

East Anglia TWO Offshore Windfarm

Appendix 10.1

Fish and Shellfish Ecology Consultation Responses

Environmental Statement Volume 3

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Glossary of Acronyms

BERR	Business Enterprise and Regulatory Reform
Cefas	Centre for Environment Fisheries and Aquaculture Science
DCO	Development Consent Order
EMF	electromagnetic fields
ES	Environmental Statement
ETG	Expert Topic Group
HRA	Habitat Regulations Assessment
IFCA	Inshore Fisheries Conservation Authority
IHLS	International Herring Larvae Survey
MMO	Marine Management Organisation
MCZ	Marine Conservation Zone
NE	Natural England
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OOOMP	Outline Offshore Operations and Maintenance Plan
PEIR	Preliminary Environmental Information Report
PSA	Particle Size Analysis
SAC	Special Area of Conservation
SEL	Sound Exposure Level
SPL	Sound Peak Level
SPR	Scottish Power renewables
SSC	Suspended Sediment Concentrations
TTS	Temporary Threshold Shift

Glossary of Terminology

Applicant	East Anglia TWO Limited.
Development area	The area comprising the Onshore Development Area and the Offshore Development Area
East Anglia TWO project	The proposed project consisting of up to 75 wind turbines, up to four offshore electrical platforms, up to one offshore operation and maintenance platform, inter-array cables, platform link cables, up to one construction operational meteorological mast, up to two offshore export cables, fibre optic cables, landfall infrastructure, onshore cables and ducts, onshore substation, and National Grid infrastructure.
East Anglia TWO windfarm site	The offshore area within which wind turbines and offshore platforms will be located.
Offshore cable corridor	This is the area which will contain the offshore export cables between offshore electrical platforms and landfall.
Offshore development area	The East Anglia TWO windfarm site and offshore cable corridor (up to Mean High Water Springs).

10.1 Fish and Shellfish Ecology Consultation Responses

10.1.1 Introduction

1. This appendix covers those statutory consultation responses that have been received as a response to the Scoping Report (2017), the Preliminary Environmental Information Report (PEIR) (2019) and Expert Topic Group (ETG) Meetings.
2. Responses from stakeholders and regard given by the Applicant have been captured in **Table A10.1**.
3. As Section 42 consultation for the proposed East Anglia TWO project was conducted in parallel with the proposed East Anglia ONE North project, where appropriate, stakeholder comments which were specific to East Anglia ONE North, but may be of relevance East Anglia TWO, have also been included in the consultation responses for East Anglia TWO.

Table A10.1 Consultation Responses Related to Chapter 10 Fish and Shellfish Ecology

Consultee	Date/ Document	Comment	Response / where addressed in the ES
<p>The following comments were received prior to consultation on the PEIR and were in response to the Scoping Report or direct consultation with stakeholders. These comments were taken into account in the production of the PEIR</p>			
Natural England	08/12/2017 Scoping Response	As part of the evidence plan process NE [Natural England], Cefas [Centre for Environment Fisheries and Aquaculture Science] and MMO [Marine Management Organisation] advised EA1N and EA2 not to scope out re-suspended contaminants without site specific data to justify that contamination levels were low. We note that this has been provided and EA1N and EA2 are collecting site specific data, so this may be scoped out at a later date dependant on findings.	This is discussed in section 10.6.1 of Chapter 10 Fish and Shellfish Ecology .
Marine Management Organisation	07/12/2017 Scoping Response	It should be noted that the proposed development is within a recognised spawning and nursery area for whiting and mackerel.	Noted, these species have been included in our assessment and addressed in Table 10.10 in the chapter and Appendix 10.2 .
Marine Management Organisation	07/12/2017 Scoping Response	The MMO welcomes the recognition of the seabass special protection measures and confirmation that the PEI will consider important seabass habitats.	Noted, for further discussion regarding seabass habitats see section 10.5.4 in the chapter and Appendix 10.2 .
Marine Management Organisation	07/12/2017 Scoping Response	The Scoping Report recognises that there are areas of sandbanks inshore of the ECR corridor area of search which is supporting features of the Outer Thames Estuary SPA which are of importance to foraging red throated diver <i>Gavia stellata</i> . Sandeels are a prey species of red throated diver. If the ornithological impact assessment indicates that sandeel are a prey item for seabirds which may be impacted by the windfarm, the	<p>Section 12.5.3 of Chapter 12 Offshore Ornithology indicates that sandeel are a prey species for various seabirds which may be impacted by the proposed East Anglia TWO project, as discussed in section 10.5.5 in the chapter. The importance of sandeel habitat is considered in Appendix 10.2.</p> <p>An assessment of the suitability of sandeel habitat is presented in Figure 10.2.3 in Appendix 10.2.</p>

Consultee	Date/ Document	Comment	Response / where addressed in the ES
		PEI should consider and assess the importance of sandeel habitat present.	
Marine Management Organisation	07/12/2017 Scoping Response	The MMO recommends that clarification regarding the scoping in or out of potential re-suspended contaminated sediment impacts on fish and shellfish ecology should be provided in the PEI following analysis of forthcoming benthic survey data.	This is discussed in section 10.6.1.3 in the chapter.
Marine Management Organisation	07/12/2017 Scoping Response	The scoping report refers specifically to fish ecology only. Please could [Scottish Power Renewables] SPR confirm that potential impacts on shellfish will also be included in the ES.	Shellfish have been included in the assessment in section 10.6 in the chapter.
Marine Management Organisation	07/12/2017 Scoping Response	The potential impact of underwater noise from operational turbines has been scoped in for marine mammals but not for fish receptors. Appendix 2.3 'Fish Ecology Method Statement' appears to suggest that underwater noise during the operational phase will be considered with regard to fish/shellfish receptors, given that the qualification of the magnitude of this impact is intended to be guided by the results of noise assessments. The MMO recommends that consideration of the potential impact of operational underwater noise is clarified for fish and shellfish receptors in the ES following completion of noise assessments.	The potential impact of operational underwater noise is discussed in section 10.6.2.4 in the chapter.
Marine Management Organisation	07/12/2017 Scoping Response	The most appropriate noise exposure criteria for fish are those published by Popper et al. (2014). The MMO recommends the use of these criteria for the East Anglia	Popper et al. (2014) has been used within the underwater noise assessment. Details of the noise

Consultee	Date/ Document	Comment	Response / where addressed in the ES
		TWO noise assessment, since they represent the most recent and relevant criteria.	assessment can be found in section 10.6.1.4.3 in the chapter.
Marine Management Organisation	07/12/2017 Scoping Response	The MMO recommends the use of the National Marine Fisheries Service (NMFS, 2016) thresholds and criteria for the modelling of underwater noise from piling activity as these are the most recent guidelines available.	Noted, NMFS threshold criteria has been used in the assessment. Details of the noise assessment can be found in section 10.6.1.4.3 in the chapter.
The Planning Inspectorate	20/12/2017 Scoping Response	No justification has been provided to support scoping the impacts of 'changes in fishing activity during construction and decommissioning' out from assessment. In the absence of information such as evidence demonstrating clear agreement with relevant statutory bodies, the Inspectorate is not in a position to agree to scope this out. Accordingly, the ES should include an assessment of this matter	Changes in fishing activity during construction and decommissioning are assessed in sections 10.6.1.7 and 10.6.2.7 respectively in the chapter.
The Planning Inspectorate	20/12/2017 Scoping Response	Physical disturbance and temporary loss of seabed habitat, spawning or nursery grounds during intrusive works during operation; The Inspectorate agrees that this matter can be scoped out on the basis that intrusive works that would be undertaken in the operational phase would be related to maintenance activities, and the Inspectorate considers that this would be unlikely to be of a scale that would result in significant effects to these receptors. The Inspectorate notes that an Outline Offshore Operations and Maintenance Plan is likely to be submitted with the DCO application (paragraph 183 of the Scoping Report). We assume that this plan will include measures designed to reduce potential impacts	An Outline Offshore Operations and Maintenance Plan (OOOMP) (Document Reference: 8.12) has been submitted as part of the Development Consent Order (DCO) application.

Consultee	Date/ Document	Comment	Response / where addressed in the ES
		and recommend that the Applicant seeks agreement on the plan from the MMO.	
The Planning Inspectorate	20/12/2017 Scoping Response	Permanent habitat loss during construction and decommissioning; The Inspectorate agrees that this matter can be scoped out on the assumption that habitat lost during construction will be considered as a temporary impact, and that any habitat that is permanently lost following construction will be assessed as part of the operational impact assessment.	Noted, this has been scoped out of the assessment.
The Planning Inspectorate	20/12/2017 Scoping Response	Underwater noise impacts to hearing sensitive species during foundation piling during operation and decommissioning; The Inspectorate agrees that this matter can be scoped out in respect of operation and decommissioning on the basis that piling would only take place during the construction phase and this will be assessed.	Noted, this has been scoped out of the assessment.
The Planning Inspectorate	20/12/2017 Scoping Response	Introduction of wind turbine foundations, scour protection and hard substrate during construction and decommissioning; The Inspectorate agrees that this matter can be scoped out on the basis that this matter would be assessed as part of the operational impact assessment.	Noted, this has been scoped out of the assessment.
The Planning Inspectorate	20/12/2017 Scoping Response	Electromagnetic fields during construction and decommissioning; Due to the nature of the construction and likely decommissioning works required for the Proposed Development the Inspectorate agrees that	Noted, this has been scoped out of the assessment.

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		significant effects are unlikely to be attributed to EMFs during these phases and can be scoped out.	
The Planning Inspectorate	20/12/2017 Scoping Response	Cumulative permanent habitat loss during construction; The Inspectorate agrees that this matter can be scoped out on the assumption that habitat lost during construction will be considered in the EIA as a temporary impact, and that any habitat that is permanently lost following construction will be considered under cumulative operational impacts.	Noted, this has been scoped out of the assessment.
The Planning Inspectorate	20/12/2017 Scoping Response	Transboundary impacts during all phases; The Inspectorate agrees that this matter can be scoped out in the knowledge that the distribution of fish and shellfish species is independent of national geographical boundaries and on the understanding that the assessment will take into account fish stocks and populations distribution irrespective of national jurisdictions.	Noted, this has been scoped out of the assessment.
The Planning Inspectorate	20/12/2017 Scoping Response	It is not clear why only designated sites with the listed interest features will be considered in the PEI (and [Habitat Regulations Assessment] HRA), particularly when it is subsequently stated that there are no Special Areas of Conservation (SACs) designated for those features within 50km of the windfarm site.	<p>The species listed are the only Annex II marine / diadromous species relevant to UK waters, therefore any sites considered for this topic would have to include these. Although it is considered unlikely that there could be effects on sites designated for fish these were referenced for completeness.</p> <p>A full HRA screening exercise was undertaken subsequent to Scoping and all SACs screened out with regard to potential for likely significant effect.</p>

Consultee	Date/ Document	Comment	Response / where addressed in the ES
The Planning Inspectorate	20/12/2017 Scoping Response	The study area for this assessment should be defined according to the relevant receptors that may experience impacts by the Proposed Development and the rationale should be explained in the PEI. No reference is made to the cable corridor AoS. The PEI should include an assessment of any impacts from the Proposed Development which could result in significant effects to designated sites.	The study area has been defined and justified in section 10.3.1 in the chapter. Section 10.5.4 details any designated sites and species which may be impacted by the proposed East Anglia TWO project, additionally, species of Conservation Interest are included within the impact assessment.
The Planning Inspectorate	20/12/2017 Scoping Response	The Inspectorate has been made aware of guidance referenced by the MMO in Section 9 of their scoping response (see Appendix 2 of this Opinion). The Applicant should take this into account in undertaking their assessment of the potential impacts of noise on fish.	Noted, this guidance has been taken into consideration.
The following comments were made in response to the PEIR and were taken into account in the production of this ES			
MMO	22/03/2019 Section 42 Response	The MMO finds the current assessment for the characterisation of sandeel and its habitats to be inadequate. Further to the comments below, these comments should be considered and amendments made as to how sandeels are assessed in the Environmental Statement.	Noted, responses to these comments can be found below.
MMO	22/03/2019 Section 42 Response	Characterisation of sandeel habitats has been based on broad scale data and publications, rather than the data available from the array and export cable corridor surveys. The limitations of using such data sets have not been factored in. This should be amended	Characterisation of sandeel habitat has now been undertaken based on Particle Size Analysis (PSA) data from benthic surveys undertaken in the offshore cable corridor and East Anglia TWO windfarm site. These data have been analysed to provide an indication of the suitability of the offshore development area in terms of

Consultee	Date/ Document	Comment	Response / where addressed in the ES
			potential for provision of habitat for sandeels (see Appendix 10.2) and Figure 10.2.3
MMO	22/03/2019 Section 42 Response	Sandeels have spatial dependency on a specific substrate, therefore paragraph 150 (154 in EA1N) in Chapter 10 is inaccurate. It is recognised that sandeels show site fidelity to areas of the seabed and do not tend to travel to spawn. Therefore Sandeels should not be included in Table 10.19.	This paragraph has now been amended to reflect the spatial dependency of Sandeels on a specific substrate. However, sandeels are still included in Table 10.18 in the chapter as this table presents pelagic spawning areas which is of relevance to sandeel.
MMO	22/03/2019 Section 42 Response	The map by Jensen et al. (2011) is a broad scale map of the southern North Sea, and whilst it is an excellent tool for indicating the presence of sandeel habitats, the resolution is too low to be able to quantify habitat loss/disturbance on a site-specific basis. When Jensen et al. (2011) mapped sandeel foraging habitat in the North Sea he found that areas varied greatly in size from 1 to 4023km ² . This indicates that habitats may be both widespread and localised. It is recommended to focus on identifying areas of suitable substrate and conditions, rather than scale of area.	Characterisation of sandeel habitat has been undertaken based on PSA data as described above and added to the assessment (see Appendix 10.2) and Figure 10.2.4 .
MMO	22/03/2019 Section 42 Response	In relation to Chapter 10 paragraph 264, the MMO does not find the reasoning surrounding the decision to consider the East Anglia Two area unimportant for sandeel fisheries to be sufficient. Whilst the Danish fleet may not target sandeels in the area, this could be due to geographical location compared to the location of Dogger Bank. This needs to be reassessed and amended (paragraph 267, in Section 10.6.2.1.1 in EA1N).	This paragraph has been amended to also take account of suitable sandeel habitat shown in Figure 10.2.4 .

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MMO	22/03/2019 Section 42 Response	It is MMOs opinion that IBTS trawls (otter and beam) are not considered suitable survey gear to adequately sample sandeel species. In the PEIR it states this as meaning the area is of comparatively low importance in the context of the sandeel assessment area 1r. Regardless, catches of sandeel in the area can only provide information on presence, however this method does not provide information about abundance and distribution. In EA1N Paragraph 266, in Section 10.6.2.1.1, should be reviewed and updated accordingly (along with equivalent in EA2)	<p>Noted. The limitations of bottom trawl gear to adequately target some species, including sandeels, are recognised in Appendix 10.2.</p> <p>The conclusion that the offshore development area supports sandeels in relatively low numbers, is supported by the results of the IBTS, but also by the distribution of sandeel fishing activity (derived from VMS data as discussed in Chapter 13 Commercial Fisheries), known sandeel fishing grounds (Jensen et al 2011) and the fact that the offshore development area does not overlap with high intensity sandeel spawning and/or nursery grounds (Ellis et al 2010).</p> <p>The location of high intensity spawning / nursery grounds, the distribution of sandeel fishing grounds and fishing activity, as well as data from the IBTS, all suggest that within Sandeel Assessment Area 1r, key sandeel areas are located north of the offshore development area, particularly around the Dogger Bank.</p>
MMO	22/03/2019 Section 42 Response	The MMO realises that given to the best method of surveying sandeel distribution and population can take several years, is expensive and can be highly disruptive for the sandeel population, it is instead recommended that the EIA characterise sandeel habitat by following the method described in Marine Space (2013) which uses broad scale sediment data and site-specific PSA data. The data collected in the Particle Size Analysis (PSA) surveys should be used to inform the characterisation of sandeel habitat and provide a more	<p>Noted. Characterisation of sandeel habitat has been undertaken based on PSA data as described above and added to the assessment (see Appendix 10.2) and Figure 10.2.4.</p> <p>Given the sandy nature of the sediment across the offshore development area, preferred and marginal sandeel habitat has been identified across the majority of the offshore development area, with unsuitable</p>

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		robust assessment of impacts in relation to disturbance and loss of sandeel habitat.	<p>areas identified at discrete locations along the offshore cable corridor (Appendix 10.1, Figure 10.2.4).</p> <p>It should be noted that the habitat classification on which the above analysis is based (Marine Space 2013) relies on sediment composition only rather than evidence of sandeel usage of the area. Therefore the presence of suitable sediment does not necessarily imply that sandeels are significantly abundant in a particular area.</p>
MMO	22/03/2019 Section 42 Response	The MMO recommends that, relating to the above, it would be an idea for the locations of grab samples used for PSA data to be presented in mapped form for the array and export cable corridor to allow the reader to assess the adequacy of sample area covered.	Noted this is presented in Figure 10.2.2 in Appendix 10.2
MMO	22/03/2019 Section 42 Response	<p>The MMO notes that given new evidence that has come to light, the use of a fleeing animal model for fish is not suitable in assessing impacts. It is therefore recommended that a stationary receptor model should be used instead in the impact assessments. Reasons for this are highlighted below:</p> <p>Observed reactions to loud noise and vibrations include: schooling more closely; moving to the bottom of the water column; swimming away and burying in substrate (Popper et al, 2014). This however, is not the same as fleeing which would require a fish to flee directly away from the source over the distance shown in the</p>	<p>Additional noise modelling has been undertaken taking a stationary animal approach. This is presented in Appendix 10.3 and also Appendix 11.4.</p> <p>It should be noted that the stationary animal model assumes that, when exposed to any noise from piling, the fish do not react in any way to reduce their exposure to noise, which will remain at the highest level modelled in the water column. It is considered unrealistic to assume that, whether the fish reacts specifically to the noise or not, it would remain at the position of highest noise level for the hours of piling. The outcomes of the modelling considering a stationary</p>

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		<p>modelling. Currently no known scientific evidence to support this assumption.</p> <p>An assumed swim speed of 1.5ms⁻¹ is not unrealistic, but it is over simplifying and it overlooks factors such as fish size, mobility, biological drivers and philopatric (stays in one place or returns to the same place) behaviour. These factors may cause an animal to remain/return to the area of impact. This is particularly relevant to herring, as they are benthic spawners which are specific to location due to its substrate needs.</p> <p>Eggs and larvae have little to no mobility, which makes them vulnerable to barotrauma and developmental effects. Therefore, they should also be assessed and modelled as a stationary receptor, as per the Popper et al. (2014) guidelines. Table 10.23 should also include the values for eggs and larvae as a receptor group.</p> <p>Swimming speed, rather than fleeing speed was used in the assessments in Hirata K, 1999. This is not empirical evidence that fish will flee from the source.</p>	<p>animal scenario therefore represent a highly conservative worst case.</p> <p>Eggs and Larvae have been included in Table 10.19 in the chapter. As discussed in section 10.6.1.4.5.1, impact criteria for potential mortality / potential mortal injury in eggs and larvae are similar to those described for fish species with a swim bladder not involved in hearing (210 dB SELcum (cumulative sound exposure level) or >207 dB SPLpeak (sound peak level)), the modelled impact ranges for this category have been used to provide an indication of the potential impacts on fish eggs and larvae.</p>
MMO	22/03/2019 Section 42 Response	<p>Further to the above comments (ID 32), If the fleeing was assumed correctly, the predicted Temporary Threshold Shift (TTS) impact ranges for fish are 27km for monopoles and 29km for pin piles, this is a concern as the herring spawning grounds are located only 4.4km to the south towards the English Channel (Chapter 10 paragraph 346) and Chapter 10 paragraph 205 acknowledges that the impact ranges associated with</p>	<p>Noted, additional noise modelling has been undertaken taking a stationary animal approach. This is presented in Appendix 11.4 and summarised in section 10.6.1.4 in the chapter.</p>

Consultee	Date/ Document	Comment	Response / where addressed in the ES
		the potential TTS onset have the potential to overlap with the herring spawning grounds to the southeast. It is further stated on page 13 of Appendix 11.3 that “basing the assessment on a stationary (zero flee speed) receptor is likely to greatly overestimate the potential risk to fish species, especially when considering the precautionary nature of the parameters already built into the cumulative exposure model’. However, the MMO believes that basing the assessment on a fleeing receptor is likely to underestimate the potential risk to fish species.	
MMO	22/03/2019 Section 42 Response	Due to the uncertainty caused by the use of fleeing model and the proximity to an important spawning ground. The MMO considers that mitigation in the form of a piling restriction during the herring spawning period may be justified.	As discussed in section 10.6.1.4.5.2 in the chapter, whilst the East Anglia TWO windfarm site is 4.4km from the herring spawning ground (Downs Stock) data from the International Herring Larvae Survey (IHLS) shows that the main important area for herring spawning is located further to the south towards the English Channel (Figure 10.45). Furthermore, it is unlikely that maximum hammer energies would reach 100% and therefore the area of overlap of piling impact with the Downs Stock would be considerably smaller than 7.49%, as presented in the chapter.
MMO	22/03/2019 Section 42 Response	The MMO notes that usually it is known that monopoles result in greatest spatial impact range for noise and vibration. Therefore it would normally be noise contours for monopoles, based on a stationary receptor that should be present in map form, as per those plotted for pin piles in (Figure 10.34-10.44). Please could you confirm that the impact ranges for pin piles are greater	As discussed in section 2.1.1 of Appendix 11.4 , the noise modelling has been updated to include a stationary animal model as presented in Appendix 10.3 . As shown in Figures 10.34 to 10.45 and in Table 10.22 in the chapter, the pin pile impact ranges are larger for fleeing animals due to the strike rate used (40 strikes per minute see Table A11.3 in Appendix 11.4 ,

Consultee	Date/ Document	Comment	Response / where addressed in the ES
		than the impact ranges for monopiles and provide clarification as to why?	<p>compared to 30 strikes per minute for monopiles). The ranges calculated for fleeing animal are highly dependent on the noise received when it is closer to the pile; a faster strike rate means it experiences a higher noise dose when the receptor is close to the pile and the noise levels are higher.</p> <p>The stationary animal results (see Appendix 10.3 and Figure 10.3.1 to 10.3.12) are larger for monopiles as a higher number of strikes were used (8850 strikes for monopiles (Table A11.2 in Appendix 11.4) compared to 6760 for pin piles). As the stationary animal modelling assumes that the receptor stays in the same place throughout piling, the strike rate is not important, and the number of strikes dictates the differences in impact ranges.</p>
MMO	22/03/2019 Section 42 Response	Concerning the potential impact of noise and vibration on the nearby Downs Herring spawning grounds (ID 35), The MMO is of the opinion that the applicant should present 10 year IHLS [International Herring Larvae Survey] data (2008-2018) in the form of a heat map which should be overlaid with the mapped noise contours for monopiles based on a stationary receptor. This will provide a better understanding of the potential extent of noise penetrating into the Down spawning grounds, making a more robust assessment. This should be considered and added to the Environmental Statement.	10 year IHLS has been mapped against noise contours from the stationary animal scenario for pin piles (as described above these result in the greatest spatial impact range) and can be seen in Figure 10.45 . It should be noted that the peak larval abundance associated with the Downs Stock is further south from the East Anglia TWO windfarm site, towards the English Channel.

Consultee	Date/ Document	Comment	Response / where addressed in the ES
MMO	22/03/2019 Section 42 Response	The MMO does not agree that Fish with Swim Bladder Involved in Hearing presented in Chapter 10 table 10.31 should be considered low value/sensitivity for the impacts of underwater noise during piling. Fish which hear like this are considered most acoustically sensitive and are susceptible to barotrauma (acknowledged in point 160 of EA2 Ch.10 and 164 of EA1N).	The sensitivity of Fish with Swim Bladder Involved in Hearing has been amended in section 10.6.1.4 and in Table 10.30 in the chapter.
MMO	22/03/2019 Section 42 Response	The MMO would also request further clarification on why herring (a fish with a swim bladder involved with hearing) has been assigned a “medium” sensitivity for the impact of physical disturbance/temp loss of seabed habitat, spawning and nursery grounds, but “low” for noise. This should be corrected, and the residual impacts amended.	The sensitivity of Herring in Table 10.30 of the chapter is assigned as ‘medium’ for both underwater noise and physical disturbance and temporary loss of seabed habitat, spawning or nursery grounds during intrusive works.
MMO	22/03/2019 Section 42 Response	The MMO requests clarification regarding the piling that will take place. It is currently unclear if piling will take place simultaneously or not for the installation of WTGs or other offshore platforms. This should be clarified in the Environmental Statement. If simultaneous is proposed, then underwater noise modelling for impacts to fish should be based on this scenario	As detailed in section 6.5.15.2.1 of Chapter 6 Project Description , there will be no concurrent piling within the East Anglia TWO windfarm site for wind turbines and offshore platforms. There will also be no concurrent piling between the proposed East Anglia TWO and East Anglia ONE North windfarm projects.
MMO	22/03/2019 Section 42 Response	It has been suggested that it might be appropriate to consider additional mitigation, such as seasonal piling restrictions to avoid the spawning months (November-January inclusive), but the MMO it is believed a decision surrounding this potential mitigation should not be made until the appropriate revised model can be reviewed.	Additional noise modelling has been undertaken taking a stationary animal approach. This is presented in Appendix 11.4 and summarised in section 10.6.1.4 Potential mitigation measures with regards to piling are discussed in section 10.3.3 .

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MMO	22/03/2019 Section 42 Response	The MMO does not agree with the conclusion that “based on the known spawning grounds of herring, there is low potential for the underwater noise associated with the construction of East Anglia TWO to impact on the herring during spawning, and therefore there is little potential for cumulative impact on herring spawning with other projects’.” (Chapter 10 paragraph 346). Figure 10.39 shows there is a partial overlap of the 186bD (SELcum) TTS contour with the spawning ground (based on pin piles at 2400kJ hammer energy). It is therefore recommended by the MMO that the potential impacts on spawning herring should be further explored, and the assessment should be based on a stationary receptor. It is also worth noting that the spawning ground may be subject to other noise and non-noise pressures, e.g. shipping, so it is not just limited to other ‘projects’ as such.	Additional noise modelling has been undertaken taking a stationary animal approach. This is presented in Appendix 11.4 and summarised in Appendix 10.3 . Noise from other activities during construction is presented in section 10.7.2.2 .
MMO	22/03/2019 Section 42 Response	The MMO appreciates the potential behavioural impacts have been considered in line with Popper et al, 2014 criteria, and the report concludes the impact significance as minor adverse. However, it is recommended that the received levels of the single strike sound exposure level at the spawning grounds are modelled and presented in addition to enable a more thorough assessment of the risk of potential impact.	The National Oceanic and Atmospheric Administration (NOAA) criteria recommend thresholds based on the Peak Sound Pressure Level (SPL _{peak}) and the SELcum, not the Single Strike Sound Exposure Levels (SELs) as presented in Appendix 11.4 Tables A11.4 and A11.5 .
MMO	22/03/2019	Table 6.12 summaries the estimated unweighted source levels for the different construction noise sources considered, which appear to be based on various data	For the purposes of identifying the greatest noise impacts, approximate subsea noise levels have been predicted using a simple modelling approach based on measured data from Subacoustech’s own underwater

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	Section 42 Response	sets, however none are referenced. The MMO requests that the data set sources are referenced in the ES.	noise measurement database, due to a shortage of equivalent publicly available data. Some of these datasets are under confidentiality clauses. References will be provided upon further request.
MMO	22/03/2019 Section 42 Response	The issues surrounding the sandeel habitat should also be resolved before mitigation measures surrounding this area can be agreed. It should also be noted that sandeel is a significant prey animal and that this may have implications for acceptability of impact on other receptors.	Noted, PSA data from benthic surveys undertaken in the offshore cable corridor and the East Anglia TWO windfarm site have been analysed to provide an indication of the suitability of the offshore development area in terms of potential for provision of habitat for sandeels (see Figure 10.2.4 in Appendix 10.2).
MMO	22/03/2019 Section 42 Response	Previous comments on herring, noise modelling and sandeels need to be addressed prior to the cumulative and inter-related impact assessments being revisited and updated.	Both the cumulative and inter-relationships sections have been updated reflecting any changes to project alone impacts in section 10.6 in this chapter.
MMO	22/03/2019 Section 42 Response	It is the MMOs opinion that the cumulative impact assessment should acknowledge that the broad areas of the Southern North Sea are considered to be sandeel habitat, and many areas are already impacted by anthropogenic activities and that many areas may not provide suitable habitat due to physical parameters such as substrate or water depth.	Section 10.7.1 in the chapter has been updated.
MMO	22/03/2019 Section 42 Response	It is recommend that Scallops (<i>Pecten maximus</i> and <i>Aequipecten opercularis</i>) are included in the assessment in section 10.5.6, table 10.17. This is due to its increased commercial importance. This should be present in the Environmental Statement (ES).	Scallops have been included in Table 10.16 in the chapter and in section 10.1.7.5 of Appendix 10.1 .

Consultee	Date/ Document	Comment	Response / where addressed in the ES
MMO	22/03/2019 Section 42 Response	It is recommended that survey data should be presented by gear type if possible to ensure the assessment is based upon appropriate gear to the species concerned (e.g. trawling is not considered an appropriate means for characterisation of edible crab/lobster).	Survey data have been presented by gear type in section 10.2.1.2 in Appendix 10.2 .
MMO	22/03/2019 Section 42 Response	The MMO suggest that inadvertent removal of shellfish should be considered in regards to the potential use of a suction dredger during ground preparation. This may impact local recruitment/stock levels and therefore should be present within the Environmental Statement (ES).	Physical disturbance and temporary loss of habitat during construction is assessed in section 10.6.1.1 in the chapter, this includes any machinery which may be used for ground preparation works (including suction dredgers). Potential impacts on shellfish are discussed in section 10.6.1.1.1 in the chapter.
MMO	22/03/2019 Section 42 Response	The MMO notes that there is some inconsistency in the Technical Appendix with regard to how commercial importance has been determined. Appendix 10.1 (sections 10.1.7.1 and 2) states that the edible crab has landing values between 2012 and 2016, however also states that the lobster had significant landing values and is commercially important in the same area. However the landing contributions of lobster are lower than that of the edible crab. Further context and clarification as to the methods used to determine commercial importance has been determined.	Further information regarding the assessment of commercial importance has been included within section 10.2.1.6 of Appendix 10.2 . With regards to the commercial importance of lobster this was an error and has been amended.
MMO	22/03/2019 Section 42 Response	In relation to the above comment (ID 49), there is a similar inconsistency regarding brown shrimp. In Appendix 10.1 Section 10.1.7.3 states that brown shrimp are not considered commercially important, however the landings information shows that brown	Further information regarding the assessment of commercial importance has been included within section 10.2.1.6 of Appendix 10.2 . With regards to the commercial importance of Brown Shrimp, this was an

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		shrimp contribute 6.88% which is 11 times more than lobster. Again, clarification on the methods used to determine commercial importance should be provided.	error and Section 10.2.7.3. of Appendix 10.2 has been amended.
MMO	22/03/2019 Section 42 Response	Further consideration needs to be given to the impact of sandwave clearance, cable installation and protection on the supporting habitat sandbank features for the Outer Thames Estuary Special Protection Area with respect to the fish prey populations of red throated diver and common tern.”	This is discussed in section 10.5.4 and also in Chapter 7 Marine Geology, Oceanography and Physical Processes , Sandbanks have been considered and paragraph 137 has been updated accordingly to signpost to this assessment. These features have been considered within the assessment of effects on the ‘Suffolk’ Natura 2000 site. Impacts from cable installation are concluded as minor adverse to negligible significance (paragraph 221).
Natural England	26/03/2019 Section 42 Response	There needs to be a greater consideration of the impact of development on the nearby Orford Inshore proposed MCZ (pMCZ). As a pMCZ this site is now a material consideration and although there is no overlap with the development area it should be factored into the impact assessment and a separate MCZ assessment carried out to rule out any significant indirect affects upon the interest features of the site.	Section 10.5.4 in the chapter discusses designated sites in relation to the offshore development area, including the proposed Marine Conservation Zone (MCZ).
Natural England	26/03/2019 Section 42 Response	Recent research suggests that bass spawning grounds may be moving further north (EEA, 2016), and a number of local fishermen have suggested that bass may be spawning around the Orford Inshore pMCZ. Spawning in bass is demersal, and therefore should be considered as part of the fisheries chapter, as well as any potential nursery grounds that may be impacted by the works.	Noted, this is reflected in section 10.2.2.6 in Appendix 10.2 which discusses seabass habitat in relation to the offshore development area. Historic seabass areas with respect to the offshore development area are presented in Figure 10.10. and seabass spawning ground in relation to the worst case Temporary Threshold Shift (TTS) impact range for pin pile installation are presented in Figure 10.43. Potential impacts on seabass are considered throughout the impact assessment in section 10.6.

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Natural England	26/03/2019 Section 42 Response	Smelt <i>Osmerus eperlanus</i> has been observed to shoal in estuaries including the lower tidal reaches of the Waveney and Yare (Colclough and Coates 2013)' - Smelt are also known to spawn and shoal in the Alde-Ore Estuary.	Noted, Section 10.5.1 has been updated to reflect this.
Natural England	26/03/2019 Section 42 Response	Laboratory studies have established that herring eggs are tolerant to elevated SSCs as high as 300mg/l and can tolerate short term exposure at levels up to 500mg/l (Kjørboe et al. 1981). These studies concluded that herring eggs suffered no adverse effects from suspended sediment concentrations in excess of the maximum levels expected from mining, dredging and similar operations. Herring eggs have been recorded to successfully hatch at SSCs up to 7000mg/l (Messieh et al. 1981)' - This reference is very old (nearly 40 years). Is there any more recent evidence to show herring tolerance to elevated SSCs. Also what does the Kiorboe et al. paper define as 'short-term' exposure? (This paper has been missed off the references list, can it please be added)?	An extensive literature review has been conducted which has not found any new studies with regards to effects of suspended sediment concentrations (SSCs) on herring eggs. Best practice guidance will be followed at the time of construction which will account for any new research which may have been conducted. Kiorbie et al (1981) exposed the eggs to silt (at day 2, 4 and 6 after fertilisation) kept in suspensions for 2 hours and then allowed to settle. This reference has now been added to the list.
Natural England	26/03/2019 Section 42 Response	Furthermore, crab and lobster are considered to be tolerant to increased SSCs so have a low sensitivity' – This contradicts paragraph 140 which gives a medium sensitivity to increased SSCs.	Noted, this has been amended to medium and Table 10.31 has been updated.
Natural England	26/03/2019 Section 42 Response	The monitoring of lesser sandeel behavioural reactions to seismic surveys has shown behavioural reactions to noise source levels of 210 dB at 1 µPa (and therefore similar to piling), but with no increase in mortality or	An extensive literature review has been conducted which has not found any studies to date which specifically look at impact from piling or seismic surveys over a comparable time period from piling. Carroll et al

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		injurious effects at this level. Normal behaviour was seen to resume following the survey (Hassel et al. 2004). The results of this study indicates that the effects of such noise levels are likely to be short term, localised and constrained to behavioural level impacts only; with no long-term effects likely. – This study was over a 2.5 day time period, piling at the site will last for a lot longer than this. Has any work been done that looks at impact of noise over a more comparable time frame?	(2017) summarise and review existing studies and whilst research with regards to pile driving in freshwater environments has been conducted, Carroll et al (2017) warn that extrapolation of these findings other environments (i.e. marine) requires caution. Best practice guidance will be followed at the time of piling which will account for any new research which may have been conducted.
Natural England	26/03/2019 Section 42 Response	‘For the purposes of impact assessment it is appropriate to adopt a worst case approach. However, it is of note that EN-3 guidance (paragraphs 2.6.75 and 2.6.76) states that “EMF during operation may be mitigated by use of armoured cable for interarray and export cables which should be buried at a sufficient depth. Some research has shown that where cables are buried at depths greater than 1.5m below the seabed impacts are likely to be negligible (CMACS, 2004)” Therefore, once installed, operational EMF impacts are unlikely to be of sufficient range or strength to create a barrier to fish movement’. – Based on this statement we advise that the minimum burial depth for the development be 1.5 metres, not 0.5 m.	It should be noted the minimum burial depth is 1m, which is based on current best practice, the Applicants experience (through their parent company Scottish Power Renewables (SPR)) from the East Anglia ONE project (which has achieved burial depths of 0.5-1m along most of the cable length), and engineering limitations based on the department for Business Enterprise and Regulatory Reform review of cabling techniques and environmental effects applicable to the offshore windfarm industry report. (BERR 2008).
Eastern Inshore Fisheries Conservation Authority (IFCA)	25/03/2019 Section 42 Response	Sandeels, which inhabit and spawn in the project area, represent one of the most important prey species for Harbour porpoise. Eastern IFCA acknowledge that the PEIR determined that there will be a low magnitude of impact on fish species and that the impact of the proposed works on prey species of the Harbour	Noted. Consideration has been given in the cumulative assessment to the potential for other projects and activities in the Southern North to result in cumulative impacts on fish and shellfish receptors, including sandeels (section 10.7).

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		porpoise are of 'minor adverse significance'. We defer to Natural England for formal conservation advice on this matter, however we would like to once again highlight Eastern IFCA's concern about the scale of both licensed and planned offshore activities in the Southern North Sea, because of cumulative effects these could have on seabed habitats. Sandeels depend on the presence of adequate sandy substratum in which they burrow and are demersal spawners that lay eggs on the seabed. Whilst we appreciate the difficulty in studying potential wide-scale impacts of all offshore activity, this is an important issue requiring further consideration.	In addition, PSA data from benthic surveys undertaken in the offshore cable corridor and the East Anglia TWO windfarm site have been analysed to provide an indication of the suitability of the offshore development area in terms of potential for provision of habitat for sandeels (see Appendix 10.2).
Eastern IFCA	25/03/2019 Section 42 Response	Any activity that causes a disturbance to the sea bed has the potential to impact fish spawning or nursery areas and could have a negative impact on fish populations and marine ecosystems. The East Anglia ONE North proposed cable corridor fall within nursery and spawning grounds for many fish species including sandeel, whiting, sole, cod, Tope shark and Thornback ray (Ellis et al., 2012). The inshore area of the offshore cable corridor crosses the Outer Thames Estuary SPA, therefore these species will be particularly susceptible to any disturbance. The proposed works have the potential to cause physical disturbance, increase seabed height and increase suspended sediments, with sediment being released into the water column and dispersed with the tide and therefore, EIFCA recommends that the MMO considers the value of undertaking a regional study to examine potential	Consideration has been given in this assessment to fish species with known spawning and nursery grounds in areas relevant to the project (Table 10.10 and Table 10.12). Fish species which are of importance as prey to marine mammals, including herring, sole and sandeels have been considered in the impact assessment within this chapter (Table 10.16). Potential impacts of the project on marine mammals are discussed in Chapter 11 Marine Mammals .

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		overall impacts of offshore activities (including windfarm-related works, aggregate extraction and demersal fishing) on fish spawning and nursery grounds in the southern North Sea.	
Eastern IFCA	25/03/2019 Section 42 Response	Electromagnetic fields (EMF) Eastern IFCA holds concerns about the proliferation of marine electricity cables off the East Anglian coast and the potential – but very poorly understood – impacts of electromagnetic fields on marine life. We would like to highlight that there are appreciable gaps in the scientific literature as to the potential effects of EMF emissions from subsea cables on marine fauna, and therefore there remain uncertainties in the ability of the Applicant to determine that there will be no adverse effects on fish and shellfish ecology.	<p>The assessment of the potential impact of electromagnetic fields (EMFs) on fish and shellfish species is based on the worst case scenario identified for the project (Table 10.2) and taking account of best available information.</p> <p>In the context of the assessment of EMFs it is important to note that from the results of post-consent monitoring conducted to date, there is no evidence to suggest that EMFs pose a significant threat to elasmobranchs at the site or population level, and little uncertainty remains (MMO 2014b) (section 10.6.2.6.1 in the chapter).</p> <p>Consideration has been given in the cumulative assessment to the potential impact of EMFs associated with the project and other developments in the wider area on sensitive receptors (section 10.7 in the chapter).</p> <p>As described in Table 10.2 and section 10.6.2.6 in the chapter, cables will be buried where possible to a minimum depth of 0.5m and protected where cable burial is not feasible.</p>

Consultee	Date/ Document	Comment	Response / where addressed in the ES
Eastern IFCA	25/03/2019 Section 42 Response	<p>Coastal habitats provide important spawning and nursery grounds for many marine species, therefore any disturbance to these habitats has the potential to negatively impact populations. Tope shark and Thornback ray utilise the Outer Thames Estuary as nursery grounds whilst herring use the area as a spawning site. The inshore area of the offshore cable corridor crosses the Outer Thames Estuary SPA, therefore these species will be particularly susceptible to any disturbance. The North sea is understood to support nursery grounds for additional species including herring, cod, whiting, mackerel, plaice and sole and spawning grounds for sole and sandeels (Ellis et al., 2012) – an important prey species of the Harbour porpoise, which is protected within the Southern North Sea cSAC.</p> <p>Although the best available information (Coull et al., 1998; Ellis et al., 2012) shows extensive spawning grounds for many species, Eastern IFCA is concerned about the scale of offshore activities in the Southern North Sea because of the cumulative effects these could have on seabed habitats and subsequently on dependent species. Whilst we appreciate the complexity of studying potential wide-scale impacts, we consider the issue does need further consideration.</p>	<p>Consideration has been given in the cumulative assessment to the potential for other projects and activities in the Southern North to result in cumulative impacts on fish and shellfish receptors (section 10.7).</p>

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