VATTENFALL

Vattenfall Wind Power Ltd

Thanet Extension Offshore Wind Farm

Annex A to Appendix 27 to Deadline 6 Submission: Response to MMO D5a submission on seasonal restriction

Relevant Examination Deadline: 6

Submitted by Vattenfall Wind Power Ltd

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1.1 Introduction

1 The MMO have made representations in their D5A submission regarding the need to accept a precautionary seasonal restriction of six months in order to mitigate potential effects on herring spawning grounds. This note provides the Applicant's response to the representation.

1.2 Detailed response on matters relating to herring and sole ecology

2 Table 1 provides a point by point response to the MMO, drawing on the application information as submitted in July 2018 and material produced during the examination, notably:

- Appendix 7 to Deadline 4C submission - Fish Clarification Note; and
- Annex A to Appendix 7 to Deadline 4C submission: Herring and sole spawning potential calculations

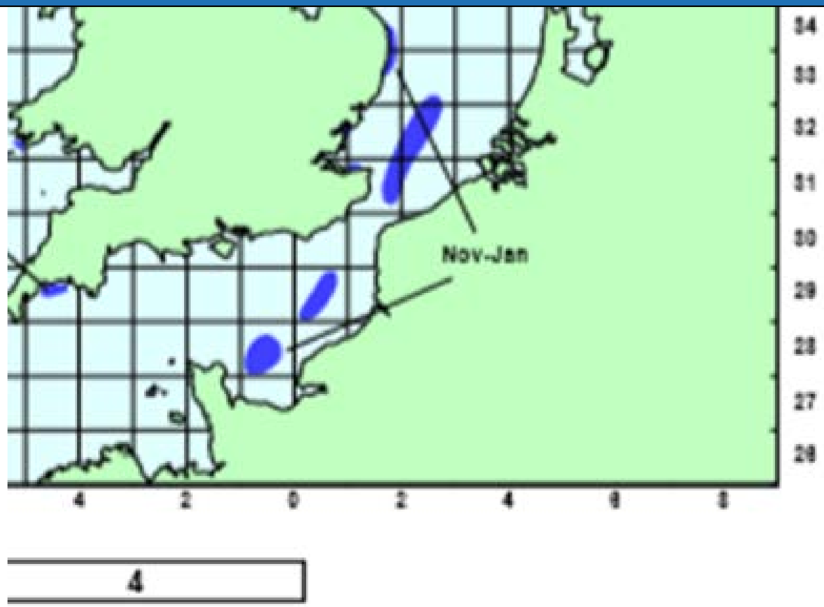
Table 1: MMO D5A representation and Applicant's response

MMO Representation	Applicant response
2.2 Herring spawning grounds 2.2.1 The modelling shows that significantly larger impact ranges are predicted, based on a stationary receptor. The modelling suggests that the predicted impact ranges for mortality, recoverable injury and Temporary Threshold Shift (TTS) (207dB, 210 dB and 186 dB SELcum) will overlap with areas of higher importance for herring spawning (East Channel (Downs) stock. The 186 dB SELcum metric has the largest overlap with the spawning grounds.	The Applicant notes that this statement refers to the East Channel (Downs) Stock to the east of the site which was identified by Coull et al (1998), a paper that provides estimates of spawning ground locations using sediment type and discrete survey data. The Applicant has submitted a more recent dataset which draws on 10 years of International Herring Larval Survey (IHLS) data which confirms that the nearest spawning grounds to the site are ~25 km to the south (Figure 1, Appendix 7 to the Applicant's D4C submission). The Applicant notes that this appears to infer that the spawning grounds identified in Coull et al (1998) have shifted such that the areas of the North Sea/ English Channel in close proximity to the proposed project are now of lesser importance. Equally it could infer that the comparatively limited dataset utilised in Coull et al (1998) identified an infrequent spawning area that is not reflected in longer terms datasets collected since.
2.2.2 The MMO advises that potential effects on fish from anthropogenic noise can also include behavioural changes. There is considerable uncertainty in assessing the risk of behavioural responses, since they are highly dependent on many factors, including behavioural context. Behavioural changes can have a significant impact to a population if sound causes fish to move away from foraging or breeding grounds, cease reproductive activities, or change their migratory behaviour. Thus, there are uncertainties as to if, and how, sound may affect the behaviour of the East Channel and Thames Estuary herring. Nonetheless,	The Applicant has made reference to the available literature with regards to the behavioural responses of herring to noise. The literature identifies that there is a limited behavioural response to noise stimulus such as noise levels akin to sonar and impulse noises. It is noted however that the D4C submission (Appendix 7) also confirmed that it is accepted that herring show a highly varied reaction to disturbance depending on the activity they are involved in (Skaret et al., 2005). Specifically, herring are considered to be potentially less responsive to noise when involved in either feeding or actively spawning compared to when generally swimming. This variation in reaction is considered to be due to a balance between predator avoidance (i.e. survival) and biological imperatives (i.e. feeding to maintain energy or spawning to pass on genetic material). The literature identifies that mean swimming speeds when feeding and actively spawning are in the region of 1.44 m/s. The

MMO Representation	Applicant response
behavioural responses would be expected to occur over larger ranges, at sound levels lower than the TTS threshold.	Applicant has therefore confirmed that whilst the species is varied in terms of response during sensitive periods, the swimming speed during these periods is 1.44m/s. The MMO (via Cefas) note that there may be a behavioural response at sound levels lower than the TTS threshold. It is the Applicant's position that if this were to be the case any behavioural reaction would be of a negligible magnitude at most, with spawning grounds that are demonstrably of a lower importance than was considered to be the case in Coull et al (1998) or the more recent Ellis et al (2012) publications. It is also important to note that in the event that a behavioural responses wasn't realised, i.e. the fish did not flee, there would be no physical (TTS or otherwise) injury to either adult fish, eggs or larvae as a result of the interaction.
2.2.3 The MMO cannot confidently say that the additional modelling results demonstrates the likely impact on spawning stock of herring is within acceptable limits. There is no evidence to support the conclusion that behavioural impacts are unlikely to significantly impact on spawning activity. It is not known if, and how, anthropogenic noise from the piling operations may affect the behaviour of the East Channel and Thames Estuary herring during this critical life stage. The applicant was previously asked to model the received levels of single pulse Sound Exposure Level at the spawning grounds, however, this information has not been provided.	The Applicant has demonstrated, using established data and methods that have been utilized previously on other OWFs (and marine industries more widely), that any impact, under a worst case scenario (foundation installation nearest to the stock), would have an effect on less than 0.05% of the spawning stock. Piling of foundations under the best case (foundation installation furthest away from the stock) would reduce the effect to 0.004%. It is therefore evident, using existing precedents, and a proportionate approach to assessment, that any effect will not be significant in EIA terms. There are two further points of important context to consider. The first is a direct question of proportionality. Although not strictly applicable, the Habitats Regulations Assessment assumes as a starting point that where an effect is <1% it is unlikely that a 'likely significant effect' will occur on a designated site or feature. The second is that the nearest 'feature' or 'site' in question is recognised only in a single dataset (Coull et al 1998) which, following a review of ten years of IHLS data, appears to be of notably lesser

MMO Representation	Applicant response
	importance than previously thought, with an absence of high larval densities (i.e. no 'hotspot'). The ten year dataset was derived from a methodology used for an ORJIP study which has been endorsed by both Cefas and MMO. The Applicant has also responded to the matter of Sound Exposure Level at on page 10 of Appendix 5 to the Applicant's D4C submission. This noted that: *The Applicant has provided the SPL* [Sound Pressure Level]*, again as agreed under the EIA Evidence Plan, and it should be noted as identified in Application Ref 6.4.6.3, that the SPL is a measure of the average level of the broadband noise, and the SEL sums the cumulative broadband noise energy. This means that, for sounds of less than one second (i.e. a single pulse), the SEL will be lower than the SPL. Given a SELss contour will provide a lesser impact range than the SPL, and that all parameters modelled are as agreed under the EIA Evidence Plan, the Applicant is unclear what the merit of further SELss modelling would be, and on what scientific evidence the request is made on.* It is therefore the Applicant's position that modelling SELss provides a less precautionary zone of influence. Therefore, as noted within the Applicant's other D4C Submissions (Appendix 7 and associated annexes), there would be an impact of <0.05% on spawning potential should the SELss or SPL be relied on.
2.2.4 In relation to behavioural responses, the applicant suggests that "herring are considered to be potentially less responsive to noise when involved in either feeding or actively spawning compared to when generally swimming, which is plausible…. Therefore, it is considered that behavioural impacts are unlikely to significantly impact on spawning activity…" At the same time, when considering injury/TTS, the applicant is of the opinion that a fleeing	As noted previously in this document, the Applicant can confirm that there is a variation in reaction in herring depending on the activity the animal is involved in. The empirical data indicate that when the animal is most susceptible to noise (during feeding/spawning) the recorded swim speed is 1.44m/s. It is therefore the Applicant's position that it is appropriate to consider a flee speed within an assessment of a realistic worst case. Notwithstanding this, the Applicant has presented a revised assessment which utilises a worst case of a stationary receptor. Under this worst case

MMO Representation	Applicant response
receptor is nevertheless more robust and a 'suitably precautionary' approach, which, the MMO would highlight that in the case of spawning herring, is a concern if they 'flee' from spawning grounds.	scenario assessment the magnitude of impact is <0.05% of the spawning stock for the nearest piling event on the nearest spawning ground (all other piling events have a reduced interaction). It is reasonable therefore to conclude that this scale of impact is unlikely to result in a significant effect on the spawning biomass of the relevant herring spawning populations.
2.2.5 The updated modelling demonstrates overlap of the East Channel spawning grounds with the SELcum noise contours (for injury and TTS). Whilst the MMO acknowledges that the IHLS data suggests that the primary spawning is further south, spawning grounds can vary / shift year on year. As a precautionary approach, the MMO recommend that pile driving operations are not permitted during the herring spawning period, to minimise the risk of impact to spawning herring - February to April for the Thames sub-stock, and from the end of November to January for the Downs stock (located to the south in the English Channel).	The Applicant notes that the MMO has not defined which data are being referred to in defining the East Channel and Thames sub-stock. The Applicant would also note that the spawning season recorded within Coull et al 1998 is noted as November to January as can be seen below which is taken directly from page 9 of Coull et al (1998) and identifies the relevant spawning periods to be November to January. This is also reflected in page 22 which confirms the SE England spawning stock to be present Nov-Jan. Following discussion with the MMO on the 15th May 2019 there remains uncertainty as to what purpose the suggested February – April seasonal restriction would serve, or what it is based on; the MMO having confirmed that the herring seasonal restriction for other OWFs in the region is limited to November – January.

MMO Representation	**Applicant response**
	 The Applicant also notes that the modelled outputs demonstrate that the presence of the Margate Sands sandbank acts as a barrier to underwater noise propagation. Given the location of the Thames sub-stock (should it still exist) to the west of the sandbank features, combined with the modelled underwater noise outputs, the Applicant does not believe that a seasonal restriction is required given the likely scale of effect.
2.2.6 This recommendation further recognises that the Thanet OWF was similarly subject to a temporal piling restriction as part of the licence conditions. The evidence provided suggests there is no reason that Thanet Extension should not be subject to the same condition.	The Applicant notes that the MMO appear to be drawing on the precedents set at Thanet OWF, which was subject to a restriction from November to January. The Applicant notes that the MMO review of post-consent monitoring for OWFs also confirms that a restriction at Thanet OWF was removed. The Applicant further notes that this restriction was based on Coull *et al* 1998 data which the applicant has stated should now be considered to

MMO Representation	Applicant response
	be superseded by the 10 year ILHS data set. The Applicant also notes that the assessment for the existing Thanet OWF was based on different noise metrics and different underwater noise modelling methodologies, as well as 100 WTGs as opposed to the 34 proposed for Thanet Extension. The methods used to characterise the herring spawning grounds in the southern North Sea for the purpose of the EIA have been taken from an ORJIP report, delivered by GoBe to the Carbon Trust in 2018. The study methodology was undertaken using the last 10 years of data from ICES International Herring Larval Surveys data and International Bottom Trawling Survey data, to identify herring larvae hotspots and therefore determine the main herring spawning grounds. The study has been welcomed by both MMO and Cefas who stated: *"the study enhances our knowledge of areas used by herring for spawning and improves the evidence base. This guidance should result in greater efficiencies in the consenting process and will help to minimise impacts to herring and thus contribute to our vision of sustainable use of our seas*"; the study "*draws together the current evidence and thinking on the topic. The project has helped collate and advance the science in this area.*". The ORJIP study was supported by an expert panel with representatives from MMO, International Council for the Exploration of the Sea (ICES), CEFAS, Scottish Natural Heritage and Marine Scotland Science. It is firmly the Applicant's position that a contemporary study methodology supported by Cefas, MMO and a range of experts, undertaken over a 10 year period, should be employed within the EIA.
2.2.7 The use of bubble curtains to reduce noise propagation when piling could reduce the impact of underwater noise and vibration on fish (in accordance with	Whilst the Applicant notes that bubble curtains may be used under certain environmental conditions to reduce the impact of underwater noise, predominantly to mitigate the impact on marine mammals, it is unclear why

MMO Representation	Applicant response
the standards applied in German waters; Umweltbundesamt, 2011), this may lower the risk of impact sufficiently for piling to be unhindered during all or part of all of the spawning seasons for herring, or could be used in conjunction with spatial piling restrictions. This method could reduce potential impacts to those species which have spawning and nursery grounds in the TEOWF area, and also to species which transit through the TEOWF area for their seasonal migratory movements. If the applicant were to commit to such measures the MMO would expect to see this reflected on the DML and revised accordingly.	the MMO are suggesting such mitigation in this case and what levels any reduction should seek to meet. The Applicant has demonstrated, using appropriate means of mapping sensitive receptors and appropriate and agreed underwater noise modelling parameters (through the EIA Evidence Plan Process), additional precautionary underwater noise modelling parameters (requested during examination), and appropriate methods for assessing potential impacts on fish receptors for which precedents have been set at multiple OWF projects, that the effect is minor and not significant in EIA terms. In the absence of a significant effect, with the weight of evidence provided, the Applicant considers that the employment of seasonal restrictions and/or bubble curtains is not required or justified.
2.3 Sole spawning grounds 2.3.1 While the applicant has considered the potential impacts of the updated modelling in relation to herring, the potential overlap of modelled noise exposure criteria for fish hearing group 1 (sole) upon sole spawning grounds is not presented, rather the potential impacted area (total calculated habitat) is considered instead. While this is useful, the potential overlap (modelled noise contours) should be overlaid onto identified sole spawning grounds as previously requested. Providing a figure with the TTS threshold (modelled based on a stationary receptor) would show the potential impact range for injury to sole. 2.3.2 As such, at this stage further information is needed to determine the likely impacts on spawning sole are within acceptable limits.	The Applicant considers that this request was made erroneously, given paragraphs 25 *et seq* of Appendix 7, and supporting Annex A to Appendix 7 explicitly provides an assessment of the potential impact on sole through reference to spawning grounds identified in Ellis *et al* 2012, but has provided a detailed response for ease of review. The Applicant has presented the modelled noise contours as a proportion of the sole spawning grounds. The SELcum ranges, and total areas within the contours associated with those ranges, have been presented in Table 1 of Appendix 7 of the D4C submission, illustrated the contours in Figure 1 and 2, and provided in Annex A to Appendix 7. Whilst the illustrations in Appendix 7 show herring spawning grounds, the contour is the same (186dB SELcum). At paragraph 25 of Appendix 7 the Applicant notes that “As detailed in Figure 6-4 of the Fish and Shellfish ES chapter (APP-043), the development is located within high intensity sole spawning grounds as defined by Ellis et al., 2012.”. The Applicant has therefore identified that the potential worst case impact

MMO Representation	Applicant response
	contours (assuming no fleeing) are entirely within the spawning grounds identified within Ellis et al 2012 (Cefas publication 147). The Applicant has identified the total area of impact through both agreed metrics (EIA Evidence Plan), requested precautionary/no flee response metrics as requested during examination, the total area of the spawning grounds as defined in Cefas publications and illustrated within the Thanet Extension ES, and identified the potential effect on spawning potential that may arise (using an established method of doing so). The significance of effect predicted through the application of the metrics and datasets employed is considered in the context of an impact on spawning potential, which is presented at paragraph 26 of Appendix 7. Paragraph 26 concludes: *Taking the worst-case modelled range at 186 dB SELcum, and assuming that an adult fish will not respond to the stimulus this [the worst case scenario noise contour] covers an area of approximately 1,224 km^2, the effect on spawning potential for sole is limited to 0.786% of the higher intensity spawning grounds in the region (which cover approximately 31,866 km^2). Assuming a more robust approach, which incorporates the likely scenario that the fish will flee the source of noise, the potential impact on sole spawning potential is limited to a maximum of 0.105%.* Given the Applicant's application of requested noise modelling parameters to Cefas published identified spawning ground data as requested, and utilization of established assessment methodologies to define the predicted effect significance, it is the Applicant's view that the assessment is robust, and appropriate.