

# Review of Report ‘An Independent Evaluation of the Potential Impact of the Aberdeen Offshore Wind Farm upon Salmon and Sea Trout’

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## 1. Commission

Marine Scotland’s Licensing Operations Team (MS-LOT) has sought third party support in their review of the paper ‘An Independent Evaluation of the Potential Impact of the Aberdeen Offshore Wind Farm upon Salmon and Sea Trout’ authored by Professor Anthony Hawkins (‘the Hawkins Report’).

This commission has been delivered through the *Scottish Government’s Marine Planning and Licensing Framework Agreement (REF: 207967) – Direct Award Number 14*. The review was undertaken by Nick Corne, Marine Environmental Consultant and Elaine Holmes an Environmental Scientist at CH2M. and reviewed by Steve Isaac, a Principal Environmental Consultant at CH2M.

## 2. Introduction

MS-LOT has commissioned CH2M to consider the questions and requirements posed below in relation to the Hawkins Report:

1. Review the points [made in the Hawkins Report] and link them to where they have been addressed or otherwise in the EIA (ES), Addendum, s36 Consent, Marine Licence, Appropriate Assessment (AA), Cable Laying Strategy (CLS) and the Project Environmental Monitoring Programme.
2. Specifically, list the failings/flaws that the author of the Hawkins Report has cited and any suggestions the author has provided on how they can be addressed?
3. Conduct a review of the noise information in the EIA (ES), Addendum, s36 Consent, Marine Licence and AA, CLS and the Project Environmental Monitoring Programme and what is cited in the Hawkins Report.
4. List any points of failure in terms of the EIA/HRA regulations and potential breaches of the relevant directives.
5. Identify any new information in the report which was not available at the time the decision was made in 2013 which could be relevant to consider when discharging conditions, and if this new information is likely to lead to different conclusions on the significance of the effects identified in the ES

Points 2 to 5 are addressed in this report with point 1 included as a spreadsheet in Appendix A.

The following documents were as issued to CH2M by Marine Scotland under this commission and reviewed in order to address these questions and requirements:

- European Offshore Wind Deployment Centre (EOWDC) 2011a, Environmental Statement, Chapter 22: Salmon and Sea Trout;
- European Offshore Wind Deployment Centre, 2011b, Environmental Statement, Appendix 22.1 Salmon and Sea Trout Baseline Technical Report;
- European Offshore Wind Deployment Centre, 2011c, Environmental Statement, Appendix 22.2 Salmon and Sea Trout EIA;
- Aberdeen Offshore Wind Farm Habitat Regulations Appraisal Addendum, 2012, Technip;
- European Offshore Wind Deployment Centre, 2017, Offshore Environmental Management Plan, ABE-ENV-DB-0012;
- European Offshore Wind Deployment Centre, Cable Laying Strategy, 2017 ABE-ENV-DB-0003;
- Section 36 of the Electricity Act Decision Letter and Consent Conditions, 2013, Marine Scotland;
- Licence for Marine Renewable Construction Work and Deposits of Substances or Objects in the Scottish Marine Area Licence Number, 2016: 04309/16/1; and
- "Hawkins, A.D. (2017) An Independent Evaluation of the Potential Impact of the Aberdeen Offshore Wind Farm upon Salmon and Sea Trout, Loughine Ltd (the Hawkins Report)

### 3. Structure of this Review

The Hawkins Report has been reviewed with each specific point (noted in the scope as failing or flaws) extracted, grouped in relevant sections:

- 4.1. Consultation;
- 4.2 Electromagnetic Fields;
- 4.3 Increased Sediment Concentration;
- 4.4 Cumulative impacts;
- 4.5 Monitoring and Research; and
- 4.6 Noise and vibration.

Under each of these sections, the points raised in the Hawkins Report are listed as items 1 to 6 with appropriate sub-items. Where applicable this 'item' has been cross-referenced to the appropriate section of documentation used to support the consent's applications or produced post consent. This is highlighted in a text box with an associated reference. Following this, the Technical Note provides commentary on the following:

1. The Hawkins Report's suggestion to how these specific points can be addressed;
2. Contextualises the points in terms of the EIA/HRA regulations; and
3. Provides references to new information and a consideration if this would have led to a different conclusion on the significance of the effects identified in the ES.

## 4. Review of the Hawkins Report

### 4.1. Consultation

**Item 1a (Hawkins Report pg4 para 5):** 'Cable laying was supposed to avoid any coastal netting stations, but it would now appear (from information provided by the owners of the Blackdog Fishing Station) that the cables are close to the station, and will affect fishing operations there adversely. It is important that the owners of salmon fishing rights that may be affected by such developments should be consulted by the developers and the Crown Estate on any proposals regarding the location and laying of cables'

**Item 1b (Hawkins Report pg9 para 3):** 'It is questionable... whether there has been sufficient consultation with coastal salmon fishers to provide an assurance that the impact on their fisheries will be negligible. Severe problems [exposure of the cable, restriction on net placement, Health and Safety concerns and increased journey times] may be expected at the Blackdog fishing station as a result of the current plans for laying cables, contrary to the assurance that cable laying would avoid such areas.'

**ES (Appendix 22.2 pg20)** 'Whilst the export cable route has yet to be finalised, taking the worst case scenario that the cable route would pass through a coastal netting station, there could be a small, localised temporary loss of fishing area. Taking the short duration of export cable laying and therefore the short period of exclusion, if the export cable route should pass through a fishing area which was being actively fished, the unmitigated impact is considered to be localised and of MODERATE significance'.

Mitigation: 'The appropriate liaison and consultation will be undertaken with the relevant stakeholders with the objective of minimising potential impacts to NEGLIGIBLE significance'.

**ES Appendix 22.2 (Section 3.5);** 'provided that adequate liaison with stakeholders and fishing interest is carried out it is not expected that the construction/ decommissioning and operational phase of the proposed EOWDC would result in direct impacts on salmon and sea trout fisheries (eg loss of fishing area, restricted access, interference with fishing activities).'

**Cable Laying Strategy (Section 6.2):** 'Two landfall locations are currently being considered within the consented OECC. These two options are being explored with the relevant stakeholders and for technical feasibility' and **Section 12.4 Relevant post-consent consultation;** 'Consultation has been undertaken with MS-LOT in relation to the cable specifications'.

#### 4.1.1. Consultation Comments

1. The Hawkins Report suggests that consultation with stakeholders with fishing interests has been poor and should be rectified.
2. This observation is contrary to the commentary provided by the developer in the CLS, as noted above, in which consultations with 'relevant stakeholders' are being undertaken. If relevant stakeholders include potentially affected fisheries, then it is considered that Hawkins Report comments have been met and this should continue. If not, then consultation should be extended to these parties as a noted mitigation measure listed in the ES to help inform the final cable route selection. The list of key constraints noted in Section 5.2 of CLS would benefit from the inclusion of coastal netting areas. In addition, a description of how any specific comments (relating to mitigating impacts on Salmon and Sea Trout) arising from stakeholder consultation have informed the CLS would aid transparency.

3. Further, the issue of cable exposure is considered in the CLS with mitigation measures noted in Section 11.3 as a condition of the planning permission (not reviewed here).
4. The Hawkins Report comments on the assurances regarding avoidance of coastal netting areas. These assurances are not listed as a mitigation measure in the ES, nor detailed as a consent condition in the consents reviewed (noted in Introduction of this report). The ES provides consideration of cable routes through the coastal netting stations (as noted above).

#### 4.1.2. Review Summary

From the information presented in this review, the output of the stakeholder consultation should be included in the CLS and both the developers and Marine Scotland should continue to facilitate stakeholder engagement during the post consent process. However, there does not appear to be any additional consideration required or new information presented in light of the Hawkins Report that would provide an alternative conclusion to be reached in the ES in regards to the consideration of coastal netting

#### 4.2. Electromagnetic Fields (EMF)

**Item 2a (Hawkins Report pg 8 para 4):** "The EIA recognised that salmon were expected to perceive the magnetic fields generated by cables and that potential impacts on salmon and sea trout migration derived from the magnetic fields generated by the export and inter-array cables could theoretically range from small or large scale disorientation to a barrier to migration.

**Item 2b (Hawkins Report pg 8 para 5):** In terms of mitigation, it was said that the cables would be buried. However, the EIA stated that burial to depths realistically achievable offshore (0.6 m - 3 m) would not make a significant difference to the resultant fields or the distance over which they propagate. Cable burial to a depth of at least 1 metre was only likely to provide some mitigation for the possible impacts of the strongest B-fields and induced E-fields that existed within millimetres of

**ES Appendix 22.2 (pg18):** 'Given the small area of the wind farm and the total cabling involved, the fact that magnetic fields will only be encountered in close proximity to the cables (within tens of metres) and the potential for fish to be using spatial orientation mechanisms other than magnetic navigation, the magnitude of the impact is considered to be NEGLIGIBLE to LOW. Taking a precautionary approach based on the conservation importance of the species and the lack of definitive evidence in respect of impacts on the migration of salmonids, the receptors, salmon and sea trout originating in rivers within the regional study area, are considered of HIGH sensitivity. The impact of EMFs on salmon and sea trout migration is therefore considered to be of NEGLIGIBLE to MINOR significance'.

'The magnetic fields anticipated to be produced by the AC cables associated with the proposed EOWDC are small (1.5  $\mu\text{T}$ ) in comparison to the Earth's magnetic field (approximately 50  $\mu\text{T}$ ). Atlantic salmon are expected to perceive these magnetic fields as new localised additions to the heterogeneous pattern of geomagnetic anomalies already occurring naturally and anthropogenically in the sea (MS, 2011 as cited EOWDC, 2012)'

Mitigation: Cable burial to a depth of at least 1 metre

**Cable Laying Strategy (Pg37):** 'The mitigation described includes the use of armoured cables and cable burial to a sufficient depth ...in line with current industry standards'. The predicted magnetic field of any of the cables buried to 0.6 m is expected to be below the earth's magnetic field (assumed to vary between 25  $\mu\text{T}$  and 65  $\mu\text{T}$ ). As such, at the indicative target burial depths of the Inter-array cables of up to 1.0 m, and OECs of up to 1.5 m, EMF emissions at the seabed are expected to be significantly lower than the earth's magnetic field

the cable. Salmon are likely to be especially vulnerable to such effects as they pass through shallow water, following the coast.

**4.2.1. EMF Comments**

1. The Hawkins Report notes in the absence of clear evidence on the impact of EMFs from subsea cables, the use of magnetic cues for orientation, and the efficacy of mitigation measures. The Report makes a case for applying the precautionary principle and delaying the EOWDC development until valid evidence is available on the significance of such effects and the efficacy of the mitigation measures proposed.
2. The ES presents a reasoned argument with supporting references to suggest EMF will not present a barrier to salmonid migration and concludes with a conservative maximum of minor significance in relation to this impact. The planned mitigation measures are noted not to significantly reduce the resultant EMF fields or the distance over which they propagate. However, the CLS calculates that EMF emissions are lower than the earth’s magnetic field and argues that the use of 66kV cables, rather than the 33Kv ones described in the ES, will reduce the EMF. This being the case, there does not appear to be a substantiative argument to delay the development pending the results of research or to alter the impact assessment rating.
3. The research topics put forward in the Hawkins Report in relation to EMF are valid and the EOWDC appears to represent an ideal research opportunity to validate the arguments as required by Condition 15 of the Section 36 consent (required research targeted at ‘migration and behaviour of European eel, salmon and sea trout due to electromagnetic fields’).

**4.2.2. Review Summary**

There does not appear to be any additional consideration or new information presented in light of the Hawkins Report that would provide an alternative conclusion to be reached in the ES in regards to consideration of EMF.

**4.3. Increased Sediment Concentration**

**Item 3 (Hawkins Report (pg 8 para 3):** ‘the assessment of the impact of suspended sediments did not consider sediment release from the placement and operation of suction bucket foundation’

**ES Chapter 3 (Section 3.7.2.5):** Suction Caisson/Bucket ‘It is not anticipated any seabed preparation would be necessary’. Table 3.5 notes that the sediment spill during installation is predicted to be negligible with a suction caisson/bucket foundations.

**ES Appendix 22.2 (pg16):** Based on the relatively short term scale of any potential impact caused by the plume, its relative small spatial extent, and the fact that the expected sediment concentrations within the plume are in line with background levels observed in the area, the magnitude of the impact is considered to be LOW. The receptors (adult and juvenile salmon and seat trout), given their tolerance to the expected levels of suspended sediment and their swimming capability, are considered to have a LOW- MEDIUM sensitivity in the case of fish originating in the Dee, Don and Ythan, as they are more likely to transit the EOWDC site. The impact of suspended sediments during construction is therefore considered of NEGLIGIBLE-MINOR significance.

**Cable Laying Strategy (pg37):** To maximise post-trenching cable cover and to minimise the disturbance of sediment away from the trench, site specific trencher settings will be derived based on the soil conditions to ensure disturbed sediment is monitored and managed efficiently throughout operations

#### 4.3.1. Increased Sediment Concentration Comments

1. The Hawkins Report highlights shortcomings in the assessment in relation to the lack of consideration of suction bucket foundations and the increased suspended sediments as a result of their deployment.
2. Construction activities that were considered to result in a temporary sediment re-suspension were modelled using gravity bases as the worst case. The increases in suspended sediment concentration levels were noted to be in line with and below background levels and, owing to the application of a worst-case scenario, are likely to be higher than for use of suction buckets.

The application of a worst-case assessment is considered to be good practice in EIA and is not indicative of assessment shortcomings.

#### 4.3.2. Review Summary

There does not appear to be any additional consideration or new information presented in light of the Hawkins Report that would provide an alternative conclusion to be reached in the ES in regards to consideration of increased suspended sediment concentration through the use of suction buckets.

#### 4.4. Cumulative Impacts

**Item 4 (Hawkins Report pg 7 para 5):** 'Since the EIA was agreed there have been several other proposals for developments in the area that might also affect salmon and sea trout. They include the extension of Aberdeen Harbour into Nigg Bay, in the vicinity of the mouth of the River Dee. Also, it is proposed that the Kincardine Offshore Wind Farm be developed to the south of the area. It will be important for the cumulative effects upon salmonids of these additional developments to be assessed before any of them are allowed to proceed'

**ES Chapter 22:** 'the theoretical worst case in terms of cumulative assessment would be the simultaneous construction of the proposed offshore wind developments in the Firth of Forth and in the Moray Firth, coinciding with the proposed EOWDC'.

'Given the limited number of turbines to be installed in the proposed EOWDC in comparison to the offshore wind developments proposed in the Firth of Forth, the contribution of EOWDC to any cumulative impact is likely to be of NEGLIGIBLE significance'.

#### 4.4.1. Cumulative Impacts Comments

1. The Hawkins Report noted a requirement to consider cumulative effects on salmonids of proposals 'in the area'.
2. The EOWDC's ES was produced in 2011 and provided consideration of the cumulative impacts of construction and operation with the proposed Round 3 windfarm in the Firth of Forth and the Moray Firth; concluding that there was unlikely to be a cumulative impact on salmonids. The proposals cited in the Hawkins Report were not referenced in the EOWDC's ES owing, perhaps, to the lack of development details available at that time of writing (2011). Both the Aberdeen Harbour extension (Aberdeen Harbour Board, 2015) and the Kincardine Offshore Wind Farm's (Atkins, 2015) ES's are dated 2015 (and provide consideration, as noted below, of the EOWDC).

The consideration of cumulative impacts through the ES process is technically and logistically challenging on account of the limited evidence base in relation to cumulative impacts and the complexities of sharing development details, where these may be preliminary in nature or

commercially sensitive. In acknowledgement of these issues, it is normal EIA practice for subsequent developments in an area to provide consideration through their cumulative impact assessment of applicable consented (and constructed) projects. Assessment of cumulative impacts may provide consideration of future proposals but this is only considered a valid activity where sufficient design information is available. It is unclear why the EOWDC's ES did not acknowledge or provide an assessment of the proposals outlined in the Hawkins Report, but it is likely due to this lack of information.

Both of the proposals cited in the Hawkins Report have provided consideration of the EOWDC in their consideration of cumulative impacts. The Aberdeen Harbour Extension's ES considered the cumulative impacts of increased underwater noise and sediment plumes on salmonids and concluded '*effects of the harbour construction and operation are forecast to be localised and temporary on low-value receptors and thus are judged to be not significant. No significant cumulative effects were identified*' (Aberdeen Harbour, 2015). The Kincardine Offshore Windfarm's ES draws a comparable conclusion in relation to disturbance or physical injury from increased underwater noise (increased suspended sediments were not considered to be an impact resulting from the proposal), citing the nature and scale of the project provided a limited scope for cumulative impacts on salmonids.

#### **4.4.2. Review Summary**

There does not appear to be any additional consideration or new information presented in light of the Hawkins Report that would provide an alternative conclusion to be reached in the ES in regards to cumulative impacts.

#### 4.5. Monitoring and Research

**Item 5a (Hawkins Report pg 4 para 4):** It seems that this programme [Project Environmental Management Programme] has yet to be made available to the public, although survey work for the development has already begun.

**Item 5b (Hawkins Report pg 4 para 4):** There have been a number of changes to the development since the Environmental Statement was prepared and it is important that the impact of these changes be evaluated

**Item 5c(Hawkins Report pg 5 para 1):** The research [as directed by the Scientific Research & Monitoring Panel] has not yet been commissioned. It is suggested that key components of the planned research activities should take place before the development is allowed to proceed, to fill the many information gaps that exist in relation to the impact of this development upon salmon and sea trout.

**ES Appendix 22.2 (Section 3.6):** The assessment of the effects of the ...EOWDC upon salmonids is constrained by gaps in available baseline information, particularly that describing the behaviour of salmon and sea trout not only in the vicinity of the proposed development but also in the wider marine environment. In addition, there is insufficient direct evidence relating to the potential impacts of offshore wind farms on salmon and sea trout. As a consequence, the precautionary principle has been adopted by taking the 'worst case scenario'.

'In practice, however, it is possible that salmon and sea trout may not be adversely affected by the construction and operation of EOWDC, particularly in light of the known obstacles the species overcome during their respective life cycles and the limited number of turbines to be installed. EOWDC will consult with Marine Scotland, Scottish Natural Heritage and the Dee, Don and Ythan Salmon District Fishery Boards in order to identify feasible and relevant monitoring options'.

**S.36 Consent Condition 15:** requirements of the Monitoring Programme in respect to salmonids... 'Operational under water and air borne noise emissions for an initial period of twelve months from the date of the Commencement of the Development, Impacts on the adjacent coastline and on other users and uses of the sea; and migration and behaviour of European eel, salmon and sea trout due to electromagnetic fields'.

##### 4.5.1. Monitoring and Research Comments

1. The Hawkins Report notes the lack of availability of plans and programmes associated with the development, a requirement for changes in the development since the preparation of the ES to be considered retrospectively and a need to conduct programmed research prior to the allowing the development to proceed.
2. All of the plans and programmes associated with the EOWDC (and all other consented and pre-consented development in the Scottish Marine Area) are available on Marine Scotland's website (<http://www.gov.scot/Topics/marine/Licensing/marine/scoping/EOWDC>).
3. As noted above in Section 4.3, the ES provided a worst-case consideration of impacts (for example through the use of piling in terms of the maximum construction noise profile) as is considered to be good practice in EIA. The application of this methodology allows revisions to the design, assuming that they are in line with the maximum parameters of the worst-case assessment scenario, without invalidating the ES.
4. The ES acknowledges the gaps in understanding in relation to salmonids and has provided an allowance for these through consideration of a worst-case assessment (which, as noted above, is



commonplace in EIA practice). Based on the scale of the development, the research that has been undertaken to date and the planned research opportunities that the EOWDC will provide, this appears to be a pragmatic approach. This is framed against consideration of wider development opportunities offshore and the potential to apply the knowledge gained in this development to other larger scale developments.

#### 4.5.2. Review Summary

There does not appear to be any new information presented in light of the Hawkins Report that would provide an evidence base to support the delay of construction pending research output.

#### 4.6. Noise and Vibration

**Item 6a (Hawkins Report pg8 para 11):** The problems for salmon and sea trout created by noise [and the generation of EMFs] were not assessed fully by the original Environmental Statement. A more complete and accurate Environmental Statement is required. The flaws that existed in the assessment undermine the conclusion that the effects of noise upon salmon and sea trout will be negligible or negligible to minor. They also cast doubt on the validity of the Appropriate Assessment carried out for the River Dee Special Area of Conservation (SAC).

**Item 6b (Hawkins Report pg7 para 6):** There were flaws in the way the EIA evaluated the effects of underwater noise upon salmonid fishes. The salmon is not sensitive to sound pressure (which is what the assessment assumed) but to particle motion. The use of sound pressure as a metric was therefore inappropriate, especially for evaluating behavioural responses."

**Item 6c (Hawkins Report pg8 para 2):** The EIA does not seem to recognise that the magnitude and nature of the noise generated by operational wind turbines will depend on the structure of the wind farm and its foundations. It is not clear whether any valid noise measurements have been made on operational turbines with suction bucket foundations."

**Item 6d (Hawkins Report pg7 para 6):** There are also other problems with the dBht (Species) metric used in the assessment -outlined in Annexe E. There were also likely to be problems with the model that was used to predict sound levels at different distances (again, outlined in Annexe E)."

**Item 6e (:(Hawkins Report pg8 para 2)** Moreover, the EIA did not consider the possible adverse impact of infrasound (sound at frequencies below 20 Hz) that may be generated by the development, to which salmon are sensitive.

**ES Appendix 22.2 (pg9):** 'Unlike hearing specialists such as herring, salmonids have no direct connection between the swim bladder and the ear and are therefore considered to be hearing generalists.

Salmon have been shown to respond to low frequency sounds (below 380 Hz), with best hearing (threshold 95 dB re 1  $\mu$ Pa) at 160 Hz (Hawkins and Johnstone, 1978, cited EOWDC, 2011c). The ability of salmonids to respond to sound pressure is regarded as relatively poor with a narrow frequency span, a limited ability to discriminate between sounds, and a low overall sensitivity (Gill and Bartlett, 2010 cited EOWDC, 2011c). Based on sound measurements undertaken in the River Dee, Hawkins and Johnstone (1978) concluded that salmon are unlikely to detect sounds originating in air, but may be sensitive to substrate borne sounds'.

'Based on the results of the noise modelling undertaken for salmon (Nedwell et al., 2011 cited EOWDC, 2011c), it is expected that lethal noise levels during construction would only occur in the immediate vicinity of areas where piling is being undertaken (< 3 m from the pile)'.

'Similarly, the potential for traumatic hearing damage in salmon and sea trout would only take place in localised areas. Using the 130dBht criteria from Nedwell et al. (2007) cited EOWDC, 2011c, and assuming fish are not deterred from the area, salmon would be expected to suffer traumatic hearing damage within 20-30 m of the piling activity. This distance has been further refined using the fleeing animal model which assumes that animal swim away from the noise source. Using a swim speed of 1 m/s and taking into account the accumulated noise dose near a typical piling operation, the model calculates that fish within 1 m of the piling activity, at the onset of piling, are unlikely to be able to flee before suffering hearing damage'.

Research on species attracted to hard bottom substrates at Horns Rev found that noise and vibration from the turbine generator did not have an impact on the fish communities within the wind farm site (Leonhard et al., 2005 cited EOWDC, 2011c). Similarly, the results of post-construction monitoring fish surveys carried out in the Barrow Offshore Wind Farm and in the North Hoyle Wind Farm did not find significant differences in catch rates during operation in relation to pre-construction catches (BOWind, 2009; RWE npower renewables, 2008 cited EOWDC, 2011c).

**HRA Appraisal Addendum (Section 8.1.9, Physical noise impacts):** 'Based on the very close range at which salmon are predicted to be required to be in order to have a physical impact and the low numbers of salmon that could occur within the small spatial area it is predicted that there will not be any adverse effect on the Atlantic salmon associated with either the River Dee SAC or River South Esk SAC.'

**HRA Appraisal Addendum (Section 8.1.10, Behavioural noise impacts):** 'Studies undertaken at offshore wind farms have not reported operational noise as having an adverse effect on fish species with no decreases in the numbers of fish present within turbine arrays during the operational period of a wind farm. Studies undertaken on Atlantic salmon indicate that although salmon can detect operational turbines at a distance of 0.4 km and 0.5 km behavioural responses only occurred 4 m and then only at high wind speeds (above 30m/s) (Walhberg & Westerberg 2005).

Based on the above it is predicted that the potential noise impacts arising from the proposed project will not have an adverse effect on the Atlantic salmon associated with the River Dee SAC or River South Esk SAC'

#### 4.6.1. Noise and Vibration Comments

1. Hawkins Report highlights a number of deficiencies in the assessment of underwater noise on Salmonids in both the construction and operational phases of the EOWDC. These deficiencies (or flaws) are reported to undermine the conclusions made in the ES and the AA.
2. In a review of the assessment of noise impacts on Salmonids as presented in the Section 3.1.1.1 of the ES Appendix 22.2 (replicated in the AA) for Direct Impacts: Lethal Effects and Hearing Damage, Disturbance/Delay/Barrier to Migration and operations the following observations are made:
  - a. The hearing ability of Salmonids is acknowledged and the results of the Hawkins and Johnstone research in relation to the salmon's response to low-frequency tones with particle motion rather than sound pressure providing the relevant stimulus is noted. The assessment of impact utilises a criterion based on the research work of Nedwell *et al* 2007. It is assumed, although not validated through this review, that salmon's behavioural responses with consideration of particle motion is considered through the application of the criterion.
  - b. Post-consent, it is reported by the Hawkins Report that the EOWDC's developers have altered their design and associated construction methodology to use 'suction bucket' as opposed to piling. This being the case, the conclusions of the ES are considered to be a conservative assessment of noise impacts through construction, as noise related impacts would be significantly reduced from those noted in the assessment.
  - c. Section 3.1.2 of the EIA Appendix 22.2 (monitoring of existing operational windfarms) concluded that 'frequency range at which fish typically exhibit a strong response would be expected to be confined to the immediate vicinity of the turbines, within a radius of no more than several hundred of metres'. These conclusions are applied to salmon with reference to research by Walhberg and Westerberg (2005 cited EOWDC, 2011c) that estimated 'that Atlantic salmon detect operational turbines at a distance of 0.4 km and 0.5 km at wind speeds of 8 and 13m/s respectively'.
  - d. The Appendix does not report on the limitations of this data as noted in the referenced article or the limited dataset these conclusions are drawn from. Of relevance is the note from Walhberg and Westerberg that 'the relevant cue for fish with no swim bladder is particle displacement rather than acoustic pressure. An extrapolation to fish with no swim bladder is therefore only valid in the free acoustic field'.
  - e. Annexe E has not been reviewed and the associated problems are not defined in the Hawkins Report, therefore, this is not considered any further.
  - f. The hearing ability of salmon used the  $d_{ht}$  (species) as outlined by Nedwell *et al* 2011. This source has not been reviewed but is widely quoted and applied to other offshore windfarm developments in the UK and Europe (for example Horn Rev 3 and Inch Cape).
  - g. Low-frequency sounds are not considered in EIA Appendix 22.2. Walhberg and Westerberg present some tentative calculations that suggest the distances from the source from the acceleration component of windfarm operational low frequency sound might frighten Salmon away from the sound source. These critical range figures of 4 - 7m are highly caveated with the recommendation that measurements around the windfarm are taken to make a more accurate assessment.
3. The deficiencies highlighted by the Hawkins Report in relation to construction underwater noise are likely to be countered through the changes in design, meaning that the underwater noise emissions are likely to be negligible. The assessment considered piling to be a worst case and concluded minor/moderation significant of impact reduced to negligible /minor through the application of mitigation measures. The pre-mitigation case could arguably be reduced owing to

the design change and this applies to the other construction activities which produce considerably less noise (and vibrational) impact. However, as presented as a worst case this would not lead to a different conclusion being made in either the ES or AA.

4. The ES concludes the assessment of operational noise impacts, which may also include low-frequency sounds, without the application of the caveats that the original authors placed on their work. The impacts are recorded in the ES as negligible. In light of the uncertainty outlined by the original authors, the use of a different technology (suction buckets as opposed to monopiles) and the associated sensitivities of the receptors, these conclusions would be more accurately be labelled as tentative and subject to the results of survey, deploy and monitor techniques.
5. There is limited post-construction monitoring data from offshore windfarms on the effect of operational noise on migratory fish. Post-construction monitoring at Robin Rigg (E.ON Climate and Renewable, 2013) did not record significant differences in catch numbers of electro-sensitive fish between survey periods and the technical report noted 'the low level of correlation between species assemblages and distance from site for both fish and epibenthic assemblages suggests the wind farm presence is not driving change within the Solway Firth'. However, the report noted the limited catches numbers and this may be only of limited relevance to migratory species.
6. This limited dataset is noted by the Marine Management Organisation (MMO) (2014) in their Review of Post-Consent Offshore Wind Farm Monitoring Data Associated with Licence Conditions. It is highlighted that there is not a significant amount of experience in determining particle displacement or vibration from operational offshore windfarms in the UK. Additional work is suggested by the MMO in this area, as echoed by the Hawkins Report, but this is suggested by MMO to be more appropriate for a research activity rather than post-consent monitoring.
7. Marine Scotland are currently reviewing operational noise impact of offshore windfarms under contract with a 3<sup>rd</sup> party provider (Per.Comms)

#### **4.6.2. Review Summary**

There does not appear to be any additional consideration or new information presented in light of the Hawkins Report that would provide an alternative conclusion to be reached in the ES in regards to construction based noise impacts. However, there is a case for further consideration of the potential of operational based noise impacts on salmonids. This is not considered to alter the conclusions of the ES, owing to the limited data available, and would provide a foundation for additional research into this impact post construction.

## **5. Conclusion**

The Hawkin's Report has been reviewed with the specific points crossed referenced with the output of the EOWDC's consenting material. The suggestions made in the Hawkins Report on how these points can be addressed have been reviewed and the implications for the consent documents outlined.

This review found the majority of points raised in the Hawkins Report have been addressed previously in the consenting documents. The technical points raised in relation to EMF, suspended sediments, cumulative impacts and potential monitoring and research opportunities were noteworthy but have been considered directly through the EIA process or indirectly through the application of a worst-case scenario. The only technical issue that appears not to have received appropriate treatment is the consideration of operational noise impacts on salmonids. Research outputs have been applied to the assessment without evaluation of the caveats placed on this research by its authors. This review notes that this observation would not necessarily change the conclusions of the assessment but provide a route to validate the quoted research or perhaps develop alternative mitigation strategies.

## 6. Additional References

Aberdeen Harbour Board, 2015, Aberdeen Harbour Expansion Project Volume 2 Environmental Statement. Authored by Fugro and Waterman Group

Atkins, 2015, Kincardine Offshore Windfarm Environmental Statement

E.ON Climate and Renewable, 2013, Analysis of Marine Ecology Monitoring Plan Data from the Robin Rigg Offshore Wind Farm, Scotland (Operational Year 2) Technical Report. Authored by Natural Power Consultants

Marine Management Organisation (2014), Review of Post-Consent Offshore Wind Farm Monitoring Data Associated with Licence Conditions, MMO Project No: 1031

# Appendix A

Environmental Statement			Consent Plans and other documents in which impacts, monitoring and mitigation raised in the ES should be addressed			Hawkin's Report Critique		Recommendation	
Document	Page#	Relevant section	Document	Page#	Relevant section	Page#	Comment	Page #	Comment
<b>EMF</b>									
Environmental Statement - Chapter 22	9	<b>Methodology - Table 22.1 - Matrix of significance</b>  Magnitude: NEGLIGIBLE/ LOW Sensitivity: HIGH Impact: NEGLIGIBLE/ MINOR Mitigation: None other than cable burial Residual impact: NEGLIGIBLE/ MINOR	Marine Licence	10	<b>3.2.1.2 Shielding or burial of cables</b> The Licensee must, no later than six months prior to the Commencement of the Works, provide the Licensing Authority for their written approval a report detailing current 'best practice' relating to the attenuation of field strengths of cables by shielding or burial designed to minimise effects on electro-sensitive and migratory fish species. Such 'best practice' guidance as is identified must be incorporated into the Construction Method Statement and the Cable Laying Strategy, in respect of which conditions 13 and 25 respectively of the Section 36 consent relates.	6	"There is evidence that salmon and eels, and possibly lampreys, use the earth's magnetic field for orientation and direction finding during their migrations. The electromagnetic fields (EMFs) from subsea cables might interact with migrating fishes in the close vicinity of the cables, particularly if they are laid in shallow water. It is common for returning adult salmon to follow the coast, swimming close to the shore, where they may be especially susceptible to EMF effects from cables."	10	"Measurements of ambient EMFs in the sea generated by electrical cables. Commercially available sensors and data acquisition hardware are available for such measurements. • Modelling to develop greater understanding of field strengths from proposed cables and other devices and to predict changes in the electromagnetic fields emitted under different conditions. • Biological studies to better understand and quantify any effects upon fishes caused by man-made EMFs. Key species would be elasmobranchs, lampreys, shad, salmon, sea trout and eels. • Full scale field studies are needed to identify any changes in the movement patterns of any fishes that encounter undersea cables."
	18	Given the small area of the wind farm and the total cabling involved, a maximum of 13 km for inter array cables and 26 km for the four export cables (1 x 5 km, 1 x 6 km, 1 x 7 km, 1 x 8 km) (further details in Chapter 3, Description of the Proposed Development), the fact that magnetic fields will only be encountered in close proximity to the cables (within tens of metres) and the potential for fish to be using spatial orientation mechanisms other than magnetic navigation, the magnitude of the impact is considered to be NEGLIGIBLE to LOW. Taking a precautionary approach based on the conservation importance of the species and the lack of definitive evidence in respect of impacts on the migration of salmonids, the receptors, salmon and sea trout originating in rivers within the regional study area, are considered of HIGH sensitivity. The impact of EMFs on salmon and sea trout migration is therefore considered to be of NEGLIGIBLE to MINOR significance.	Consent Conditions	29	A joint consultation response from the Dee, Don and Ythan District Fishery Boards raised the importance of the location of the Development due to the presence of salmon and sea trout. The 2 key issues identified by the Boards included the potential impacts associated with noise and vibration, particularly avoidance behaviour by salmon at distances from 3.5 to 4.2 km from construction activities, and potential EMF impacts during the operation of the wind farm.	8	"The EIA recognised that salmon were expected to perceive the magnetic fields generated by cables and that potential impacts on salmon and sea trout migration derived from the magnetic fields generated by the export and inter array cables could theoretically range from small or large scale disorientation to a barrier to migration. However, the magnitude of the impact was considered to be negligible to low. Based on the conservation importance of the species and the lack of definitive evidence in respect of impacts on the migration of salmonids, the receptors, salmon and sea trout originating in rivers within the regional study area, were considered of high sensitivity. The overall impact of EMFs on salmon and sea trout migration was considered to be of negligible to minor significance."		
Environmental Statement - Appendix 22.2	17	<b>3.3 Electromagnetic Fields (EMFs)</b> <b>3.3.1 Operation</b> The magnetic fields anticipated to be produced by the AC cables associated with the proposed EOWDC are small (1.5 µT) in comparison to the Earth's magnetic field (approximately 50 µT). Atlantic salmon are expected to perceive these magnetic fields as new localised additions to the heterogeneous pattern of geomagnetic anomalies already occurring naturally and anthropogenically in the sea (MS, 2011).  <b>Potential Impact</b> The potential impacts on salmon and sea trout migration derived from the magnetic fields generated by the export and inter array cables could theoretically range from small or large scale disorientation to a barrier to migration.	Offshore Environmental Management Plan (OEMP)	56	<b>8.5 Environmental Management and Mitigation of Cable Installation and Electromagnetic Field (EMF) attenuation of the Cables</b> The requirement to manage EMF attenuation to take account of potential disturbance to electro-sensitive fish and migratory fish species is set out through the requirement in the Project consents to draft, for approval, a Cable Attenuation Plan which has been submitted as part of the CLS. The requirement to manage construction methods to take account of potential disturbance to marine habitats is set out through the requirement in the Project consents to draft, for approval a Cable Laying Strategy. The approved CLS must be referred to in planning and conducting marine subsea cable installation operations to ensure that the approved procedures are applied. The CLS sets out requirements related to: -The location and cable laying techniques for the Inter-array cables and OECs; - The results of survey work (including geophysical, geotechnical and benthic surveys) which will have helped inform cable routing; - The technical specification of all cables, including a desk based assessment of attenuation of electro-magnetic field strengths and shielding; - Route clearance operations; - Target Burial Depth; and	10	"Where cables are immersed in water, there is potential for the generation of EMFs that may affect fishes. However, there is little published information on observed effects upon marine species from exposure to EMFs."		
			HRA Addendum	116	<b>8.1.12 Risk of impacts from Electromagnetic Fields</b> The magnetic fields anticipated to be produced by the AC cables associated with the proposed EOWDC are small (1.5 µT) in comparison to the Earth's magnetic field (approximately 50 µT). Atlantic salmon are expected to perceive these magnetic fields as new localised additions to the heterogeneous pattern of geomagnetic anomalies already occurring naturally and anthropogenically in the sea (MS, 2011). The location of the proposed development, to the north of the River Dee SAC and River South Esk SAC means that returning salmon from the south will not be impacted by any potential EMF arising from the proposed development. Salmon leaving the SACs may pass across the cables and therefore detect an electro magnetic field. However, studies undertaken on chum salmon and other fish species have not been able to detect any effects from magnetic fields (OSPAR 2008). Consequently, it is predicted that there will not				
			Cable Laying Strategy - Cable Attenuation Plan	37	In relation to the current 'best practice' on EMF, National Policy Statement EN-3 refers to the assessment of EMFs in relation to fish (Paragraph 2.6.75). The document suggests that where mitigation is applied, it is expected that the residual effects of EMF on sensitive species from cable infrastructure during operation are likely to be not significant. The mitigation described (Paragraph 2.6.76) includes the use of armoured cables and cable burial to a sufficient depth (with indicative burial depths of up to 1.5 m for OEC and 1.0 m for Inter-array cables, dependent on geological conditions), both of which are suggested for the EOWDC. It is also important to note that the construction and shielding of the cables				
Environmental Statement - Appendix 22.2	19	<b>Mitigation</b> The cables will be buried. Burial to depth realistically achievable offshore (0.6 m – 3 m) will not make significant difference to the resultant fields or the distance over which they propagate. Cable burial to a depth of at least 1 metre is only likely to provide some mitigation for the possible impacts of the strongest B-fields and induced E-fields that exist within millimetres of the cable (CMACS, 2003).		37	<b>8.3 Electromagnetic Fields</b> This section summarises the results of a desk based assessment on the attenuation of electromagnetic fields associated with the OECs and Inter-array cables, using the 400 mm <sup>2</sup> , 500 mm <sup>2</sup> and 630 mm <sup>2</sup> core cables as a basis for field attenuation calculations. The study calculated the magnetic field magnitudes at a given distance from the 66 kV cables at indicative burial depths of 0.6, 1 and 2 m. The insulation and sheathing of the cable power cores, and the burial of the cables, encourage shielding of EMF. The magnetic field generated by a single conductor at a given point was calculated using the Biot-Savart Law. When there are three conductors (a three core cable) such as the Interarray cables and OECs being used for the EOWDC, the magnetic field can be calculated using the superposition of fields of a single conductor. The predicted EMF attenuation from the 400 mm <sup>2</sup> cables are shown in Figure 7-9 below The predicted EMF attenuation values from the 400 mm <sup>2</sup> , 500 mm <sup>2</sup> and the 600 mm <sup>2</sup> cables are shown in Table 7. The x axis on Figure 7-9 indicates the	8	"In terms of mitigation, it was said that the cables would be buried. However, the EIA stated that burial to depths realistically achievable offshore (0.6 m - 3 m) would not make Significant difference to the resultant fields or the distance over which they propagate. Cable burial to a depth of at least 1 metre was only likely to provide some mitigation for the possible impacts of the strongest B-fields and induced E-fields that existed within millimetres of the cable. Salmon are likely to be especially vulnerable to such effects as they pass through shallow water, following the coast."	8	"In the absence of clear evidence on the impact of EMFs, and the efficacy of mitigation measures, there is a case for applying the precautionary principle and delaying the EOWDC development until valid evidence is available on the significance of such effects and the efficacy of the mitigation measures proposed."
				39	The predicted magnetic field of any of the cables buried to 0.6 m is expected to be below the earth's magnetic field (assumed to vary between 25 µT and 65 µT). As such, at the indicative target burial depths of the Inter-array cables of up to 1.0 m, and OECs of up to 1.5 m, EMF emissions at the seabed are expected to be significantly lower than the earth's				

			Cable Laying Strategy	59	It is AOWFL's understanding that the 66 kV cables remain within the consented design envelope since the available evidence suggests that EMF field strength is proportional to the current in the conductor cables. The use of 66 kV cables rather than 33 kV cables will reduce the current by a factor of 2 for the same power transmission so that EMF will be correspondingly reduced and the potential impacts on the environment will be no greater than (or less than) those described in the original Application. Consultation has been undertaken with MS-LOT in relation to the cable specifications. Confirmation has been received from MS-LOT that the 66 kV cables may be considered to lie within the consented envelope and are therefore acceptable				
<b>NOISE</b>									
Environmental Statement - Chapter 22	9	<b>Methodology - Table 22.1 - Matrix of significance</b>  <b>CONSTRUCTION/ DECOMMISSIONING</b> <b>Direct impact</b> Impact: NEGLIGIBLE Mitigation: Soft-star piling Residual impact: NEGLIGIBLE  <b>Disturbance/ Delay/Barrier to Migration</b> Impact: MINOR/ MODERATE Mitigation: Installation schedule to be discussed with relevant stakeholders and regulators Residual impact: NEGLIGIBLE/ MINOR  <b>Key prey species</b> Impact: NEGLIGIBLE Mitigation: None required Residual impact: NEGLIGIBLE  <b>OPERATIONAL</b>  <b>Disturbance/ Delay/Barrier to Migration AND Feeding</b> Impact: NEGLIGIBLE Mitigation: None required Residual impact: NEGLIGIBLE	Marine Licence	11	<b>3.2.1.8 Noise Registry</b> The Licensee must, in the event that pile foundations are to be used, submit a noise reduction form (Marine Scotland Application Noise Details (Form 1)) to the Licensing Authority and the Joint Nature Conservation Committee ("JNCC") stating the proposed date(s), location(s) and nature of the piling activities under authority of this licence.	6	"The problems for salmon and sea trout created by noise and the generation of EMFs were not assessed fully by the original Environmental Statement. A more complete and accurate Environmental Statement is required."	10	Full description of the sound fields (spectral, temporal, and spatial) generated by the various sound sources associated with wind farm developments. Particle motion, which is an important component of sound detection for
				13	<b>3.2.2.7 Noise registry</b>  The Licensee must, in the event that pile foundations are to be used, and piling is to be carried out for a prolonged period of time, at quarterly intervals, submit a noise reduction form (Marine Scotland Closeout Pulseblock days (Wind Farm)) to the Licensing Authority and the JNCC stating the date(s), location(s) and nature of such activities under authority of this licence.	6	"Survey and construction phase activities may generate noise that may affect the behaviour of fishes directly, or might mask the detection of important biological signals and orientation cues. Seismic and other surveys, pile driving or drilling, rock breaking, rock filling, dredging and trenching, the installation of foundations, and increased levels of shipping may all produce noise within the frequency band to which fishes are sensitive. Noise may also be generated subsequently when a wind farm is operational, through the running of the wind turbines and the coupling of vibrations to the seabed."	11	Identification of those features of underwater sounds that result in stronger effects on fishes from some sounds than from others.
Environmental Statement - Appendix 22.2	9	Unlike hearing specialists such as herring, salmonids have no direct connection between the swim bladder and the ear and are therefore considered to be hearing generalists.  Salmon have been shown to respond to low frequency sounds (below 380 Hz), with best hearing (threshold 95 dB re 1 µPa) at 160 Hz (Hawkins and Johnstone, 1978). The ability of salmonids to respond to sound pressure is regarded as relatively poor with a narrow frequency span, a limited ability to discriminate between sounds, and a low overall sensitivity (Gill and Bartlett, 2010). Based on sound measurements undertaken in the River Dee, Hawkins and Johnstone (1978) concluded that salmon are unlikely to detect sounds originating in air, but may be sensitive to substrate borne sounds.	HRA Addendum	114	<b>8.1.9 Risk of physical impacts from noise</b> Potential adverse effects could arise from noise generated during the construction, operation and decommissioning phases of the proposed development. In particular, during the construction period where, should piling occur, the highest noise levels will arise. Noise modelling undertaken for the proposed EOWDC predict that should piling of 8.5 m diameter piles take place, there is the potential for traumatic hearing damage to Atlantic salmon (based on 130 dBht) at distances of 20 m or less from the piling operations. The results from noise modelling undertaken indicate that lethal effects on Atlantic salmon from pile driving associated with the proposed development will only occur out to 3 m from the source. Physical hearing damage may occur out to 20 m or less. Based on the very close range at which salmon are predicted to be required to be in order to have a physical impact and the low numbers of salmon that could occur within the small spatial area it is predicted that there will not be any adverse effect on the Atlantic salmon associated with either the River Dee SAC or River South Esk SAC.	7	"There were flaws in the way the EIA evaluated the effects of underwater noise upon salmonid fishes. The salmon is not sensitive to sound pressure (which is what the assessment assumed) but to particle motion. The use of sound pressure as a metric was therefore inappropriate, especially for evaluating behavioural responses."	11	Improved models of sound propagation are required to estimate the level of exposure to which fishes will be subjected in the water column, close to the sea surface, or close to the seabed, taking account of propagation through the substrate as well as through the water and including particle motion as well as sound pressure.
Environmental Statement - Appendix 22.2	9	Research carried out on the effects of piling noise on caged brown trout ( <i>Salmo trutta</i> ) at the Red Funnell's Southampton Terminal (Nedwell et al., 2003a) found no behavioural reactions to vibropiling and no responses to hammer pile operations for fish as close as 50 and 417 m from the source, respectively. Further studies carried out on brown trout ( <i>Salmo trutta</i> ) suggest that the hearing of brown trout is less sensitive than that of salmon. Analysis using the dBht metric indicated that the noise at the nearest locations during impact piling reached levels at which salmon were expected to react strongly, however, brown trout showed little reaction (Nedwell et al., 2006).  For the purposes of this assessment, salmon has been used as a surrogate for sea trout, whilst it is appreciated that the sensitivities of the two species may be different. In addition, it is recognised that juveniles, such as smolts, and small grilse, may also have different sensitivities than adults, being generally considered to be more		115	<b>8.1.10 Risk of behavioural impacts from noise</b> Modelling undertaken based on the piling of 8.5 m diameter piles indicates that there is the potential for a strong behavioural reaction out to between 3.6 km and 4.7 km from the construction activities based on a threshold of 90 dBht and that at levels of 75 dBht up to 85% of salmon may react to noise. The results from the noise modelling undertaken are presented in Figure 8-3. Salmon are considered to be poor at detecting sounds within the water column although they may be able to detect substrate borne sounds (Gill and Bartlett, 2010). Salmon smolts and post smolts leaving the SACs do so rapidly leaving the rivers between April and June and most likely move northwards towards north-west Atlantic, Greenland and the Faroes and unlike returning adults do not necessarily follow the coastlines. Therefore, there is the potential for salmon leaving the relevant SACs to occur within the vicinity of the proposed development. However, the number of salmon smolts and post smolts likely to be in the area of potential impact at any one time is predicted to be low and the consequences to those that could be effected may mean that either they delay their departure from the rivers for the relatively short period of time during construction or they may detour around the sound source during the period of migration. The scale of any detour is very small compared to the distances travelled during migration. It is predicted that any behavioural responses arising from construction of the proposed development will not have an adverse effect. Adult salmon returning to the River South Esk will not be impacted by the construction activities associated with the proposed development as they return to the river from the south and therefore outwith any zone of potential effect. Salmon returning to the River Dee SAC may be impacted as there is a potential overlap with sound sources that could cause behavioural responses and the River Dee SAC. There are predicted to be potentially two behavioural responses that may occur. Returning Atlantic salmon may delay their entry into the river during piling activities or they may ignore the sound source and enter the river without delay. Should they delay their entry into the River Dee SAC then it will for the duration of piling operations which are predicted to last no longer than 24 hrs per wind turbine and therefore of relatively short duration. Although Atlantic salmon do not delay entry into rivers if the	7	"There are also other problems with the dBht (Species) metric used in the assessment -outlined in Annexe E."	11	Effects on fish behaviour need to be examined, as significant changes in behaviour can occur at considerable distances from sound sources. Most sound exposure experiments have previously been conducted on fish held in tanks, cages, and large enclosures. Such studies on captive fish need to be supplemented by studies in
Environmental Statement - Appendix 22.2	10	Based on the results of the noise modelling undertaken for salmon (Nedwell et al., 2011), it is expected that lethal noise levels during construction would only occur in the immediate vicinity of areas where piling is being undertaken (< 3 m from the pile).  Similarly the potential for traumatic hearing damage in salmon and sea				7	"There were also likely to be problems with the model that was used to predict sound levels at different distances (again, outlined in Annexe E)."		
						7	"The flaws that existed in the assessment undermine the conclusion that the effects of noise upon salmon and sea trout will be negligible or negligible to minor. They also cast doubt upon the validity of the Appropriate Assessment carried out for the River Dee Special Area of Conservation (SAC)."		



		trout would only take place in localised areas. Using the 130dBht criteria from Nedwell et al. (2007), and assuming fish are not deterred from the area, salmon would be expected to suffer traumatic hearing damage within 20-30 m of the piling activity. This distance has been further refined using the fleeing animal model which assumes that animal swim away from the noise source. Using a swim speed of 1 m/s and taking into account the accumulated noise dose near a typical piling operation, the model calculates that fish within 1 m of the piling activity, at the onset of piling, are unlikely to be able to flee before suffering hearing damage.			conditions are right, they are known to do so if natural river conditions aren't suitable. Therefore, should there be some avoidance owing to piling operations (if they occur) during the migrating periods, then a temporary delay in migrating into the rivers would not likely have an adverse effect on the salmon. Studies undertaken at offshore wind farms have not reported operational noise as having an adverse effect on fish species with no decreases in the numbers of fish present within turbine arrays during the operational period of a wind farm. Studies undertaken on Atlantic salmon indicate that although salmon can detect operational turbines at a distance of 0.4 km and 0.5 km behavioural responses only occurred 4 m and then only at high wind speeds (above 30m/s) (Walhberg & Westerberg 2005). Based on the above it is predicted that the potential noise impacts arising from the proposed project will not have an adverse effect on the	8	"The EIA does not seem to recognise that the magnitude and nature of the noise generated by operational wind turbines will depend on the structure of the wind farm and its foundations. It is not clear whether any valid noise measurements have been made on operational turbines with suction bucket foundations."		
			Consent Conditions	41	Construction Noise Management Plan - condition 18 Prior to the Commencement of the Development, a Construction Noise Management Plan must be submitted to, and approved by, the Scottish Ministers, in consultation with any such advisors from Aberdeenshire Council and Aberdeen City Council, as identified at the discretion of the Scottish Ministers.  The Company must implement the approved Construction Noise Management Plan in full, unless otherwise agreed in writing by the Scottish Ministers.	8	"Moreover, the EIA did not consider the possible adverse impact of infrasound (sound at frequencies below 20 Hz) that may be generated by the development, to which salmon are sensitive."		

**VIBRATION**

Environmental Statement - Appendix 22.2	15	Furthermore, research on species attracted to hard bottom substrates at Horns Rev found that noise and vibration from the turbine generator did not have an impact on the fish communities within the wind farm site (Leonhard et al., 2005). Similarly the results of post-construction monitoring fish surveys carried out in the Barrow Offshore Wind Farm and in the North Hoyle Wind Farm did not find significant differences in catch rates during operation in relation to pre-construction catches	Noise, Dust and Vibration Management Plan		A Construction Noise Management Plan (CNMP) (ABE-ENV-DC-0005) has been submitted to MS for approval for offshore works. Sections 3.4 and 3.6 of the Construction Environmental Management Plan (ABE-JMS0017) submitted to Aberdeenshire Council provide information relating to the management of dust, noise and vibration onshore.	8	"The EIA did not take the generation of particle motion and seabed vibration by operational wind turbines fully into account."		
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**SEDIMENT**

Environmental Statement - Appendix 22.2	16	Potential Impacts A wide range of studies have assessed the effect of turbidity levels above natural background on the physiology and behaviour of salmonids. The majority of these are, however, based on freshwater and experimental settings rather than the marine environment. The research indicates that high levels of suspended sediment may be fatal to salmonids while lower levels of suspended sediment and turbidity may cause chronic sub-lethal effects such as loss or reduction of foraging capability, reduced growth, resistance to disease, increased stress and interference with cues necessary for orientation in homing and migration (Bash et al., 2001). Lethal levels of sediment in fish typically range from hundreds to thousands mg/l whilst sub-lethal effects may manifest at significantly lower levels, ranging from tens to hundreds mg/l depending on species specific tolerance (Birtwell, 1999). Research on the behaviour of juvenile Atlantic salmon has found that initial introduction of sediment (20mg/l) increases foraging activity (Robertson et al., 2007). The same study found a decline in territorial behaviour and avoidance reactions at sediment levels ranging from 60 to 180mg/l. Short term pulses of suspended sediment have also been shown to disrupt feeding behaviour and elicit alarm reactions that may cause fish to relocate downstream to undisturbed areas (Berg and Northcote, 1985)  Whilst physiological and behavioural responses have been observed in a number of studies, salmonids are considered to have the ability to cope with some level of turbidity at certain life stages. Juvenile salmonids are present in turbid estuaries prior migration, as well as in streams with high natural levels of glacial silt, and therefore high turbidity and low visibility (Gregory and Northcote, 1993). In addition salmonids may also encounter naturally turbid conditions during flood events and other natural circumstances (Bash et al., 2001). Measurements undertaken in the River Don (Hillier, 2001), found that concentrations of suspended solids typically ranged from 1 to 10mg/l during base flows, however reached levels up to 150mg/l during high flows.  Cumulative Impact In the absence of other offshore activities that could potentially contribute to increased sediment concentrations (e.g. dredging) expected to take place in the vicinity of the proposed EOWDC,	HRA Addendum	116	8.1.11 Risk of impacts from increased sediments Construction activities such as cable laying, piling and rock placement have potential to result in temporary sediment re-suspension increasing turbidity. Suspended sediment concentrations within Aberdeen Bay range from 0.1 to 43.1 mg/l with an average of 20.7 mg/l. Sediment modelling has indicated that following construction there is the potential for a sediment plume to occur with a maximum concentration of 35mg/l extending from Aberdeen Harbour to approximately 3 km south of the River Ythan. Salmon can be affected by high sediment loads, which if high enough can be lethal or at lower levels cause behavioural changes. Lethal sediment loads typically range from between hundreds and thousands mg/l, whilst sub-lethal effects may occur at lower levels, ranging from tens to hundreds mg/l depending on species specific tolerance. Salmon are considered tolerant of relatively high sediment loads with behavioural changes occurring at between 60 to 180 mg/l and therefore unlikely to be affected by the potentially increased loads arising during construction period. The duration of any impact will be short and should it occur only during the period of construction, which is predicted to be less than 24 hrs per turbine. It is therefore predicted that there is unlikely to be an adverse effect arising from the proposed development on Atlantic salmon due to possible short-term increased in turbidity.	6	"There is potential for fish to be affected adversely by any increase in marine pollution and disturbance arising from boats and other activities during both the construction and future operation and maintenance of the wind farm."		
			Cable Laying Strategy	48	... To maximise post-trenching cable cover and to minimise the disturbance of sediment away from the trench, site specific trencher settings will be derived based on the soil conditions to ensure disturbed sediment is monitored and managed efficiently throughout operations.	7	"The environmental effects from installing suction bucket foundations, or during the operation of wind turbines based on such foundations, were not considered by the original EIA, which concentrated on piled foundations."		
						8	"...the assessment of the impact of suspended sediments did not consider sediment release from the placement and operation of suction bucket foundations."		

**ALL IMPACTS: EMF/NOISE/ SEDIMENT**

Environmental Statement - Appendix 22.2	4	2.4 Data and Information Limitations and Data Gaps Extensive studies and research concerning the behaviour of salmon, and to a lesser extent sea trout, have been, and are being, undertaken. Despite this, however, the behavioural patterns of the species in the marine environment, particularly on the Scottish east coast, are not fully known and a degree of uncertainty exists regarding salmon and sea trout migratory routes, behaviour in coastal waters, navigation mechanisms and the implication of responses to factors such as noise and EMFs during migration. In light of this, and in order to provide a robust assessment of impacts, a number				6	"Alterations to migratory cues as a result of wind farm and other developments may have severe effects upon migratory fish populations and must be avoided."		
						9	"There are a number of gaps in our knowledge and understanding of the impacts of wind farm developments upon salmon and sea trout, which on a precautionary basis must be dealt with before potentially harmful wind farm developments are allowed to take place."	9	"The tagging and tracking of individual fish along the coast would provide valuable information on those factors and cues that determine their patterns of

		of assumptions have been made that are further discussed in Section 2.5.7 below.				10	"Particular information gaps, include, but are not limited to: • The swimming depths of migrating fishes • Responses to water flow • Orientation to different environmental cues (magnetic fields, sound fields, celestial cues, olfactory stimuli)"	10	"Collecting data to address these knowledge gaps is likely to require tagging, tracking and telemetry studies. Modelling of fish movements is also required to complement tracking studies and extend
						3	"The Appropriate Assessments concluded that the Development would not adversely affect the integrity of any of the designated sites if the mitigation measures outlined were implemented by means of enforceable conditions attached to any consent. Again, there were flaws in the Environmental Statement on which the Ministers' decision was based. It is also not clear whether the enforceable conditions have been observed."		

**CUMULATIVES**

Environmental Statement - Chapter 22	7	<b>2.5.6 Worst Realistic Case</b> The worst realistic case is assumed to be the installation of 11 turbines, all of which have 8.5 m diameter monopile foundations. The theoretical worst case in terms of cumulative assessment would be the simultaneous construction of the proposed offshore wind developments in the Firth of Forth and in the Moray Firth, coinciding with the proposed EOWDC.	HRA Addendum	117	8.1.13 In-combination effects Atlantic salmon from the relevant SACs may also occur in either the proposed developments in the Moray Firth or the Firth of Forth. Currently there are no known planned construction activities being undertaken at any of the Round 3 or Scottish Territorial Waters proposed offshore wind farms in 2013, the first year of potential construction planned for the EOWDC. There is potential for some construction to be undertaken in 2014 and this may overlap with construction of one other proposed development in the Moray Firth (Table 5-2). Should this occur then there may be a relatively short period of overlapping construction in 2014 during which seven turbines may be installed at the proposed EOWDC. The relatively short duration of any overlapping activities and that the projects are both in excess of 100 km away it is predicted that should there be any in-combination effects they will not cause an	7	"Since the EIA was agreed there have been several other proposals for developments in the area that might also affect salmon and sea trout. They include the extension of Aberdeen Harbour into Nigg Bay, in the vicinity of the mouth of the River Dee. Also it is proposed that the Kincardine Offshore Wind Farm be developed to the south of the area. It will be important for the cumulative effects upon salmon ids of these additional developments to be assessed before any of them are allowed to proceed."	11	Properly designed scientific studies should be carried out, perhaps at other wind farms already in existence, before the Aberdeen Offshore Wind Farm development is allowed to proceed further.
	13	<b>Cumulative Impact Juvenile Salmon and Sea Trout</b> The installation of the proposed Ocean Laboratory will involve the piling of a 8.5 m diameter pile, assuming the worst case scenario. This would result in further 24h piling in the area of the EOWDC being undertaken. Given the small area to be affected and the short duration of the noise disturbance, it is not considered that the installation of the proposed Ocean Laboratory will result in a significant cumulative impact in relation to construction noise. In addition, the installation of the Ocean Laboratory, as proposed for the installation of the turbines, would also be scheduled to minimise potential impacts on juvenile salmon and sea trout.  <b>Adult Salmon and Sea Trout</b> In the case of adult salmon, noise derived from construction activities in the Firth of Forth proposed developments, could result in further impacts on fish migrating towards rivers in the regional area. Taking the worst case scenario, that piling activities in the proposed offshore wind farm developments in the Firth of Forth area are undertaken coinciding with piling operations at the proposed EOWDC, potential direct impacts and avoidance reactions in the Firth of Forth area could result in disturbance to adult salmon migration, further contributing to potential delays in	Consent Conditions	21	<b>Cumulative Impact</b> The issue of potential cumulative impact on landscape, visual amenity and natural heritage was considered by SNH. In particular, SNH raised concerns about the cumulative impacts arising from the Development and onshore wind farms at Keith Inch and Green Hill, Peterhead. The Company further assessed the cumulative impact issue on all relevant species in the Supplementary Environmental Information Statement (SEIS) submitted to Scottish Ministers on 6th August 2012. SNH considered this additional evidence and did not raise any objection on the grounds of cumulative impact with regards to natural heritage.  With respect to landscape and visual amenity, SNH acknowledged that the Development would set a new precedent of proposals of this type being situated close to shore rather than on land, and it would necessitate cumulative impacts with onshore developments being considered in the future. SNH did not raise any objection on the grounds of cumulative impacts with regards to landscape and visual amenity. The Scottish Ministers accept this view.				
	14	Cumulative Impact There is potential for salmon, in some cases, and more importantly sea trout, to use the Moray Firth and Firth of Forth areas as a feeding ground, principally in relation to the presence of herring and sandeels in these areas.  In view of the limited number of turbines and piling events to be undertaken in the EOWDC in comparison to the developments proposed in the Firth of Forth and the Moray Firth, the contribution by the EOWDC							
	17	Cumulative Impact In the absence of other offshore activities that could potentially contribute to increased sediment concentrations (e.g. dredging) expected to take place in the vicinity of the proposed EOWDC,							
	19	<b>Cumulative Impact</b> EMF emissions from the proposed offshore wind farm developments in the Firth of Forth and in the Moray Firth could potentially further affect migrating salmon. Assuming the prevalent travelling direction of coastal migration is northerly, there is potential for salmon heading to the rivers in the regional area to be present in the vicinity of the proposed developments in the Firth of Forth at an early stage of their migration. Similarly, there is potential for sea trout to transit both the Moray Firth and the Firth of Forth development areas either during migration or as a result of foraging activity.  Given the relatively small area of the proposed EOWDC and the total cabling used in comparison to the proposed offshore wind developments							

**MONITORING**

Environmental Statement - Chapter 22	8	Table 22.2 Noise - Construction/ Decommissioning Appropriate and relevant monitoring would be assessed through discussion with relevant stakeholders and regulators	Consent Conditions	39	<b>Environmental Management Monitoring</b> 15. Within six months of the date of the granting of the Section 36 consent, an expert panel must be established by Scottish Ministers to provide scientific advice to them on a research and monitoring programme to inform, where appropriate and as timescales allow, the Project Environmental Management Programme. Membership, funding, the terms of reference and the functions of the panel are to be agreed by Scottish Ministers in consultation with any such advisors at the discretion of the Scottish Ministers. The programme must survey and monitor the impact of the Development on important species, habitats, and users of the sea within Aberdeen Bay all as agreed by the Scientific Panel. The programme must also monitor the habitats around, and the communities that develop on, the submerged structures. The monitoring programme must be subject to input from the expert panel, to consultation with agreed consultees and subject to agreed review periods. The programme must ensure that the monitoring is robust and covers pre, during and post construction aspects and must be agreed, so far as is possible, prior to the Commencement of Development.  The subjects to be included for monitoring, but not exclusively, are: (a) Agreed methods to consider any changes to species, densities and behavioural patterns during all phases of the wind farm; (b) Agreed measures to detect bird collisions e.g. blade sensors, targeted radar studies, thermal detection systems etc. (c) Gathering field measurements of under water and air borne noise during piling and operation of the turbines at the Development; (d) Operational under water and air borne noise emissions for an initial period of twelve months from the date of the Commencement of the Development and then for such further periods when considered necessary by the expert panel based upon the results received and as agreed by Scottish Ministers in consultation with advisors as identified at their discretion. (e) Deployment of Passive Acoustic Monitoring systems to record vocalisation of marine mammals before, during and after construction of the Development; (f) The agreement of a Marine Mammal Protection Plan (MMPP); (g) Impacts on the adjacent coastline and on other users and uses of the sea; and (h) Migration and behaviour of European eel, salmon and sea trout due to electro-magnetic fields.  The research and monitoring programme information and outputs must be reported annually to the Scottish Ministers	4	"A condition laid down for the development was that a Project Environmental Management Programme should be prepared, with input from an expert panel, in consultation with agreed consultees and subject to agreed review periods. The programme had to ensure that the monitoring was robust and covered pre, during and post construction aspects. The programme had to be agreed, so far as was possible, prior to the commencement of development. No later than three months prior to the commencement of the development, the programme had to be submitted to, and approved by, the Scottish Ministers in consultation with SNH and any other ecological, or such other advisors as required. It seems that this programme has yet to be made available to the public, although survey work for the development has already begun. There have been a number of changes to the development since the Environmental Statement was prepared and it is important that the impact of these changes be evaluated."			
Environmental Statement - Appendix 22.2	21	<b>3.6 Monitoring</b> As emphasized above, the assessment of the effects of the construction/decommissioning and operation of EOWDC upon salmonids is constrained by gaps in available baseline information, particularly that describing the behaviour of salmon and sea trout not only in the vicinity of the proposed development but also in the wider marine environment. In addition, there is insufficient direct evidence relating to the potential impacts of offshore wind farms on salmon and sea trout. As a consequence, the precautionary principle has been adopted by taking the 'worst case scenario'.  In practice, however, it is possible that salmon and sea trout may not be adversely affected by the construction and operation of EOWDC, particularly in light of the known obstacles the species overcome during their respective life cycles and the limited number of turbines to be installed. EOWDC will consult with Marine Scotland, Scottish Natural Heritage and the Dee, Don and Ythan Salmon District Fishery Boards in order to identify feasible and relevant monitoring options.	S.36 Consent		<b>Condition 15 of the S.36 Consent sets out the following requirement in respect of the Monitoring Programme:</b> The programme must survey and monitor the impact of the Development on important species, habitats, and users of the sea within Aberdeen Bay all as agreed by the Scientific Panel. The programme must also monitor the habitats around, and the communities that develop on, the submerged structures. The monitoring programme must be subject to input from the expert panel, to consultation with agreed consultees and subject to agreed review periods. The programme must ensure that the monitoring is robust and covers pre, during and post construction aspects and must be agreed, so far as is possible, prior to the Commencement of Development The Condition goes on to list the following subjects to be included in the Monitoring Programme: Agreed methods to consider any changes to species, densities and behavioural patterns during all phases of the wind farm; <input type="checkbox"/> Agreed measures to detect bird collisions e.g. blade sensors, targeted radar studies, thermal detection systems etc. <input type="checkbox"/> Gathering field measurements of under water and air borne noise during piling and operation of the turbines at the Development; <input type="checkbox"/> Operational under water and air borne noise emissions for an initial period of twelve months from the date of the Commencement of the Development and then for such further periods when considered necessary by the expert panel based upon the results received and as agreed by Scottish Ministers in consultation with advisors as identified at their discretion. <input type="checkbox"/> Deployment of Passive Acoustic Monitoring systems to record vocalisation of marine mammals before, during and after construction of the Development; <input type="checkbox"/> The agreement of a Marine Mammal Protection Plan (MMPP); <input type="checkbox"/> Impacts on the adjacent coastline and on other users and uses of the sea; and <input type="checkbox"/> Migration and behaviour of European eel, salmon and sea trout due to electromagnetic fields.					
			Offshore Environmental Management Plan (OEMP)	70	(h) Migration and behaviour of European eel, salmon and sea trout due to EMF. In relation to Condition 15h, SNH consider that any potential impacts to fish interests will be addressed through mitigation (such as burying the export cable) and do not identify any project monitoring requirements for these species. Marine Scotland has completed research on fish responses to EMF and SNH did not identify any other specific requirements for AOWFL to address.					
<b>RESEARCH PROGRAMME</b>										
			Offshore Environmental Management Plan (OEMP)	67	...The list of projects will be agreed, so far as is possible, prior to the Commencement of the Development as required by	4	A Scientific Research & Monitoring Panel has recently been established under the direction of Scottish Ministers to steer the allocation of funding to those areas most in need of further research. A €3million scientific research programme to understand the environmental impacts of offshore wind is currently being evaluated. A call was issued in August 2016, inviting scientists to apply for funding to study the environment around the 11-turbine scheme. The research has not yet been commissioned.			
			Offshore Environmental Management Plan (OEMP)	68	<b>Migration and behaviour of European eel, salmon and sea trout due to electro-magnetic fields.</b> A project regarding salmon is also under consideration. As previously mentioned the selected monitoring projects will be confirmed in the coming months and agreed, so far as is possible, prior to the Commencement of the Development as					
			Consent Conditions	40	<b>Condition 16.</b> Within six months of the date of the granting of the Section 36 consent, the Company must provide to the Scottish Ministers information on the funding mechanisms for the research and monitoring programme referred to in Condition 15  <b>Condition 17.</b> No later than three months prior to the Commencement of the Development, a Project Environmental Monitoring Programme (PEMP) must be submitted to, and approved by, the Scottish Ministers in consultation with SNH and any other ecological, or such other advisors as required at the discretion of the Scottish Ministers. The PEMP must detail the measures through all the phases of the wind farm (before, during and after the construction work) to prevent adverse impacts to marine mammals, birds, fish, migratory fish including European eels, habitats, coastal processes, and other users and uses of the area and must include species protection plans where appropriate and necessary. Where appropriate and reasonable, the PEMP must take account of, and implement recommendations from, the Construction Noise Management Plan, the Design Statement, the Cable Laying Strategy, the Black Dog Firing Range Management Plan, the Construction Method Statement, the Research and Monitoring Programme, the Vessel Management Plan and the		It is suggested that key components of the planned research activities should take place before the development is allowed to proceed, to fill the many information gaps that exist in relation to the impact of this development upon salmon and sea trout.			
<b>CONSULTATION - COMMERCIAL FISHERIES AND COASTAL NETTING</b>										

Environmental Statement - Appendix 22.2	20	<p><b>Loss of or Restricted Access to Fishing Areas</b></p> <p>In the case of the local coastal fisheries, given the limited range of netting operations (1300 metres from the shore Low Water), There will be no loss of area or restricted access impacts associated with the construction and operation of the EOWDC and therefore the significance of the impact will be NEGLIGIBLE.</p> <p>Whilst the export cable route has yet to be finalised, taking the worst case scenario that the cable route would pass through a coastal netting station, there could be a small, localised temporary loss of fishing area. As given in the Salmon and Sea Trout Baseline Assessment for the proposed EOWDC, there has been a progressive decline in coastal netting by fixed engines in the local area since 2000 with no reported catches being recorded in the Don District in 2008 and 2009.</p> <p>Taking the short duration of export cable laying and therefore the short period of exclusion, if the export cable route should pass through a fishing area which was being actively fished, the unmitigated impact is considered to be localised and of MODERATE significance.</p> <p><b>Mitigation</b></p> <p>Mitigation may well naturally occur whereby the final export cable route will avoid any areas where coastal netting occurs. Similarly, as occurred in 2008 and 2009 in the Don District, fixed engine activity may not occur. The appropriate liaison and consultation will be undertaken with the relevant stakeholders with the objective of minimising potential impacts to NEGLIGIBLE significance.</p>	Cable Laying Strategy	22	<p><b>5.2 Key constraints identified</b></p> <p>There are a small number of physical spatial constraints within the Development Area and the Offshore Export Cable Corridor (OECC) and the surrounding area. The following constraints have been taken into account in defining the route for the OEC and/or Inter-array cables, and are shown in (Figure 3):</p> <ul style="list-style-type: none"> <li>- The Ministry of Defence (MoD) Back Dog Firing Range – a small arms firing range on the coast, with an associated exclusion zone at sea;</li> <li>- The Maritime and Coastguard Agency (MCA) designated anchorage area just to the north of the Aberdeen Harbour boundary;</li> <li>- The presence of layers of consolidated glacial material; and</li> <li>- The location of navigation buoys.</li> </ul> <p>Several features of potential archaeological interest were also identified by geophysical surveys which have informed the route of the OEC and Inter-array cables.</p>	4	<p>"No later than six months prior to the commencement of cable laying, a Cable Laying Strategy had also to be submitted by the Company to the Scottish Ministers for approval. Cable laying was supposed to avoid any coastal netting stations, but it would now appear (from information provided by the owners of the Blackdog Fishing Station) that the cables are close to the station, and will affect fishing operations there adversely. It is important that the owners of salmon fishing rights that may be affected by such developments should be consulted by the developers and the Crown Estate on any proposals regarding the location and laying of cables."</p>		
Environmental Statement - Chapter 22	10	<p>Paragraph 27:</p> <p>Given the socio-economic importance of the salmon and sea trout fishery in Scottish rivers and coastal waters, the potential for the fishery to be impacted directly through loss of fishing area, restricted access or interference with fishing activities, and indirectly as a result of the ecology of salmon and sea trout being impacted, have been evaluated. A</p> <p>Paragraph 30:</p> <p>Similarly, provided that adequate liaison with stakeholders and fishing interest is carried out, it is not expected that the construction/ decommissioning and operational phase of the proposed EOWDC would result in direct impacts on salmon and sea trout fisheries (eg loss of</p> <p>Paragraph 31:</p> <p>Indirect impacts on the fishery through loss or reduction of salmon and sea trout catches, would in effect, be directly related to the effects on the ecology of the two species as assessed above. As given in Table 22.2 above, the significance of the residual impacts on salmon and sea trout is predicted to range from negligible to minor. It is however recognised that the scale and magnitude of the potential impacts would vary between districts and would be primarily related to the relative value of</p>	Cable Laying Strategy	59	<p><b>12.4 Relevant Post-consent consultation</b></p> <p>Consultation has been undertaken with MS-LOT in relation to the cable specifications.</p>	9	<p>"...local salmon fishermen appear to have been largely ignored. Salmon fishermen have full rights for fishing in those areas to which they own title and have the right to control the use of the water column in those areas."</p>		
			Cable Laying Strategy	33	The final locations and layout of the OECs and the final layout of the Inter-array cables remains subject to possible minor route refinement.				
Environmental Statement - Appendix 22.2	12	<p><b>Mitigation</b></p> <p><b>Juvenile Salmon and Sea Trout</b></p> <p>It is proposed that piling activities be scheduled in consultation with Marine Scotland Science, Scottish Natural Heritage and the Dee, Don and Ythan District Salmon Fishery Boards to ensure minimal disturbance to smolt runs.</p> <p>The timing of the principal smolt runs in the Ythan, Dee and Don Salmon Fishery Districts as given by the Boards during consultation is given in</p>	Offshore Environmental Management Plan (OEMP)	111	<p>Appendix F - Compliance with ES mitigation measures</p> <p>Table F1 - ES and SEIS Environmental Management Mitigation relevant to this OEMP</p>	6	<p>It was accepted that there was uncertainty regarding the behaviour of salmon and sea trout and the implications of their responses to factors such as noise and EMFs. For this reason, once detailed construction information was available, appropriate and robust mitigation and monitoring was to be discussed with the relevant stakeholders and regulators. It is not clear whether those discussions have actually taken place and whether the views of stakeholders have been taken fully into account.</p>		

Environmental Statement - Appendix 22.2	20	<p><b>Loss or Reduction of Catches</b> The impact of loss or reduction of salmon and sea trout catches, will in effect, be directly related to the effects on the ecology of the two species as assessed above. As given in Table 4.1 below, the significance of the residual impacts is predicted to range from NEGLIGIBLE to MINOR.</p> <p>In the case of coastal fisheries, and particularly those which currently appear to not be actively fished, it is expected that the residual impacts will be for the most part NEGLIGIBLE. There is however the possibility of MINOR impacts, if piling coincides with the migration times of returning adult fish following migration routes along which fishing occurs. An impact would only occur however if construction activities caused the fish to alter their migration routes away from fishing locations as opposed to them only causing a short term delay in migration.</p> <p>The significance of the impacts on rod and line fisheries, which have a substantially greater overall socio-economic value than the coastal fisheries in the relevant districts, will similarly be dependent upon the short and longer term impacts of the development on salmon and sea trout. As given above, it is considered that the impacts of the construction, operational and decommissioning phases of the EOWDC will range in significance from NEGLIGIBLE to MINOR. It is however recognised that the scale and magnitude of the potential impacts will vary between districts and will also be related to the relative values of the rod and line fisheries within individual districts and the timing and</p>	Consent Conditions	30	<p>Regarding commercial fishing activity, although the Scottish Fisherman's Federation and the Scottish Fisherman's Organisation were consulted on the Application, no responses were received. Additionally, Marine Scotland's Compliance Division, having consulted the owners of the three inshore boats that work from Aberdeen and fish in the general area where the Development will be located, also did not receive any comments or objections.</p> <p>The Scottish Ministers consider that, having taken account of the information provided by the Company and the response of the Dee, Don and Ythan District Fishery Boards, the impact of fishing activity is not likely to be so significant, in light of the mitigation measures proposed, that it would require consent to be withheld.</p>	7	"It was proposed that further consultation would be held with statutory consultees and salmon fisheries boards when construction methods and timing were considered further. It is not clear whether that consultation has taken place."		
Environmental Statement - Appendix 22.1 Baseline	46	<p>6.8 Main Concerns raised by Fisheries Stakeholders The main concerns expressed during consultation meetings and in questionnaires by fisheries stakeholders are as follows:</p> <ul style="list-style-type: none"> <li>• Potential impact on migratory patterns and disturbance derived from EMFs</li> <li>• Potential impact on migratory patterns and disturbance derived from underwater noise during construction</li> <li>• Potential impact of sediment plumes derived from construction activities</li> <li>• Potential for the proposed EOWDC to alter the path the salmon take to return to home rivers</li> <li>• Indirect impacts caused by changes in prey availability,</li> </ul>				9	"It is questionable, however, whether there has been sufficient consultation with coastal salmon fishers to provide an assurance that the impact on their fisheries will be negligible. Severe problems may be expected at the Blackdog fishing station as a result of the current plans for laying cables, contrary to the assurance that cable laying would avoid such areas. Although the cables on the foreshore are to be buried, the owners of the Blackdog Fishing Station contend that conditions on the beach at Blackdog are very dynamic and sand levels can drop by as much as 4 to 5 meters at any time of the year. Exposure of the cables would make access to the fishings impossible. The cables need to be buried at sufficient depth to avoid being crushed by the tractor, trailer, boat etc., as when loaded, there would be a combined weight of approximately 8 tons. Deployment of fishing nets on the foreshore will also be restricted because of the need to place anchors in position and drive head poles into the ground. There is a real danger that the fishing vessel's anchors will snag the cables and there may also be dangers when fishers dismount from boats into the water. Also, the positioning of the wind turbines relative to the fishing station and the nearby Blackdog firing range, may result in longer journeys by fishers to reach some of their nets, which has implications for their safety."		
	55	<p><b>Consultation - list of consultees</b></p> <p>District Salmon Fishery Boards</p> <ul style="list-style-type: none"> <li>• Don</li> <li>• Ythan</li> <li>• Dee</li> <li>• Brora</li> <li>• Kyle of Sutherland</li> <li>• Tweed</li> <li>• Caithness</li> <li>• Lossie</li> <li>• Cromarty</li> <li>• Ness/Beaully</li> <li>• Helmsdale</li> </ul> <p>Netsmen/Net Fisheries</p> <ul style="list-style-type: none"> <li>• Kincurdie Salmon Fishings-Patience Family Trust (Ness)</li> <li>• Wilkhaven and Castle Salmon Fishery - Ian N. Paterson (Cromarty)</li> </ul> <ul style="list-style-type: none"> <li>• Moray Firth Sea Trout Project (MFSTP)</li> </ul>							
		<p><b>Consultation Meetings</b> Consultation meetings were carried out with the following District Salmon Fishery Boards and net fisheries:</p> <ul style="list-style-type: none"> <li>• Ugie District Salmon Fishery Board (26/10/2010)</li> <li>• Ythan District Salmon Fishery Board (26/10/2010)</li> <li>• Don District Salmon Fishery Board (27/10/2010)</li> <li>• Dee District Salmon Fishery Board (17/01/2011)</li> <li>• Esk District Salmon Fishery Board (27/10/2010)</li> <li>• Usan Fisheries (Montrose) (17/02/2011)</li> </ul>							
	3	Consultation with coastal netting individual right holders will be undertaken once the location of the export cable is defined.							

44	<p>6.6.5 Coastal Netting Stations in the Don</p> <p>There are eight coastal netting stations in the Don district located in the immediate vicinity of the Aberdeen Offshore Wind Farm. Their locations and current owners are shown in Figure 6.22.</p> <p>Three of the eight stations have been bought up by the DDSFB, the Atlantic Salmon Trust and Trump International and are not currently fished (Consultation Meeting, 2010c). The five remaining stations (shown in dark and light blue in Figure 6.22) are owned by two right holders. No catches have been reported in the last two years from these stations, suggesting that they are not current fished. It should however be recognised that a degree of under-reporting may have occurred. In addition, netting activities may at any time recommence.</p> <p>Figure 6.22: Netting Stations which are potentially still used are -</p> <p>Owner - [REDACTED]</p> <ul style="list-style-type: none"><li>- Egie</li><li>- Millden</li><li>- Black Dog</li></ul>							
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