behavioural changes (potentially impacting foraging, navigation, breeding, socialising) | Medium |
| Shipping, recreational boating, tidal energy installations | **Death or injury by collision** | • Mortality<br>• Injury | Medium/Low |
| Commercial fisheries (reduction in prey resources) | **Removal of target species** | • Reduction in food availability<br>• Increased competition from other species<br>• Displacement from natural range | Medium |

## Removal of non-target species (harbour porpoise bycatch)

Bycatch of harbour porpoise in fishing gear is one of the most significant anthropogenic pressures impacting on the population. The relevant commercial fisheries with harbour porpoise bycatch are certain bottom set nets. The areas where bycatch is of greatest concern is off southwest England and the southern North Sea. Mitigation of bycatch through the use of acoustic deterrent devices ('pingers') is required under EU Regulation 812/2004[9] on setnet vessels of 12m or over. However, smaller set net vessels (<12m) comprise the majority of the fleet and are the major source of harbour porpoise bycatch in UK waters. Where the bycatch/risk of bycatch within porpoise SACs threatens the sites' integrity, mitigation maybe required.

## Contaminants

The latest evidence (Law *et al* 1992-2005 & 2009; Law *et al* 2008; ASCOBANS, 2011; Murphy *et al* 2015) shows that there is still a significant pollution issue for at least some cetacean species in European waters, which includes harbour porpoise and organochlorines (e.g. Polychlorinated biphenyls [PCBs]). Monitoring and investigation will continue to be important, and research in this field should not remain focused on 'old' compounds and

[9] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:150:0012:0031:EN:PDF

contaminants. Careful consideration is required to ensure we also monitor historical contaminant impacts as well as any current or emerging issues.

**Anthropogenic underwater sound**

Harbour porpoise use sound for foraging, navigation, social activities and predator detection. Changes in underwater noise therefore have the potential to interrupt these behaviours. The peak frequency of echolocation pulses produced by harbour porpoise is 120–130 kHz, corresponding to their peak hearing sensitivity although hearing occurs throughout the range of ~1 and 180 kHz (Southall *et al* 2007). A range of activities emit sound that falls within the hearing sensitivities of porpoise, including shipping, pile driving, Acoustic Deterrent Devices and military activities. The exact frequency, intensity and longevity of the sound will determine the response. The impact on the porpoise is also mediated through individual behaviour, and perhaps quality of its immediate habitat, at the time of exposure.

**Death or injury by collision**

Post-mortem evidence indicates that few collisions between harbour porpoise and vessels occur and is not a significant pressure for this species.

Research surrounding wet renewables shows potential risk of harbour porpoise collision with sub-marine turbines, although there is no evidence of such collisions to date.

**Removal of target species (harbour porpoise prey)**

Porpoise diet within UK waters includes a wide variety of fish and they will generally focus on the most abundant local species (De Pierrepont *et al* 2005; Camphuysen *et al* 2006). The predominant prey type in general appears to be whiting, gobies and sandeel, although shoaling fish such as mackerel and herring are also taken. In the north-east Atlantic, a long term shift from predation on clupeid fish (mainly herring) to predation on sandeels and gadoid fish, possibly related to the decline in herring stocks since the mid-1960s has been observed. Porpoise diets overlap extensively with diets of other piscivorous marine predators (notably seals) and many of the main prey species are also taken by commercial fisheries, although porpoises tend to take smaller fish than those targeted by fisheries (Santos and Pierce 2003).

# 6 Site specific considerations: Southern North Sea pSAC

## 6.1 Sensitivity of harbour porpoise to existing activities within or impacting on the site

The Southern North Sea site spans territorial and offshore waters and covers a large geographical area. A summary of the site can be found in the Selection Assessment Document[10]. Precise information on many activities within the boundary is not currently available due to lack of targeted data collection to date. Assessing exposure carries certain assumptions about the spatial extent, frequency and intensity of the pressures associated with marine activities. Therefore site based exposure and resulting current level of impact has not been assessed at this stage.

[10] SAC Selection Assessment Document:

http://jncc.defra.gov.uk/pdf/SouthernNorthSeaSelectionAssessmentDocument.pdf

Table 2 is an overview of activities occurring within or in proximity to the Southern North Sea site to which the harbour porpoise has a current level of impact risk of High or Medium at UK level (Table 1) and therefore may require further consideration concerning options for management. This was derived from spatial data as GIS layers and a review of the literature, and includes all available data at time of writing.

Management measures are the responsibility of the relevant regulatory bodies, which consider the SNCBs' advice and hold appropriate discussions with the sector concerned, but the scale and type of mitigation is decided by the Regulators. Where consent is required and the activity (if considered a plan or a project) is likely to significantly affect a European Marine site, Article 6(3) of the Habitats Directive requires that an Appropriate Assessment is carried out. Assessments under Article 6(3) of the Directive are often referred to in the UK as "Habitat Regulations Assessments" (HRA). The HRA is a case-specific assessment made in view of the Conservation Objectives for the affected site. Each HRA requires case-specific, unbiased advice from the SNCB but is the responsibility of the regulatory body concerned.

In 2012 the UK Government adopted a revised approach to the management of fishing activities within European marine sites (EMS) in England. The revised approach is designed to ensure the consistency of the management of fishing activities with Article 6 of the Habitats Directive. Risk based prioritisation of managing the fishing activities of UK and non UK vessels has been applied to relevant European marine site features and sub features within the UK 12nm territorial limit. For EMS outside of 12nm, or sites outside 6nm where there are access rights for other Member States, management measures designed to ensure adequate protection are to be proposed to and agreed by the European Commission in accordance with the Common Fisheries Policy (CFP).

**Table 2:** Activities occurring within/near to the Southern North Sea site to which the harbour porpoise is considered sensitive.

| Activities | Pressure | Comment on current level of activity | Management considerations |
|---|---|---|---|
| Commercial fisheries (with harbour porpoise bycatch) | Removal of non-target (bycatch) species | UK registered vessels >12m: Negligible effort of Vessel Monitoring System (VMS) registered vessels using static net gears within the site[11]<br><br>UK registered vessels <12m: current exposure is unknown<br><br>EU registered vessels: higher effort of static net setting than UK vessels with two concentrated areas. Effort in the south east appears to have increased between 2009 and 2013. | Where management measures are required, the development of these would be undertaken via discussion with fishing interests and fishery managers and informed by any detailed information about fishing activity that can be made available. Detailed measures, if required, will be developed by the relevant regulator (European Commission/MMO/IFCA/Defra)<br><br>The use of pingers as a mitigation measure is required on static nets deployed by vessels >12m in length in specified areas through EU Regulation 812/2004. Through derogation, this part of the UK fleet currently utilise the DDD.<br><br>Because bycatch most often occurs in bottom set nets deployed from vessels <12m, and the use of pingers |

[11] The fisheries data are aggregated VMS data collected between 2006 and 2013.

| | | | |
|---|---|---|---|
| | | | is not mandatory under Regulation 812/2004, one option for management could be to extend the pinger requirement to further vessels. The risk of bycatch from this sector in the context of the Conservation objectives of the site will need to be established . Such a requirement may have a seasonal component. However, further work is needed to understand the scale of disturbance that would be caused by wide-spread deployment of the different types of pinger. |
| Discharge/run-off from land-fill, terrestrial/ offshore industries | Contaminants | Current exposure within/near the site is unknown | This pressure cannot be managed effectively at the site level. Most of the relevant pollutants have been effectively phased out of use by action under the OSPAR Convention and, more recently, the EU (e.g. PCBs). However, their chemical stability will lead to them remaining in the marine environment for some time and, consequently, human activities such as dredging may cause the re-release of these chemicals into the environment or introduce other contaminants of which the impacts are poorly known.<br><br>Any novel sources of potential contamination associated with a new plan or project may be assessed under HRA. It is recognised that further efforts to limit or eliminate PCB discharges to the marine environment may still be needed. |
| Shipping | Anthropogenic underwater sound | Several large ports along the East coast of England resulting in large vessel shipping routes throughout the site. | The underwater sounds created by large ships are unlikely to cause physical trauma, but could make preferred habitats less attractive as a result of disturbance (habitat displacement, area avoidance). However, additional management is unlikely to be required given current levels within the site and elevated densities of porpoises in this area. |
| Oil and gas drilling | | Areas licensed for oil and gas extraction in the northern and central parts of the site | This is a highly regulated industry. Existing and inactive (exploratory and dry) wells and oil and gas licensed blocks occur within the suite of proposed sites and any future applications would be subject to an HRA. |
| Dredging and disposal | | Capital dredging and disposal sites in the southern portion of the | Dredging and disposal can cause disturbance leading to physical and acoustic behavioural changes. |

| | | | |
|---|---|---|---|
| | | site | However, the risk is considered relatively low and additional management is unlikely to be required |
| Aggregate extraction | | Extensive existing licensed and active areas within the site | Aggregate extraction can cause disturbance leading to physical and acoustic behavioural changes. However, the risk is considered relatively low and additional management is unlikely to be required |
| Pile driving | | Current and licensed areas for offshore wind, including construction and maintenance phases within the site | A European Protected Species (EPS) licence is already required for any construction activity which carries the risk of significant disturbance or injury As a minimum, developers are required to follow the 'Statutory Nature Conservation Agency protocol for minimising the risk of injury to marine mammals from piling noise'. (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/50006/jncc-pprotocol.pdf).<br><br>A Habitats Regulations Assessment (HRA) will be considered for all new developments (coastal and marine) using pile driving within the site **or** within 26km (see Dahne *et al* 2013; Tougaard *et al* 2014) of site boundaries. If additional mitigation (to that required under EPS licence) is required, planning and management of pile driving activities may be needed within the site to ensure the Conservation Objectives are met. There is potential for a reduction or limitation of the disturbance/displacement effects by varying the schedule of piling, particularly if several developments are constructing at the same time and pile driving footprints do not overlap (i.e maximising area from which porpoise are excluded). Limited spatio-temporal restrictions may be needed.<br><br>Other examples of mitigation include the use of sound dampers, methods that create a barrier to sound transfer (e.g. bubble curtains) and, more effectively, the use of alternative foundation types (e.g. gravity foundations, suction cups, floating turbines, drilling). Scheduling of activities may minimise cumulative exclusion from areas. |
| Acoustic (including | | Seismic exploration | Some geophysical surveys within 5km of site boundary may require consent |

| | | | |
|---|---|---|---|
| seismic) surveys | | activity occurs in the site | and be subject to HRA.<br><br>Seismic surveys are likely to require an EPS licence which may specify conditions. As a minimum, it is expected that developers will adhere to the *JNCC Guidelines for minimising the risk of injury and disturbance to marine mammals from seismic surveys* (updated August 2010; https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/50005/jncc-seismic-guide.pdf) |
| Recreational boating activity | | Royal Yachting Association (RYA) cruising routes across the extent of the site, focussed along the coast | Adherence to wildlife codes of conduct is already advocated (e.g the WiSe scheme http://www.wisescheme.org ). No further management measures are likely to be required. |
| Acoustic deterrent/ mitigation devices | | Unknown, no consistent areas of usage but maybe used as a mitigation tool during pile driving. | See pile driving. |
| Pinger devices | | 31 UK registered >12m setnet boats of which 4 use pingers in the area of the site. Use in North Sea on vessels under 12m is unknown but likely low. | See 'Fisheries (commercial and recreational) with harbour porpoise bycatch'<br><br>The use of pingers is low/not needed in the site. |
| Shipping | Death or injury by collision | Several large ports along the East coast of England resulting in busy shipping routes throughout the site, with the highest level of activity in the south. | Post mortem investigations of harbour porpoise deaths have revealed death caused by trauma (potentially linked with vessel strikes) is not currently considered a significant risk and no additional management is therefore required. |
| Recreational boating activity | | RYA cruising routes cross the site, most are coastal | See 'Shipping' (with death or injury by collision).<br><br>Boats conducting recreational activity should adhere to wildlife codes of conduct (e.g the WiSe scheme http://www.wisescheme.org/). |
| Commercial fisheries | Removal of target (prey) species | Fisheries targeting prey species such as whiting, herring, mackerel, sandeel and sprat throughout their ranges in the North Sea, fished by UK and EU fisheries. | Commercial species are managed at the larger scale through the CFP.<br>. |

## 6.2 Limitations of the evidence

It is important to note that the information used to catalogue activities occurring within the site is not complete. The available data are drawn from existing monitoring programmes (e.g. the UK's bycatch of protected species monitoring and other European datasets linked to VMS monitoring of fishing vessels) but these have limitations including availability and accessibility at the time of preparing this advice. Caveats with how the data have been collected also need to be understood in order to correctly interpret the information. This can result in the use of expert judgement where sufficient evidence is lacking, but risk is implied. Below are some points to consider alongside the above table in order to ensure the information is not taken out of context:

- **Data availability**
  - Globally, the marine environment is generally far behind the evidence levels of that on land, particularly in offshore areas, mainly due to scale and cost.
  - Sensitivities surround data that has been gathered by industry, and some data are not available for use for advice and management purposes. Often these data become available eventually, but not in time to inform management decisions.

- **Fishing: Limitations of fishing Vessel Monitoring System (VMS) data**
  - VMS positional data are transmitted at approximately 2 hour intervals. There is no information transmitted regarding precise vessel activity, therefore assumptions on its activity are often made using the location of the vessel and its speed profile.
  - Fishing vessels under 12m, (and until 2013, vessels under 15m long) are not required to use the VMS, and therefore VMS data tells us nothing regarding the activity of this segment of the fleet. However, relevant data can be obtained from Association of Inshore Fisheries and Conservation (IFCAs) and will be used to develop more detailed guidance to assist with identification of any management measures.

- **Contaminants**
  - Although use of many substances that have contaminated the environment is now illegal, re-suspension or reintroduction of pollutants that were used historically occurs. It is also difficult to identify sources of contamination when dealing with highly mobile species.

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# 8 Annex A: Assessment process to establish the significant threats to UK harbour porpoise populations

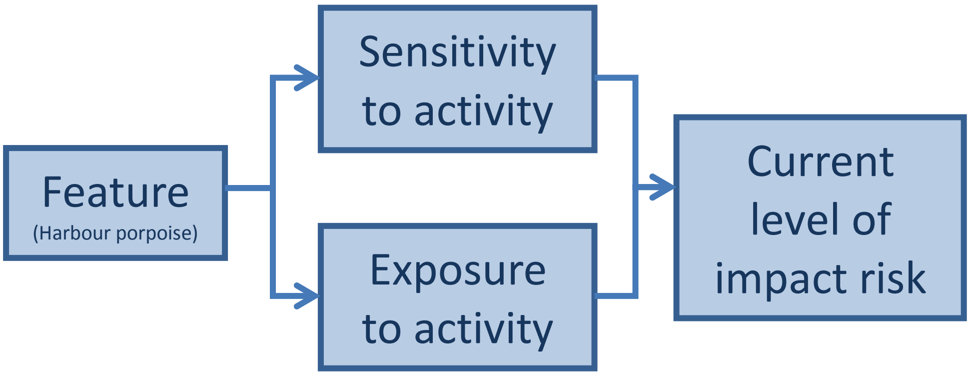
The sensitivity and vulnerability of harbour porpoise was assessed at UK level against the *pressure themes* identified by OSPAR's Intersessional Correspondence Group on Coordination of Biodiversity Assessment and Monitoring (ICG-COBAM)[12] which have been adapted slightly in order to suit the application of a highly mobile species. See Annex B for the definitions of pressures as used for the harbour porpoise assessments.

**Definition of key terms**

| Term | Definition |
|---|---|
| Pressure theme | A group of like-pressures defined by ICG-COBAM |
| Sensitivity | A measure of tolerance (or intolerance) to changes in environmental conditions |
| Vulnerability | Vulnerability is a measure of the degree of exposure of a receptor to a pressure to which it is sensitive. |
| Pressure | The mechanism through which an activity has an effect on any part of the ecosystem'. The nature of the pressure is determined by activity type, intensity and distribution. |
| Impact | The effects (or consequences) of a pressure on a component. |
| Impact Risk | The current risk of impact |
| Exposure | The action of a pressure on a receptor, with regard to the extent, magnitude and duration of the pressure. |
| Activity | Human social or economic action or endeavours that may create pressures on the marine environment. |

*Source: jncc.defra.gov.uk/page-6515*

**Determining the level of impact risk of harbour porpoise to an activity**




**Sensitivity**

Harbour porpoises were assessed as sensitive to a pressure when viability of an individual (including physiological stress, reduced fecundity, reduced growth) would be negatively affected and recovery did not take place rapidly (within weeks). The assessment incorporated expert judgement where required and adopted a single threshold to differentiate only between 'sensitive' and 'not sensitive'. The pressures that harbour porpoise are deemed sensitive to are listed in Table A1.

[12] OSPAR 20011: https://ospar.basecamphq.com/projects/6526112-icg-cobam/log

**Table A1:** Pressures to which harbour porpoise may be sensitive.

| Pressure Theme | Pressures | Direct or Indirect impact |
|---|---|---|
| **Pollution and other chemical changes** | Contamination | Indirect – prey and habitat |
| | Enrichment | Indirect - habitat |
| **Other physical pressures** | Litter | Direct |
| | Anthropogenic underwater sound | Direct |
| | Barrier to species movement | Direct |
| | Death or injury by collision | Direct |
| **Biological pressures** | Introduction of microbial pathogens | Direct |
| | Removal of target species | Direct |
| | Removal of non-target species | Direct |

### Exposure

The list of pressures to which harbour porpoise is sensitive was combined with evidence of general exposure to these pressures in UK waters to get an understanding of the current level of impact risk; it combined expert knowledge on the overlap in spatial and temporal distributions of activities contributing towards a pressure and harbour porpoise densities, with direct evidence of impact as reported in the literature and from the UK Cetacean Strandings Investigation Programme[13].

### Current level of impact risk

Caution was applied throughout the assessment process where there was a lack of direct evidence of exposure to an activity; a pressure to which a species was sensitive, was assumed to overlap with that species unless a case could be made to the contrary. In this sense, lack of direct evidence of exposure does not imply the species is not currently at risk. The current level of impact risk of harbour porpoise has not been assessed on a site basis due to uncertainties in exposure, driven by incomplete evidence to support the assessment at the site scale. The following level of impact scores were chosen to represent harbour porpoise vulnerability to activities within UK waters:

| Scores | Criteria for overlap in space & time between pressure & species | Evidence of impact |
|---|---|---|
| **Low** | None or limited | No direct evidence in UK waters |
| **Medium** | Some | Some evidence of an impact occurring in UK waters |
| **High** | Widespread | Good evidence of a significant impact |

The evidence used to assess the current level of impact is summarised in Table A3 and subsequent reference list.

Activities with a level of impact risk of 'low' have not been considered in the site assessments unless there is evidence to support a significant vulnerability despite the criteria described in the table above. This assessment, although inclusive of expert judgement in order to arrive at the assessment outcomes at UK level, provide a base from which to apply weighting to site based sensitivity assessments, using all available activity data.

[13] UK Cetacean Strandings Investigation Programme: http://ukstrandings.org/

**Table A2:** Full assessment of level of impact of activities on harbour porpoise in UK waters.

| Activities | Pressures | Impacts | Current level of impact risk |
|---|---|---|---|
| Commercial fisheries with bycatch (predominantly static nets) | Removal of non-target species | • Mortality through entanglement/bycatch | High |
| Discharge/run-off from land-fill, terrestrial and offshore industries | Contaminants | • Affects on water and prey quality<br>• bioaccumulation through contaminated prey ingestion<br>• health issues (e.g. on reproduction) | High |
| Noise from shipping, drilling, dredging and disposal, aggregate extraction, pile driving, acoustic surveys, underwater explosion, military activity, acoustic deterrent devices and recreational boating activity | Anthropogenic underwater sound | • Mortality<br>• Internal injury<br>• disturbance leading to physical and acoustic behavioural changes (potentially impacting foraging, navigation, breeding, socialising) | Medium |
| Shipping, recreational boating, renewable energy installations | Death or injury by collision | • Mortality<br>• Injury | Medium/ Low |
| Commercial fisheries, bycatch | Removal of target species | • Reduction in food availability<br>• increased competition from other species<br>• displacement from natural range | Medium |
| Agriculture, aquaculture, sewage | Nutrient enrichment | • Affects on water quality<br>• increased risk of algal blooms may present health issues | Low |
| Agriculture, aquaculture, sewage | Organic enrichment | • Affects on water quality<br>• increased risk of algal blooms may present health issues | Low |
| Waste disposal - navigational dredging (capital, maintenance) | Physical change (to another seabed type) | • Changes in availability of prey species | Low |
| Bridges, tunnels, dams, installations, presence of vessels (shipping, recreation) | Water flow (tidal current) changes - local | • Changes in location of prey species Displacement of harbour porpoise | Low |
| Terrestrial and at-sea 'disposal' | Litter | • Mortality through entanglement Ingestion | Low |
| Bridges, tunnels, dams, installations, presence of vessels (shipping, recreation) | Barrier to species movement | • Habitat inaccessible potential physiological effects | Low |
| Sewage | Introduction of microbial pathogens | • Increased risk of disease | Low |

**Table A3:** Evidence used to assess exposure to each pressure to which harbour porpoise is considered sensitive.

Example activities linked to each pressure are listed.

| Key activities linked to pressures | Pressures | Evidence | | Key references |
|---|---|---|---|---|
| | | Spatial overlap (species & pressure) | Post-mortem examination | |
| Discharge/run-off from land-fill, terrestrial and offshore industries | **Contaminants** | | ✓ | Jepson *et al* 2005; Deaville & Jepson, 2011; ICES, 2015a; Van De Vijver *et al* 2003; Law *et al* 2012; Pierce *et al* 2008; Murphy *et al* 2015. |
| Agriculture, aquaculture, sewage | **Nutrient enrichment** | ✓ | ✓ | Craig *et al* 2013 |
| Agriculture, aquaculture' sewage | **Organic enrichment** | ✓ | | Craig *et al* 2013 |
| Terrestrial and at-sea 'disposal' | **Litter** | ✓ | ✓ | Deaville and Jepson, 2011 |
| Marine renewable energy | **Electromagnetic changes** | ✓ | | WGMME, 2012, ICES 2015a |
| Shipping, drilling, dredging, pile driving, military sonar, seismic surveys | **Anthropogenic underwater sound** | ✓ | | Deaville & Jepson, 2011; Stone & Tasker, 2006; Stone, 2015; Jepson *et al* 2005; Fernandez *et al* 2005; Würsig & Richardson, 2009; WGMME, 2012. |
| Bridges, tunnels, dams, installations | **Barrier to species movement** | ✓ | | WGMME., 2012; ICES 2015a |
| Shipping, recreational boating, renewable energy devices | **Death or injury by collision** | ✓ | ✓ | Deaville & Jepson, 2011; Dolman *et al* 2006; ICES 2015a |
| Sewage | **Introduction of microbial pathogens** | | ✓ | Harvell *et al* 1999; Gulland and Hall, 2007; Van Bressem *et al* 2009 |
| Commercial fisheries | **Removal of target species** | | ✓ | Simmonds and Isaac, 2007; OSPAR QSR 2010; MacLeod *et al* 2007a, b; Thompson *et al* 2007; Santos and Pierce, 2003; Pierce *et al* 2007; ICES 2015a |
| Commercial fisheries with by-catch | **Removal of non-target species** | ✓ | ✓ | Deaville and Jepson, 2011; Morizur *et al* 1999; Read *et al* 2006; Northridge, S. and Kingston, A. 2010; Northridge *et al* 2013; ICES 2015b |

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# 9 Annex B: Definitions of Pressures as applied within harbour porpoise SAC Advice on Activities

| **Pressures** | **Definition in the context of harbour porpoise advice** |
|---|---|
| **Removal of non-target species** | The removal of species not targeted by the fishery; in this case the bycatch (and probable mortality) of harbour porpoise |
| **Contaminants** | Introduced material capable of contaminating harbour porpoise, prey or habitat important to harbour porpoise, with a negative impact directly or indirectly on porpoises |
| **Anthropogenic underwater sound** | Introduced noise in a frequency with the potential to cause injury or displace harbour porpoise from their natural range |
| **Death or injury by collision** | Introduction of physical objects; mobile or immobile, that may collide with or result in potential collision of harbour porpoise resulting in injury or mortality |
| **Removal of target species** | Removal of harbour porpoise prey, resulting in increased competition amongst porpoise and other species, and/or displacement from their natural range |

# NATURA 2000 – STANDARD DATA FORM

## Special Protection Areas (SPAs) classified under Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (codified version), also known as the 'Birds Directive'

## and

## Special Areas of Conservation (SACs) (includes candidate SACs, Sites of Community Importance (SCIs) and designated SACs) designated under Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, also known as the 'Habitats Directive'

Each Natura 2000 site in the United Kingdom has its own Standard Data Form containing site-specific information.

The information provided here follows the officially agreed site information format for Natura 2000 sites, as set out in the Official Journal of the European Union recording the Commission Implementing Decision of 11 July 2011 (2011/484/EU).

The Standard Data Forms are generated automatically for all of the UK's Natura 2000 sites using the European Environment Agency's Natura 2000 software. The structure and format of these forms is exactly as produced by the EEA's Natura 2000 software (except for the addition of this coversheet and the end notes). The content matches exactly the data submitted to the European Commission.

Please note that these forms contain a number of codes, all of which are explained either within the data forms themselves or in the end notes.

Further technical documentation may be found here:
http://bd.eionet.europa.eu/activities/Natura_2000/reference_portal

In December 2015, several sections of the UK's previously published Standard Data Forms were updated. For details of the approach taken by the UK in this submission please refer to the following document:
http://jncc.defra.gov.uk/pdf/Natura2000_StandardDataForm_UKApproach_Dec2015.pdf.
These changes formed part of the UK Submission to the European Commission on 22/12/2015.

More general information on Special Protection Areas (SPAs) and Special Areas of Conservation (SACs) in the United Kingdom, including in Gibraltar, is available from the SPA homepage and SAC homepage on the JNCC website. These webpages also provide links to Standard Data Forms for all Natura 2000 sites in the UK.

| | |
|---|---|
| Date **SAC** Standard Data Form generated by the Joint Nature Conservation Committee: | 30th May 2018 |

# NATURA 2000 - STANDARD DATA FORM

**For Special Protection Areas (SPA),**
**Proposed Sites for Community Importance (pSCI),**
**Sites of Community Importance (SCI) and**
**for Special Areas of Conservation (SAC)**

SITE **UK0030395**

SITENAME **Southern North Sea**

## TABLE OF CONTENTS



## 1. SITE IDENTIFICATION

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| 1.1 Type | 1.2 Site code |
|---|---|
| B | UK0030395 |

### 1.3 Site name

Southern North Sea

| 1.4 First Compilation date | 1.5 Update date |
|---|---|
| 2017-01 | 2017-12 |

### 1.6 Respondent:

**Name/Organisation:** Joint Nature Conservation Committee
**Address:** Monkstone House, City Road, Peterborough, PE1 1JY
**Email:**

| | |
|---|---|
| **Date site proposed as SCI:** | 2017-01 |
| **Date site confirmed as SCI:** | 2017-12 |
| **Date site designated as SAC:** | No data |
| **National legal reference of SAC designation:** | Regulations 11 and 13-15 of the Conservation of Habitats and Species Regulations 2010 (http://www.legislation.gov.uk/uksi/2010/490/contents/made), and Regulations 11, 16 and 17 of the Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (http://www.legislation.gov.uk/uksi/2007/1842/contents/made). |

## 2. SITE LOCATION

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### 2.1 Site-centre location [decimal degrees]:

| Longitude | Latitude |
|---|---|
| 1.7999 | 53.551 |

| 2.2 Area [ha]: | 2.3 Marine area [%] |
|---|---|
| 3695054.0 | 100.0 |

**2.4 Sitelength [km]:**

0.0

### 2.5 Administrative region code and name

| NUTS level 2 code | Region Name |
|---|---|
| UKZZ | Extra-Regio |

### 2.6 Biogeographical Region(s)

Atlantic (100.0 %)

## 3. ECOLOGICAL INFORMATION

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### 3.2 Species referred to in Article 4 of Directive 2009/147/EC and listed in Annex II of Directive 92/43/EEC and site evaluation for them

| Species | | | | | Population in the site | | | | | | | Site assessment | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| G | Code | Scientific Name | S | NP | T | Size | | Unit | Cat. | D.qual. | A\|B\|C\|D | A\|B\|C | | |
| | | | | | | Min | Max | | | | Pop. | Con. | Iso. | Glo. |
| M | 1351 | Phocoena phocoena | | | p | 11864 | 28889 | i | C | M | A | A | C | A |

- **Group:** A = Amphibians, B = Birds, F = Fish, I = Invertebrates, M = Mammals, P = Plants, R = Reptiles
- **S:** in case that the data on species are sensitive and therefore have to be blocked for any public access enter: yes
- **NP:** in case that a species is no longer present in the site enter: x (optional)
- **Type:** p = permanent, r = reproducing, c = concentration, w = wintering (for plant and non-migratory species use permanent)
- **Unit:** i = individuals, p = pairs or other units according to the Standard list of population units and codes in accordance with Article 12 and 17 reporting (see reference portal)
- **Abundance categories (Cat.):** C = common, R = rare, V = very rare, P = present - to fill if data are deficient (DD) or in addition to population size information
- **Data quality:** G = 'Good' (e.g. based on surveys); M = 'Moderate' (e.g. based on partial data with some extrapolation); P = 'Poor' (e.g. rough estimation); VP = 'Very poor' (use this category only, if not even a rough estimation of the population size can be made, in this case the fields for population size can remain empty, but the field "Abundance categories" has to be filled in)

## 4. SITE DESCRIPTION

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### 4.1 General site character

| Habitat class | % Cover |
|---|---|
| N01 | 100.0 |
| **Total Habitat Cover** | 100 |

### Other Site Characteristics

General site characteristics: Sand and coarse sediments. Non-vegetated. Full salinity. Water depths between 10m and 75m.

### 4.2 Quality and importance

Harbour porpoise (Phocoena phocoena) "For which this is considered to be one of the best areas in the United Kingdom".

### 4.3 Threats, pressures and activities with impacts on the site

The most important impacts and activities with high effect on the site

| Negative Impacts | | | |
|---|---|---|---|
| Rank | Threats and pressures [code] | Pollution (optional) [code] | inside/outside [i\|o\|b] |
| H | C03 | | b |
| H | F02 | | b |
| L | D03 | | b |
| M | H03 | O | b |
| L | J03 | | b |
| H | C02 | | b |
| L | G04 | | b |

| Positive Impacts | | | |
|---|---|---|---|
| Rank | Activities, management [code] | Pollution (optional) [code] | inside/outside [i\|o\|b] |

Rank: H = high, M = medium, L = low
Pollution: N = Nitrogen input, P = Phosphor/Phosphate input, A = Acid input/acidification,
T = toxic inorganic chemicals, O = toxic organic chemicals, X = Mixed pollutions
i = inside, o = outside, b = both

### 4.5 Documentation

For information on this site, including the Selection Assessment Document, Conservation Objectives and Advice on Activities document, as well as information about the identification process of the UK network of harbour porpoise SACs, see the Site Information Centre (see link) for this site. NB. It should be noted that because the population size estimate (Section 3.2) is from a one-month survey in a single year it cannot be considered as a specific population number for the site. It is therefore not appropriate to use site population estimates in any assessments of effects of plans or projects (i.e. Habitats Regulations Assessments). Refer to the bodies responsible for the site management.

Link(s): http://jncc.defra.gov.uk/page-7243

## 6. SITE MANAGEMENT

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### 6.1 Body(ies) responsible for the site management:

| | |
|---|---|
| Organisation: | Natural England |
| Address: | |
| Email: | |

| | |
|---|---|
| Organisation: | Joint Nature Conservation Committee |
| Address: | |
| Email: | |

**6.2 Management Plan(s):**
An actual management plan does exist:

| | |
|---|---|
| [ ] | Yes |
| [ ] | No, but in preparation |
| [X] | No |

## 7. MAP OF THE SITES

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INSPIRE ID:

Map delivered as PDF in electronic format (optional)

[ ] Yes [X] No

Reference(s) to the original map used for the digitalisation of the electronic boundaries (optional).

# EXPLANATION OF CODES USED IN THE NATURA 2000 STANDARD DATA FORMS

The codes in the table below are also explained in the official European Union guidelines for the Standard Data Form. The relevant page is shown in the table below.

### 1.1 Site type

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| A | SPA (classified Special Protection Area) | 53 |
| B | cSAC, SCI or SAC (candidate Special Area of Conservation, Site of Community Importance, designated Special Area of Conservation) | 53 |
| C | SPA area/boundary is the same as the cSAC/SCI/SAC i.e. a co-classified/designated site (Note: in the UK Natura 2000 submission, this is only used in Gibraltar) | 53 |

### 3.1 Habitat representatively

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| A | Excellent representatively | 57 |
| B | Good representatively | 57 |
| C | Significant representatively | 57 |
| D | Non-significant presence representatively | 57 |

### 3.1 Habitat code

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| 1110 | Sandbanks which are slightly covered by sea water all the time | 57 |
| 1130 | Estuaries | 57 |
| 1140 | Mudflats and sandflats not covered by seawater at low tide | 57 |
| 1150 | Coastal lagoons | 57 |
| 1160 | Large shallow inlets and bays | 57 |
| 1170 | Reefs | 57 |
| 1180 | Submarine structures made by leaking gases | 57 |
| 1210 | Annual vegetation of drift lines | 57 |
| 1220 | Perennial vegetation of stony banks | 57 |
| 1230 | Vegetated sea cliffs of the Atlantic and Baltic Coasts | 57 |
| 1310 | Salicornia and other annuals colonizing mud and sand | 57 |
| 1320 | Spartina swards (Spartinion maritimae) | 57 |
| 1330 | Atlantic salt meadows (Glauco-Puccinellietalia maritimae) | 57 |
| 1340 | Inland salt meadows | 57 |
| 1420 | Mediterranean and thermo-Atlantic halophilous scrubs (Sarcocornetea fruticosi) | 57 |
| 2110 | Embryonic shifting dunes | 57 |
| 2120 | Shifting dunes along the shoreline with Ammophila arenaria ("white dunes") | 57 |
| 2130 | Fixed coastal dunes with herbaceous vegetation ("grey dunes") | 57 |
| 2140 | Decalcified fixed dunes with Empetrum nigrum | 57 |
| 2150 | Atlantic decalcified fixed dunes (Calluno-Ulicetea) | 57 |
| 2160 | Dunes with Hippopha• rhamnoides | 57 |
| 2170 | Dunes with Salix repens ssp. argentea (Salicion arenariae) | 57 |
| 2190 | Humid dune slacks | 57 |
| 21A0 | Machairs (* in Ireland) | 57 |
| 2250 | Coastal dunes with Juniperus spp. | 57 |
| 2330 | Inland dunes with open Corynephorus and Agrostis grasslands | 57 |
| 3110 | Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae) | 57 |
| 3130 | Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Isoëto-Nanojuncetea | 57 |
| 3140 | Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. | 57 |
| 3150 | Natural eutrophic lakes with Magnopotamion or Hydrocharition - type vegetation | 57 |

### 3.1 Relative surface

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| A | > 15%-100% | 58 |
| B | > 2%-15% | 58 |
| C | ≤ 2% | 58 |

### 3.1 Degree of conservation

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| A | Excellent conservation | 59 |
| B | Good conservation | 59 |
| C | Average or reduced conservation | 59 |

### 3.1 Global assessment

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| A | Excellent value | 59 |
| B | Good value | 59 |
| C | Significant value | 59 |

### 3.2 Population (abbreviated to ‘Pop.’ in data form)

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| A | > 15%-100% | 62 |
| B | > 2%-15% | 62 |
| C | ≤ 2% | 62 |
| D | Non-significant population | 62 |

### 3.2 Degree of conservation (abbreviated to ‘Con.’ in data form)

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| A | Excellent conservation | 63 |
| B | Good conservation | 63 |
| C | Average or reduced conservation | 63 |

### 3.2 Isolation (abbreviated to ‘Iso.’ in data form)

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| A | Population (almost) Isolated | 63 |
| B | Population not-isolated, but on margins of area of distribution | 63 |
| C | Population not-isolated within extended distribution range | 63 |

### 3.2 Global Grade (abbreviated to ‘Glo.’ or ‘G.’ in data form)

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| A | Excellent value | 63 |
| B | Good value | 63 |
| C | Significant value | 63 |

### 3.3 Assemblages types

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| WATR | Non-breeding waterbird assemblage | UK specific code |
| SBA | Breeding seabird assemblage | UK specific code |
| BBA | Breeding bird assemblage (applies only to sites classified pre 2000) | UK specific code |

### 4.1 Habitat class code

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| N01 | Marine areas, Sea inlets | 65 |
| N02 | Tidal rivers, Estuaries, Mud flats, Sand flats, Lagoons (including saltwork basins) | 65 |
| N03 | Salt marshes, Salt pastures, Salt steppes | 65 |
| N04 | Coastal sand dunes, Sand beaches, Machair | 65 |
| N05 | Shingle, Sea cliffs, Islets | 65 |
| N06 | Inland water bodies (Standing water, Running water) | 65 |
| N07 | Bogs, Marshes, Water fringed vegetation, Fens | 65 |
| N08 | Heath, Scrub, Maquis and Garrigue, Phygrana | 65 |
| N09 | Dry grassland, Steppes | 65 |
| N10 | Humid grassland, Mesophile grassland | 65 |
| N11 | Alpine and sub-Alpine grassland | 65 |
| N14 | Improved grassland | 65 |
| N15 | Other arable land | 65 |
| N16 | Broad-leaved deciduous woodland | 65 |
| N17 | Coniferous woodland | 65 |
| N19 | Mixed woodland | 65 |
| N21 | Non-forest areas cultivated with woody plants (including Orchards, groves, Vineyards, Dehesas) | 65 |
| N22 | Inland rocks, Screes, Sands, Permanent Snow and ice | 65 |
| N23 | Other land (including Towns, Villages, Roads, Waste places, Mines, Industrial sites) | 65 |
| N25 | Grassland and scrub habitats (general) | 65 |
| N26 | Woodland habitats (general) | 65 |

### 4.3 Threats code

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| A01 | Cultivation | 65 |
| A02 | Modification of cultivation practices | 65 |
| A03 | Mowing / cutting of grassland | 65 |
| A04 | Grazing | 65 |
| A05 | Livestock farming and animal breeding (without grazing) | 65 |
| A06 | Annual and perennial non-timber crops | 65 |
| A07 | Use of biocides, hormones and chemicals | 65 |
| A08 | Fertilisation | 65 |
| A10 | Restructuring agricultural land holding | 65 |
| A11 | Agriculture activities not referred to above | 65 |
| B01 | Forest planting on open ground | 65 |
| B02 | Forest and Plantation management & use | 65 |
| B03 | Forest exploitation without replanting or natural regrowth | 65 |
| B04 | Use of biocides, hormones and chemicals (forestry) | 65 |
| B06 | Grazing in forests/ woodland | 65 |
| B07 | Forestry activities not referred to above | 65 |
| C01 | Mining and quarrying | 65 |
| C02 | Exploration and extraction of oil or gas | 65 |
| C03 | Renewable abiotic energy use | 65 |
| D01 | Roads, paths and railroads | 65 |
| D02 | Utility and service lines | 65 |
| D03 | Shipping lanes, ports, marine constructions | 65 |
| D04 | Airports, flightpaths | 65 |
| D05 | Improved access to site | 65 |
| E01 | Urbanised areas, human habitation | 65 |
| E02 | Industrial or commercial areas | 65 |

## 5.1 Designation type codes

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| UK00 | No Protection Status | 67 |
| UK01 | National Nature Reserve | 67 |
| UK04 | Site of Special Scientific Interest (UK) | 67 |
| UK05 | Marine Conservation Zone | 67 |
| UK06 | Nature Conservation Marine Protected Area | 67 |
| UK86 | Special Area (Channel Islands) | 67 |
| UK98 | Area of Special Scientific Interest (NI) | 67 |
| IN00 | Ramsar Convention site | 67 |
| IN08 | Special Protection Area (SPA, EC Birds Directive) | 67 |
| IN09 | Special Area of Conservation (SAC, EC Habitats Directive) | 67 |

# Inshore and Offshore Special Area of Conservation: Southern North Sea

## SAC Selection Assessment Document


January 2017

## Further information

This document is available as a pdf file on the JNCC website for download if required (www.jncc.gov.uk).

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# 1. Introduction

This document provides detailed information about the Southern North Sea site proposed for designation for the Annex II species harbour porpoise (*Phocoena phocoena*) and evaluates this interest feature according to the Habitats Directive[1] selection criteria and guiding principles. This is a single feature site, proposed to be designated solely for the purpose of aiding the management of harbour porpoise populations throughout UK waters, in accordance with EU legislation. The site includes parts of both territorial waters (out to 12 nautical miles from the baseline) and offshore waters (from 12 nautical miles from the coast out to 200 nautical miles or to the UK Continental Shelf limit), and is therefore a joint responsibility between the Joint Nature Conservation Committee (JNCC) and Natural England (NE).

The Conservation of Habitats and Species Regulations 2010[2] (as amended) transpose the Habitats Directive into law on land and in territorial waters of England and Wales. The Offshore Marine Conservation (Natural Habitats &c.) Regulations 2007[3] (as amended in 2010) transpose the Habitats Directive into law for UK offshore waters.

The advice contained in the present document is produced to enable the Secretary of State to decide whether he/she proposes to submit the Southern North Sea site to the European Commission as a site eligible for designation as a Special Area of Conservation (SAC), in accordance with Regulation 10 of the Conservation of Habitats and Species Regulations 2010 (as amended), and Regulation 7 of the Offshore Marine Conservation (Natural Habitats &c) Regulation 2007 (as amended). JNCC and NE have been asked by Defra to provide this advice.

The Habitats Directive aims to conserve biodiversity by maintaining or restoring Annex I habitats and Annex II species to a favourable conservation status. Member States are required to contribute to a coherent European ecological network of protected sites through designation of SACs for natural habitats and wild species listed on the Annexes of the Directive. Sites eligible for designation as marine SACs are selected on the basis of the criteria set out in Annex III (Stage 1) of the Habitats Directive and relevant scientific information. Sites are considered only if they host a Habitats Directive Annex I habitat or Annex II species. For Annex II aquatic species that range over wide areas, sites must clearly identify areas that represent the physical and biological factors essential to these species' life and reproduction. Socio-economic factors are not taken into account in the identification of sites to be proposed to the European Commission.

While some wide-ranging highly mobile aquatic species have clearly-defined breeding/nurturing/feeding areas (i.e. areas 'essential to their life and reproduction'), the harbour porpoise is a naturally widely-distributed cetacean in European North Atlantic waters, and relatively little is known about its breeding behaviour. In addition, there are few obvious natural site boundaries for mobile species in the open sea. In practice, therefore, Article 4 of the Habitats Directive, which requires Member States to propose sites for Annex II species, and Annex III (site selection criteria) have proved difficult to apply to this species.

To address this problem, the European Commission (EC) held a workshop involving experts in December 2000 and published guidance on the designation of SACs for harbour porpoise in 2007 (EC, 2007). The guidance states that '*it is possible to identify areas representing crucial factors for the life cycle of this species. These areas would be identifiable on the basis of:*

- *the continuous or regular presence of the species (although subject to seasonal variations);*
- *good population density (in relation to neighbouring areas);*
- *high ratio of young to adults during certain periods of the year and*

[1] http://www.central2013.eu/fileadmin/user_upload/Downloads/Document_Centre/OP_Resources/HABITAT_DIRECTIVE_92-43-EEC.pdf
[2] http://www.legislation.gov.uk/uksi/2010/490/pdfs/uksi_20100490_en.pdf
[3] http://www.legislation.gov.uk/uksi/2007/1842/pdfs/uksi_20071842_en.pdf

- *other biological elements are characteristic of these areas, such as very developed social and sexual life.'*

The guidance also states that '*defining boundaries for 'sites' in offshore waters which support a given percentage of the national population of some mobile species may be difficult due to the lack of obvious natural boundaries (such as coast, topographical boundaries, etc.) in the open sea. This criterion is also challenging to use in the offshore marine environment where populations may often be distributed across several national boundaries.'* Therefore, the application of these additional criteria has also proven difficult.

In addition to information on the Annex II species hosted within the site, this document contains;

i) a map of the site;
ii) its name, location and extent;
iii) the data resulting from application of the criteria specified in Annex III (Stage 1) to the Habitats Directive.

In preparing this document, JNCC and NE have taken into consideration the format established by the European Commission, under which the Member States are required to provide site information to the Commission when proposing candidate SACs. This format is set out in the 'Natura 2000 Standard data form'[4] (prepared by the European Topic Centre for Biodiversity and Nature Conservation on behalf of the European Commission to collect standardised information on SACs throughout Europe).

[4] The Standard Data Form template is available here: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32011D0484&from=EN

# 2. Background to identification of harbour porpoise Special Areas of Conservation in UK waters

The Joint Cetacean Protocol (JCP) was created in 2004 and is amongst the largest collation of standardised survey data on harbour porpoise in the world, comprising 39 data sources with data from at least 545 distinct survey platforms (ships and aircraft) representing over 1.05 million km of survey effort (coverage) over an 18-year period from 1994-2011. DHI Water Environments (UK) Ltd (DHI) were contracted by JNCC to undertake an analysis of these data in order to determine if persistent areas of high harbour porpoise density were present in the wider UK seas (Heinänen and Skov, 2015). This study will hereafter be referred to as the DHI analysis/model.

Partly to ensure geographic representation, UK waters were divided into three Management Units (MUs)[5] identified by the Interagency Marine Mammal Working Group (IAMMWG): the North Sea (NS), the Celtic and Irish Seas (CIS) and West Scotland (WS). These MUs align with the UK parts of the Assessment Units[6] proposed for the harbour porpoise by the International Council for the Exploration of the Sea (ICES) in their advice to OSPAR. The Management Units were selected to combine what we understand of the ecology of harbour porpoise with the practicality of managing human activities.

The DHI analysis modelled the relationship between environmental variables and the observed harbour porpoise distribution to develop distribution models in each MU. These models described discrete areas of predicted high porpoise density and captured the year-to-year variation within the different locations. Areas within the MUs that were identified to persistently have the top 10% of predicted high densities of harbour porpoise were considered in detail in the analysis. Areas of Search (AoS), within which the final SAC boundaries would be identified, were selected based on these top 10% of predicted high density areas. The top 10% areas were filtered by model confidence and areas of less than 500km$^2$ were removed on the grounds that such small areas are ineffective for harbour porpoise conservation in relation to the much larger AoS identified in the Management Units. Sites within the AoS were restricted to higher confidence areas only7.

Sufficiency, seasonality and geographic spread of sites were considered in order to identify a network of recommended draft SACs (rdSACs). Sufficiency thresholds of 20% of the nominal UK harbour porpoise abundance and 10-14% of the UK habitat for the species[7] within the rdSACs of each MU were met.

A UK network of sites for harbour porpoise was submitted to Government as draft SACs (dSACs) in June 2015. Once the sites gain approval from Governments to go to consultation, the classification changes from dSACs to possible SACs (pSACs), once submitted to the European Commission they are classed as candidate SACs (cSACs). The Governments of Wales and Northern Ireland, and Defra on behalf of England and offshore decided to proceed to consultation with five of the sites (Figure 1), subject to an adjustment to the North Channel SAC boundary. This adjustment reflected the decision by Scottish Ministers not to proceed with pSACs in their waters at that time. Together with the existing Skerries & Causeway SAC (grade C for harbour porpoise), these five sites cover 10.3% of the UK habitat and 18.7% of the UK population[8] of harbour porpoises, and are distributed in territorial and offshore waters throughout the North Sea MU and the Celtic and Irish Seas MU. In addition, there are 34 UK SACs which already list harbour porpoise as a non-qualifying feature (grade D) in UK waters. The five sites consulted on were submitted to the European Commission as cSACs on 30th January 2017.

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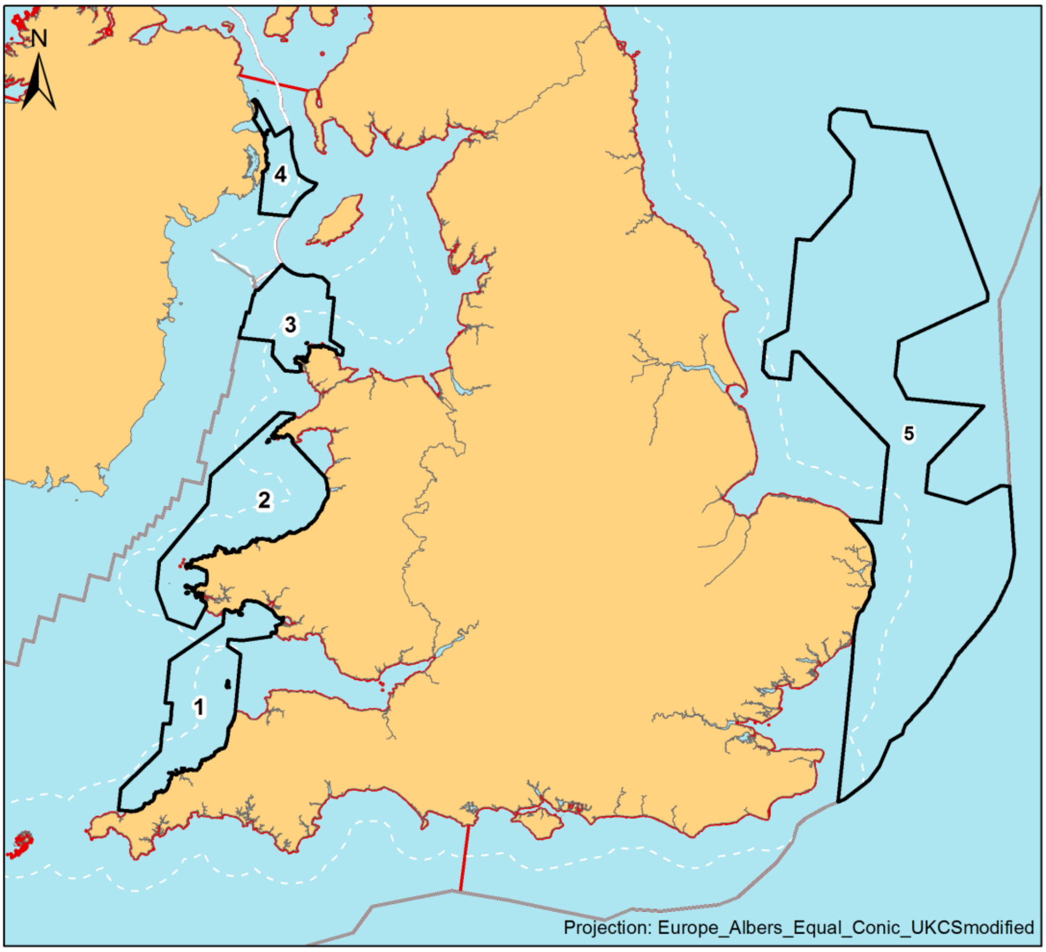
[5] IAMMWG, 2015. Management Units for cetaceans in UK waters (January 2015). JNCC Report No. 547, JNCC Peterborough. 37pp.

[6] ICES. 2014 available from http://www.ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/acom/2014/WGMME/wgmme_2014.pdf

[7] IAMMWG, 2015. The use of harbour porpoise sightings data to inform the development of draft Special Areas of Conservation in UK waters. JNCC Report No. 565, JNCC Peterborough. 29pp.

[8] UK habitat for harbour porpoise is considered the UK continental shelf which is approximated by waters of 200m depth or less.

Along with all other Member States, the UK has legal obligations to protect harbour porpoises throughout the territory over which it exercises sovereignty. The network of protected sites will contribute towards maintaining the favourable conservation status of the wider population of harbour porpoise. Alongside and in addition to the identification of the network of harbour porpoise sites, an overarching conservation strategy[9] has been in place for harbour porpoise since 2000. This was further reviewed in 2009 and will continue to be reviewed and updated when necessary.




Possible SAC boundary

1. Bristol Channel Approaches
2. West Wales Marine
3. North Anglesey Marine
4. North Channel
5. Southern North Sea

UK EEZ (Apr. 2014)
Northern Ireland Adjacent Water boundary (NI 2002)
UK Territorial Seas
MU boundary



**Figure 1:** A network of five possible SACs (pSACs) for harbour porpoise in Wales, England, Northern Ireland and offshore waters**.**

[9] DETR. 2000. A UK conservation strategy for the harbour porpoise (*Phocoena phocoena*). Department for the Environment Transport and the Regions; Ministry of Agriculture, Fisheries and Food; Scottish Executive Rural Affairs Department; Department of Agriculture and Rural Development (Northern Ireland); National Assembly for Wales Environment Division; Department of the Environment in Northern Ireland

## 3. Southern North Sea SAC: Selection Assessment

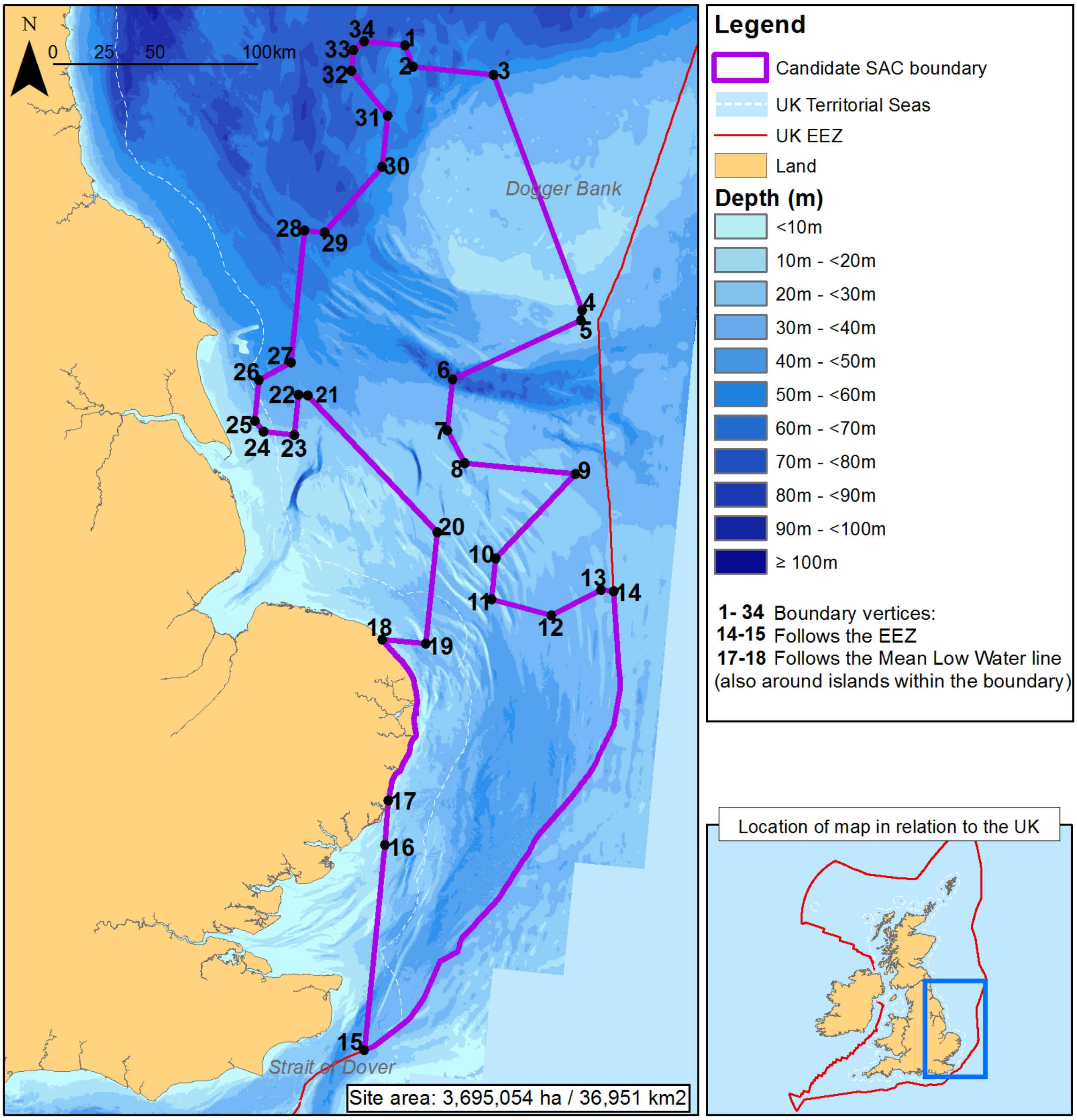
| | |
|---|---|
| **Site name**<br>Southern North Sea | **Site centre location**<br>53º33'03.6"N, 01º47'59.6"E<br>(Datum: WGS 1984) |
| **Site surface area**<br>3,695,054ha / 36,951km$^2$<br>(Datum: Europe Albers Equal Area modified to UK, calculated in ArcGIS) | **Biogeographic region**<br>Atlantic |
| **Administrative Region**<br>UK offshore waters (JNCC)<br>English inshore waters (NE) | **Percentage cover within region**<br>Offshore waters: 88%<br>English inshore waters: 12% |

## 4. Interest features under the EU Habitats Directive

1351: Harbour porpoise (*Phocoena phocoena*)

## 5. Map of site

Southern North Sea






| ID | Latitude | Longitude | ID | Latitude | Longitude | ID | Latitude | Longitude | ID | Latitude | Longitude |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 55° 28' 53.1" N | 01° 02' 24.8" E | 10 | 53° 17' 32.9" N | 02° 11' 31.6" E | 19 | 52° 53' 06.4" N | 01° 45' 21.9" E | 28 | 54° 37' 00.5" N | 00° 27' 44.8" E |
| 2 | 55° 23' 34.2" N | 01° 07' 24.8" E | 11 | 53° 06' 45.7" N | 02° 11' 43.8" E | 20 | 53° 22' 42.4" N | 01° 44' 22.2" E | 29 | 54° 37' 11.8" N | 00° 37' 01.8" E |
| 3 | 55° 24' 03.2" N | 01° 45' 17.6" E | 12 | 53° 04' 11.8" N | 02° 38' 38.6" E | 21 | 53° 54' 05.6" N | 00° 39' 29.7" E | 30 | 54° 56' 28.6" N | 00° 59' 18.7" E |
| 4 | 54° 25' 05.4" N | 02° 37' 56.9" E | 13 | 53° 12' 19.1" N | 02° 59' 22.3" E | 22 | 53° 54' 00.3" N | 00° 35' 04.2" E | 31 | 55° 09' 56.9" N | 00° 58' 38.1" E |
| 5 | 54° 22' 23.6" N | 02° 37' 58.3" E | 14 | 53° 12' 19.0" N | 03° 04' 57.1" E | 23 | 53° 43' 17.2" N | 00° 35' 41.1" E | 32 | 55° 20' 23.2" N | 00° 39' 10.7" E |
| 6 | 54° 03' 07.5" N | 01° 43' 06.7" E | 15 | 51° 04' 38.9" N | 01° 39' 44.1" E | 24 | 53° 43' 00.0" N | 00° 22' 03.6" E | 33 | 55° 25' 46.4" N | 00° 38' 51.5" E |
| 7 | 53° 49' 40.4" N | 01° 43' 32.5" E | 16 | 51° 59' 04.9" N | 01° 38' 08.0" E | 25 | 53° 45' 35.5" N | 00° 17' 20.7" E | 34 | 55° 28' 33.4" N | 00° 43' 26.4" E |
| 8 | 53° 41' 38.9" N | 01° 52' 54.2" E | 17 | 52° 10' 53.8" N | 01° 37' 10.6" E | 26 | 53° 56' 22.0" N | 00° 16' 38.8" E | | | |
| 9 | 53° 41' 57.7" N | 02° 42' 50.7" E | 18 | 52° 52' 51.5" N | 01° 26' 06.6" E | 27 | 54° 02' 03.1" N | 00° 30' 01.3" E | | | |

# 6. Site summary

The Southern North Sea site is located in the North Sea MU and has been recognised as an area with predicted persistent high densities of harbour porpoise. The main area included within the site covers important winter and summer habitat, which emerged as part of the top 10% persistent high density areas for these seasons within the UK. Approximately two thirds of the site, the northern part, is recognised as important for porpoises during the summer season, whilst the southern part is more important during the winter.

The Southern North Sea site is very large and covers an area of 36,951km$^2$ stretching from the central North Sea north of the Dogger Bank southwards to the Strait of Dover. The water depths within the site range between 10m and 75m, with the majority of the site shallower than 40m. The majority of the substrate types within the site are categorised as sublittoral sand and sublittoral coarse sediment (Eunis level 3, EUSeaMap). The boundary of the Southern North Sea site crosses four other Special Areas of Conservation. The four SACs, the Dogger Bank SAC, Margate and Long Sands SAC, the North Norfolk Sandbanks and Saturn Reef SAC and Haisborough, Hammond and Winterton SAC, are all classified for their Annex I habitat of 'Sandbanks which are slightly covered by sea water all the time' and the latter two are also designated for 'Reef'.

Defining habitats of cetaceans is problematic; this is primarily due to their highly mobile nature and their distribution being driven mainly by the distribution and availability of their prey. In the absence of prey data, relationships between habitat variables (such as depth, water temperature, seabed sediment etc) are often used as proxies of prey distribution (e.g. Marubini *et al,* 2009; Skov & Thomsen, 2008; Embling *et al,* 2010). Regional variation in these relationships between habitat variables occurs and was evident between the Management Units in the analyses undertaken by DHI.

The analyses undertaken by DHI used several different environmental variables and modelled them against observed density of harbour porpoise for each MU. In all MUs, the coarseness of the seabed sediment was important, with porpoises showing a preference for coarser sediments (such as sand/gravel) rather than fine sediments (e.g. mud). Similar habitat associations have been made in the eastern part of the North Sea (Skov *et al,* 2014). Sandeels (*Ammodytidae*), which are known prey for harbour porpoises, exhibit a strong association with particular surface sediments (Benke & Siebert, 1996; Santos, 1998). Fine particle fractions have been demonstrated to limit the distribution of the lesser sandeel (*Ammodytes marinus*) around the Shetland Isles (Wright *et al,* 2000). Harbour porpoise feed on a wide variety of fish and generally focus on the most abundant local species. The predominant prey type appears to be bottom-dwelling fish, although shoaling fish such as mackerel (*Scomber scombrus*) and herring (*Clupea harengus*) are also taken (Santos & Pierce, 2003; Pierce *et al,* 2007).

For the North Sea MU the DHI model results for both the summer and winter seasons show water depth and variables within the water column are the most important physical factors that increase the probability of presence and density of harbour porpoise. The harbour porpoise density in the North Sea MU peaked in stable waters (based on vertical differences in temperature) with lower gradients of eddy activity (turbulence); higher densities were also found in areas with current speeds of 0.4-0.6m/s. The analysis indicated a preference for water depths between 30 and 50m throughout the year. There was a negative relationship with increasing levels of traffic beyond a threshold of approximately 80 ships per day.

The physical characteristics of the Southern North Sea site are well aligned to the environmental variables determining the probability of presence and the density of harbour porpoise. The majority of the site incorporates shallow depths of around 40m (see section 5). The seabed energy layer of EU SeaMap[10] indicates that the energy levels, including current and wave energy, are predominantly medium across the majority of the site.

# 7. Site boundary

To date, the guidance developed by JNCC for defining SAC boundaries for marine sites away from the coast has focused on habitat features; largely from modelled data. The harbour porpoise sites are also, in part, based on modelled data and the outputs predict areas with expected high densities of harbour porpoise. The outputs from this approach and that for habitat features are similar. Therefore, the guidelines are largely transferable to consideration of boundaries for harbour porpoise sites:

1. As a general principle, site boundaries should be drawn closely around the qualifying feature for which the sites have been selected, taking into account the need to ensure that the site operates as a functional whole for the conservation of the feature;
2. Where possible, the seaward boundaries of the sites should be drawn using straight lines to ensure ease of identification on charts and at sea (and thereby minimising the number of nodes in the boundary where feasible);
3. However, a balance is needed between more complex site shapes drawn more tightly around the feature and simple square/rectangular boundaries so that the area of ‘non-interest-feature’ included within the site boundary is minimised, but this should not be to the detriment of the structural and functional integrity of the interest feature;
4. Site boundary coordinates be provided in degrees, minutes, seconds.

The nature of the boundaries for the recommended draft SAC were ‘blocky’ due to their emergence from the 25km$^2$ gridded model output of the DHI analysis (5km x 5km grid squares). Additional principles for creating boundaries for the harbour porpoise sites were also needed:

5. Diagonal runs of pixels (the DHI grid squares) should be straightened by a line that approximates the centre of the diagonal;
6. Vertical and horizontal lengths of more than two pixels of the sites were maintained whenever possible to preserve overall shape;
7. Modifications of the boundary of each recommended draft SACs should not alter the total area of the site by more than approximately 5%;
8. Candidate SACs will not extend into rivers;
9. Estuaries are excluded where the width of the entrance is ≤2km and the model did not indicate the area was included;
10. The ‘coastal’ edge of sites is defined by the Mean Low Water (MLW) tide line;
11. In England, small ports and harbours, which have enclosed inner harbours areas, have been excluded.
12. Site boundaries were aligned with the EEZ boundary where they were closely aligned.

[10] Phase 1 energy layers are available for download from EUSeaMap: http://www.emodnet-seabedhabitats.eu/default.aspx?page=1953

# 8. Assessment of interest feature against selection criteria

## 8.1. Harbour porpoise (*Phocoena phocoena*)

## Annex III selection criteria for Annex II Species: Stage 1B

Stage 1 of Annex III of the Habitats Directive refers to the assessment at national level of the relative importance of sites based on:

(a) Size and density of the population of the species present on the site in relation to the populations present within national territory.
(b) Degree of conservation of the features of the habitat which are important for the species concerned and restoration possibilities.
(c) Degree of isolation of the population present on the site in relation to the natural range of the species.
(d) Global assessment of the value of the site for conservation of the species concerned.

As UK waters are divided into Management Units to ensure geographic coverage and to facilitate management for harbour porpoise, each site has been assessed in relation to the MU rather than at the national level.

### a) Proportion of UK part of the North Sea Management Unit population[11]

Abundance estimates calculated for each site were used directly to grade criterion iii a) *Size and density of the population of the species present on the site in relation to the populations present within national territory.* The identification of SACs for harbour porpoise has been driven by assessments at the scale of national territory within Management Units to ensure sites constitute a geographically *representative* network; the criterion has been applied at this scale.

The explanatory notes to the Natura 2000 standard data form suggest the following ranking to grade the sites based on the size of the population in the site relative to the population in the national territory (criterion III (a)) and for the purpose of harbour porpoise candidate SACs, relative to the relevant UK management unit:

Grade A: >15% to 100% of the relevant UK management unit population
Grade B: >2% to 15% of the relevant UK management unit population
Grade C: >0% to 2% of the relevant UK management unit population

The candidate SACs are '*clearly identifiable'* based on the modelling and persistence analyses undertaken by DHI. The analytical approach taken by DHI incorporated some of the sub-criteria of the European Commission guidance for identifying sites for marine mobile species (EC, 2007), such as sub-criteria *'Continuous or regular presence of the species (although subject to seasonal variations', 'Good population density (in relation to neighbouring areas)'* and some elements of sub-criteria *'Other biological elements that are characteristics, such as very developed social and sexual life'*. All of the sites have regular presence of harbour porpoise, whilst some show seasonal variation. It was not possible to assess the ratio of young to adults because data have not been collected consistently at an appropriate scale. The abundance within the candidate SACs can be estimated from existing survey data (Hammond *et al,* 2013) and thereby Criterion III (a) can be applied directly for the purposes of grading the site.

The Southern North Sea site was identified as being within the top 10% of persistent high density areas for harbour porpoise in UK waters for both winter and summer seasons (Heinänen and Skov, 2015). Due to the large area of the Southern North Sea site, the population supported is substantial in the UK and

[11] UK MU population is defined throughout this document as 'the UK portion of the MU where water depths are 200m or less'.

European context. It is estimated (based on the SCANS-II survey which took place in July 2005 only) that the site supports approximately 18,500 individuals (95% Confidence Interval: 11,864 - 28,889) for at least part of the year, as seasonal differences are likely to occur, and represents approximately 17.5% of the population within the UK part of the North Sea MU. It should be noted that because this estimate is from a one-month survey in a single year it cannot be considered as a specific population number for the site. It is therefore not appropriate to use site population estimates in any assessments of effects of plans or projects (i.e. Habitats regulation Assessments), as these need to take into consideration population estimates at the MU level, to account for daily and seasonal movements of the animals.

Although survey effort was not constant for all months of the year, the DHI analysis showed high confidence in the modelling across the majority of the site during the winter and the summer season, indicating a year round presence of raised densities of harbour porpoise within the site.

***Therefore the Southern North Sea site has been identified as an important area for harbour porpoise during both seasons and, based on the figure of 17.5% of the North Sea MU population, the Southern North Sea site would be graded A on the basis of the EC standard data form (A = >15% to 100% of the UK part of the MU population).***

## b) Degree of conservation of the features of the habitat which are important for the species concerned and restoration possibilities

The five sites (Figure 1) cover approximately 10.3% of available porpoise habitat (continental shelf) and porpoise densities within this network are amongst the highest modelled for the population as indicated by the DHI analysis. This supports the notion that these areas, relative to the rest of the continental shelf, include the best habitat for harbour porpoises and have been used persistently over the last two decades. It is assumed that the preference for these habitats is associated with good feeding opportunities and prey aggregations. The available evidence indicates that the conservation status of the UK harbour porpoise population is currently Favourable[12]. Therefore, it is considered that the conservation of the feature in all the sites is graded as II (elements are well conserved), and ‘restoration possibilities’ do not have to be considered. Therefore, the overall grade for this criterion is at least grade B. We do not know which features of the habitat are the most important drivers of the association with prey; nor do we know what the main prey species of porpoise within the sites are. Until this is known, the quality of the habitat (good or excellent) cannot be determined, so a grade of A/B has been awarded.

***Therefore, with respect to the degree of conservation of the features of the habitat important for the harbour porpoise, the Southern North Sea site would be graded A/B (‘Excellent’/‘Good conservation’) overall, without the necessity for consideration of restoration possibilities.***

## c) Degree of isolation of the population present on the site in relation to the natural range of the species

As a wide-ranging species, the animals within the site cannot be considered isolated in relation to the rest of the population. Animals within the site are part of the wider MU population.

***Therefore, with respect to isolation, the Southern North Sea site would be graded C: population not isolated within extended distribution range.***

## d) Global assessment

The global assessment is weighted towards the grade awarded to the site for its size and density, given that the conservation of features is not clearly understood and the sites are all equal in quality with regard to their ‘degree of isolation’.

[12] http://jncc.defra.gov.uk/pdf/Article17Consult_20131010/S1351_UK.pdf

***Therefore, the Southern North Sea site is considered to have a global grade A, i.e. within the context of the UK North Sea management unit. It contains a significant proportion of both the UK MU (17.5%) and European population of harbour porpoises and it covers important and persistent high density areas for both summer and winter season.***

*Summary of grades for Stage 1B criteria*

| | **Proportion of UK MU Population (a)** | **Conservation of features (b)** | **Isolation of population (c)** | **Global assessment (d)** |
|---|---|---|---|---|
| **Southern North Sea** | A | A/B | C | A |

# 9. Supporting scientific documentation

The process leading to the selection of the Southern North Sea site was based on a combination of observed data and predictive modelling (Heinänen and Skov, 2015). The study investigated whether persistent high density areas of harbour porpoise could be identified in UK waters, using 18 years (1994 to 2011) of sea-based Joint Cetacean Protocol (JCP) data covering the entire UK EEZ.

The JCP assembled disparate effort-related cetacean sightings datasets from European / north-east Atlantic waters and included those from all major UK sources e.g. 'Small Cetacean Abundance in the North Sea and adjacent waters' SCANS & SCANS-II from 1994 and 2005 respectively (Hammond *et al,* 2002; Hammond *et al,* 2013); 'Cetacean Offshore Distribution and Abundance in European Atlantic' CODA surveys from 2007 (CODA, 2009); European Seabirds At Sea (ESAS), which collected and collated seabird and cetacean data from the majority of countries with a north-west European coastline between 1979 and 1999, with ad hoc surveys beyond 1999; Sea Watch Foundation (SWF; i.e. NGO led surveys); Atlantic Research Coalition (ARC); and from other non-governmental and marine renewable industry sources.

The DHI report addressed challenges, such as variable survey coverage in different parts of the UK EEZ within the study period, by developing statistical distribution models capable of predicting seasonal and yearly means. Where there were sufficient data, models were run for two seasons: summer and winter for each MU.

Data on concentrations of prey of harbour porpoises were not available for the entire EEZ at a fine spatial scale (5km). Therefore, physical oceanographic properties of currents, water masses and the seafloor were used as variables in the model. It is assumed that these variables affect the probability of harbour porpoises encountering prey. Mean shipping intensity was also included in the model to account for some anthropogenic disturbance.

The DHI model results indicate that densities of harbour porpoises are influenced by both oceanographic and pressure variables. The degree of influence of these factors varies in different parts of UK waters and with the different seasons. Analyses of the persistency of high density areas integrated evaluations of the number of years that high densities were predicted for an area, with evaluations of the degree of recent high densities as predicted by the distribution models. Due to the uneven survey effort over the period, the uncertainty in modelled distributions varied greatly. Robust model predictions (based on relative standard errors) were found in all shelf waters of the North Sea north of the Channel.

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# Information Sheet on Ramsar Wetlands (RIS)

*Categories approved by Recommendation 4.7 (1990), as amended by Resolution VIII.13 of the 8th Conference of the Contracting Parties (2002) and Resolutions IX.1 Annex B, IX.6, IX.21 and IX. 22 of the 9th Conference of the Contracting Parties (2005).*

Notes for compilers:

1. The RIS should be completed in accordance with the attached *Explanatory Notes and Guidelines for completing the Information Sheet on Ramsar Wetlands*. Compilers are strongly advised to read this guidance before filling in the RIS.

2. Further information and guidance in support of Ramsar site designations are provided in the *Strategic Framework for the future development of the List of Wetlands of International Importance* (Ramsar Wise Use Handbook 7, 2nd edition, as amended by COP9 Resolution IX.1 Annex B). A 3rd edition of the Handbook, incorporating these amendments, is in preparation and will be available in 2006.

3. Once completed, the RIS (and accompanying map(s)) should be submitted to the Ramsar Secretariat. Compilers should provide an electronic (MS Word) copy of the RIS and, where possible, digital copies of all maps.

---

**1. Name and address of the compiler of this form:**

FOR OFFICE USE ONLY.

| DD | MM | YY |
|---|---|---|
| | | |

Designation date

| | | | | | |
|---|---|---|---|---|---|
| | | | | | |

Site Reference Number

**Joint Nature Conservation Committee**
Monkstone House
City Road
Peterborough
Cambridgeshire PE1 1JY
UK
Telephone/Fax: +44 (0)1733 – 562 626 / +44 (0)1733 – 555 948
Email: RIS@JNCC.gov.uk

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**2. Date this sheet was completed/updated:**

Designated: 28 July 1994

**3. Country:**

**UK (England)**

**4. Name of the Ramsar site:**

**Thanet Coast and Sandwich Bay**

**5. Designation of new Ramsar site or update of existing site:**

**This RIS is for:** Updated information on an existing Ramsar site

**6. For RIS updates only, changes to the site since its designation or earlier update:**

**a) Site boundary and area:**

** Important note: If the boundary and/or area of the designated site is being restricted/reduced, the Contracting Party should have followed the procedures established by the Conference of the Parties in the Annex to COP9 Resolution IX.6 and provided a report in line with paragraph 28 of that Annex, prior to the submission of an updated RIS.

**b) Describe briefly any major changes to the ecological character of the Ramsar site, including in the application of the Criteria, since the previous RIS for the site:**

## 7. Map of site included:

Refer to Annex III of the *Explanatory Notes and Guidelines*, for detailed guidance on provision of suitable maps, including digital maps.

**a) A map of the site, with clearly delineated boundaries, is included as:**

i) **hard copy** (required for inclusion of site in the Ramsar List): *yes* ✓ -or- *no* □;
ii**) an electronic format** (e.g. a JPEG or ArcView image) Yes
iii) **a GIS file providing geo-referenced site boundary vectors and attribute tables** *yes* ✓ -or- *no* □;

**b) Describe briefly the type of boundary delineation applied:**

e.g. the boundary is the same as an existing protected area (nature reserve, national park etc.), or follows a catchment boundary, or follows a geopolitical boundary such as a local government jurisdiction, follows physical boundaries such as roads, follows the shoreline of a waterbody, etc.

The site boundary is the same as, or falls within, an existing protected area.

For precise boundary details, please refer to paper map provided at designation

## 8. Geographical coordinates (latitude/longitude):

51 18 18 N 01 22 47 E

## 9. General location:

Include in which part of the country and which large administrative region(s), and the location of the nearest large town.

Nearest town/city: Margate and Ramsgate

The site lies on the east Kent coast, between Deal to the south-east and Whitestable to the north-west.

**Administrative region:** Kent

## 10. Elevation (average and/or max. & min.) (metres): 11. Area (hectares): 2169.23

| | |
|---|---|
| Min. | -1 |
| Max. | 6 |
| Mean | 0 |

## 12. General overview of the site:

Provide a short paragraph giving a summary description of the principal ecological characteristics and importance of the wetland.

A coastal site, consisting of a long stretch of rocky shore, adjoining areas of estuary, sand dune, maritime grassland, saltmarsh and grazing marsh. The wetland habitats support 15 British Red Data Book invertebrates, as well as a large number of nationally scarce species. The site attracts internationally important numbers of turnstone *Arenaria interpres*, and nationally important numbers of nationally important wintering populations of four wader species: ringed plover, golden plover, grey plover and sanderling, as well as Lapland bunting. The site is used by large numbers of migratory birds.

## 13. Ramsar Criteria:

Circle or underline each Criterion applied to the designation of the Ramsar site. See Annex II of the *Explanatory Notes and Guidelines* for the Criteria and guidelines for their application (adopted by Resolution VII.11).

**2, 6**

## 14. Justification for the application of each Criterion listed in 13 above:

Provide justification for each Criterion in turn, clearly identifying to which Criterion the justification applies (see Annex II for guidance on acceptable forms of justification).

Ramsar criterion 2

Supports 15 British Red Data Book wetland invertebrates.

**Ramsar criterion 6 – species/populations occurring at levels of international importance.**

**Qualifying Species/populations (as identified at designation):**
**Species with peak counts in winter:**

| | |
|---|---|
| Ruddy turnstone , *Arenaria interpres interpres*, NE Canada, Greenland/W Europe & NW Africa | 1007 individuals, representing an average of 1% of the population (5 year peak mean 1998/9-2002/3) |

Contemporary data and information on waterbird trends at this site and their regional (sub-national) and national contexts can be found in the Wetland Bird Survey report, which is updated annually. See www.bto.org/survey/webs/webs-alerts-index.htm.

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**15. Biogeography** (required when Criteria 1 and/or 3 and /or certain applications of Criterion 2 are applied to the designation)**:**

Name the relevant biogeographic region that includes the Ramsar site, and identify the biogeographic regionalisation system that has been applied.

**a) biogeographic region:**

Atlantic

**b) biogeographic regionalisation scheme** (include reference citation):

Council Directive 92/43/EEC

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**16. Physical features of the site:**

Describe, as appropriate, the geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; downstream area; general climate, etc.

| | |
|---|---|
| Soil & geology | basic, neutral, shingle, sand, mud, clay, alluvium, peat, nutrient-rich, nutrient-poor, sedimentary, limestone/chalk |
| Geomorphology and landscape | lowland, coastal, valley, floodplain, barrier beach, intertidal sediments (including sandflat/mudflat), open coast (including bay), estuary, cave/tunnel, lagoon, cliffs, pools |
| Nutrient status | eutrophic, highly eutrophic |
| pH | alkaline |
| Salinity | brackish / mixosaline, fresh, saline / euhaline |
| Soil | mainly mineral, mainly organic |
| Water permanence | usually permanent |
| Summary of main climatic features | Annual averages (Greenwich, 1971–2000) (www.metoffice.com/climate/uk/averages/19712000/sites/greenwich.html)<br>Max. daily temperature: 14.8° C<br>Min. daily temperature: 7.2° C<br>Days of air frost: 29.1<br>Rainfall: 583.6 mm<br>Hrs. of sunshine: 1461.0 |

**General description of the Physical Features:**

Thanet Coast and Sandwich Bay consists of a long stretch of rocky shore, adjoining areas of estuary, sand dune, maritime grassland, saltmarsh and grazing marsh.

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## 17. Physical features of the catchment area:

Describe the surface area, general geology and geomorphological features, general soil types, general land use, and climate (including climate type).

Thanet Coast and Sandwich Bay consists of a long stretch of rocky shore, adjoining areas of estuary, sand dune, maritime grassland, saltmarsh and grazing marsh.

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## 18. Hydrological values:

Describe the functions and values of the wetland in groundwater recharge, flood control, sediment trapping, shoreline stabilization, etc.

Shoreline stabilisation and dissipation of erosive forces

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## 19. Wetland types:

Inland wetland, Marine/coastal wetland

| Code | Name | % Area |
|---|---|---|
| G | Tidal flats | 56 |
| D | Rocky shores | 15.5 |
| 4 | Seasonally flooded agricultural land | 15 |
| M | Rivers / streams / creeks: permanent | 10 |
| Xf | Freshwater, tree-dominated wetlands | 1 |
| E | Sand / shingle shores (including dune systems) | 0.9 |
| F | Estuarine waters | 0.8 |
| Tp | Freshwater marshes / pools: permanent | 0.6 |
| H | Salt marshes | 0.2 |

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## 20. General ecological features:

Provide further description, as appropriate, of the main habitats, vegetation types, plant and animal communities present in the Ramsar site, and the ecosystem services of the site and the benefits derived from them.

Chalk cliffs and rocky shore: Much of the Thanet coastline consists of chalk cliffs, approx. 75% of which has been subjected to the building of sea defences. Where the cliffs are undefended they contain a large number of sea caves which are are rich in marine algae. The chalk shore platform is the most extensive such area in the UK and supports a range of characteristic biotopes.

Sand/mud flats: There are extensive areas of intertidal mud and sand flat that are attractive to waders.

Saltmarsh: The relatively small areas of saltmarsh integrate in some areas with the sand dune communities. Common species include *Puccinellia maritima*, *Atriplex portulacoides*, and *Limonium vulgare*. Scarce plants include *Inulia crithmoides*.

Shingle beach: The coastline around Sandwich and Reculver is fringed by shingle beach, mostly unvegetated. There are small areas of vegetated shingle with species such as *Glaucium flavum*, and *Crambe maritima*.

Sand dune: Part of the site includes a part of a larger area of dune grassland. Here there are small areas of young *Ammophila arenaria* dune, with large areas of fixed dune, dominated by *Festuca rubra*, *Galium verum* communities. The scarce rush *Juncus acutus* occurs here. Lizard orchid *Himantoglossum hircinum* and bedstraw broomrape *Orobanche caryophyllacea* both occur on the dune grassland.

There are extensive areas of grazing marsh located in some areas on alluvial deposits, and in other areas on thick beds of peat. The peat-dominated areas have the greatest interest, supporting the nationally scarce *Potamogeton coloratus* and *Sparganium minimum* at its only locality in south-east England; the ditches support a wide diversity of aquatic plants typical of south-eastern grazing marsh, other scarce species include *Myriophyllum verticillatum* and *Althaea officinalis*. Much of the grazing marsh has been subject to agricultural improvement. A few fields remain, however, with an unimproved turf and a relatively diverse flora.

Arable: Some areas of grazing marsh have been ploughed and drained. The ditches retain some water, but with an impoverished flora, dominated by emergents such as *Typha latifolia*, *T. angustifolia* and *Phragmites australis*.

Ecosystem services

## 21. Noteworthy flora:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in **12**. Justification for the application of the Criteria) indicating, e.g. which species/communities are unique, rare, endangered or biogeographically important, etc. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

**Nationally important species occurring on the site.**

**Higher Plants.**

*Juncus acutus, Potamogeton coloratus, Ceratophyllum submersum, Myriophyllum verticillatum, Carex divisia, Althaea officinalis, Frankenia laevis, Inula crithmoides*

Non-wetland higher plants of importance:

Plants of sand dunes: *Himantoglossum hircinum* (90% UK population on dunes at Sandwich Bay); *Orobanche caryophyllacea*.

Plants of chalk cliffs: *Brassica oleracea* var. *oleracea*; *Matthiola incana*; *Matthiola sinuata*; *Limonium binervosum*.

## 22. Noteworthy fauna:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in **12**. Justification for the application of the Criteria) indicating, e.g. which species/communities are unique, rare, endangered or biogeographically important, etc., including count data. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

**Birds**

**Species currently occurring at levels of national importance:**

**Species with peak counts in spring/autumn:**

| | |
|---|---|
| Ringed plover , *Charadrius hiaticula*, Europe/Northwest Africa | 649 individuals, representing an average of 2% of the GB population (5 year peak mean 1998/9-2002/3) |
| Common greenshank , *Tringa nebularia*, Europe/W Africa | 35 individuals, representing an average of 5.8% of the GB population (5 year peak mean 1998/9-2002/3) |

**Species with peak counts in winter:**

| | |
|---|---|
| Red-throated diver , *Gavia stellata*, NW Europe | 57 individuals, representing an average of 1.1% of the GB population (5 year peak mean 1998/9-2002/3) |
| Great crested grebe , *Podiceps cristatus cristatus*, NW Europe | 218 individuals, representing an average of 1.3% of the GB population (5 year peak mean 1998/9-2002/3) |

| | |
|---|---|
| European golden plover , *Pluvialis apricaria apricaria*, P. a. altifrons Iceland & Faroes/E Atlantic | 4190 individuals, representing an average of 1.6% of the GB population (5 year peak mean 1998/9-2002/3) |
| Sanderling , *Calidris alba*, Eastern Atlantic | 598 individuals, representing an average of 2.9% of the GB population (5 year peak mean 1998/9-2002/3) |

**Species Information**

**Nationally important species occurring on the site.**

Sand lizards *Lacerta agilis* are being reintroduced to the site on the Sandwich & Pegwell Bay NNR, September 2004, as part of a national programme of reintroduction to seven sites across England.

**Invertebrates.**

*Lixus vilis, Stigmella repentiella, Bagous nodulosus, Deltote bankiana, Poecilobothrus ducalis, Emblethis verbasci, Pionosomus varius, Nabis brevis, Euheptauclacus sus, Melanotus punctolineatus, Eluma purpurescens, Ectemnius ruficornis, Alysson lunicornis, Orthotylus rubidus*

Non-wetland invertebrates of importance recorded during 2004 survey:

Bees & wasps: *Cerceris quadricincta* (RDB 1; largest UK colony discovered on site in Pegwell area); *Philanthus triangulum* (RDB2, pRDB4); *Hedychrum niemelai* (RDB3); *Smicromyrme rufipes* (Notable b species); *Andrena minutuloides* (Notable a species); *Andrena pilipes* (Notable b species); *Melitta leporine* (Notable b species); *Nomada fucata* (Notable a species).

Moths found on sand dunes at Sandwich: *Idaea ochrata* (BAP priority species); *Aplasta ononaria* (RDB3); *Phibalapteryx virgata* (Nationally Scarce),

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## 23. Social and cultural values:

Describe if the site has any general social and/or cultural values e.g. fisheries production, forestry, religious importance, archaeological sites, social relations with the wetland, etc. Distinguish between historical/archaeological/religious significance and current socio-economic values.

Aesthetic
Archaeological/historical site
Environmental education/ interpretation
Livestock grazing
Non-consumptive recreation
Scientific research
Sport fishing
Sport hunting
Tourism
Transportation/navigation

**b)** Is the site considered of international importance for holding, in addition to relevant ecological values, examples of significant cultural values, whether material or non-material, linked to its origin, conservation and/or ecological functioning? No

If Yes, describe this importance under one or more of the following categories:

i) sites which provide a model of wetland wise use, demonstrating the application of traditional knowledge and methods of management and use that maintain the ecological character of the wetland:

ii) sites which have exceptional cultural traditions or records of former civilizations that have influenced the ecological character of the wetland:

iii) sites where the ecological character of the wetland depends on the interaction with local communities or indigenous peoples:

iv) sites where relevant non-material values such as sacred sites are present and their existence is strongly linked with the maintenance of the ecological character of the wetland:

## 24. Land tenure/ownership:

| Ownership category | On-site | Off-site |
|---|---|---|
| Non-governmental organisation (NGO) | + | |
| Local authority, municipality etc. | + | |
| Private | + | |
| Public/communal | + | |

## 25. Current land (including water) use:

| Activity | On-site | Off-site |
|---|---|---|
| Nature conservation | + | |
| Tourism | + | |
| Recreation | + | |
| Current scientific research | + | |
| Collection of non-timber natural products: (unspecified) | + | |
| Fishing: (unspecified) | + | |
| Fishing: commercial | + | |
| Fishing: recreational/sport | + | |
| Marine/saltwater aquaculture | | + |
| Gathering of shellfish | + | |
| Bait collection | + | |
| Arable agriculture (unspecified) | + | |
| Permanent arable agriculture | | + |
| Grazing (unspecified) | + | |
| Permanent pastoral agriculture | + | |
| Hunting: recreational/sport | + | |
| Industrial water supply | + | |
| Industry | + | |
| Sewage treatment/disposal | | + |
| Harbour/port | | + |
| Flood control | + | |
| Mineral exploration (excl. hydrocarbons) | + | |
| Transport route | | + |
| Domestic water supply | + | |
| Urban development | + | |

### 26. Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land (including water) use and development projects:

*Explanation of reporting category:*

1. *Those factors that are still operating, but it is unclear if they are under control, as there is a lag in showing the management or regulatory regime to be successful.*
2. *Those factors that are not currently being managed, or where the regulatory regime appears to have been ineffective so far.*

*NA = Not Applicable because no factors have been reported.*

| Adverse Factor Category | Reporting Category | Description of the problem (Newly reported Factors only) | On-Site | Off-Site | Major Impact? |
|---|---|---|---|---|---|
| Vegetation succession | 2 | Survey 2003 revealed problem of lack of ditch management in some areas. | + | | + |
| Water diversion for irrigation/domestic/industrial use | 1 | | + | + | + |
| Eutrophication | 1 | Subsidence in former colliery areas has created sump effect and contributed to eutrophication. | + | + | + |
| Pollution – pesticides/agricultural runoff | 2 | Runoff from agricultural fields. | + | + | + |
| Recreational/tourism disturbance (unspecified) | 1 | Disturbance of turnstones *Arenaria interpres*, especially by dog walking and kite surfing/boarding, which can result in loss of condition to birds if unmanaged. | + | | + |
| Unspecified development: urban use | 1 | Activities connected with ongoing management and new development on the coast cause significant disturbance to wintering birds if unmanaged. | + | | + |
| | | | | | |

For category 2 factors only.
What measures have been taken / are planned / regulatory processes invoked, to mitigate the effect of these factors?
Vegetation succession - Management agreements in place. It is intended that the number of these will increase when Environmental Stewardship Scheme is introduced.
Negotiation is underway with owners to reinstate ditch management in neglected areas.

Pollution – pesticides/agricultural runoff - Environment Agency currently investigating nature and extent of problem with view to implementing appropriate controls.

Is the site subject to adverse ecological change? YES

## 27. Conservation measures taken:

List national category and legal status of protected areas, including boundary relationships with the Ramsar site; management practices; whether an officially approved management plan exists and whether it is being implemented.

| Conservation measure | On-site | Off-site |
|---|---|---|
| Site/ Area of Special Scientific Interest (SSSI/ASSI) | + | |
| National Nature Reserve (NNR) | + | |
| Special Protection Area (SPA) | + | |
| Land owned by a non-governmental organisation for nature conservation | + | |
| Management agreement | + | |
| Site management statement/plan implemented | + | |
| Special Area of Conservation (SAC) | + | |

**b)** Describe any other current management practices:
The management of Ramsar sites in the UK is determined by either a formal management plan or through other management planning processes, and is overseen by the relevant statutory conservation agency. Details of the precise management practises are given in these documents.

## 28. Conservation measures proposed but not yet implemented:

e.g. management plan in preparation; official proposal as a legally protected area, etc.

No information available

## 29. Current scientific research and facilities:

e.g. details of current research projects, including biodiversity monitoring; existence of a field research station, etc.

**Fauna.**
Numbers of migratory and wintering wildfowl and waders are monitored annually as part of the national Wetland Birds Survey (WeBS) organised by the British Trust for Ornithology, Wildfowl & Wetlands Trust, the Royal Society for the Protection of Birds and the Joint Nature Conservation Committee.
A littoral and sublittoral marine life survey of the chalk cliffs, caves and reefs was undertaken by the Natural History Museum in 1997 (Tittley *et al*. 1998); the littoral element was repeated in 2001 (Tittley *et al*. 2004).
A sublittoral diving survey of the chalk reefs took place in Summer 2004.
A survey of the numbers and distribution of the golden plover population was undertaken in 2002-03.
Turnstone research was undertaken from 2001-03.
A sand dune NVC survey was undertaken in 2002 and a ditch flora survey in 2003.
Reintroduction of sand lizards *Lacerta agilis* to Sandwich & Pegwell Bay NNR, September 2004.

## 30. Current communications, education and public awareness (CEPA) activities related to or benefiting the site:

e.g. visitor centre, observation hides and nature trails, information booklets, facilities for school visits, etc.

The Thanet Coast Project was set up in 2001 and operates over most of the site. The Project implements aspects of the North East Kent European marine sites Management Scheme and works with local people, providing a wide range of coastal educational activities for adults and children as well as leaflets and other information.

Sandwich and Pegwell Bay NNR and LNR is managed by Kent Wildlife Trust. Guided walks and events are held on site throughout the year and information leaflets and interpretive boards are provided.

Sandwich Bay Bird Observatory is situated close to the site and provides information and leaflets on birds, as well as guided walks and events. It has conference and laboratory facilities as well as accommodation for visiting groups.

## 31. Current recreation and tourism:

State if the wetland is used for recreation/tourism; indicate type(s) and their frequency/intensity.

### Activities, Facilities provided and Seasonality.

There are a number of beach resorts around this Ramsar site, and the whole coastline is heavily used for recreation. Although there is more use in summer, there are a number of recreational activities that take place year-round on the coast, such as dog walking, and it is these that have most effect on wintering birds.

The inland parts of this Ramsar Site are the only areas that are not heavily used for recreation.

Water-based recreation includes jet-skiing, power-boat use, sailing, water-skiing and kite-surfing at a number of locations around the site. These activities happen mostly in spring, summer and autumn, but there is some year-round use.

Kite-boarding has been noted at two locations and has caused bird disturbance problems. This activity happens intermittently but more often in summer.

## 32. Jurisdiction:

Include territorial, e.g. state/region, and functional/sectoral, e.g. Dept. of Agriculture/Dept. of Environment, etc.

Head, Natura 2000 and Ramsar Team, Department for Environment, Food and Rural Affairs, European Wildlife Division, Zone 1/07, Temple Quay House, 2 The Square, Temple Quay, Bristol, BS1 6EB

## 33. Management authority:

Provide the name and address of the local office(s) of the agency(ies) or organisation(s) directly responsible for managing the wetland. Wherever possible provide also the title and/or name of the person or persons in this office with responsibility for the wetland.

Site Designations Manager, English Nature, Sites and Surveillance Team, Northminster House, Northminster Road, Peterborough, PE1 1UA, UK

## 34. Bibliographical references:

Scientific/technical references only. If biogeographic regionalisation scheme applied (see **15** above), list full reference citation for the scheme.

### Site-relevant references

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# European Site Conservation Objectives for Thanet Coast and Sandwich Bay Special Protection Area Site Code: UK9012071

With regard to the SPA and the individual species and/or assemblage of species for which the site has been classified (the 'Qualifying Features' listed below), and subject to natural change;

**Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring;**

- **The extent and distribution of the habitats of the qualifying features**
- **The structure and function of the habitats of the qualifying features**
- **The supporting processes on which the habitats of the qualifying features rely**
- **The population of each of the qualifying features, and,**
- **The distribution of the qualifying features within the site.**

This document should be read in conjunction with the accompanying *Supplementary Advice* document, which provides more detailed advice and information to enable the application and achievement of the Objectives set out above.

**Qualifying Features:**

A140 *Pluvialis apricaria*; European golden plover (Non-breeding)
A169 *Arenaria interpres*; Ruddy turnstone (Non-breeding)
A195 *Sterna albifrons*; Little tern (Breeding)

## This is a European Marine Site

This SPA is a part of the North East Kent European Marine Site (EMS). These Conservation Objectives should be used in conjunction with the Regulation 35 Conservation Advice document for the EMS. For further details about this please visit the Natural England website at: http://www.naturalengland.org.uk/ourwork/marine/protectandmanage/mpa/europeansites.aspx or contact Natural England's enquiry service at enquiries@naturalengland.org.uk or by phone on 0845 600 3078.

## Explanatory Notes: European Site Conservation Objectives

These Conservation Objectives are those referred to in the Conservation of Habitats and Species Regulations 2010 (the "Habitats Regulations") and Article 6(3) of the Habitats Directive. They must be considered when a competent authority is required to make a 'Habitats Regulations Assessment' including an Appropriate Assessment, under the relevant parts of this legislation.

These Conservation Objectives and the accompanying Supplementary Advice (where this is available) will also provide a framework to inform the management of the European Site under the provisions of Articles 4(1) and 4(2) of the Wild Birds Directive, and the prevention of deterioration of habitats and significant disturbance of its qualifying features required under Article 6(2) of the Habitats Directive.

These Conservation Objectives are set for each bird feature for a Special Protection Area (SPA). Where the objectives are met, the site will be considered to exhibit a high degree of integrity and to be contributing to achieving the aims of the Wild Birds Directive.

**Publication date:** 30 June 2014 (Version 2). This document updates and replaces an earlier version dated 29 May 2012 to reflect Natural England's Strategic Standard on European Site Conservation Objectives 2014. Previous references to additional features identified in the 2001 UK SPA Review have also been removed.

# Thanet Coast
# Marine Conservation Zone

## Where is this site?

Thanet Coast MCZ is an inshore site located on the Kent coast. The site boundary stretches from the east of Herne Bay, around Thanet to the northern wall of Ramsgate harbour. The site protects an area of approximately 64 $km^2$. Thanet Coast MCZ partially overlaps with an existing Special Area of Conservation (SAC) and will build upon this designation, protecting features which are not already protected.

## Why is this site important?

This MCZ contains the best examples of a variety of features found within the south-east region, including an area of subtidal chalk that extends seawards from the chalk reefs, cliffs and coves already afforded protection by the Thanet Coast SAC. The chalk seabed within the area is the longest continuous stretch of coastal chalk in the UK. This is the only designated MCZ to protect one species of stalked jellyfish (*Lucernariopsis cruxmelitensis*).

Ross worm reef © Natural England

## What does this Marine Conservation Zone protect?

The MCZ includes an unusual composition of blue mussel (*Mytilus edulis*) beds and ross worm (*Sabellaria spinulosa)* reefs that have formed a complex intertidal biogenic reef. Living reefs such as this play an important role within the ecosystem as they stabilise mobile sediment. The small habitat niches they provide can then support a range of species which live on or within the sediment pockets. Reefs also play an important role in protecting our coastlines, by reducing the energy of incoming waves and improving water quality through water filtration processes.

The stalked jellyfish (*Lucernariopsis cruxmelitensis)* found within the site is small, reaching less than 1 cm in height. Unlike other species of stalked jellyfish it is rarely attached to seagrasses but instead is typically found on small red seaweeds on rocky shores.

**Stalked jellyfish (*Lucernariopsis cruxmelitensis)* © S Trewhella**

| Features | General management approach |
|---|---|
| Subtidal coarse sediment | Maintain in favourable condition |
| Subtidal mixed sediments | Maintain in favourable condition |
| Subtidal sand | Maintain in favourable condition |
| Moderate energy infralittoral rock | Maintain in favourable condition |
| Moderate energy circalittoral rock | Maintain in favourable condition |
| Blue mussel (*Mytilus edulis*) beds | Maintain in favourable condition |
| Peat and clay exposures | Maintain in favourable condition |
| Ross worm (*Sabellaria spinulosa)* reefs | Recover to favourable condition |
| Subtidal chalk | Maintain in favourable condition |
| Stalked jellyfish (*Haliclystus auricula)* | Maintain in favourable condition |
| Stalked jellyfish (*Lucernariopsis cruxmelitensis)* | Maintain in favourable condition |

## Who will manage Marine Conservation Zones?

Many activities within the marine environment are regulated through marine licences. More information regarding the marine licensing process in relation to MCZs can be found on the MMO website [www.marinemanagement.org.uk/licensing/marine.htm](www.marinemanagement.org.uk/licensing/marine.htm)

Other activities are regulated through different mechanisms. For example fishing activities are managed through European legislation, national statutory instruments, byelaws and self-imposed voluntary agreements. Similar arrangements are in place to manage the range of activities that may impact MCZs including pollution, coastal development and recreation.

Management of sites is currently being prioritised nationally according to the potential or actual adverse impacts of activities on the features designated in relation to fishing activities. This prioritisation will be further refined at a local level taking into account relevant information and will guide regulators to those sites which may need protection before others.

Any management measures that are required for MCZs will be applied on a case-by-case basis. Management measures will be implemented at sites most at risk of damage first, regulating only those activities which have a detrimental impact on the features. In cases where there is a high risk to designated features being damaged emergency measures may be put in place to ensure the protection of vulnerable habitats and species.

**Blue mussel beds © Natural England**

## What happens now this site has been designated?

The site specific information below provides an overview of which activities may be affected by the designation of the MCZ and the current management measures. As with all management measures, they may, of course, be subject to change in the light of new evidence becoming available.

Current activities identified at this site which could be affected include commercial fisheries, ports and harbour operations and archaeological excavations. Most of these activities will be regulated through the appropriate licensing regimes. MCZ designation will need to be taken into consideration when assessing environmental impacts of marine works as part of the licensing application process.

With regards to fisheries management the site is within the jurisdiction of Kent and Essex IFCA. All relevant IFCA District-wide byelaws will apply to this site, in addition to all relevant national and EU fisheries legislation. Further information is available at
www.marinemanagement.org.uk/fisheries/monitoring/regulations_bluebook.htm

Relevant restrictions relating to this site include restrictions on the size of the vessels able to operate in the area.

For further information visit the Kent & Essex IFCA website at
http://www.kentandessex-ifca.gov.uk

## Where can I find out further information?

An interactive map showing this MCZs and other marine protected areas is available at http://jncc.defra.gov.uk/page-5201

Additional information about this site and other MCZs is available at
https://www.gov.uk/government/policies/protecting-and-sustainably-using-the-marine-environment
and within Natural England's advice available at
http://publications.naturalengland.org.uk/category/1499649

Department
for Environment
Food & Rural Affairs

Love Sea Life


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## Annex: Management

| Lead organisation | Activities |
|---|---|
| **Inshore Fisheries and Conservation Authorities (IFCAs)** | • Fisheries (0-6nm) including commercial fisheries and recreational fishing activities such as sea angling<br>For further information visit www.association-ifca.org.uk |
| **Marine Management Organisation (MMO)** | • Fisheries (management) (6-12nm)<br>• Fisheries (enforcement) national and EU legislation<br>• Licensable activities such as deposit and removal activities below mean high water springs, including subsea cables (up to 12nm), construction (including renewables <100MW, ports and costal protection), dredging and disposal<br>• Harbour Orders and Harbour Empowerment Orders<br>• Section 36 and safety zone consents<br>• Enforcement of licensable activity and other consents (including deemed marine licences)<br>• Development of marine plans integrating the social requirements, economic potential and environmental priorities of marine plan areas<br>• Activities requiring a wildlife licence<br>For further information visit www.marinemanagement.org.uk/fisheries or www.marinemanagement.org.uk/licensing/marine.htm |
| **Environment Agency (EA)** | • Fisheries management for migratory and fresh water fish<br>• Coastal protection and flood management<br>• Water quality<br>• Permitted discharges from terrestrial sources<br>For further information visit www.environment-agency.gov.uk/default.aspx |
| **Department of Energy and Climate Change (DECC)** | • Oil and Gas related activities<br>• Renewable energy related activities<br>For further information visit www.gov.uk/government/organisations/department-of-energy-climate-change |
| **Harbour Authorities and local planning authorities** | • Harbour authorities have management responsibilities for the port and coastal waters within their jurisdiction<br>• Local authorities have role to manage, regulate and facilitate activities at the coast. These include management of coastal recreation, tourism, economic regeneration, flood protection, spatial planning and coastal zone and estuary management,<br>For further information contact your local authority or IFCA |
| **Department for Transport (DfT)** | • Responsible for shipping, harbours, ship pollution and offshore safety<br>For further information visit www.gov.uk/government/organisations/department-for-transport |
| **Natural England (NE)** | • Public access<br>For further information visit www.naturalengland.org.uk/ |

## EC Directive 79/409 on the Conservation of Wild Birds: Special Protection Area

# Thanet Coast (Kent)

The Thanet Coast proposed Special Protection Area includes a wide variety of coastal habitats including areas of chalk cliff, rocky shore, shingle, sand and mudflats, saltmarsh and sand dunes. As well as its value for breeding and wintering birds, the site supports outstanding communities of terrestrial and marine plant species, a significant number of rare invertebrate species, and is of considerable geological importance.

The Thanet Coast qualifies under Article 4.1 by supporting, in summer, a nationally important breeding population of little tern *Sterna albifrons* (30 pairs - over 1% of the British population).

The site also qualifies under Article 4.1 by supporting a nationally important wintering population of golden plover *Pluvialis apricaria*. During the five year period 1985/86 - 1989/90, an average peak count of 1,980 golden plover was recorded, representing 1% of the British wintering population.

The site qualifies under Article 4.2 by regularly supporting an internationally important wintering population of turnstone *Arenaria interpres*. In the five year period 1986/87 - 1990/91, an average peak count of 1,340 turnstone was recorded, representing 2% of the East Atlantic Flyway population and 3% of the British wintering population. The site also supports nationally important wintering populations of a further four species (average peak counts over the five year period 1986/7 - 1990/91): 370 ringed plover *Charadrius hiaticula* (over 1% of the British wintering population), 530 grey plover *Pluvialis squatarola* (over 2% of British), 700 sanderling *Calidris alba* (over 5% of British), and 40 Lapland bunting *Calcarius lapponicus* (about 11% of British). In addition large numbers of migratory passerine birds pass through the site during the spring and autumn migration periods. These migratory birds have been monitored since 1952 by the Sandwich Bay Bird Observatory.

This citation / map relates to a site entered in the Register of European sites for Great Britain.
Register reference number UK 0012 07
Date of registration 30 JAN 1996 [redacted]
Signed [redacted]
on behalf of the Secretary of State for the Environment

SPA Citation
HTR/DAS June 1992

# European Site Conservation Objectives for Flamborough and Filey Coast Special Protection Area Site Code: UK9006101

With regard to the SPA and the individual species and/or assemblage of species for which the site has been classified (the 'Qualifying Features' listed below), and subject to natural change;

**Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring;**

- **The extent and distribution of the habitats of the qualifying features**
- **The structure and function of the habitats of the qualifying features**
- **The supporting processes on which the habitats of the qualifying features rely**
- **The population of each of the qualifying features, and,**
- **The distribution of the qualifying features within the site.**

This document should be read in conjunction with the accompanying Supplementary Advice document (where available), which provides more detailed advice and information to enable the application and achievement of the Objectives set out above.

**Qualifying Features:**

A016 *Morus bassanus*; Northern gannet (Breeding)

A188 *Rissa tridactyla*; Black-legged kittiwake (Breeding)

A199 *Uria aalge*; Common guillemot (Breeding)

A200 *Alca torda;* Razorbill (Breeding)

Seabird assemblage

## Explanatory Notes: European Site Conservation Objectives

These Conservation Objectives are those referred to in the Conservation of Habitats and Species Regulations 2017 (as amended from time to time (the "Habitats Regulations"). They must be considered when a competent authority is required to make a 'Habitats Regulations Assessment' including an Appropriate Assessment, under the relevant parts of this legislation.

These Conservation Objectives and the accompanying Supplementary Advice (where this is available) provide a framework to inform the management of the European Site, and the prevention of deterioration of habitats and significant disturbance of its qualifying features.

These Conservation Objectives are set for each bird feature for a Special Protection Area (SPA). Where the objectives are met, the site will be considered to exhibit a high degree of integrity and to be contributing to achieving the aims of the Wild Birds Directive.

**Publication date:** 23 November 2018 (Version 3). This document updates and replaces an earlier version dated 30 June 2014 to reflect the extension and re-naming of the Flamborough Head and Bempton Cliffs SPA (classified as an SPA on 5 March 1993).