

**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)**



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Cover photograph illustrates red-throated diver in winter.

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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 change², maintain³ or enhance the red-throated diver population (*Gavia stellata*) and its supporting habitats in favourable condition⁴

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**

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 report⁵ 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 2000⁶ 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 Directive⁷ (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 18¹¹ 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 authorities¹² to explore and put in place management measures (if required), and by competent authorities¹³ 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 Area¹⁴.

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 work¹⁵. This resulted

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/ukxi/2010/490/contents/made>

⁹ <http://www.legislation.gov.uk/ukxi/2010/491/contents/made>

¹⁰ <http://www.legislation.gov.uk/ukxi/2010/490/regulation/35/made>

¹¹ <http://www.legislation.gov.uk/ukxi/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/ukxi/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 evidence¹⁶ through the development of a suite of Evidence Standards¹⁷. Implementation of these standards has included Natural England working with JNCC to develop a protocol¹⁸, 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 website¹⁹

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 report²⁰ 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 36²¹ of the Habitats Regulations relevant authorities may use this advice to draw up a management scheme for the SPA relevant 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 27²² 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/ukxi/2010/490/regulation/36/made>

²² <http://www.legislation.gov.uk/ukxi/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 as 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 Brief²⁶ 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 change²⁸, maintain²⁹ or enhance the red-throated diver population and its supporting habitats in favourable condition³⁰

Relevant habitats include shallow coastal waters and areas in the vicinity of sub-tidal sandbanks

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 <i>Gavia stellata</i>	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 & Huppopp (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 & Huppopp 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 (Zydalis *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.

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 Brief³³ 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 & Huppopp 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 km² 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 aggregate 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

³⁵ Scroby Sands, Kentish Flats, Gunfleet Sands 1 & 2 plus London Array Phase 1 occupy a total area of 137.5 km² 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 trawling, 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 February³⁶. 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 & Huppopp, 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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7. References

- APEM 2010. *London Array offshore wind farm: aerial survey methods, data collection and statistical analysis. Report to London Array Ltd APEM 410955; August 2010.*
- APEM 2011. *Red-throated divers and offshore wind farms in the Outer Thames: Historic data review. Report to London Array Ltd APEM 411134; June 2011.*
- Barrett, J. & Barrett, C.F. 1985. *Divers in the Moray Firth, Scotland.* Scottish Birds 13: 149-154.
- Camphuysen, C.J. 1989. *Beached bird surveys in the Netherlands 1915-1988; Seabird mortality in the southern North Sea since the early days of Oil Pollution.* Techn. Rapport Vogelbescherming 1, Werkgroep Noordzee, Amsterdam.
- Camphuysen, C.J. 2008. *Entanglements of seabirds in marine litter and fishing gear, 1970-2007.* Sula 21: 88-92.
- CEFAS 2006. *The coastal fisheries of England and Wales, Part V: a review of their status 2005-6;* Science Series Technical Report no.140
- des Clers, S. 2010. *Inshore fishing fleet of the Greater Thames Estuary.* MacAlister Elliott and Partners Ltd
- Cook, A.S.C.P., Johnston, A., Wright, L.J. & Burton, N.H.K. 2012. *A review of flight heights and avoidance rates in relation to offshore wind farms.* BTO report to Crown Estate.
- Cramp, S. & Simmons, K.E.L. 1977. *Handbook of the birds of Europe, the Middle East, and North Africa: the Birds of the Western Palearctic. Vol. 1: Ostrich-Ducks.* Oxford University Press, Oxford.
- De Leeuw, J. 1997. *Demanding divers. Ecological energetics of food exploitation by diving ducks.* Wiskunde en Natuurwetenschappen. Groningen, Rijksuniversiteit Groningen: 178pp
- Defra Circular 01/2005 Government Circular: *Biodiversity and Geological Conservation – Statutory Obligations and their impact within the Planning System*
- DETR & The Welsh Office. 1998. *European Marine Sites in England & Wales - A guide to the Conservation (Natural Habitats &c.) Regulations 1994 and to the Preparation and Application of Management Schemes.* London: DETR.
- Drewitt, A.L. & Langston, R.H.W. 2008 *Collision Effects of Wind-power Generators and Other Obstacles on Birds.* Ann. N.Y. Acad. Sci. **1134**: 233-266
- Durinck J, Skov H, Jensen FP, Pihl S (1994) *Important marine areas for wintering birds in the Baltic Sea.* EU DG XI research contract no. 2242/90-09-01. Ornis Consult report
- Erdmann, F, Bellebaum, J, Kube, J, Schulz, A. 2005. *Losses of seabirds and waterfowl by fisheries with special regards to the international important resting, moulting, and wintering areas in the coastal waters of Mecklenburg -Western Pomerania.* Final Report by LUNG, ILN Griefswald & IfAO 130pp.

- Environmentally Sustainable Systems Ltd 2008. *Kentish Flats Windfarm 5th Ornithological Monitoring Report, 16th July 2008, Report to Kentish Flats Ltd.*
- Furness, B. & Wade, H. 2012. *Vulnerability of Scottish seabirds to offshore wind farms.* MacArthur Green Ltd report to Marine Scotland.
- Garthe, S. & Huppopp, O. 2004. *Scaling possible adverse effects of marine windfarms on seabirds: developing and applying a vulnerability index.* Journal of Applied Ecology **41** 724-734
- Guse et al. 2009. *Diet of red-throated divers Gavia stellata reflects the seasonal availability of Atlantic herring Clupea harengus in the southwestern Baltic Sea.* Journal of Sea Research 62 pp268-275. .
- Hiscock, K. 1996. *Marine Nature Conservation Review: rationale and methods.* Peterborough, JNCC.
- Jennings, S. & Kaiser, M.J. 1998. *The Effects of Fishing on Marine Ecosystems.* Advances in Marine Biology 34: 201-212
 JNCC 2004 - *Common Standards Monitoring Guidance for Birds*, Version August 2004, Updated from (February 2004), ISSN 1743-8160 (online).
- JNCC and Natural England, 2011
<http://jncc.defra.gov.uk/pdf/1105%20MARINE%20CONSERVATION%20ZONES%20AND%20FISHERIES-FINAL.pdf>
- Kaiser et al 2004 – *Demersal Fish and Epifauna associated with sandbank habitats.* Estuarine Coastal and Shelf Science 60: 445-456
- Kaiser et al 2006 Global analysis and prediction of the response of benthic biota to fishing. Marine Ecology Progress Series 311: 1–14
- Lack, P. 1986. *The Atlas of Wintering Birds in Britain and Ireland.* T & A D Poyser, Calton.
- Madsen, F. J. 1957. *On the food habits of some fish-eating birds in Denmark.* Danish Review of Game Biology, 3: 19-83.
- Manville, A. M. II 2005. *Seabird and waterbird bycatch in fishing gear: next steps in dealing with a problem.* USDA Forest Service Gen. Tech. Rep. PSW-GTR-191.
- Marine Management Organisation 2012. *Evaluating the distribution, trends and value of inshore and offshore fisheries in England.* MMO Report 1011
- MarLIN, 2003. *Species sensitivity assessment rationale summary.* [on-line]. Plymouth: Marine Biological Association of the United Kingdom. Available from: http://www.marlin.ac.uk/glossaries/SpeciesSensRationale_Summ.htm [Accessed August 2008].
- Moser, M.E., Broad, R.A., Dennis, R.H. & Madders, M. 1986. *The distribution and abundance of some coastal birds on the west and north-west coasts of Scotland in winter.* Scottish Birds 14: 61-67.

- O'Brien, S.H., Wilson, L.J., Webb, A. & Cranswick, P.A. 2008. *Revised estimate of numbers of wintering Red-throated Divers Gavia stellata in Great Britain*. Bird Study 55: 152-160.
- Okill, D. 2002. Red-throated diver. In: C. Wernham, M. Toms, J. Marchant, J. Clark, G. Siriwardena & S. Baillie. *The migration atlas. Movements of the birds of Britain and Ireland*. T & AD Poyser, London pp 109 – 111.
- Percival, S., Cranswick, P., Hartley, C., Ford, J., Harding, I., Dodds, P. & Percival, T. 2004. *Thames Estuary proposed offshore wind farm. Progress report on ornithological surveys August 2002 – December 2003*. Ecology Consulting, Durham.
- Percival, S. 2010. Kentish Flats Offshore Wind Farm: *Diver surveys 2009-10*. Ecology Consulting report to Vattenfall Wind Power.
- Petersen, I.K., Christensen, T.J., Kahlert, J., Desholm, M. & Fox, A.D. (2006) *Final results of bird studies at the offshore windfarms at Nysted and Horns Rev, Denmark*. Report commissioned by DONG energy and Vattenfall A/S. NERI report, National Environmental Research Institute, Ministry of the Environment, Denmark. www.dmu.dk
- Petersen, I.K. & Fox, A.D. 2007. *Changes in bird habitat utilisation around the Horns Rev 1 offshore windfarm, with particular emphasis on Common Scoter*. NERI Report to Vattenfall A/S, 36pp.
- Pollitt, M., Cranswick, P., Musgrove, A., Hall, C., Hearn, R., Robinson, J. & Holloway, S. 2000. *The Wetland Bird Survey 1998-99: Wildfowl and Wader Counts*. Slimbridge: BTO, WWT, RSPB & JNCC.
- RPS Group PLC. 2005. Environmental Statement. Volume 1: Offshore Works. London Array Ltd.
- Schirmeister, B., 2003. *Verluste von Wasservögeln in Stellnetzen der Küstenfischerei – das Beispiel der Insel Usedom*. Meer und Museum 17: 160–166.
- Schwemmer, P., Mendel, B., Sonntag, N., Dierschke, V. and Garthe, S. 2011. *Effects of ship traffic on seabirds in offshore waters: implications for marine conservation and spatial planning*. Ecological Applications 21: 1851-1860.
- Skov, H., Durinck, J., Leopold, M.F. & Tasker, M.L. 1995. *Important Bird Areas for Seabirds in the North Sea including the Channel and the Kattegat*. Cambridge, BirdLife International.
- Skov, H., Heinanen, S., Lohier, S., Thaxter, C. & Zydalis, R. (2011). *Modelling the abundance and area use of the Outer Thames Estuary*. DHI / BTO Report to London Array Ltd.
- Skov, H. & Prins, E. 2001. *Impact of estuarine fronts on the dispersal of piscivorous birds in the German Bight*. Marine Ecology Progress Series 214, 279-287.
- Stillman, R.A., West, A.D., Caldow, R.W.G. & Durell, S.E.A. le V dit. 2007. *Predicting the effect of disturbance on coastal birds*. Ibis, 149 (Suppl 1), 73-81.
- Stone, C.J., Webb, A., Barton, C., Ratcliffe, N., Reed, T.C., Tasker, M.L., Camphuysen, C.J. & Pienkowski, M.W. 1995. *An atlas of seabird distribution in north-west European waters*. Peterborough, JNCC.

Stroud, D.A., Chambers, D., Cook, S., Buxton, N., Fraser, B., Clement, P., Lewis, I., McLean, I., Baker, H. & Whitehead, S. 2001. *The UK SPA network: its scope and content. Volumes 1-3*. JNCC, Peterborough, UK.

Taylor, M., Seago, M., Allard, P. & Dorling, D. 1999. *The Birds of Norfolk*. Sussex, Pica Press.

Thorpe, R.I. 2002. *Numbers of wintering seaducks, divers and grebes in North Cardigan Bay, 1991 – 1998. Welsh Birds* 3: 155 – 170.

Webb, A., Dean, B.J., O'Brien, S.H., Söhle, I., McSorley, C., Reid, J.B., Cranswick, P.A., Smith, L.E. & Hall, C. 2009. *The numbers of inshore waterbirds using the Greater Thames during the non-breeding season; an assessment of the area's potential for qualification as a marine SPA. JNCC Report, No. 374*.

Weston, K. & Caldow, R.W.G., 2010. *A review of the scientific evidence on red-throated divers and netting bycatch: its role in the development of future management measures on netting in the Outer Thames Estuary SPA*. Unpublished report, Natural England.

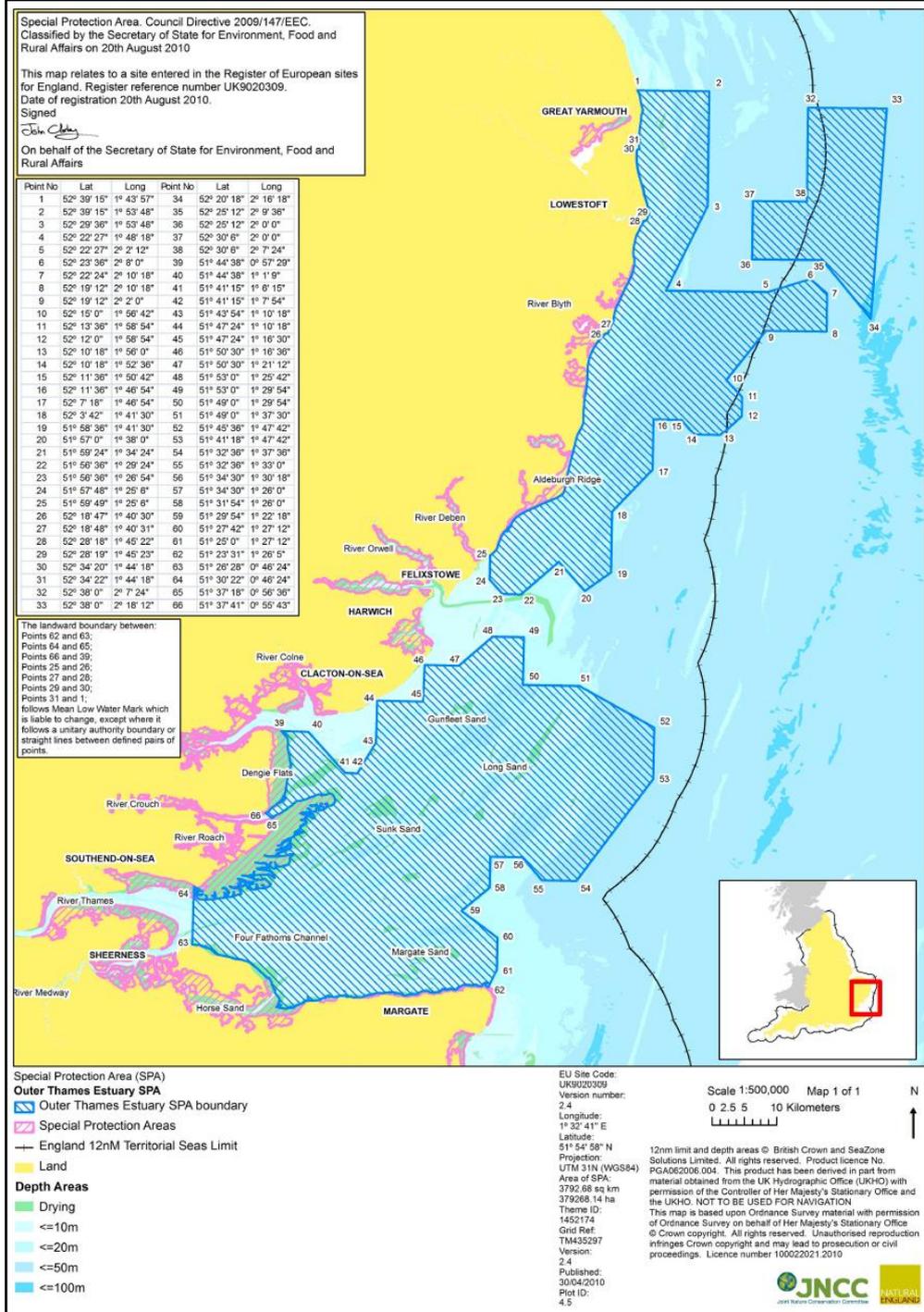
Williams, J.M., Tasker, M.L., Carter, I.C. & Webb, A. 1994. *A method of assessing seabird vulnerability to surface pollutants. Ibis*, **137**, S147-S152.

Zydelis R, Bellebaum J, Ôsterblom H, Vetemaa M, Schirmeister B, Stipniece A, Dagys M, Eerden M, Garthe S. 2009. *Bycatch in gillnet fisheries – An overlooked threat to waterbird populations. Biological Conservation* 142:1269-1281.

Appendix A
Favourable Condition Table (FCT) for Outer Thames Estuary SPA

Attributes	Measure	Targets	Comments
Red-throated diver population size (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 <i>et al.</i> (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		Exposure		Vulnerability	
None	-	None	-	None detectable	
Low	•	Low	+	Low	
Moderate	••	Medium	++	Moderate	
High	•••	High	+++	High	

Additional Category for insufficient information = DD (Data Deficient)

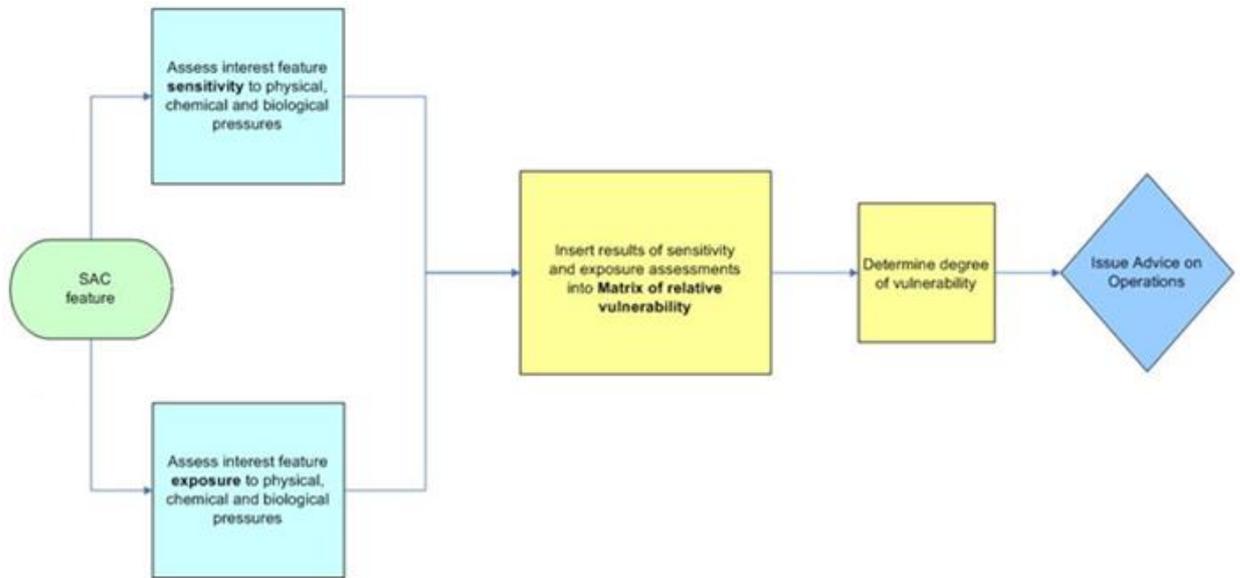
The relative vulnerability of an interest feature or sub-feature is determined by multiplying the scores for relative sensitivity and exposure, and classifying that total into categories of relative vulnerability.

Relative sensitivity of the interest feature

		High (3)	Moderate (2)	Low (1)	None detectable (0)
Relative exposure of the interest feature	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.



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Appendix D. Summary of operations/pressures that may cause deterioration or disturbance of red-throated divers 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
<p>Physical loss of supporting habitat</p> <p>Removal of habitat feature (e.g. offshore development, capital dredging, 'active dredging zones')</p> <p>Smothering (e.g. by artificial structures, disposal of dredge spoil)</p>		<p>✓</p> <p>✓</p>
<p>Physical damage to their habitats</p> <p>Siltation (e.g. run-off, channel dredging, outfalls)</p> <p>Abrasion (e.g. anchoring, cables)</p> <p>Selective extraction (e.g. aggregate dredging)</p>		<p>✓</p> <p>✓</p> <p>✓</p>

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 (<i>Gavia stellata</i>)		
	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