Title: Greater Wash Special Protection Area (SPA) **IA No:** **Lead department or agency:** Defra Marine Biodiversity **Other departments or agencies:** Natural England	Impact Assessment (IA) **Date: 31/03/2016** **Stage: Consultation Draft** **Source of intervention: EU** **Type of measure: Other** **Contact for enquiries:** SNS_N2K@naturalengland.org.uk
Summary: Intervention and Options	**RPC Opinion:** Not Applicable

Cost of Preferred (or more likely) Option				
Total Net Present Value **£ -0.69m**	**Business Net Present Value** **£0.00 million**	**Net cost to business per year** (2014 prices: 2015 present value) **£ 0.00 million**	**In scope of One-In, Two-Out?** **No**	**Measure qualifies as** **NA**

What is the problem under consideration? Why is government intervention necessary?

The UK Government is committed to delivering a healthy natural environment for the benefit of everyone, both now and in the future. Protecting biodiversity is a critical part of this commitment. Government intervention is needed to protect biodiversity because it is a public good and market incentives alone will not stimulate sufficient conservation effort. In order to meet government commitments under the European Council's Directive 79/409/EEC on the conservation of wild birds, it is proposed that the Greater Wash site is classified as a Special Protection Area.

What are the policy objectives and the intended effects?

Government aims to have 'clean, healthy, safe, productive and biologically diverse seas[1]'. It is a Government priority to establish and manage a network of ecologically coherent Marine Protected Areas (MPAs) covering 25% of the English waters by 2017. The Greater Wash site has been recommended for classification as it meets formal SPA selection guidelines for nationally important numbers of red-throated diver, little gull and common scoter and important foraging areas for breeding terns. Classification of the site will give it a high level of protection from degradation by human activities and will contribute to meeting the UK's commitments to international agreements and obligations (including the European Council's Directive 79/409/EEC on the conservation of wild birds "Birds Directive", as implemented through the Wildlife & Countryside Act 1981 (as amended), the Conservation (Natural Habitats, & c.) Regulations 2010 (as amended) and the Offshore Marine Conservation (Natural Habitats, & c.) Regulations 2007 and the Marine Strategy Framework Directive).

What policy options have been considered, including any alternatives to regulation? Please justify preferred option (further details in Evidence Base)

Only one policy option has been considered: to classify the site as an SPA. Other options are not considered because classification of the most suitable territories as SPAs for the conservation of rare or vulnerable bird species (listed in Annex I) and regularly occurring migratory birds is required under the Birds Directive. It is expected that this classification will lead to additional costs for monitoring and research activities. The proposed Greater Wash SPA has been identified as a 'most suitable area' for conservation of five Annex I species in Britain (red-throated diver, little gull, Sandwich tern, common tern, little tern) and one regularly occurring migratory bird, common scoter. If the site is not classified, the condition of these features may be at risk of deterioration in the future which may include irreversible damage. Though the site could be conserved under voluntary agreements or a national designation, this would not contribute to fulfilling the requirements of the Birds Directive. The purpose of the IA is to inform the government of the impacts the SPA could have on the UK economy, it does not inform the decision to classify the site.

Will the policy be reviewed? It **will** be reviewed. **If applicable, set review date: 2026**						
Does implementation go beyond minimum EU requirements?			No			
Are any of these organisations in scope? If Micros not exempted set out reason in Evidence Base.	**Micro Yes**	**< 20** Yes	**Small Yes**	**Medium Yes**	**Large Yes**	
What is the CO_2 equivalent change in greenhouse gas emissions? (Million tonnes CO_2 equivalent)			**Traded: N/A**	**Non-traded: N/A**		

I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.

[1]Marine Policy Statement: https://www.gov.uk/government/publications/uk-marine-policy-statement

Signed by the responsible SELECT SIGNATORY: _____ Date: _____

Summary: Analysis & Evidence **Policy Option 1**

Description: Classification of the Greater Wash SPA

FULL ECONOMIC ASSESSMENT

Price Base Year 2016	**PV Base Year** 2016	**Time Period Years** 10	**Net Benefit (Present Value (PV) (£m)**		
			Low: - 0.24	**High: - 121.98**	**Best Estimate: - 0.69**

COSTS (£m)	**Total Transition** (Constant Price) Years		**Average Annual** (excl. Transition) (Constant Price)	**Total Cost** (Present Value)
Low	0	2017	0.03	**0.24**
High	124.46		0.23	**121.98**
Best Estimate	0.19		0.06	**0.69**

Description and scale of key monetised costs by 'main affected groups'

In the best estimate scenario the majority of costs fall to the public sector for research and monitoring totalling £685,620 NPV, with some small costs to wind farms for the production of a shadow habitat regulations assessment, totalling £1,739 NPV. In the worst case scenario the largest costs are from the unlikely refusal of consent for two unconstructed windfarms. The worst case scenario also includes smaller losses to the fisheries sector (£447,461 NPV).

Other key non-monetised costs by 'main affected groups'

It was not proportionate to calculate second round or indirect effects of the, as yet unconsented, wind farms and fisheries losses in the worst case scenario. It is likely that any closure of the local fishery would have local economic and social impacts.

BENEFITS (£m)	**Total Transition** (Constant Price) Years		**Average Annual** (excl. Transition) (Constant Price)	**Total Benefit** (Present Value)
Low	Optional		Optional	**Optional**
High	Optional		Optional	**Optional**
Best Estimate	-		-	**-**

Description and scale of key monetised benefits by 'main affected groups'

Significant additional research would have been required to monetise the benefits from this policy proposal, and this was not judged proportionate. Further information will be sought at formal consultation.

Other key non-monetised benefits by 'main affected groups'

The classification will protect the interest features for present and future generations. This will provide use-value (recreational wildlife watching), existence and option values to the UK public. The classification may also encourage scientific research in the area.

Key assumptions/sensitivities/risks **Discount rate** 3.5%

The key assumption is that management measures are not likely to require the refusal/revocation of wind farm consent in the classfied area. A similar assumption is that is that it is unlikely that management measures will require closure of the fishery in the area. The refusals/ closure therefore do not feature in the best estimate and are only included in the worst case scenario.

BUSINESS ASSESSMENT (Best Estimate)

Direct impact on business (Equivalent Annual) £m:			**In scope of**	**Measure**
Costs: 0.00	Benefits: 0.00	Net: 0.00	No	NA

Evidence Base for the Greater Wash Special Protection Area

1 Introduction

1. The assumptions and evidence employed in assessing both costs and benefits are provided in Section 8. The approach adopted to assess the costs is described in Section 8.1, followed by an assessment of the costs (Section 8.2). The benefits of the SPA are assessed in Section 8.3. Section 9 summarises the costs and benefits of the SPA.

2 Purpose

2. This is the Evidence Base for the Impact Assessment (IA) to accompany Natural England and JNCC's joint recommendation to the Department for Environment, Food and Rural Affairs (Defra) for classification[2] of the Greater Wash Special Protection Area (SPA) (see chart 1). Covering 3,443km^2 the potential Special Protection Area (pSPA) lies within the southern North Sea spanning the east coast of Yorkshire, Lincolnshire, Norfolk and Suffolk.

3. The IA informs the government of the impacts the site could have on the UK economy[3] and the environmental and social effects of classification. Significant local impacts have been identified where these arise. The IA should not inform the decision to classify the site (which is based on the scientific justification set out in the Departmental Brief). This is because European case law has established that economic and social impacts should not influence the selection of SPAs or delineation of their boundaries. The information provided within this IA may be used to inform management of the site upon classification but not the decision to classify. This document (the Evidence Base) provides supporting evidence for the information presented in the separate IA Summary above.

4. The structure and method used for this IA is based on government guidance[4]. 'One-in, Two-out' regulatory burden assessment is not provided because implementation of European Directives is not currently within its scope. Abbreviations used in the IA are presented in Appendix A

3 Background

5. It is a priority for the government to establish and effectively manage a network of Marine Protected Areas (MPAs) that covers in excess of 25% of English waters by 2017. The network will help deliver good environmental status (under the Marine Strategy Framework Directive[5]) and the government's vision of clean, healthy, safe, productive and biologically diverse oceans and seas in the UK. The protection that it provides to habitats and species will maintain the value of the marine environment to society[6]. The MPA network will comprise SPAs as well as Marine Conservation Zones (MCZs), Ramsar sites[7], Sites of Special Scientific Interest (SSSIs) and Special Areas of Conservation (SACs).

[2] A new SPA is 'classified' whereas other new protected areas are generally 'designated'.
[3] In keeping with guidance provided by Defra, impacts on the other Member States and other countries are not considered in this impact assessment.

[4] Department for Business Innovation and Skills, 2013; HM Treasury (2003)
[5] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:164:0019:0040:EN:PDF
[6] Defra (2012)
[7] Ramsar sites are wetlands of international importance designated under the Ramsar Convention (1971)

6. Though the site could be conserved under voluntary agreements or a national designation, such as an MCZ, this would not contribute to fulfilling the requirements of the Birds Directive.

7. As an EU member state the UK is required to classify the most suitable territories of rare and vulnerable birds listed on Annex I of the Birds Directive[8] and regularly occurring migratory birds, as SPAs. The Birds Directive is transposed into UK law through the Wildlife & Countryside Act 1981 (as amended), the Conservation (Natural Habitats, & c.) Regulations 2010 (as amended) and the Offshore Marine Conservation (Natural Habitats, & c.) Regulations 2007. The Greater Wash SPA meets this definition of 'most suitable territory' as it has proven to be an important area for several Annex I and migratory species. It is contains the greatest number of little gull in UK inshore waters, is the second most important area for non-breeding red-throated diver and contains the most southerly population of common scoter on the east coast of the United Kingdom. Additionally, it provides foraging areas for 5.1% of the UK population of breeding common tern, 35% of the UK breeding population of Sandwich tern, and 42% of the UK breeding population of little tern. Given its importance to a number of species, this proposed SPA is best placed to meet the requirements of the Birds Directive.

4 Rationale for Government intervention

8. Many human activities cause degradation to marine habitats and species, ultimately imposing costs on society. This may include disturbance to rare, or vulnerable, bird species from human activities, or degradation of their supporting habitats. This is an example of market failure, which occurs when the market does not deliver a socially efficient outcome because the prices faced by decision-makers do not fully reflect the costs and benefits to society.[9] Marine biodiversity is a public good[10] - all people benefit but most will not bear the full cost of its provision and exploitation, and therefore no one has an individual incentive to protect it. Government intervention is appropriate to ensure that an optimal amount of marine biodiversity is conserved at the lowest cost to society and its value is protected for future generations. Trends in the UK non-breeding populations of red-throated diver, common scoter and little gull are not known. However; red-throated diver are decreasing globally, evidence suggests that wintering common scoter have shifted distribution making UK waters increasingly important in recent years. (Birdlife International 2016). All three tern species are Amber listed because of decline in breeding population (Sandwich tern), breeding range (little tern) or increasing localisation within protected sites (common tern) (Eaton *et al.* 2015).

5 Problem under consideration

9. As set out in detail in the departmental brief, Natural England has used the data from work by the JNCC, to identify the Greater Wash as a most suitable area for conservation of five Annex I species; red-throated diver, little gull, common tern, Sandwich tern and little tern in Britain and one regularly occurring migratory species; common scoter, hereby collectively referred to as interest features.

10. The site is proposed for designation because it;

[8] Council Directive 2009/147/EC on the conservation of wild birds
[9] HM Treasury (2003)
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/220541/green_book_complete.pdf
[10] Public goods are non-excludable (no one can be excluded from accessing the good) and non-rival (one person's use of the good does not prevent anyone else from also benefiting from it).

- regularly supports more than 1% of the Great Britain breeding populations of three tern species listed in Annex I of the EC Birds Directive; little tern, common tern, Sandwich tern.

- regularly supports over 1% of the Great Britain wintering population of two waterbird species listed in Annex I of the EC Birds Directive; red-throated diver and nationally important numbers of little gull.

- has a wintering population of common scoter, a regularly occurring migratory species, in order to identify an adequate suite of the most suitable sites for its conservation in UK waters.

6 Intervention objectives and intended effects

11. The objective of the intervention is to contribute towards fulfilling the UK government's obligation under the Birds Directive. The Greater Wash pSPA qualifies as a 'most suitable area' for conservation of five Annex I species and common scoter in Britain, as detailed in section 4 and therefore there is an obligation to classify the site as an SPA.

12. The Conservation of Habitats and Species Regulations (2010), which transposes the Birds Directive into UK law, states that a proposed plan or project can only be consented by the competent authority[11] when it has been ascertained it will have no adverse effect on the integrity of an SPA (further details provided in Appendix B) and byelaws can be made to protect the site from damaging activities.

13. This protection is intended to reduce the risk that the populations of the pSPA features declining over time, as a result of possible human activities and development pressures in the future. This would include the extent of their habitat and the abundance and distribution of their prey.

7 Description of the options considered

14. Only one option has been considered: to classify the site as an SPA under the Birds Directive. Other options are not considered here because Natural England is proposing the site as a necessary contribution by the UK to the SPA network.

15. The option to classify is assessed in the IA against the 'do nothing' option which at the moment does not provide adequate protection for these species.

8 Costs of the pSPA

16. If classified, the cost of the pSPA protection to the UK economy will vary between the interest features. Within the Greater Wash pSPA, the breeding colonies of common, little and Sandwich tern are already protected as SPAs, so this Impact Assessment assumes that appropriate management measures are already in place for these features. However, classification of the pSPA would incorporate the foraging areas of these tern species and therefore this IA covers the additional monitoring of foraging tern distribution surrounding their breeding colonies.

17. This IA identifies red-throated diver, common scoter and little gull as features which are vulnerable to pressures (detailed in Section 8.1) that will be present in the Greater Wash in the future. It therefore considers the impacts of the protection of these non-breeding species.

[11] A competent authority is a public body or statutory undertaker that grants consents for regulated activities.

18. The site has pSPA status from the time that formal consultation begins. Because it is government policy that pSPAs have the same protection as fully classified SPAs, the Conservation of Habitats and Species Regulations (2010) will apply from then onwards. The IA assumes that the site will be classified at the beginning of 2017 (following its submission to the European Commission (EC)) and that additional work managing the site will arise from then onwards. The IA assumes that once implemented management, as detailed in the Scenarios in Section 8 and 9, is effective and fully complied with. Impacts have been assessed in the IA over a time scale of 10 years based on government guidance[12]. Definitions of the terms used to communicate the level of confidence in information presented in the IA are presented in Appendix C. Figures used in the calculations have been rounded for presentation in the text and tables.

19. The level of analysis undertaken in the IA is proportionate to the magnitude of the anticipated social or economic impact of the SPA. All values are presented as real values in 2016 unless otherwise stated and projected values are given in constant prices. The present value (PV) of the costs and benefits has been calculated using a discount rate of 3.5%[13].

20. In the absence of data on future trends that could be incorporated into the analysis, impacts on sectors are assessed relevant to known levels of activities.

8.1 Approach adopted to assess costs

21. The assessment of costs of the pSPA considers additional costs that could arise relative to the 'do nothing option'. These are:

- surveys to assess the level of activity by users of the marine environment;
- developing and enforcing additional management and or mitigation that is required for the SPA; and
- the monitoring programme that will assess the condition of the features of the SPA.

22. It is anticipated that some users will incur additional costs as a result of the pSPA classification in the event that an Appropriate Assessment (under the Conservation of Habitats and Species Regulations) of a plan or project is required, these costs will vary with project specifics but are assumed to be *de minimis* (further detail is provided in the relevant Sections, this assumption will be tested during formal consultation).

23. Although an Appropriate Assessment may already be required to assess the impacts of a plan or project on the interest features due to existing nearby SPAs, the additional features of the pSPA will require inclusion in these assessments.

24. Many types of plan or project are required to undergo comprehensive environmental assessment under existing legislation. Much of the information required for Appropriate Assessment is required as part of the wider environmental assessment.

25. As with other stages of the planning process developers will need to plan sufficient time for the regulator to undertake an Appropriate Assessment and address any outcomes.

[12] Department for Business Innovation and Skills, 2013.
[13] Discounting is used to reflect society's preference to receive benefits now rather than later.

The length of time this takes is reduced if the developer instigates appropriate consultation[14] at an early stage and provides a comprehensive Habitats Regulations Assessment (HRA).

26. Following classification the relevant authorities assess impacts arising from new human activities on the pSPA and determine the management that is required for the site. As the management is not known at this stage, the additional mitigation that is likely to be needed to address impacts of human activities on the pSPA features has been assessed using the best available information, specifically;

- Discussion with local stakeholders to identify existing activities taking place within the pSPA and any relevant existing management.
- A Vulnerability Assessment conducted by specialists, ornithologists and local staff in Natural England. This analysed the sensitivity of the interest features to different environmental pressures exerted by activities taking place within the pSPA and the level of exposure of the features to these pressures.
- Specialists in Natural England, drawing on their knowledge of existing management and licence conditions for plans and projects to develop management scenarios for those pressures to which the interest features are assessed as showing high and moderate vulnerability.

27. The Vulnerability Assessment highlighted that the non-breeding pSPA interest features show high vulnerability to visual disturbance. Red-throated diver also shows vulnerability to by-catch pressure. This suggests that some additional management may be required for some activities.

28. The remaining non-breeding interest features show moderate vulnerability to by-catch, collision above water, changes in tidal regimes, habitat structure changes, siltation rate changes, abrasion of disturbance of the surface of the seabed or the substrate below, and water flow changes, including sediment transport. Some of these pressures may require additional monitoring as described in Sections 8 and 9.

Table 1 Summary of the Best Estimate costs as a result of classification of the Greater Wash pSPA.

Impacted Private Sector	**Best Estimate Cost £m/yr** (**low - high**)	**Description of Costs**
Recreation	£0	Assumes that the digital aerial survey shows that no restriction or prohibition of unlicensed recreational activities is required and voluntary codes of conduct to encourage responsible use of the environment are extended to cover the pSPA.
Managing the SPA	£10,000	Management coordination by lead authority

[14] Consultation of nature conservation bodies, The Crown Estate, regulatory authorities, non-government organisations (NGOs) and other stakeholders.

	annually	at a cost of £10,000 per annum for joint virtual meetings with a few relative authorities and subsequent reporting.
Electricity from Renewable Energy Sources	£9,500 one off cost	*De minimis* costs (£900 +£3,850) for two developments, associated with undertaking a Habitats Regulations Assessment and cursory review of consent assumed to be in the year after classification (2017).
Commercial Fisheries	£30,000 one off cost	The best estimate scenario would be a bycatch survey to look at red-throated diver bycatch from the net fisheries within the area at a cost to the North Eastern and Eastern IFCAS of £30,000,beginning in the year following classification (2018) and lasting 3 years. A national level study looking at competition and prey availability would be required at a cost to NE. It is assumed that there would be no additional cost to the commercial fishing sector.
Digital Aerial Survey costs	£340,000 one off cost	£150,000 per year for surveys £20,000 per year for analysis **Total Cost: £340,000** in the 2 years post classification
Surveys to assess condition of qualifying features	£300,000 one off cost	£300,000 in 2022 as part of the requirement to report on condition every 6 years.

8.2 Costs

29. The costs to the UK economy are assessed below by sector. Calculation of the total costs is provided in Appendix D. The assessments are subject to considerable uncertainty because it is difficult to predict the exact management that will be required and the costs of complying with new management.

30. The management assumptions used within this impact assessment are specific to the requirements of the species which will be protected by the pSPA. Recent impact assessments for other designations in the area, such as Special Areas of Conservation and Marine Conservation Zones, are based on differing management assumptions which are relevant solely to those habitats and species which they seek to protect.

31. Costs have been estimated using hypothetical management scenarios. These scenarios reflect the uncertainty surrounding what management measures may be implemented once the site is classified. It is assumed that the true costs of any final management measures that are developed for the site will fall within the range stated. The management measures that are implemented will be determined by the relevant authorities (as described in Appendix B) and may differ from the hypothetical scenarios used for this analysis.

32. **Minimum Scenario**: This scenario involves the smallest change in activity and therefore cost that may plausibly be needed as a result of the pSPA classification.

33. **Best Estimate Scenario:** This scenario is considered the most likely cost as a result of the pSPA classification. The best estimate is not a mathematical average of the minimum and worst case scenario but is based upon Natural England's judgement and represents the most likely scenario.

34. **Worst Case Scenario:** This scenario involves the maximum change in activities that could possibly be required as a result of the pSPA classification and the maximum potential cost. It assumes that the activities, plans and projects that could potentially impact upon interest features are deemed to have a Likely Significant Effect (LSE) and assumes that no mitigation could counteract the impact.

35. There is a parallel exercise taking place at the moment to identify a Special Area of Conservation (SAC) for Harbour Porpoise. The result of the Harbour Porpoise SAC is currently unknown, and therefore the counterfactual for this IA does not include any management changes due to the Harbour Porpoise SAC (and vice-versa). It is therefore possible that limitations might affect the same industries. This would mean that the total costs of the two IAs could not be added together without a risk of double-counting. This caveat applies to any other regulatory changes which are not advanced enough to be included in the counter-factual.

8.3 Commercial Fisheries

36. The main commercial fishing methods used within the inshore area of the Greater Wash pSPA are trawling and potting, with a variety of netting activities also occurring throughout the winter months. Netting activities include, gillnetting for cod, fixed intertidal bass nets and longlining also takes place (Eastern IFCA mapping Project, 2010; RSS Marine, 2013).

37. The vulnerability assessment undertaken for the Greater Wash showed that some of the interest features are vulnerable to pressures from commercial fishing activities. Red throated diver are potentially vulnerable to visual disturbance caused by commercial fishing and as bycatch of commercial netting activity. Red throated diver, little gull and common scoter are vulnerable to competition with commercial fisheries for prey.

38. Only UK vessels operate within the inshore 6nm limit. The resources within this inshore area are managed by the Eastern and North Eastern Inshore Fisheries and Conservation Authorities (IFCAs) through local byelaws, national and EU fisheries legislation. Fisheries beyond 6 nautical miles are managed by the Marine Management Organisation (MMO). The IA assumes that management is effective and fully complied with, therefore no enforcement costs are provided.

39. The **Minimum Scenario** assumes that there would be no impact from commercial fisheries on interest features of the pSPA; therefore there would be no management of commercial fisheries needed in addition to the current management in place through existing byelaws.

40. The **Best Estimate Scenario** assumes the need for future surveys.

41. It is assumed with medium confidence that upon classification, Natural England, with the support of IFCAs and other stakeholders, would undertake a national prey study to look at the implications of commercial fisheries on prey availability for pSPA birds. The assumption is therefore that until a management scenario is defined costs are mostly

associated with monitoring only and no extra costs to fisheries arise. This would be a national study looking at the whole suite of marine SPAs, of which Greater Wash area would constitute a small part. The contributing costs of the Greater Wash pSPA would be *de minimis* in the context of the wider study and have not been quantified.

42. In the year following classification, a minimum of a three year bycatch study would be undertaken throughout the pSPA to establish whether there is an impact from netting or longline fisheries on red-throated diver. The bycatch study would be undertaken by the North Eastern IFCA (NEIFCA) and Eastern IFCA (EIFCA), within their districts, to look at the impacts from the netting and longline fisheries. It is estimated with high confidence that a three year bycatch study across the pSPA would cost the IFCAs approximately £30,000 jointly. It is assumed that this cost would be spread evenly across the three years, hence £10,000 per year in 2017,18 and 19. It is assumed with that the bycatch study is likely to find no impact from netting and longline fisheries on red-throated diver. This assumption is based upon evidence from a study conducted in the Outer Thames Estuary[15] in 2013 and will be tested at formal consultation along with the need for the by-catch study.

43. The **Worst Case Scenario** assumes the closure of netting and longline fisheries as a result of the by-catch study. This scenario would only be enacted if netting or longlines showed significant impacts on red-throated diver.

44. If the bycatch study, costing £30,000 in the year after classification, revealed an impact on red throated diver, then a netting and longline byelaw may need to be implemented. Discussions with NEIFCA have given an estimated cost of £50,000 for the advertisement, consultation and implementation for a new byelaw to manage the whole pSPA site, assumed to be implemented in 2021.

45. Bycatch is not considered as a major issue within the Greater Wash area and if bycatch studies revealed that there was a significant impact then suitable management would be implemented**. The closure of netting and longline fisheries would be a final resort and consultation with interested parties would be sought before any decision on the best management measure is made.** We have attempted to estimate the cost of this closure based on modelling of landings and VMS data from the MMO and Fishermap data (further details of which can be found in Appendix F). The estimate is £96,362 annually and it is assumed that this cost begins in 2021. The total value is likely to be an overestimate given that it is based on the broad-scale gear types; nets and lines and only some of the line gear types will interact with red-throated diver. The market value of the landings is also an overestimate of the welfare loss because it does not include the costs of the economic inputs to produce them. Given the limitations of the model and age of the data this value is estimated with low to medium confidence. The lost value of fish landings is in some respects an overestimate of the welfare loss because it takes no account of the produced capital and labour costs savings. Furthermore it takes no account of potential displacement. Conversely there is the possibility of further economic losses as a result of losses within supply chain linkages. However, for the purposes of this assessment it would be disproportionate to further investigate these issues and assumptions can be further explored during consultation.

8.4 Ports and Shipping (including dredging of channels)

46. The IA assumes that the existing port and harbours were operating before the Greater Wash bird survey data was collected and therefore the impact of ongoing use of these ports, including commercial shipping lanes will be reflected in the survey data as the activity forms

[15] http://www.kentandessex-ifca.gov.uk/im-interested-in/research/red-throated-diver-survey/

part of the baseline. Indeed densities of red-throated diver, little gull and common scoter within the Greater Wash are generally lower around ports and harbours (Lawson et al. 2015), as birds forage further from the coast.

47. Appropriate Assessments are already required for coastal development within the pSPA due to the presence of adjacent European marine sites. All of the large ports and harbours in the vicinity of the pSPA fall within these existing SPA boundaries and therefore there is existing management and best practice in place within these sites.

48. In the event of, as yet unconsented, proposals leading to significant increases in commercial shipping through the pSPA, additional management for the non-breeding interest features might need to be considered to mitigate visual disturbance under HRA. Although, given these would be likely to use existing shipping routes, it is assumed that a conclusion of no adverse effect on integrity may be reached as birds will have already adapted their behaviour accordingly e.g. been displaces and/ or habituated.

49. The costs attributable to the classification of the pSPA are thought to be small, as the information required for HRAs is likely to be necessary as part of wider environmental assessments (such as Environmental Impact Assessments), and are therefore not quantified further. The assumption will be tested at the formal consultation stage.

Dredging

50. Dredging is an important activity that facilitates economic activity in the vicinity of the pSPA. Dredging is a long standing activity and will therefore its effects will be reflected in the survey data. Given that it occurs outside of the pSPA there are not assumed to be any additional costs to dredging activity attributable to the classification of the pSPA.

8.5 Recreation

51. Within the pSPA there is a medium level of use by a variety of recreational vessels (sailing boats, wind-surfing, kite-surfing, power boats, jet skis, recreational fishing boats, boats for recreational divers) (MMO 2014). Wildlife watching is popular within the area, with visitors keen to learn more about the natural environment and its attributes (MMO, 2012). There are 23[16] popular bird watching sites on the coastline adjacent to the site, which attract tourists and bring locally significant levels of economic activity (Rayment & Dickie, 2001). Public awareness of the environment and conservation issues positions wildlife watching as a potential growth sector (MMO, 2012).

52. The vulnerability assessment flagged the potential for visual disturbance to interest features from recreational activity within the pSPA.

53. A study to quantify the level of activity would be required as part of the wider digital aerial survey detailed and quantified in Section 9.

[16] Yorkshire Wildlife Trust: Kilnsea Wetlands, Spurn National Nature Reserve; Lincolnshire Wildlife Trust: Donna Nook NNR, Toby's Hill, Saltfleetby-Theddlethorpe Dunes NNR, Sandilands Pit, Huttoft Bank Pit, Anderby Marsh, Wolla Bank Pit, Wolla Bank Reedbed, Chapel Pit, Gibraltar Point NNR; Norfolk Wildlife Trust: Holme Dunes NNR, Cley Marshes, Salthouse Marshes; RSPB: Tetney Marshes, Titchwell Marsh, Snettisham, Breydon Water; National Trust; Blakeney Point NNR, Horsey; Other National Nature Reserves; Holkham, Winterton Dunes.

54. The **Minimum Scenario** assumes that the study of recreational activity levels shows no management measures are required.

55. The **Best Estimate Scenario** assumes with high confidence that the recreational study shows that no restriction or prohibition of unlicensed recreational activities is required and voluntary codes of conduct, to encourage responsible use of the environment, are extended to cover the Greater Wash. The cost of the study is encompassed in the digital aerial survey detailed in Section 9.

56. The **Worst Case Scenario** assumes that the recreational study shows that activity levels have the potential to impact the interest features of the pSPA and the creation of a byelaw to restrict or prohibit certain unlicensed recreational activities is required.

57. At this stage we do not know if the recreational study will lead to any requirements for limitations to recreational activities, which recreational activities would be affected and to what extent. Voluntary codes of conduct to encourage responsible use of the environment would be considered prior to the worst case scenario. The restriction of any recreational activity would be a final resort and consultation with interested parties would be sought before any decision on the best management measure is made. The cost is therefore not quantified in this IA but consultation might help to collate information about any costs.

8.6 Electricity generation from Renewable Energy Sources

58. There are fourteen planned or constructed offshore windfarm projects, with cables or arrays, that fall, in part or wholly, within the boundary of the Greater Wash pSPA (Chart 2). The extent of the impact of classification on these developments will depend on which developmental stage they are at (i.e. in the planning system, consented but not fully constructed, or operational). The different stages are therefore covered below.

59. The Worst Case Scenario assumes that two of the offshore windfarms would not be able to go ahead on the site planned. Directly estimating the resulting welfare loss is difficult and would theoretically require estimates of electricity produced, the value of the electricity and the costs of production. We do not have access to some of this data and some assumptions would need to be modelled into the future. Accordingly, a replacement cost approach has been chosen, which assumes that the proposed offshore windfarms in question would be displaced to another suitable location. We have used an estimate of the windfarms pre-development sunk costs as the best available proxy for the replacement cost. If any of the pre-development costs were transferable to a new site this proxy would represent an overestimate, but it seems likely that most of them are site-specific. We assume the full replacement cost for displacing the windfarms elsewhere falls at the assumed commencement of the designation in 2017, focussing on the decision point when the costs are incurred, rather than expenditure. It is important to note there is a large amount of uncertainty when estimating the pre-development costs for offshore windfarms.

60. The management scenarios outlined below are specific to the requirements of the species which will be protected by the pSPA and may differ from management scenarios outlined for other designations intended to protect different species or habitats.

61. Changes to the funding regime for renewables[17] may limit total funding available for offshore wind farm development. This would change the counterfactual for this assessment, meaning that some wind farms may not go ahead, or may go ahead at less than full capacity, regardless of the Greater Wash SPA. This is another reason why the replacement cost estimate might be an overestimate of the welfare loss in the Worst Case Scenario.

Offshore windfarm infrastructure – with an application yet to be determined

62. The Greater Wash pSPA has the potential to overlap with the offshore cable routes of the Hornsea Project 2 offshore windfarm and the Triton Knoll Electrical System. At the time of writing both projects have submitted an application for development consent which has yet to be determined. It is assumed with high confidence that a conclusion of no LSE on the interest features of the Greater Wash pSPA would be reached for Hornsea Project 2 based upon assessments submitted as part of the project examination[18]. The **minimum scenario** assumes a test for LSE is undertaken by the competent authority, which in this case is the Secretary of State (SoS) for the Department of Energy and Climate Change. In this scenario the SoS concludes quickly that there is no LSE for the Triton Knoll Electrical System and, therefore, an Appropriate Assessment is not required. Given that the SoS must already undertake An HRA for other European sites nearby, the cost to UK PLC is assumed to be *de minimis*.

63. The **best estimate scenario** assumes with medium confidence that the SoS concludes that the Triton Knoll electrical system has a LSE on the Greater Wash pSPA and, therefore, an Appropriate Assessment is required. In undertaking an Appropriate Assessment the assessment assumes that the SoS uses the information available within the Environmental Statement and HRA to conclude that the development does not have an Adverse Effect On Integrity (AEOI) of the pSPA. While this work will not be an additional cost to the developers as they have already undertaken a shadow HRA at an estimated costs of £900, DECC will incur the costs of undertaking the more detailed assessment required to complete an Appropriate Assessment. The amount of time required to carry out such an assessment is assumed to take between 2 and 5 days at an estimated cost to DECC of £3,850 (Table 2).

64. The **worst case scenario** assumes that the SoS concludes that the Triton Knoll electrical system has an AEOI and developmental consent yet to be determined cannot be granted. This scenario assumes that the consent holder is required produce a more detailed HRA document that makes use of new monitoring data and analysis. On completion of the review of consent, the SoS concludes that the project has an AEOI of the Greater Wash pSPA and any proposed mitigation cannot reduce the impact below adverse levels. Although **very unlikely** the lost development costs associated with a refused consent would be

[17] A Contract for Difference is a private law contract between a low carbon electricity generator and the Low Carbon Contract Company, which is a government-owned company. A generator party to a Contract for Difference is paid the difference between the 'strike price'- a price for electricity reflecting the cost of investing in a particular low carbon technology- and the reference price'- a measure of the average market price for electricity in Great British market. Offshore renewable developers can apply for Contracts for Difference within specific funding rounds. There have been two funding rounds to date. In April 2014 five offshore windfarm projects were awarded Contracts for Difference, one of which was Hornsea Project 1. A second round took place in February 2015. Further funding rounds are anticipated on an approximately annual basis. The level and availability of funding for Contracts for Difference is also set annually.

[18] The examination for Hornsea Project 2 closed on 16 December 2015. There is then a period of 3 months for the Examining Authority to consider and make a recommendation to the Secretary of State. The Secretary of State will have 3 months in which to make their decision.

incurred by the developer and the cost of completing an Appropriate Assessment would be incurred by the SoS. Given that the SoS must already undertake a Habitats Regulations Assessment (HRA) for other European sites, the cost to the SoS is assumed to be *de minimis*. However, the cost to the developers would be significant.. The pre-development costs for the Triton Knoll Electrical System are incorporated within the estimate for the Triton Knoll Array, detailed in paragraph 67 (see Appendix E for pre-development cost calculations).

Table 2. Estimated cost to DECC and Offshore wind farm developer of undertaking an Appropirate Assessment or shadow HRA

	Hourly rate	Hours /day	Days	Total (one off cost)
Estimated cost to developer of shadow HRA	£60	7.5	2	£900
Estimated cost to DECC of completing Appropriate Assessment	£110	7	5	£3,850

Hourly rate is based upon Natural England Discretionary Advice Service hourly rate. Hourly cost to developer is based upon an average ecological consultant hourly rate.

Offshore windfarms infrastructure – with consent but not yet operational

65. The Greater Wash pSPA has the potential to overlap with five offshore windfarms arrays and/or cables that have been given developmental consent but are yet to be constructed. These are:1.) Dogger Bank Creyke Beck A & B, 2.) Hornsea Project 1, 3.) Dudgeon, 4.) Race Bank and 5.)Triton Knoll.

66. Should the greater Wash be classified, the SoS has a duty, under the 'Habitats Regulations', to review any existing consents for offshore wind farm projects that are not yet generating power. The SoS also has a duty to undertake a HRA for any additional 'tailpiece' conditions, i.e. those that have been deemed must be discharged before a project can be implemented.

67. It is assumed with high confidence that a conclusion of no LSE on the interest features of the Greater Wash pSPA would be reached for Dogger Bank Creyke Beck A&B, Hornsea Project 1 and Dudgeon based upon assessments submitted as part of the project examinations and the informal dialogue process.

68. The **Minimum Scenario** assumes a test for LSE is undertaken by the SoS in consultation with the relevant Statutory Nature Conservation Bodies (SNCBs) for each project. In this scenario the SoS concludes quickly for each project that there is no LSE and an Appropriate Assessment is not required. The cost of undertaking a test for LSE is incurred by the SoS, and there will also be a cost to NE for providing advice to the SoS. However, the cost of this process is assumed to be *de minimis* when compared to worst case scenario costs.

69. The **Best Estimate Scenario** assumes with medium confidence that the SoS concludes that the Race Bank and Triton Knoll developments have a LSE on the Greater

Wash pSPA and, therefore, an Appropriate Assessment is required. In this scenario the consent holder is required to produce a shadow HRA document to sign-post the competent authority to the relevant information to inform the review of consent. It is assumed that upon review of this information the competent authority concludes that all five projects do not have an Adverse Effect on the Integrity (AEOI) of the site's interest features. The cost of producing a shadow HRA document will be determined by the requirement for new assessment work, but much of this information is likely to come from the Environmental Statement. Accordingly, this scenario assumes that the production of a shadow HRA will come at *a cost of £900* to the consent holder. Multiplying £900 by two developments gives a one-off cost of £1,800 to business assumed to occur in 2017.The cost of undertaking a review of consent and provision of statutory advice is borne by DECC and NE. The amount of time required to carry out such an assessment is assumed to take DECC between 2 and 5 days at an estimated cost of £3,850 per development. Multiplying £3,850 by two developments gives a one off cost of £7,700.

70. The **Worst Case Scenario** assumes that the consent holder is required to produce a more detailed HRA document that makes use of new monitoring data and analysis. On completion of the review of consent, the SoS concludes that the Race Bank and Triton Knoll offshore windfarm projects have an Adverse Effect On the Integrity of the Greater Wash pSPA and any proposed mitigation cannot reduce the impact below adverse levels. Accordingly, the maximum scenario, although **very unlikely**, assumes that both consents are revoked. The cost to the consent holders will be significant as pre-development[19] costs are estimated to be £40 million for Race Bank and £84 million for Triton Knoll (DECC, 2013a) (see Appendix E for pre-development cost calculations). These costs are all assumed to fall in 2017 upon classification

Table 3. Summary of the worst case scenario costs for Triton Knoll and Race Bank offshore wind farm projects

Project Name	Pre development costs based upon the maximum Mega Watts awarded[20]
Triton Knoll Array and Triton Knoll Electrical System	£84 million
Race Bank	£40 million

71. *Offshore windfarm infrastructure – in operation*[21]

[19]Here Pre-development refers to work undertaken prior to the commencement of physical construction work.

[20] Calculation of the worst case scenario costs is based upon projected pre-development electricity generation costs by the Department of Energy & Climate Change for Round 2 and Round 3 offshore windfarms (DECC 2013). The projections are provided in £/KW for the year 2017. Costs were multiplied by the total awarded capacity of each project in MW[20] to give a high, medium and low pre-development cost (Appendix E). As all of the projects considered are at the pre-development stage no construction costs were included in the calculations.

[21] 'Operational' offshore windfarm infrastructure is defined as those which are generating power at the time of classification.

72. There are seven operational offshore wind farm projects with an array or cable route that overlap with the distribution of at least one of the pSPA interest features. These are: Humber Gateway, Lincs, Lynn, Inner Dowsing, Scroby Sands, Sheringham Shoal, and Westermost Rough. This IA assumes with very high confidence that these projects will not be required to undergo a review of consent as their consent is already dispatched. However, the competent authority will be required to make an assessment of the LSE and adverse effect on site integrity under the Habitats Regulations, **if** a project varies or amends an existing consent. Operators may request future variations and amendments to consent for unforeseen reasons, or for ongoing Operation and maintenance activities not considered as part of the original consent, the costs of which will be highly project specific and are not quantified in this IA. Further information will be sought from relevant representatives during consultation.

8.7 Aggregate Extraction

73. Aggregate dredging and aggregate screening occurs within the boundary of the Greater Wash pSPA and requires a Marine Licence provided by the MMO under the Marine and Coastal Access Act (2009) in parallel with meeting the requirements of the Marine Works (Environmental Impact Assessment) Regulations 2007 as amended in 2011 (MWR).

74. There are 13[22] licensed areas and two application areas located partially or wholly within the pSPA (Chart 3).

75. Within the pSPA the majority of aggregate licences were recently renewed in 2013/2014 for a period of fifteen years. Should the pSPA be classified then all such licences, would likely be required to be reviewed to ensure they comply with the Habitats Regulations.

76. A similar review of consent for 36 aggregate licenses or applications took place in the nearby Outer Thames Estuary SPA when it was classified in 2010 (DECC 2013b) reaching a conclusion of no likely significant effect[23]. The Outer Thames Estuary SPA is a similar offshore site which also protects red-throated diver, the most sensitive of the three non-breeding interest features.

77. For the purposes of the IA it is assumed that the disturbance effect of the activity alone on the non-breeding interest features is very small and could possibly be considered as immaterial as much of this activity forms part of the baseline. If the impact alone were found to be of material consideration a Review of Consent with other activities would be required. The costs of such a Review of Consent are not quantified in this IA.

8.8 Coastal Defence

78. A variety of hard coastal defences are located along the landward boundary of the pSPA, protecting coastal communities, industry and nationally important infrastructure[24].

[22] Crown Estate Aggregate Licence GIS data 10/06/2015

[23] https://itportal.decc.gov.uk/EIP/pages/projects/LondonAAssessmentThames.pdf

[24] These are described in detail in the relevant Shoreline Management Plans, SMP3 Flamborough Head to Gibraltar Point (Scott Wilson, 2010), SMP4 Gibraltar Point to Hunstanton (EACG 2010a), SMP5 Hunstanton to Kelling Hard (EACG, 2010b), SMP6 Kelling Hard to Lowestoft (AECOM 2010).

79. Maintenance of existing hard coastal defences are unlikely to impact on the populations of red-throated diver, common scoter and little gull as the density of these species is lower in the coastal zone where works would occur.

80. There are two ongoing beach re-nourishment schemes along the coast of the pSPA; Lincshore and Eccles-Winterton. Any associated marine aggregate activity is carried out under licence and would require HRA (Section 8.7).

81. Information in the Shoreline Management Plans suggests that it is highly likely that, along with maintenance of existing coastal defences, the Environment Agency will apply for licencing to continue this work, which was ongoing at the time of the bird surveys and as such forms part of the baseline (Crown Estates 2014).

82. The costs attributable to the classification of the pSPA, in light of known plans and project are thought to be small as the information required for such an assessment is likely to be required as part of wider environment assessments (such as Environmental Impact Assessments) and appropriate assessments are already required for development within the pSPA area due to the presence of adjacent European marine sites (Gibraltar Point & The Wash SPAs). These *de minimis* costs have not been quantified for this IA.

8.9 Oil and Gas

83. Licenced oil and gas areas within the Southern North Sea predominantly occur further offshore from the pSPA boundary, although a few extend to the seaward edges of the pSPA and there are some subsea wellheads within the site. These are connected to centralised pumping units and subsequently pipelines that cross the site making landfall at Easington, Theddlethorpe, Tetney and Bacton.

84. The oil and gas authority (part of DECC) recently completed a new offshore oil and gas licensing round (the 28th seaward licensing round). Licence holders have exclusive rights to explore, but would be required to undertake an Environmental Impact Assessment and Habitats Regulation Assessment before any extraction activity could commence. The cost of any future licence application is subject to considerable uncertainties and would be highly project specific: therefore not quantified in this IA but further information will be sought during consultation.

85. Oil & gas infrastructure consents that are yet to be implemented may be reviewed to ensure that they comply with the Habitats Directive. However, given their location it is assumed with high confidence that works are unlikely to significantly affect the interest features or their supporting benthic habitat: therefore a full review would not be required.

86. The costs attributable to the classification of the pSPA are thought to be small, as the information required for any assessment is likely to be required as part of wider environment assessments (such as Environmental Impact Assessments). The costs are therefore not quantified because it would be disproportionate to do so. Furthermore, the use of existing infrastructure would reduce the likelihood of a significant impact on the pSPA and the small costs have not been quantified for this IA.

9 Costs of Managing the pSPA

9.1 European Marine Site (EMS) Management Group

87. There is no legal requirement to establish local or regional management coordination groups, although provisions are provided for European Marine Sites in The Conservation of Habitats and Species Regulations 2010 (as amended) for relevant authorities to work together to develop a suitable management scheme.

88. Traditional EMS Management Schemes comprise of groups of the relevant authorities to coordinate management, the major associated cost being funding of a project officer.

89. With current fiscal restraints and an increased number of sites in the Marine Protected Area (MPA) network, there is a need to review how and where management coordination is required to ensure structures are appropriate and sustainable.

90. The relevant and competent authorities with responsibilities for the Greater Wash pSPA will need to determine the appropriate management arrangements upon classification, linked to future national reporting requirements.

The IA assumes that management detailed in the management scenarios will be effective and fully complied with therefore no enforcement or compliance costs are provided

91. The **Minimum Scenario** assumes a national MPA management steering group would be established. The aim of this group would be to facilitate improved national reporting and co-ordination of MPA management. A national coordinator post is likely to be in place by 2016.

92. Relevant Authorities would report on management action and outcomes in Natural England's designated sites, with local coastal issues being coordinated through existing EMS Management Schemes.

93. The **Best Estimate Scenario** assumes, with moderate confidence, that coordination between a small number of relative authorities is sufficient, since, despite the relatively large size of the pSPA, the number of interest features, and the number of interactions that may cause significant adverse effects, are relatively low.

94. Management coordination would be led by a lead authority, and consist of virtual meetings with a small annual cost associated with attending meetings and implementing reporting (approximately £10,000 per annum based on W&NNC project costs). This is based on the assumption that there would be a lead authority but the relatively large area of the site is reflected in the estimated cost.

95. The **Worst Case Scenario** assumes the need for an entirely new management group. It is assumed the management group would meet quarterly, based on experience. Its members would be responsible for:

a. Establishing and reviewing a scheme of management, including an action plan;

b. Establishing and reviewing a monitoring plan for periodic assessment and review of the site;

c. Meeting periodically to consult with representatives from any advisory group/s of local sea users that may be established to inform the management group or other existing interest groups (local or national).

96. Where appropriate, public consultation (with publicity at appropriate stages) may be required for site management proposals[25]. It is assumed for the purposes of the IA that an advisory group of representatives of other stakeholders including local interests, user groups and conservation groups would also be formed.

97. The cost of such a group would be £35,000 annually, with higher initial costs due to establishment as outlined in Table 3. Organisations would incur costs from involvement in the management group and advisory group.

98. In addition, stakeholder groups participating in the advisory group are estimated to incur total costs of around £13,500 per year[26]. Though this is an annual cost that will be incurred by the private sector it is not an administrative cost[27] as defined by the government's Simplification Programme. The total cost of inputs to the management and advisory group are outlined in Table 3.

Table 3 Economic costs of impact of the pSPA on Relevant and Competent Authorities: EMS Management

Minimum scenario:	***Assumptions***	***Costs***
National Coordination of management.	Assumed that cost to National group per site would be negligible. Reporting on management to DSS also likely to be negligible.	£0
Best estimate:	***Assumptions***	***Annual Costs***
Management by small group of Relevant/Competent Authorities (NE, JNCC, EIFCA, NEIFCA, MMO)	Assumed that costs would be similar to existing EMS Management Schemes such as W&NNC, but would be less expensive as management would be relatively simple based on the number and requirements of the features. Wouldn't require dedicated full time project officer, although absence of this post may place more of a burden on the lead authority to drive management co-ordination. This is based on the assumption that there would be a lead authority but the relatively large area of the	£10,000 total per annum – joint meetings and reporting.

[25] The management schemes for existing English marine Natura 2000 sites were developed with participation of user groups and extensive consultation. Many of these sites are located in estuaries or on the coast and have strong links with adjacent terrestrial protected sites (such as The Wash SPA, North Norfolk Coast SPA, Gibraltar Point SPA and Humber Estuary SPA).

[26] Input to the advisory group for each of the stakeholder groups (of which there could be about fifteen) is estimated here to cost about £900 per year (in staff time and travel costs), a total cost of £40,000 per year.

[27] Under the Simplification Programme, administrative costs arise from regulatory obligations for the private sector to provide information and data to the public sector (Better Regulation Executive, 2005).

	site is reflected in the estimated cost of £10,000.	
Worst Case scenario:	***Assumptions***	***Annual Costs***
EMS Management Scheme	Assumes a similar arrangement as existing EMS schemes, with startup costs in first and second year being significantly higher. Costs based on Wash & North Norfolk Coast EMS Management Scheme	EMS & Advisory group Year 1 post classification £105,000[28] + £13,500 Year 2 post classification £70,000 +£13,500 Subsequent years post classification £35,000 EMS £13,500 Advisory group

9.2 Survey Costs

99. Population abundances of the non-breeding features of this pSPA are based upon the results of visual aerial surveys. The industry standard is now digital aerial surveys, with recent work at existing marine SPAs indicating current population estimates derived from visual aerial surveys are potentially gross underestimates.

100. These surveys will have the additional benefit of contributing to the understanding of the drivers of bird distribution.

101. There is currently no funding set aside for baseline setting of proposed marine SPAs. While Natural England, JNCC and other Statutory Nature Conservation Bodies are exploring alternative funding streams, there is current uncertainty as to whether funding would be available.

102. In each of the cost scenarios presented below, data analysis would include modelling of activity data with environmental factors and bird distributions of the three non-breeding species to inform the level of potential visual disturbance from recreational and fishing activities and the need for any further survey or management.

103. The **Minimum Scenario** assumes that no survey is carried out. The current evidence (from visual aerial survey) is current best available evidence, and could be used to set a baseline. A desk based study to look at potential disturbance from recreational and fisheries activity is undertaken at negligible cost.

104. The **Best Estimate Scenario** assumes, that two surveys per annum are carried out over two years. This scenario involves one survey in autumn and one in winter and/or by means of stratified sampling, whereby survey effort is concentrated in focal areas that are already known to consistently hold the bulk of the populations.

[28] Costs based on costs of the Wash & North Norfolk Coast EMS Management scheme for FY 2014/15 (approximately £35,000, with £32,000 being project officer salary and associated costs.) Input to the management group for each of the relevant authorities (of which there could be about twenty) is estimated here to cost about £2,000 per year (in staff time and travel costs), a total cost of £40,000 per year. The cost to the lead authority of hosting the group is estimated at about £7,000 per year (in staff time for participating in the group, arranging meetings, taking minutes amongst other things). Costs in first and second year assumed to be triple and double normal annual costs to reflect start-up costs whilst the management scheme for the site is developed and the advisory group is established.

105. Costs could be reduced if only one year of survey was conducted, with one survey in autumn and one in winter. However, there is a risk that not enough data would be collected to meaningfully estimate population abundances and distributions.

106. The cost of this combined site survey to confirm population numbers and distribution for the three waterbird species and the disturbance survey is estimated with high confidence at £170,000 per year for two years, leading to a total cost of £340,000 (assumed to take place in the first two years after classification with half the cost falling in each year).The cost of additional analysis of data to ascertain the impacts of recreational and fisheries disturbance is assumed to be negligible.

107. This **Worst Case Scenario** assumes a three year digital aerial survey for red-throated diver, common scoter and little gull, consisting of four surveys per year.

108. One feature occurs in autumn only and another two features that occur most in late winter. Therefore Digital aerial surveys of the pSPA in autumn and winter, with two surveys in each season (four total per year), would provide precise and reliable estimates of the populations and distributions of three of the site's features based on the current best practice for such at-sea surveys.

109. Analysis of this data would be required to determine species density and populations. The cost of additional analysis of the data to ascertain impacts of recreational and fisheries disturbance is assumed to be negligible.

Table 4 Economic costs of impact of the pSPA on Natural England/JNCC: Digital Aerial surveys

Minimum scenario:	***Assumptions***	
Do nothing.	Assumed that current data from visual aerial survey is best available evidence.	**£0**
Best estimate:	***Assumptions***	
	Two seasons of survey, with one survey in Autumn and one survey in winter would give sufficient data to calculate population abundances. Cost of analysis would remain as for the Maximum scenario.	£150,000 per year for surveys £20,000 per year for analysis **£340,000** total cost over two years post classification (2017 & 2018)
Worst Case scenario:	***Assumptions***	
	Three seasons of survey would give sufficient data to determine distributions and population sizes. Two surveys in each relevant season would be required. Peak occurrence of little gull is in autumn/early winter, and peak occurrence of red-throated diver/common scoter	£300,000 per year for surveys (Year 1,2 &3 post classification) £20,000 per year for analysis (Year 1,2 &3 post classification) **£960,000** total cost over the three years post classification.

	is in late winter, requiring four surveys per season. Assumed to be double cost of the full survey of the entire Outer Thames Estuary SPA (£150,000), similar sized site but only 2 surveys conducted.	

9.3 Site Monitoring

110. The JNCC and Natural England will face additional survey costs to assess the condition of interest features in the site given the requirement to report on the condition of the UK network of Marine Protected Areas on a 6-yearly basis under the Marine and Coastal Access Act 2009[29].

Tern Species

111. Monitoring of tern numbers at their breeding sites is already undertaken. This is anticipated to continue, with data being collated via the JNCC Seabird Monitoring Programme Database.

112. The foraging areas of breeding terns was previously unknown, and was assumed to occur within the maximum range each species could energetically achieve (Thaxter *et al.* 2012). The survey and modelling of terns to determine their foraging areas away from their breeding colonies has refined understanding of the areas actually used by each colony, and in the future may be required to inform an assessment of site condition of the pSPA over time. The monitoring strategy to achieve this has yet to be agreed and will depend on several factors, such as a policy decision on the future of marine monitoring of birds.

Red-throated diver, common scoter, little gull

113. In addition to the digital aerial surveys for the non-breeding qualifying features discussed above, a one-year digital aerial monitoring survey will be required in 2022 to report on the condition of the interest features. The cost of this is estimated with high confidence at £300,000, based upon previous survey work at a similar sized site. This is a cost of managing the site and therefore included in all 3 scenarios.

114. It is assumed that the survey would be repeated every 6 years thereafter to inform statutory reporting on site condition although this is very unlikely given the limited budgets available to the JNCC and Natural England. The JNCC and Natural England are investigating External Funding options for this work as part of wider seabird monitoring, but there is current uncertainty around securing such funding.

9.4 National Fisheries research

115. Commercial fishing may reduce the availability of prey items for the protected birds within the pSPA either by targeting those fish species on which the birds rely or indirectly as a result of by-catch or modification of the habitat upon which the prey species depend. However there is currently insufficient evidence to determine whether or not this is a significant issue, and therefore a study is required to quantify the level of fishing activity and determine whether additional management measures are needed and what they might be.

[29] http://www.legislation.gov.uk/ukpga/2009/23/schedule/13

Management measures would be a last resort and only advocated where a significant impact was demonstrated.

116. This is an issue across several SPA and pSPAs within England and it is assumed that this survey would be undertaken at a national level to address the uncertainty at a cost to Natural England. The cost of this work attributable to the Greater Wash pSPA would be *de minimis* in the context of the wider suite of classified sites. Should this study show significant impacts upon the features of the pSPA then further management of fisheries may be required as detailed in Section 8.3.

9.5 Other unquantified costs of managing the SPA:

117. The following costs to the public sector (which cannot be quantified) will also be incurred as a result of the SPA:

- Informing users of the marine environment about the site and any management measures that are required. This will include addition of the site to charts by the UK Hydrographic Office and communication through Notice to Mariners.
- If necessary, review by competent authorities of outstanding permissions and consents and other existing activities that may have impacts on the features protected by the SPA. This will include Habitats Regulation Assessments and if required, Appropriate Assessments undertaken by competent authorities, as a result of potential development in the local area. There will also be one-off costs to Natural England for providing advice to inform this review.
- As future plans and projects came forward, Lead competent authorities will need to undertake an Appropriate Assessment of any that have a likely significant effect on the SPA qualifying features.

10 Industries that are not expected to incur costs as a result of classification

10.1 Cables and Pipelines

118. There are 34 active gas and chemical pipelines that run through the pSPA and intersect the coastline. In addition there are three telecommunication cables, only one of these is active and connects the UK to the Netherlands.

119. Infrequent maintenance and/or repair activities may be required for cables and pipelines during their lifetime. Such activities are likely to have little impact on the potential interest features of the pSPA and it is assumed that additional conditions to protect the interest features will not be required.

120. Accordingly, this IA assumes that classification of the pSPA will not create any additional cost to the industry or its regulators.

10.2 National Defence

121. Any area of United Kingdom waters can be used for military defence activities.

122. Ministry of Defence training areas overlap with a relatively small proportion of western (landward) areas of the Greater Wash, with the whole of the landward side of the site overlapping with Military Low Flying Zones (Defra 2014), and Air Weapons Ranges located at RAF Holbeach (within The Wash SPA) and RAF Donna Nook (Defence Estates, undated). There are also minor training areas close to the site at Salthouse Heath and Kelling Heath. A number of RAF bases are located in the East Midlands and East Anglia.

123. The extent of current military activities in the pSPA and any impact these may have on the interest features is unknown. However Naval activities in designated sites are currently managed through the Environmental Protection Guidelines (Maritime), which ensures that the MoD does not operate without due regard for protected habitats and species (Royal Navy 2013).

124. Accordingly this IA assumes that classification of the pSPA will not create any additional cost to national defence.

11 Benefits of the SPA

125. The benefits of the pSPA are set out in terms of the ecological impacts and economic benefits.

Ecological benefits

126. Classification of the pSPA will reduce the risk that the size of the population of red-throated diver, common scoter, little gull, common tern, little tern and Sandwich tern will decrease in the future. This will include the extent of their habitat and the abundance and distribution of their prey.

127. Classification of the pSPA will provide a mechanism through which any impact of human activities on the interest features can be identified and if necessary addressed.

128. Furthermore, classification of the SPA will provide a monitoring and management mechanism to identify non-anthropogenic changes over time.

Economic benefits

129. Quantification of the site-specific economic benefits would require an in-depth valuation study. The effort and resources required for this would be disproportionate to the expected scale of the impacts and therefore benefits are described in qualitative terms.

130. The pSPA may result in benefits through wildlife watching if it encourages people to start wildlife watching, increases the number of wildlife watching visits people make, or visitors perceive that it improves their experience. For some of these visitors this wildlife watching could be a contribution to formal education. Although there is moderate confidence that these benefits will occur they are not quantified in this IA[30]. However as an example of the importance of wildlife watching to local economies, it is worth noting that tourists spend £191 million per year in North and West Norfolk and that this provides 7,870 full time jobs representing 17.5% of employment in the two districts. A survey of six sites on the coast associated with landscape and biodiversity estimate that the annual spend of visitors to these sites was £12 million which supports 442 full time jobs (Rayment & Lewis 2000). Along the coastline included in the pSPA, there are a total of 23 sites (see section 8.5).

131. Classification of the site could potentially provide a stimulus for research in the Greater Wash pSPA that increases understanding of the proposed species and their habitat and interaction with industry sectors such as offshore wind.

[30] For the SPA to have an impact at national scale, an overall increase in the contribution that wildlife watching makes to visitors" wellbeing would need to arise. This is because the contribution that the SPA makes to visitors" wellbeing may substitute for the contribution made by visits to alternative locations in the UK.

132. The pSPA may provide access to new opportunities and encourage new collaborations for improved monitoring and research by NGOs, universities and industry on bird species and associated habitats in the area.

133. Some people benefit from the knowledge that seabirds and waterbirds are protected and therefore present in higher numbers in the SPA (this is known as existence value). There is no research specific to the pSPA and its interest features, but McVittie and Moran (2008) found significant values for marine production in general. They also gain from having the option to benefit in future from species in the SPA, even if they do not currently benefit from them (option value). Extra economic evidence for any studies aimed at assessing economic benefits of marine protected areas (both nationally and internationally) will be sought during consultation even though it is expected that these will be treated as indicative estimates.

12 Summary of costs and benefits

134. In summary, the known costs of the SPA arise from assessing and if necessary mitigating, the impacts of commercial fisheries and electricity generation from renewable energy sources on the interest features. In addition there are likely to be costs as a result of management, a digital aerial survey, a fisheries by-catch study and 6 yearly site monitoring.

135. The benefits arise through impacts on the populations of red-throated diver, common scoter, little gull, common tern, little tern and Sandwich tern and their supporting habitat. Classification will provide a mechanism through which anthropogenic impacts on these populations can be identified, monitored and if necessary addressed as well as providing opportunities for research and collaborations. Further benefits include additional wildlife watching opportunities and non-use or existence values.

136. If the pSPA is not classified, an important component of the UK's marine protected area network will be missing. This could increase the risk that the marine ecosystem will not be resilient to environmental change, particularly in the context of climate change and market failures in the marine environment.

Table 5 Summary of costs and benefits of the SPA

	Best Estimate Scenario	**Minimum Scenario**	**Worst Case Scenario**
Costs			
Commercial Fisheries	The best estimate scenario would be a bycatch survey to look at red-throated diver bycatch from the net fisheries within the area at a cost to the North Eastern and Eastern IFCAS of £30,000,beginning in the year following classification (2018) and lasting 3 years. A national level study looking at competition and prey availability would be required at a cost to NE. It is assumed that there would	Assumes that no additional fisheries management measures would be required. A national level study looking at competition and prey availability would be required at a cost to NE.	In the event that the bycatch study, costing the IFCAs £30,000, showed an impact from netting fisheries on red-throated diver. A byelaw to prevent netting activities within the pSPA would cost the IFCAs £50,000 in advertisement, consultation and implementation in

	be no additional cost to the commercial fishing sector.		2021. These costs would be incurred in the years following the bycatch study. The closure of the netting and longline fishery would cost the fisheries £96,362. A national level study looking at competition and prey availability would be required at a cost to NE.
Recreation	Assumes that the recreational study shows that no restriction or prohibition of unlicensed recreational activities is required and voluntary codes of conduct to encourage responsible use of the environment are extended to cover the pSPA.	Assumes that the study of recreational activity levels shows no management measures are required.	Assumes the creation of a byelaw to restrict or prohibit certain unlicensed recreational activities.
Electricity from renewable energy	*De minimis* costs (£900 +£3,850) per development associated with undertaking a Habitats Regulations Assessment and cursory review of consent assumed to be in the year after classification (2017). **Total cost: £9,500**	*De minimis* costs associated with undertaking a Habitats Regulations Assessment assumed to be in the year after classification (2017)	The unlikely loss of pre-construction costs for two offshore wind farm projects if consent is not granted/revoked. £124 million assumed to be in the year after classification (2017)
Managing the SPA	Management coordination by lead authority at a cost of £10,000 per annum for joint virtual meetings with a few relative authorities and subsequent reporting. This is based on the assumption that there would	National MPA management steering group at a cost of £0.	EMS & Advisory group: **Year 1** post classification £105,000[31] + £13,500 **Year 2** post classification

[31] Costs based on costs of the Wash & North Norfolk Coast EMS Management scheme for FY 2014/15 (approximately £35,000, with £32,000 being project officer salary and associated costs.) Input to the management group for each of the relevant authorities (of which there could be about twenty) is estimated here to cost about £2,000 per year (in staff time and travel costs), a total cost of £40,000 per year. The cost to the lead authority of hosting the group is estimated at about £7,000 per year (in staff time for participating in the group, arranging meetings, taking minutes amongst other things). Costs in first and second year assumed to be triple and double normal annual costs to reflect start-up costs whilst the management scheme for the site is developed and the advisory group is established.

	be a lead authority but the relatively large area of the site is reflected in the estimated cost.		£70,000 +£13,500 **Subsequent years** post classification £35,000 EMS + £13,500 Advisory group **Total cost:** £202,000 first two years post classification and £48,500 each subsequent year.
Digital Aerial Survey Costs	£150,000 per year for surveys £20,000 per year for analysis **Total Cost: £340,000** in the 2 years post classification	£0.	£300,000 per year for surveys (first 3 years post classification) £20,000 per year for analysis (first 3 years post classification) **Total cost:** **£960,000** over three years post classification
Surveys to assess condition of qualifying features	£300,000 in 2022	£300,000 in 2022	£300,000 in 2022 as part of the requirement to report on condition every 6 years.
Other unquantified costs of managing the SPA	Cost of informing users of the site including incorporating the site onto nautical charts and into relevant publications. Other costs to competent and relevant authorities as a result of: • reviewing outstanding or existing consents or permissions; • undertaking Appropriate Assessment of future plans and projects. Natural England may incur additional costs in informing the above.		
Benefits			
Ecological	Reduced risk to the population and habitats of the proposed species from human activities and the provision of a monitoring and management mechanism to identify non-anthropogenic changes over time		
Education	Increased opportunities to educate the public on the proposed species and wider marine conservation issues.		
Research	Stimulus for research to increase understanding of the proposed species and their habitat and interaction with industry sectors such as offshore wind and aggregates. Classification of the pSPA may also provide new opportunities for collaboration.		
Recreational wildlife	Protection of and the potential for increased numbers of qualifying and other marine bird species will preserve and potentially improve the quality		

watching	of bird watching.
Non-use values	May benefit the (unknown) proportion of the UK population that values conservation of waterbirds and/or the marine environment (estimated with medium confidence).

13 References

AB ports http://www.abports.co.uk/Our_Locations/Short_Sea_Ports/Kings_Lynn (last accessed 12/11/2015).

AB ports http://www.abports.co.uk/Our_Locations/Humber/ (last accessed 03/12/2015)

AB Ports (2014) Economic value of ABP to the UK PLC. Online: http://www.allaboutshipping.co.uk/wp-content/uploads/2014/07/ABP-Economic-Value-Final-Issued-14012014.pdf (last accessed 03/12/2015)

AECOM, 2010. Kelling to Lowestoft Ness Shoreline Management Plan. Adopted August 2012. http://www.northnorfolk.org/smp6/

Armstrong, M., Brown, A., Hargreaves, J., Hyder, K., Pilgrim-Morrison, S., Munday, M., Proctor, S., Roberts, A. and Williamson, K. 2013. Sea Angling 2012 – a survey of recreational sea angling activity and economic value in England. Defra report. 16pp.

BirdLife International (2016) IUCN Red List for birds. Downloaded from http://www.birdlife.org on 16/03/2016.

Crown Estate and British Marine Aggregate Producers Association (2013) 16th annual report; marine aggregate extraction 2013. Available online at http://www.thecrownestate.co.uk/media/438891/ei-marine-aggregate-dredging-sixteenth-year-review.pdf last accessed 07.10.2015.

Crown Estates, 2014. Marine Aggregates: The Crown Estate Licences: Summary of Statistics 2014. http://www.thecrownestate.co.uk/media/476134/ei-marine-aggregate-statistics-2014.pdf

Department for Business Innovation and Skills (2013) Better Regulation Framework manual: practical guidance for UK government officials*. BIS, London.* *https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/211981/bis-13-1038-better-regulation-framework-manual-guidance-for-officials.pdf*

Department for Energy and Climate Change (2013a) Electricity Generation Costs (December 2013) [pdf] online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/269888/131217_Electricity_Generation_costs_report_December_2013_Final.pdf (last accessed 16th December 2015)

Department for Energy and Climate Change (2013b) Review of the Outer Thames Estuary Sepcial Protection Area (SPA) [pdf] online at: https://itportal.decc.gov.uk/EIP/pages/projects/LondonAAssessmentThames.pdf (last accessed 12th January 2016)

Defra (2007) An Introductory Guide to Valuing Ecosystem Services*. Defra, London.* *https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69192/pb12852-eco-valuing-071205.pdf*

Defra (2002) Safeguarding *our Seas*. Defra, London. http://www.defra.gov.uk/environment/marine/documents/marine_stewardship.pdf *Impact Assessment for Flamborough and Filey Coast Special Protection Area* 13

Defra (2012) *Biodiversity 2020: A Strategy for England's Wildlife and Ecosystem Services.* Defra, London. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69446/pb13583-biodiversity-strategy-2020-111111.pdf

Defra (2009) Delivering *Marine Conservation Zones and European Marine Sites: a draft strategy for marine protected areas*. http://www.defra.gov.uk/corporate/consult/marine-conservation-zones/MPA-draft-strategy-consultation.pdf

Defra (2012) *Biodiversity 2020:* A Strategy for England's Wildlife and Ecosystem Services http://www.defra.gov.uk/publications/files/pb13583-biodiversity-strategy-2020-111111.pdf

Drew Associates (2004) Research into the Economic Contribution of Sea Angling. http://resources.anglingresearch.org.uk/sites/resources.anglingresearch.org.uk/files/Economic_Impact_Sea_Angling_England_Drew_Report_2004.pdf

Department for Energy & Climate Change (2013) Review of the Outer Thames Estuary Special Protection Area (SPA) July 2013. Available online at: https://www.og.decc.gov.uk/EIP/pages/projects/LondonAAssessmentThames.pdf last accessed 07.10.2015

EACG (East Anglian Coastal Group), 2010a. The Wash Shoreline Management Plan 2: Gibraltar Point to Old Hunstanton. August 2010 http://eacg.org.uk/smp4.asp

EACG (East Anglian Coastal Group), 2010b. North Norfolk Shoreline Management Plan: Final Plan. November 2010. http://eacg.org.uk/smp5.asp

Eastern Inshore Fisheries Conservation Authority. www.eastern-ifca.gov.uk (last accessed 12/11/2015)

Eastern Inshore Fisheries Conservation Authority Mapping Project 2010 http://www.eastern-ifca.gov.uk/index.php?option=com_content&view=article&id=130&Itemid=199 (last accessed 01/12/2015)

Eaton, M., Aebischer, N., Brown, A., Hearn, R., Lock, L., Musgrove, A., Noble, D., Stroud, D. & Gregory, R. 2015. Birds of Conservation Concern 4: the population status of birds in the UK, Channel Islands and Isle of Man. British Birds 108: 708–746

Flamborough Head Management Group (undated) Flamborough Headland Codes of Conduct. http://www.hull.ac.uk/coastalobs/media/pdf/Flamborough%20Head%20Code%20of%20Conduct%20leaflet.pdf [last accessed 23.3.13].

Furness, R.W., Wade, H.M., Masden, E.A. 2013. Assessing vulnerability of marine bird populations to offshore wind farms. Journal of Environmental Management 119: 56-66HM Government (2011) UK Marine Policy Statement http://www.defra.gov.uk/publications/files/pb3654-marine-policy-statement-110316.pdf

Garthe, S. & Hüppop, O. 2004. Scaling possible adverse effects of marine wind farms on seabirds: developing and applying a vulnerability index. Journal of Applied Ecology 41: 724–734HM Government (2011b) *IA Toolkit. How to Do an Impact Assessment*. URL: www.bis.gov.uk/assets/biscore/better-regulation/docs/i/11-1112-impact-assessment-toolkit.pdf.

HM Government (2011) *UK Marine Policy Statement* https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69322/pb3654-marine-policy-statement-110316.pdf

HM Treasury (2003) *The Green Book*. *Appraisal and evaluation in central government*. TSO, London. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/220541/green_book_complete.pdf

Holderness Coast Fishery Local Action Group (FLAG) Strategy 2011-2015

http://www.eastyorkshirecoast.com/14-content/the-coast-at-work/51-the-holderness-coast-fishery.html (last accessed 12/11/2015)

Humber Nature Partnership. Humber Management Scheme. FAQ's Ports, Harbours and Commercial Shipping: http://www.humbernature.co.uk/admin/resources/faq-ports-harbours-and-commercial-shipping.pdf

Humber.com http://www.humber.com/Home/ (last accessed 12/11/2015).

Intergovernmental Panel on Climate Change (2005) Guidance notes for Lead Authors of the IPCC Fourth Assessment Report on Addressing Uncertainties. http://www.ipcc.ch/pdf/supporting-material/uncertainty-guidance-note.pdf.

JNCC (2001) The UK SPA network: its scope and content. Volume 1: Rationale for the selection of sites. Peterborough. http://jncc.defra.gov.uk/PDF/UKSPAVol_1.pdf .

JNCC (2004). Common Standards Monitoring Guidance for Birds. Version August 2004. Peterborough. http://jncc.defra.gov.uk/pdf/CSM_birds_incadditionalinfo.pdf

JNCC and Natural England. (2011). *Advice from the Joint Nature Conservation Committee and Natural England with regard to fisheries impacts on Marine Conservation Zone habitat features.* Peterborough: Natural England. http://www.naturalengland.org.uk/Images/MCZ-fish-impacts_tcm6-26384.pdf

Kenter, J.O., Bryce, R., Davies, A., Jobstvogt, N., Watson, V., Ranger, S., Solandt, J.L., Duncan, C., Christie, M., Crump, H., Irvine, K.N., Pinard, M. and Reed, M.S. (2013). *The value of potential marine protected areas in the UK to divers and sea anglers*. UNEP-WCMC, Cambridge. http://uknea.unep-wcmc.org/LinkClick.aspx?fileticket=Mb8nUAphh%2BY%3D&tabid=82

Lawson, J., O'Brien, S.H., Win, I., Kober, K., Allcock, Z., and Reid, J.B. 2015 *An assessment of the numbers and distributions of wintering red-throated diver, little gull and common scoter in the Greater Wash.* JNCC Report No. 574.

MASLF (2011) http://www.cefas.defra.gov.uk/media/462749/mepf%2009%20p104%20annex%20b.pdf

McVittie, A. & Moran, D. (2008) *Determining monetary values for use and non-use goods and services: marine biodiversity - primary evaluation*. Research report CRO 383, Defra, London. http://randd.defra.gov.uk/Document.aspx?Document=WC0605_7414_FRP.pdf

MMO (2012) *East Inshore and East Offshore Marine Plan Areas Evidence and Issues. Overview Report 2012*. 119pp. MMO, Newcastle. https://www.gov.uk/guidance/east-inshore-and-east-offshore-marine-plan-areas

MMO (2014) Modelling Marine Recreation Potential in England https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/317762/1064-annex1.pdf

Moffat, A. (2012) *Appendix 2: Anticipated benefits of marine protected area policy.* In: Finding Sanctuary, Irish Seas Conservation Zones, Net Gain and Balanced Seas. 2012. Impact Assessment materials in support of the Regional Marine Conservation Zone Projects' Recommendations. Annex L. Peterborough: Natural England**.** http://publications.naturalengland.org.uk/publication/1935462?category=1730361

Natural England (2010b)*. Report of the 2009-2010 consultation on 12 marine Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) in English, Welsh and offshore waters around the UK* http://www.naturalengland.org.uk/ourwork/marine/sacconsultation/default.aspx

Natural England (2011) Studland to Portland possible Special Area of Conservation: Draft conservation objectives and advice on operations http://www.naturalengland.org.uk/ourwork/marine/sacconsultation/default.aspx

North Eastern Inshore Fisheries Conservation Authority. www.ne-ifca.gov.uk (last accessed 11/11/2015)

Parliamentary Office of Science and Technology (2007) *Ecosystem Services. Postnote No. 281.* Parliamentary Office of Science and Technology, London. http://www.parliament.uk/documents/post/postpn281.pdf

Pett, M. (2006) *Assessing the Value of Marine Protected Areas in the UK: A Contingent Valuation Study of Lundy Marine Nature Reserve*. MSc dissertation submitted to University College London.

Petersen, I. K., Christensen, T.K., Kahlert. J., Desholm, M., D. Fox. A.D. 2006. Final results of bird studies at the offshore wind farms at Nysted and Horns Rev, Denmark. NERI Report Commissioned by DONG energy and Vattenfall A/S

Rayment, M., P. Lewis, et al. 2000. Valuing Norfolk's Coast: The Economic Benefits of Environmental and Wildlife Tourism. Sandy, Royal Society for the Protection of Birds.

Rayment, M. and Dickie, I. 2001. Conservation Works…for local economies in the UK. RSPB report. 61pp. RSPB, Bedfordshire. https://www.rspb.org.uk/Images/conservationworks_tcm9-132933.pdf

Reid, J.B. and Webb, A. (2005). Marine Natura 2000 – Recommendations for the Extension of Existing Seabird (Colony) Special Protection Areas into the Marine Environment http://jncc.defra.gov.uk/PDF/comm05P14B.pdf

Royal Navy (2013) Statement of Intent between the UK SNCBs and Navy Command Headquarters regarding the use and maintenance of the Environmental Protection Guidelines (Maritime (EPG(M)) and Maritime Environmental and Sustainability Assessment

Royal Yatching Association Boating Atlas (2015) http://www.rya.org.uk/infoadvice/planningenvironment/Pages/boatingatlas.aspx

RSPB (2010) *The Local Value of Seabirds: Estimating spending by visitors to RSPB coastal reserves and associated local economic impact attributable to seabirds*. The RSPB, Sandy. http://www.rspb.org.uk/Images/localvalueseabirds_tcm9-258550.pdf

RSS Marine, North Eastern Inshore Fisheries Conservation Authority: Strategic Environmental Assessment, 2013. RSS-NEIFCA-ER-SEA-Version 2 20022014

Scott Wilson, 2010. Humber Estuary Coastal Authorities Group: Flamborough Head to Gibraltar Point Shoreline Management Plan. Interim Plan 2010. Prepared for Humber Estuary Coastal Authorities Group. http://www.nelincs.gov.uk/council/planning-policy/evidence-base/sub-regional-documents/shoreline-management-plan/

Sustainability and the North Norfolk Crab and Lobster Fisheries (2015) Report to North Norfolk Fisheries Local Action Group. http://www.northnorfolkflag.org.uk/resource-library/flag-research-papers/ (last accessed 12/11/2015)

Suffolk County Council (2011) Suffolk's Local Economic Assessment 2011: http://www.suffolk.gov.uk/assets/suffolk.gov.uk/Business/Business%20Services/Economic%20development/Final%20Assessment.pdf (last accessed 12/11/2015)

TIDE: Tidal River Development. The Potential Alternative Uses of Dredged Material in the Humber Estuary. Jemma-Anne Lonsdale (2012): http://www.tide-toolbox.eu/pdf/reports/Pilot_project_Humber_estuary.pdf

Thaxter.C.B, Lascelles.B, Sugar.K, Cook.A, Roos.S, Bolton.M, Langston.R, Burton.N. (2012). Seabird foraging ranges as a preliminary tool for identifying candidate Marine Protected Areas. Biological Conservation 156: 53–61.

The Potential Fisheries Interactions with Protected Features on the North Norfolk Coast (2015). Report to North Norfolk Fisheries Local Action Group. Marine Planning Consultants (MPC) .Project Reference: MPC 1415/107

Webb, A. and Reid, J.B. 2004. Guidelines for the selection of marine SPAs for aggregations of inshore non-breeding waterbirds. Annex B in Johnston, C., Turnbull, C., Reid, J.B., and Webb, A. 2004. Marine Natura 2000: Update on progress in Marine Natura. Unpublished JNCC paper, March 2004. http://www.jncc.gov.uk/PDF/comm04P05.pdf

Charts

Chart 1

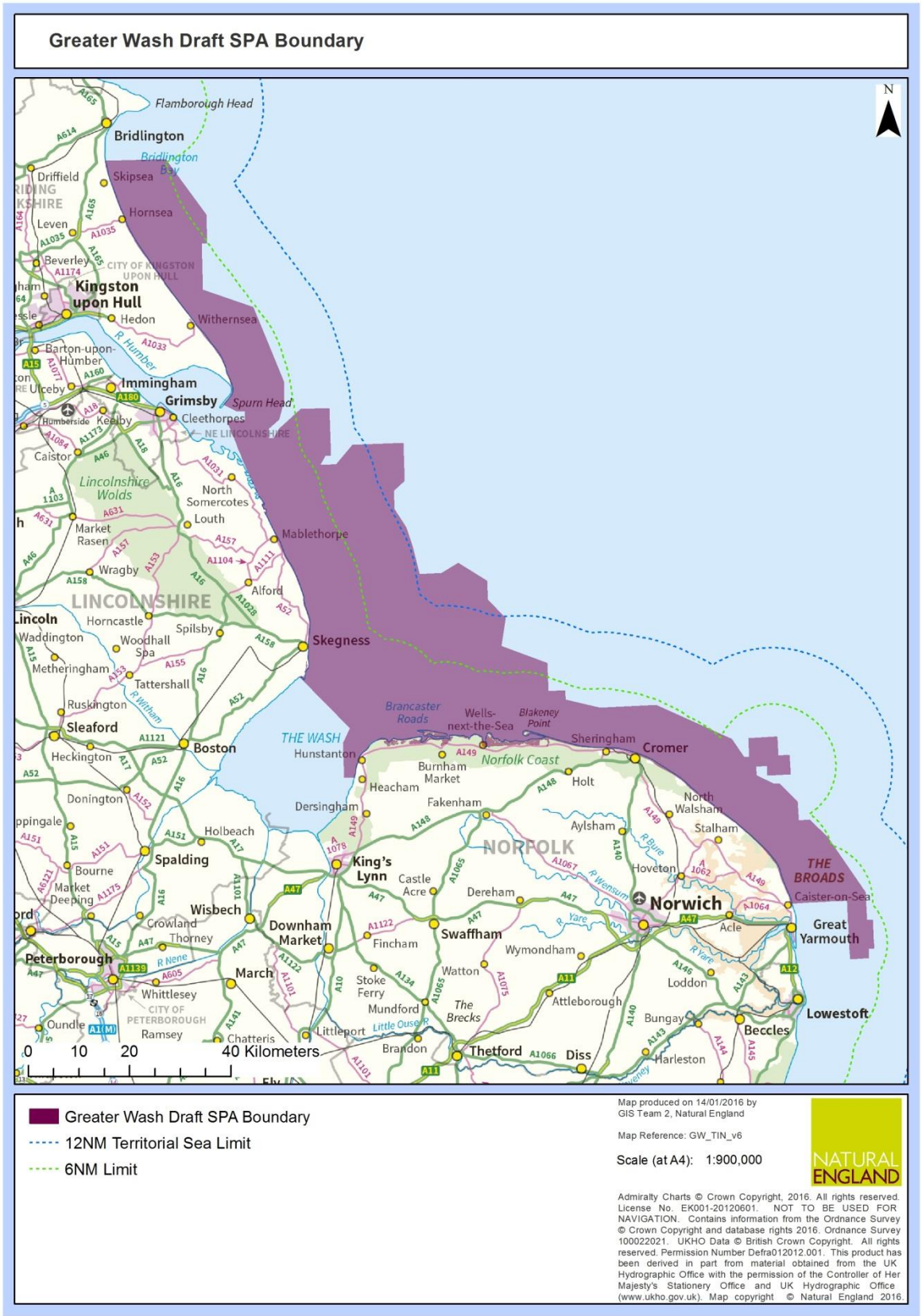

Chart 2.

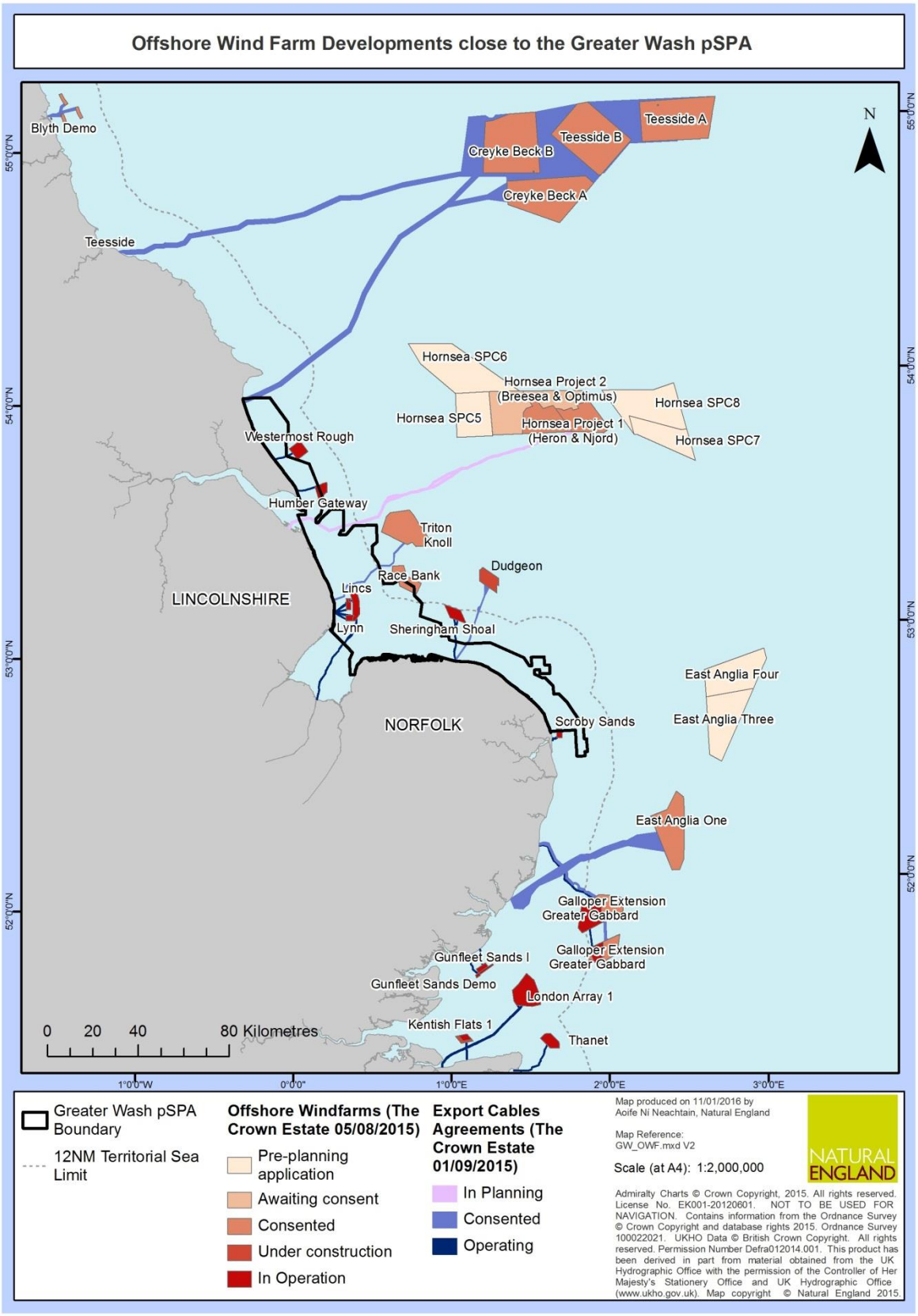
Offshore Wind Farm Developments close to the Greater Wash pSPA
Blyth Demo
Teesside A
Teesside B
Creyke Beck B
Creyke Beck A
Teesside
Hornsea SPC6
Hornsea Project 2
(Breesea & Optimus)
Hornsea SPC8
Hornsea SPC5
Hornsea Project 1
(Heron & Njord)
Hornsea SPC7
Westermost Rough
Humber Gateway
Triton
Knoll
Dudgeon
Race Bank
Lincs
LINCOLNSHIRE
Lynn
Sheringham Shoal
East Anglia Four
East Anglia Three
NORFOLK
Scroby Sands
East Anglia One
Galloper Extension
Greater Gabbard
Gunfleet Sands I
Galloper Extension
Greater Gabbard
Gunfleet Sands Demo
London Array 1
Kentish Flats 1
Thanet
N
0 20 40 80 Kilometres
55°0'0"N
54°0'0"N
53°0'0"N
52°0'0"N
1°0'0"W
0°0'0"
1°0'0"E
2°0'0"E
3°0'0"E
Greater Wash pSPA Boundary
12NM Territorial Sea Limit
Offshore Windfarms (The Crown Estate 05/08/2015)
Pre-planning application
Awaiting consent
Consented
Under construction
In Operation
Export Cables Agreements (The Crown Estate 01/09/2015)
In Planning
Consented
Operating
Map produced on 11/01/2016 by Aoife Ni Neachtain, Natural England
Map Reference: GW_OWF.mxd V2
Scale (at A4): 1:2,000,000
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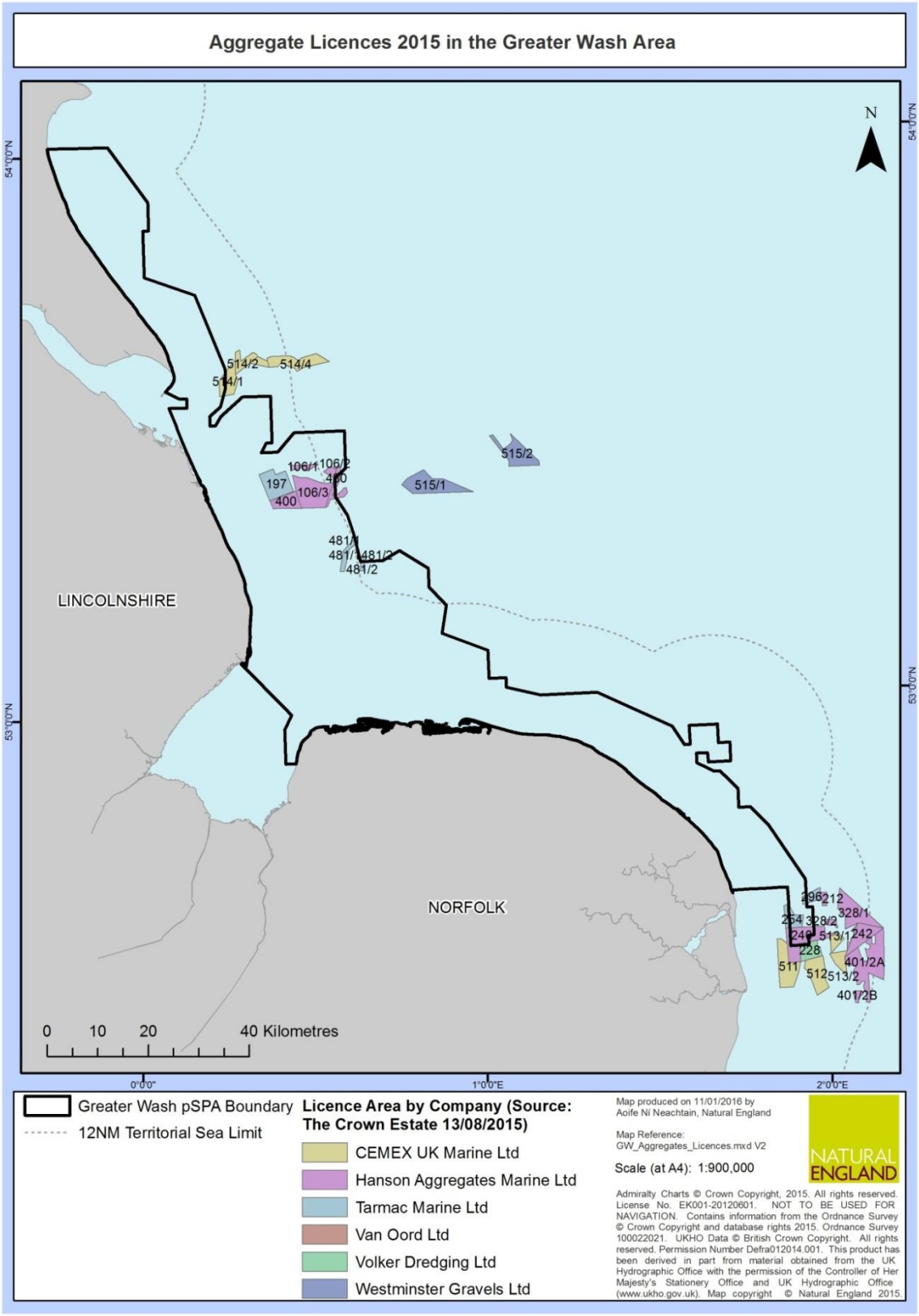
Chart 3.


Aggregate Licences 2015 in the Greater Wash Area
N
54°0'0"N
53°0'0"N
LINCOLNSHIRE
NORFOLK
514/2
514/4
514/1
515/2
515/1
106/1
106/2
197
400
106/3
481/1
481/2
481/3
481/2
396
212
328/1
254
328/2
249
513/1
242
228
511
512
513/2
401/2A
401/2B
0 10 20 40 Kilometres
0°0'0"
1°0'0"E
2°0'0"E
Greater Wash pSPA Boundary
12NM Territorial Sea Limit
Licence Area by Company (Source: The Crown Estate 13/08/2015)
CEMEX UK Marine Ltd
Hanson Aggregates Marine Ltd
Tarmac Marine Ltd
Van Oord Ltd
Volker Dredging Ltd
Westminster Gravels Ltd
Map produced on 11/01/2016 by Aoife Ní Neachtain, Natural England
Map Reference: GW_Aggregates_Licences.mxd V2
Scale (at A4): 1:900,000
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Appendices

A. Abbreviations
B. Consents in SPAs
C. Definitions of levels of confidence and uncertainty
D. Spreadsheets used for the calculations
E. Calculating fishing effort and landings values for fisheries within designated marine areas

A. Abbreviations

AEOI	Adverse Effect on Integrity
DECC	Department of Energy and Climate Change
Defra	Department for Environment, Food and Rural Affairs
EC	European Commission
EMS	European Marine Sites
EU	European Union
HRA	Habitats Regulations Assessment
IA	Impact Assessment
IROPI	Imperative Reasons of Over-riding Public Interest
IFCAs	Inshore Fisheries and Conservation Authorities
LSE	Likely Significant Effect
MCZ	Marine Conservation Zone
MMO	Marine Management Organisation
MPA	Marine Protected Area
NPV	Net Present Value
pSPA	potential Special Protection Area
SAC	Special Area of Conservation
SoS	Secretary of State
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
VMS	Vessel Monitoring System
W&NNC	The Wash and North Norfolk Coast

B. Consents in SPAs

Statutory nature conservation advisors[32] in each UK country specify the conservation objectives for an SAC or SPA and provide advice on operations that may take place or are planned which affect the site. These Conservation Objectives and Advice on Operations inform management of activities within the site.

Where a new plan or project requires consent or permission and which affects an SAC or SPA, the regulator, known as the competent authority[33], must make an assessment under the Conservation of Habitats and Species Regulations 2010 and Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (as amended 2009), often known as a Habitats Regulations Assessment (HRA). These transpose the Habitats and Wild Birds Directives into UK law and so form the legal basis for their implementation in the UK's offshore waters, which covers waters beyond 12nm, within British Fishery Limits and the seabed and subsoil within the UK Continental Shelf Designated Area.

The competent authority, will assess whether the new plan or project is directly connected with or necessary to the management of the site for conservation purposes and if not, whether there is likely to be a significant effect[34] on the qualifying features in the SAC or SPA either alone or in combination with other plans or projects. For SPAs, the species for which the site is designated will be taken into account as well as the supporting habitat and prey species. The conservation objectives of the site must be considered as well as the dynamics of the habitats, species and ecology.

The assessment is based on information provided and paid for by the applicant, and may be supplemented by additional information requested by the competent authority. This could involve collecting and processing additional data (see below).

An Environmental Impact Assessment (EIA) is required for most plans and projects and the information may overlap with the Habitats Regulations Assessment (HRA). However, the HRA must be documented separately to the EIA. The information that is required for the assessment of a plan or project proposed within or near a proposed SAC or SPA is likely to differ from that required for an EIA in an area that is not designated as follows:

- More detailed information on the area and the wider marine environment is likely to be required to set the site in context and to enable monitoring of environmental impacts;
- Plans and projects that cause permanent and physical damage to the seabed may be subject to higher scrutiny by the regulators (though this is not necessarily the case). Developers are expected to justify their proposals and demonstrate that no satisfactory alternatives exist.

If the developer consults appropriately at an early stage and the plan or project has no likely 'significant effect' there will be little or no additional delay arising.

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[32] Natural England is the adviser to the government on nature conservation in England (out to 12 nm), the Countryside Council for Wales is the adviser on nature conservation in Wales (out to 12 nm), and the JNCC advises the government on UK and international nature conservation (beyond 12nm).

[33] A competent authority is a public body that grants consents for regulated activities, for example, the Department of Energy and Climate Change (DECC) is the competent authority for wind farm and oil and gas licensing. Competent authorities are usually a public body or statutory undertaker of any kind. They include all relevant authorities with local powers or functions which have, or could have, an impact in the marine area within or adjacent to a European Marine Site, for example local authorities, harbour authorities or sea fisheries committees. Relevant authorities also have powers to establish a management scheme for a European Marine Site and have a general duty under the legislation to exercise their functions so as to further the conservation of marine SACs and SPAs.

[34] The decision over significance of effect should be precautionary; be determined on a case by case basis in relation to the specific features and environmental conditions of the protected site, and based on assessment of the likelihood of impacts on the site's conservation objectives. The likelihood of the effect occurring should consider various factors including the nature, size and location of a project and resilience of the receiving environment.

If the plan or project is likely to have a significant effect, the competent authority must undertake an Appropriate Assessment (AA)[35] to consider its implications for the SAC or SPA in view of that site's conservation objectives. They must consult the statutory nature conservation adviser(s) on the AA and have regard to their advice. The statutory nature conservation adviser(s) may advise on the information that is required to inform the assessment (which may include undertaking a baseline survey). Where there is more than one competent authority for a proposed activity the statutory nature conservation adviser(s) may advise that a lead competent authority be nominated to undertake the assessment on behalf of the other competent authorities. The plan or project proponent is responsible for providing and paying for the information required. In the AA the competent authority, with advice from the statutory nature conservation adviser(s) as necessary, will consider whether it is possible to ascertain that the plan or project will not adversely affect the integrity[36] of the SAC or SPA, and will have regard to the manner in which the developer proposes to carry it out. This includes any conditions or restrictions to the consent or permissions which can be applied. If it is not possible to ascertain that there is no adverse effect on the integrity of the site, then the project or plan cannot proceed although this is subject to the provisions of Article 6(4) of the Habitats Directive.

The financial costs of undertaking the Appropriate Assessment fall on the public sector so are not a direct cost to businesses. However, there could be delays to starting the plan or project which are likely to incur costs to the developer. For example, the start may need to be delayed until such time as the Secretary of State is satisfied that the operators have implemented appropriate mitigation strategies to ensure the activities will not adversely affect the integrity of the site. Restrictions may also be placed on the timing or manner in which the plan or project can be implemented, with associated cost implications for the developer. Habitats Directive case examples from across Europe clearly demonstrate that early and open dialogue between the developer, competent authorities and conservation bodies, can facilitate efficient assessments and successful outcomes for both developers and conservation, and should therefore be regarded as best practice.

When assessing plans and projects that could potentially impact on an SAC or SPA the legislation requires that competent authorities apply the precautionary principle. When advising on the assessment of impacts on SACs and SPAs from human activities, statutory nature conservation advisers will use the best available scientific information. However, when damaging impacts on a site is both potentially significant and uncertain, it is necessary to enact the precautionary principle. Government guidance[37] describes this as follows:

> *"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 which 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 proven to be harmless and it cannot be used as a licence to invent hypothetical consequences. Moreover, it is important, when*

[35] The Appropriate Assessment is a recorded and reasoned assessment of the implication of the proposal in relation to the conservation objectives of each qualifying feature of the SAC or SPA. Considering all likely and reasonably foreseeable effects, the competent authority has to ascertain that the proposal will **not** have an adverse effect on the integrity of the SAC or SPA before granting permission. The scope and content of the assessment should be appropriate to the nature, location, duration and scale of the proposal and the qualifying features of the site. All aspects of the proposal that can by themselves or in combination with other plans and projects affect the conservation objectives of the site must be identified in light of the best scientific knowledge in the field. In making their assessment, the competent authority may, if it wishes, consult the public or other stakeholders. Although not strictly required, there may be benefits of the Appropriate Assessment considering possible alternative solutions and mitigation measures in terms of the efficiency of the overall Conservation of Habitats and Species Regulations and Offshore Marine Regulations assessment process.

[36] The integrity of an SAC or SPA site is 'the coherence of ecological structure and function across its whole area, that enables it to sustain the habitats (in the case of an SAC) or levels of populations (in the case of an SPA) for which it was classified'.

[37] DETR & The Welsh Office, 1998.

considering whether the information available is sufficient, to take account of the associated balance of likely cost, including environmental costs, and benefits".

This effectively places the burden of proof on applicants and regulators to objectively demonstrate the absence of effects, rather than requiring those opposing a scheme to show that there would be an effect. This is an important distinction and greatly enhances the protection of habitats under the Habitat Regulations compared with other legislation where a prior approval procedure does not exist. Competent authorities can consent to a plan or project if they can ascertain at the screening stage that there will be no significant effect on an SAC or SPA; or, if an Appropriate Assessment is required, if they can ascertain from that assessment that there will be no adverse effects on the integrity of SACs and SPAs.

A plan or project must be refused if the competent authority cannot demonstrate that there will be no adverse effect on the integrity of the SAC or SPA.

Derogations for limited circumstances are put in place through Article 6(4) of the Habitats Directive which allows that a plan or project with the potential to adversely affect an SAC or SPA may be permissible for 'imperative reasons of over-riding public interest' (IROPI

), provided there are no alternative solutions and compensatory measures can be secured. This is for the Secretary of State to decide. An opinion may be sought from the EC. Consent on grounds of IROPI is most likely for activities that are of regional or national strategic importance. Assessment of the grounds for IROPI entails additional costs. If the development is given permission to go ahead despite a negative assessment, the Secretary of State is responsible for ensuring that the developer meets the cost of the compensatory measures required for damage caused to the SAC or SPA in order to protect the overall coherence of the Natura 2000 network. Such costs are likely to be significant and so IROPI should not be regarded as an easy option.

Outstanding decisions, permissions, consents and other authorisations that are not yet completed and that are likely to have a significant effect on an SAC or SPA (either individually or in combination with other plans or projects)[38] and that are not directly connected with or necessary to the management of the site are subject to a review of existing permissions. For an SAC this occurs when the site becomes a candidate SAC (when Defra recommends the site to the European Commission) and for an SPA this occurs when the Secretary of State classifies the site as an SPA and informs the European Commission of this. This review is done under the Habitats and Offshore Marine Regulations by the competent authority responsible for each type of consent, with advice from the statutory nature conservation bodies, and follows a very similar process to that previously outlined for new plans and projects. If the review determines that activities are likely to have a significant effect then an Appropriate Assessment will have to be carried out. If that assessment is not able to ascertain that there will not be an adverse effect on the qualifying features in the site, the permissions may need to be amended or revoked (and in some circumstances, compensation may be paid). In general, plans and projects that do not result in pressures, to which the features are sensitive or that are determined not to have an adverse effect on features in the site may continue though this is not necessarily the case.

Determining the management measures required for the site

The management measures required for plans and projects that are relevant to a site will be determined through the processes set out above for plans and projects.

An activity that does not qualify as a 'plan or project' (as referred to in Regulation 61 of the Conservation of Habitats and Species Regulations) still requires management if it is likely to prevent the conservation objectives of the sites from being achieved. The management of such activities, often referred to generically as 'on-going activities', and of which recreation is

[38] For example, licensed areas for aggregate extraction, a wind farm that has been consented but not constructed or an oil well has been consented but not yet drilled.

often an example, is the responsibility of the competent authorities of the site. The competent authorities use the advice on operations and the conservation objectives, to inform their decisions on which activities will require management. The competent authorities are then responsible for implementing the management measures necessary to ensure that the conservation objectives of the sites are met. Stakeholder consultation will ensure that the necessary management measures both protect the features of the sites and account for socio-economic considerations.

C. Definitions of levels of confidence and uncertainty

The definitions used are based on Intergovernmental Panel on Climate Change (2005).

A level of confidence is used in the IA to describe uncertainty that is based on expert judgment (in terms of the correctness of an analysis or a statement). Definitions of the terms used to communicate this are provided in Table A.1.

Table A. 1 Definition of terms used to communicate confidence in information

Terminology	Degree of confidence in being correct
Very High confidence	At least 9 out of 10 chance of being correct
High confidence	About 8 out of 10 chance
Medium confidence	About 5 out of 10 chance
Low confidence	About 2 out of 10 chance
Very low confidence	Less than 1 out of 10 chance

Descriptions of likelihood are used in the IA to provide a probabilistic assessment of an outcomes occurring. The terms used to describe this in the IA are provided in Table A.2.

Table A. 2 Definition of terms used to communicate the likelihood of outcomes

Terminology	Likelihood of the occurrence or outcome
Virtually certain	More than 99% probability of occurrence
Very likely	More than 90% probability
Likely	More than 66% probability
About as likely as not	33 to 66% probability
Unlikely	Less than 33% probability
Very unlikely	Less than 10% probability
Exceptionally unlikely	Less than 1% probability

D. Spreadsheets used for the calculations

Greater Wash IA SPA Costs Final TS 18th March 2016.tr5

E. Projected pre-development cost of Offshore Wind Farm Projects that overlap with the Greater Wash pSPA Calculation of the worst case scenario costs is based upon projected pre-development electricity generation costs by the Department of Energy & Climate Change for Round 2 and Round 3 offshore windfarms (DECC 2013). The projections are provided in £/KW for the year 2017. Costs were multiplied by the total awarded capacity of each project in MW[39] to give a high, medium and low pre-development cost (Table 1). As all of the projects considered are at the pre-development stage no construction costs were included in the calculations.

Table 1. Pre- development cost of Round 2 and 3 offshore wind farm projects within the Greater Wash.

Project	**Development Round**	**Awarded capacity (MW)**	**Pre-development cost per MW (2017)**		**Pre-development Cost**
Dogger Bank Creyke Beck A & B	Round 3	2400	High	=£150,000* 2400	£360,000,000
			Med	=£105,000* 2400	**£252,000,000**
			Low	=£50,000 *2400	£120,000,000
Dudgeon	Round 2	402	High	=£120,000* 402	£48,240,000
			Med	=£70,000 * 402	**£28,140,000**
			Low	=£50,00* 402	£20,100,000
Hornsea Project 1	Round 3	600	High	=£150,000 *600	£90,000,000
			Med	=£105,000 *600	**£63,000,000**
			Low	= £50,000 *600	£30,000,000
Hornsea Project 2	Round 3	1800	High	=£150,000* 1800	£270,000,000
			Med	=£105,000* 1800	**£189,000,000**
			Low	=£50,000 *1800	£90,000,000
Race Bank	Round 2	580	High	=£120,000 *580	£69,600,000
			Med	=£70,000 *580	**£40,600,000**
			Low	=£50,000 *580	£290,000,000
Triton Knoll[40]	Round 2	1200	High	=£120,000 *1200	£144,000,000

[39] Kilowatts = 1,000 Watts, Megawatts = 1,000,000 Watts.

[40] Includes Triton Knoll Array and Triton Knoll Electrical System

			Med	=£70,000 *1200	**£84,000,000**
			Low	=£50,000 *1200	£60,000,000

References:

Department for Energy and Climate Change (2013) Electricity Generation Costs (December 2013) [pdf] online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/269888/131217_Electricity_Generation_costs_report_December_2013_Final.pdf (last accessed 16th December 2015)

F. Calculating fishing effort and landings values for fisheries within designated marine areas

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Introduction

This document provides an overview of the process for using fisheries landings and effort data to calculate the value of a fishery to a specific designated marine area. This process has been adapted from the 'MCZ fisheries model', first developed by Finding Sanctuary to assess the impact of recommended Marine Conservation Zones on commercial fisheries. The work and methodology has since been adapted to take into consideration changes in the way data are supplied by the MMO. This methodology has been used to assess the impact of the Greater Wash pSPA on commercial fisheries based on hypothetical fisheries management scenarios.

This document covers the background to the model and the theory behind it. An additional document detailing the specific GIS processes and methodology to be undertaken will be written as a manual to follow when re-running the modelling process to obtain new results for different management scenarios. This can then feed into the impact assessments, assessing the impacts of new Marine Protected Areas including MCZs, SPAs and Specials Areas of Conservation (SACs) on commercial fisheries.

GIS requirements

The models are designed to be run using ArcGIS 10.1 software. Due to the large datasets involved and high volumes of processing required, it is recommended that a suitable platform with fast processing speed and higher RAM – such as a 'power laptop' or dedicated processing machine is used to carry out the analysis.

Input layers and data sources

The input layers for the approach come from a number of different sources:

iFish data. This is provided by the Marine Management Organisation (MMO) to give value of landings for different fish species, gear types and home port, per ICES rectangle. It is sourced from commercial landings data from UK registered vessels, and is officially audited. The ICES rectangles are the minimum reporting units for the dataset, but are too large to assume homogeneity of value across the whole rectangle. In order to provide a suitable calculation for smaller SPA management scenarios, the spatial distribution of fishing effort at larger spatial scales is also used in the form of the VMS data (for vessels over 15m) and FisherMap data (for vessels <15m). The Impact Assessment for the Greater Wash pSPA used data for the period 2004 to 2010.

Vessels over 15 metres are required by European legislation to have a **Vessel Management System (VMS)**, based on a GPS tracking device which records the location of the vessel at

certain time intervals. By analysing the positions of the vessel, speed can be calculated, and from this, the interpretation made that a vessel is fishing when travelling at certain speeds. A methodology has been developed to therefore use this data to generate a spatial distribution of fishing effort. This work is undertaken by the MMO and categorised by gear type, as well as being attributed spatially to a VMS square, which is approximately 3 x 5.5km. There are 200 VMS squares per ICES rectangle (10 x 20 grid) and the boundaries abut.

Fishermap – As VMS data is only collected on vessels over 15m in length, a different system of effort recording was required for those vessels under 15m. FisherMap was a survey conducted for the regional MCZ projects to collect information on where fishers fish, what they fish for, when, and what gear they use. This was carried out through interviews with fishermen, and the information was digitised in a GIS to give a map of fishing grounds for these smaller vessels, resulting in a layer showing the spatial distribution of fishing effort per gear type for the period 2004 to 2010.

The FisherMap dataset is now 6 years old and there are currently no plans to re-run the exercise or update the data. Cefas are however currently undertaking a project to develop a series of data layers illustrating the location and intensity of inshore fishing activities based on sightings data provided by the IFCAs and MMO (Defra contract MB0117). It may therefore be more appropriate to base estimations of the spatial distribution of fishing effort on these new datasets in the future.

Modelling Assumptions

Due to the nature of the datasets available, and the data processing and modelling undertaken, a number of assumptions have to be made in the process.

1. Landings are proportional to effort.
2. Vessel effort is homogenous across a VMS square.
3. For Fishermap data, effort is assumed to be evenly distributed across an individual vessel's fishing ground. Value is then distributes according to the interaction between fishing ground extent and ICES rectangle.

Data preparation by the MMO

The data collected and provided through the datasets were firstly aggregated into 6 gear classifications: (i) demersal trawls or seines; (ii) pelagic trawls or seines; (iii) dredges; (iv) hooks or lines; (v) gill nets or trammel nets and (vi) pots or traps. These were then aggregated by the MMO to maintain confidentiality, into figures for relative effort, and landings value, per gear type, for each VMS square. This is the format that the data were provided to Natural England, with a separate file for each year.

It should be noted that although collection by hand (such as surface and submerged picking and hand-pushed nets) are included in the iFISH data, only fishing conducted from a vessel has been included in the analysis and therefore the final calculations do not include the value of landings from hand fisheries.

Overview of the model and process

The process of generating landings values figures from the data sources above is not a simple one step process, but a series of steps and operations carried out in Microsoft Excel, Microsoft Access and ArcGIS software, where the output of one step, provides the input for the next. As part of the regional MCZ project, a series of toolboxes were developed using ArcGIS modelbuilder to automate some of the process, and enable some data processing

actions to be carried out through the use of dialogue boxes for specifying inputs and outputs of the various stages.

Due to the two different datasets (for vessels under 15m and over 15m) the modelling takes place in two stages, to generate a value of catch landings for each of the 6 gear types, for the two different size vessel groups. These can then be aggregated to provide a landings value for all vessels within the area of interest. This area of interest is delimited by a GIS boundary file, such as for a proposed MCZ or a SAC or SPA.

Fisheries management scenarios could be in relation to spatial changes such as changing a proposed boundary, temporal changes concerning which times of the year fishing is permitted, or changes relating to the types of fishing gear used in the area. It could also be a combination of any two or three of these factors, and all can be taken into account when carrying out the calculations. The spatial changes are probably the most straightforward, as they require a different GIS input file. The temporal and gear type changes require the user to alter the fields used from the database when carrying out the calculations.

Creating a value layer for fishing vessels over 15m length

The MMO currently supply landings data as a set of shape files that describe annual landings value for a given gear type for a single VMS cell (e.g. £s from dredging/ 0.05 degree square/year).

In order to report on a single value for a given gear use upon a given site, the average value for a gear/ 0.05 degree cell should be calculated. Due to the MMO reporting on fishery values using a temporally invariant sampling grid, this value can be calculated by summing all of the reported landings values for a given cell and dividing that sum by the number of years of data that are recorded for the cell.

Once this value layer has been created, the proportion of each VMS cell that is inside a feature of interest should be calculated. This value (the proportion of the VMS cell that overlaps a conservation feature) is then used to calculate the contribution of this VMS cell to the total value of fisheries within the site:

MMO landings value (Mean annual landings value of gear within 0.05*0.05 degree VMS cell) * % of VMS cell within site of interest = contribution of gear use within that VMS cell to the economic value of the site.

Creating a value layer for vessels under 15m in length - simple version (only 2004 – 2011 data)

The regional MCZ project modelled landing data for the under 15m fleet can be used in an identical fashion to the data supplied by the MMO – however, annual means have already been calculated and therefore this step can be omitted from the analysis. The sample unit has the same dimension as the MMO VMS cells.

Incorporating post 2011 landings data into the model from landings under 15m

Whilst the specific approach will be determined by the nature of the data involved, the following general principles hold.

1) Landings data need to be summarised as a single value for a given broad-scale gear type (lines, nets, pots, dredging, bottom trawls, midwater trawls) for an ICES rectangle. The **gearindex** xls should be used to guide the recoding of gear types into their broad-scale gear equivalent (Table A.3).

2) This mean annual landings value for a broad-scale gear type is considered to be distributed across the ICES rectangle according to the relative effort value recorded

in the RE fields within the regional MCZ project modelled landings u15 feature class. Calculating the value of a given grid cell is therefore a matter of multiplying the value of an ICES rectangle by the relative effort recorded for a grid cell.

3) Once this value layer has been created the analysis can proceed to the calculation of the proportions of grid cell that overlap sites of interest.

These calculated values are then attributed to the ICES rectangle they relate to. The model essentially carries out a series of calculations based upon the proportion of each ICES rectangle or VMS cell within the proposed site boundary, using the relative effort values to weight the catch landings values data, so that higher value is attributed to areas with proportionally more effort attached. When carrying out spatial operations, the model clips VMS and ICES squares along the coastline and attributes the effort and landings values to the smaller area of sea, in order to avoid erroneous calculations in coastal areas. The final result will give the landings values for the proposed area, per gear type, and can be split by vessel size (under and over 15) or aggregated together as required by the specific management scenario.

NOTE: All the iFISH data is in the 'European Albers Equal Area' projection. It is important to ensure that all data layers are converted into this same projection system before any analysis is carried out. If this isn't done, erroneous values will be given by the model, especially where spatial queries (such as cutting around a boundary) are carried out.

Table A.3. Broad-scale gear type equivalents of the gear type categories used in FisherMap

Broad-scale gear type	**FisherMap gear category**
Demersal trawl or seine	Bottom trawls
	Bottom trawls – twin rigs
	Bottom pair trawls
	Bottom trawls – nephrops target species
	Beam trawls– shrimp target species
	Danish seine
	Scottish seine
	Pair seine
Dredges	Towed dredges
	Power/suction/unspecified dredges
	Hand dredging
Hooks or lines	Hand lines (incl/ gurdy), rod and line
	Hand lines (incl. gurdy)
	Lines
	Trolling
	Drift long lines
	Long lines
	Static long lines
Gill nets or trammel nets	Nets – gill net
	Nets – gill net – trammel
	Nets – drift net

	Nets – fixed net – hoop net or fyke net
	Nets – fixed net – stake net
	Nets
	Gill nets – trammel
	Gill nets
Pelagic trawl or seine	Mid-water trawls
	Mid water pair trawls
	Mid water trawls – shrimp target species
	Purse seine
	Ring net
Pots or traps	Traps
	Pots