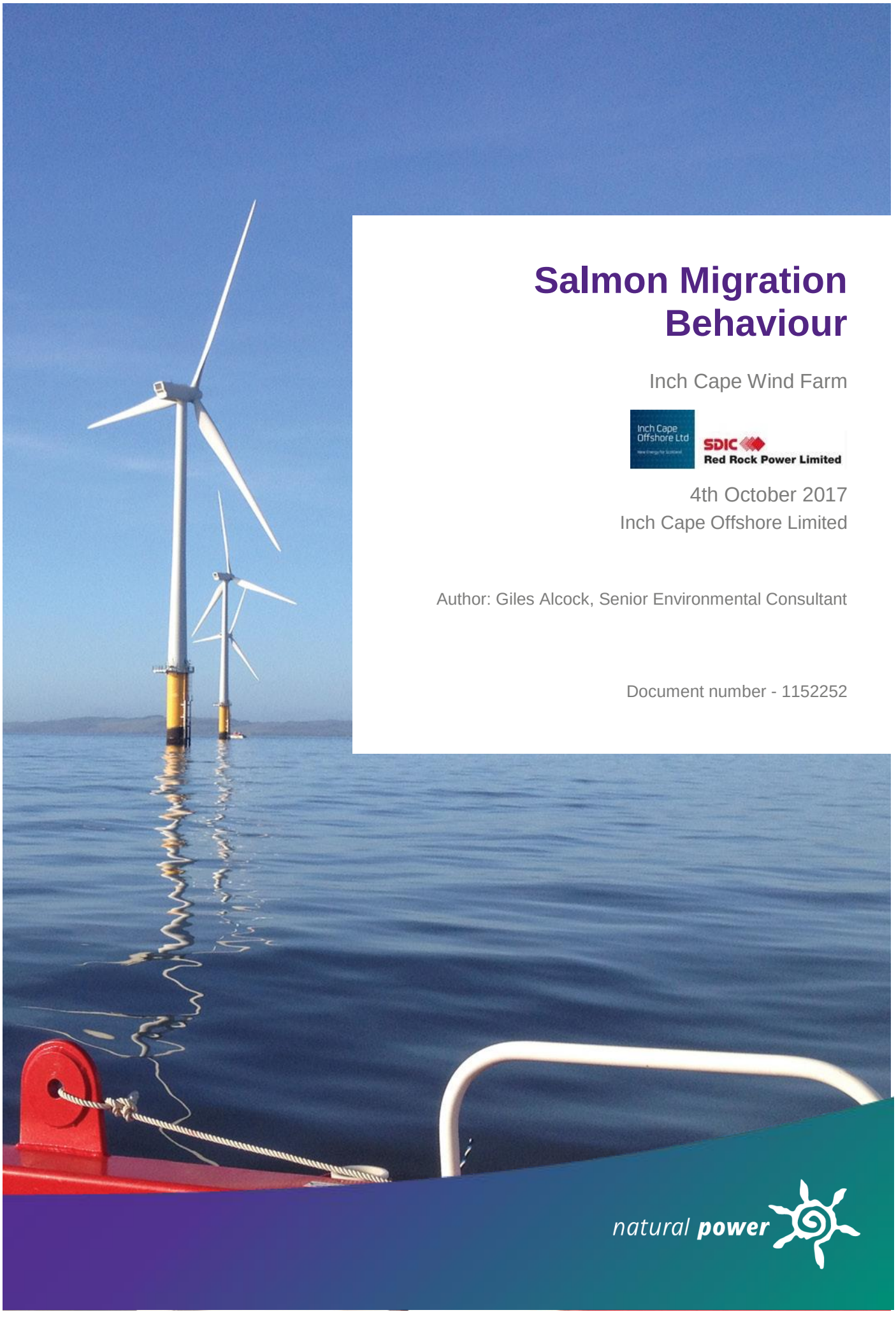

Salmon Migration Behaviour

Inch Cape Wind Farm

4th October 2017

Inch Cape Offshore Limited

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Contents

1. Introduction

1.1. The Inch Cape project

Inch Cape Offshore Limited (ICOL) is promoting the development of the Revised Inch Cape Wind Farm and associated Revised Inch Cape Offshore Transmission Works (OfTW), the Revised Development. The Revised Development is located in the North Sea off the east coast of Angus, Scotland. It will comprise an offshore array of up to 72 Wind Turbine Generators (WTG's), connected by up to 190 km of subsea inter-array cables, connected to one or two Offshore Substation Platform(s) (OSP's) where power generated by the WTGs is transformed and subsequently carried to an onshore landfall location via Offshore Export Cables.

The Revised Development will comprise an offshore generating station with a capacity of greater than one megawatt (MW) and therefore requires Scottish Ministers' consent under section 36 of the Electricity Act (Section 36 Consent) to allow its construction and operation. Under the Marine (Scotland) Act 2010, the Revised Development will also require Marine Licences granted by the Scottish Ministers to allow for the construction and deposition of substances and structures in the sea and on the seabed.

An Offshore Scoping Report for the Revised Development was prepared in support of a request for an opinion from Marine Scotland Licensing and Operations Team (MS-LOT) as to the scope of the information to be provided within the Revised Development Environmental Impact Assessment (EIA) Report. The Offshore Scoping Report was submitted to MS-LOT on 28th April 2017 and an opinion received on 28th July 2017.

1.2. Purpose of this Report

This report has been produced in response to the opinion received from MS-LOT on the Natural Fish and Shellfish chapter within the Offshore Scoping Report with particular reference to diadromous fish. The Offshore Scoping Report sets out the approach to the assessment of the Revised Development EIA, whereby if the original baseline for a receptor group was still considered valid, it was proposed that there was no need to update the baseline for the Revised Development EIA Report. For the Natural Fish and Shellfish chapter Scottish Ministers agree that the existing fish and shellfish baseline was still valid with the exception of diadromous fish. Marine Scotland (MS) identified within their Scoping Opinion that more evidence is now available to support the assumption from the Original Development ES that Atlantic salmon (from herein referred to as salmon) are present in the Development Area. MS-LOT comments are as follows:

MSS agreed, in the majority of cases, that the existing fish and shellfish baseline and proposed updates are appropriate to the potential level of impact from the proposed development. The exception is in relation to diadromous fish. The main points raised were:

MSS provided information on recently published work that provided more evidence on:

- Adult salmon routes to the coast during migration (Godfrey *et al.,* 2014 and 2015)
- Coastal migration of salmon smolts (Lothian *et al.,* 2017)
- The importance of geomagnetic navigation post-smolts in migrating to sea feeding grounds and by returning adult salmon in homing to their natal rivers (Putman *et al*., 2013 and Putman *et al.,* 2014)
- The timing of salmon smolt movement across Scotland (Malcolm *et al.,* 2015)

Godfrey, JD Stewart, DC Middlemas, SJ and Armstrong, JD (2015) Depth use and migratory behaviour of homing Atlantic salmon (Salmo salar) in Scottish coastal waters. ICES Journal of Marine Science, 72: 568–575.
http://icesjms.oxfordjournals.org/content/early/2014/07/16/icesjms.fsu118.full.pdf?keytype=ref&ijkey=y9lmPDRLdC04n7B

Godfrey, JD, Stewart, DC, Middlemas SJ and Armstrong JD (2014) Depth use and movements of homing Atlantic salmon (Salmo salar) in Scottish coastal waters in relation to marine renewable energy

development. Scottish Marine and Freshwater Science. Volume 5 Number 18 http://www.gov.scot/Resource/0046/00466487.pdf

Lothian AJ, Newton M, Barry, J, Walters M, Miller RC and Adams CE (2017) Migration pathways, speed and mortality of Atlantic salmon (Salmo salar) smolts in a Scottish river and the near-shore coastal marine environment. Ecology of Freshwater Fish. On line via http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1600-0633/earlyview as an early view paper

Malcolm, IA, Millar CP and Millidine KJ (2015) Spatio-temporal variability in Scottish smolt emigration times and sizes. Scottish Marine and Freshwater Science. Volume 6 Number 2 http://www.gov.scot/Resource/0047/00472202.pdf.

Putman,NF, Lohmann, KJ, Putman, EM, Quinn,TP, Klimley, AP and Noakes, DLG (2013) Evidence for Geomagnetic Imprinting as a Homing Mechanism in Pacific Salmon. Current Biology 23, 312–316 http://www.cell.com/current-biology/pdf/S0960-9822(13)00003-1.pdf

Putman,NF,Scanlan,MM, Billman,EJ, O'Neil, JP, Couture, RB, Quinn, TP, Lohmann,KJ and Noakes, DLG (2014) An Inherited Magnetic Map Guides Ocean Navigation in Juvenile Pacific Salmon. Current Biology 24, 446–450 http://www.cell.com/current-biology/pdf/S0960-9822(14)00018-9.pdf

MSS note that this information provides more evidence to support the assumption from the Original Development ES that salmon are present in the Development Area. MSS consider that the Original Development ES understated the likelihood that salmon will be present and that this new evidence provides more detail regarding where the salmon are likely to be.

The 2017 EIA Regulations require that the Scottish Ministers come to a reasoned conclusion, based on up to date information, on the significant effects of the Revised Development. As the information noted above has been published since the previous assessment the Scottish Ministers advise ICOL to consider whether it changes the outcome of the Original Development ES and, if so, carry out a further assessment. If ICOL consider no further assessment is required they must provide justification of their reasons.

The Scottish Ministers agree, with the exception of diadromous fish, that the existing fish and shellfish baseline and proposed updates are appropriate to the potential level of impact from the Revised Development.

2. Approach

This document aims to address the comments raised by MSS and Scottish Ministers on the Fish and Shellfish section of the Offshore Scoping Report for the Revised Development by undertaking a thorough review of the documents identified by MSS (in addition to other pertinent papers identified) and, based on their findings an assessment made as to the validity of the baseline presented in the Original Development ES in respect to diadromous fish.

The comments from both MSS and Scottish Ministers relate to new evidence concerning diadromous fish which has been published since the submission of the Original Development ES. This new evidence may challenge the assumptions made in the original fish and shellfish baseline and therefore question its integrity. The comments have been broken down into specific points and the means of addressing each point proposed.

Scoping Opinion Point 1: MSS agreed, in the majority of cases, that the existing fish and shellfish baseline and proposed updates are appropriate to the potential level of impact from the proposed development. The exception is in relation to diadromous fish.

This point confirms MSS' agreement that the existing fish and shellfish baseline and proposed updates identified in the Offshore Scoping Report are appropriate to the potential level of impact from the proposed development.

There are a number of diadromous fish species which were identified in the Offshore Scoping Report. These include salmon, seatrout, European eel, allis shad, twaite shad, sea lamprey and river lamprey. The references identified by MSS all relate to salmon and it is therefore assumed that salmon are the only diadromous species for which additional information is required. As such, no other diadromous fish identified in the Offshore Scoping Report are considered within this discussion paper.

Scoping Opinion Point 2: MSS list the relevant reports which should be reviewed and note that this information provides more evidence to support the assumption from the Original Development ES that salmon are present in the Development Area.

This point identifies the areas of recently published work with respect to salmon and smolt migration, how it is achieved and the timings of these migrations. It also identifies the reports that should be reviewed which support the assumption from the Original Development ES that salmon are present in the Development Area.

In order to consider this point in detail a thorough review of each of the relevant reports identified by MSS has been undertaken along with pertinent papers. The conclusions of these reports will then be compared to the conclusions presented in the Original Development ES and consideration given to the suggestion that they support its assumptions.

Scoping Opinion Point 3*:* MSS consider that the Original Development ES understated the likelihood that salmon will be present and that this new evidence provides more detail regarding where salmon are likely to be.

This point suggests that the assessment of salmon within the Original Development ES was understated and by reviewing the new evidence a better understanding of salmon locations (and therefore interaction with the development) will be ascertained.

In order to determine the validity of this comment, the Fish and Shellfish chapter of the Original Development ES (Chapter 13) was reviewed alongside the evidence provided by MSS. Consideration will be given to the possibility that the likelihood of salmon presence was understated in the Original Development ES and if so, the effects of this on the conclusions reached by that document will be validated in light of the new evidence provided.

Scoping Opinion Point 4: Scottish Ministers highlight that as the information noted by MSS has been published since the previous assessment the Scottish Ministers advise ICOL to consider whether it changes the outcome of the Original Development ES and, if so, carry out a further assessment.

Scottish Ministers highlight that if ICOL consider no further assessment is required they must provide justification of their reasons.

This point leads on from Point 2 (above) made by MSS, however Scottish Ministers specifically request that if the new evidence highlighted by MSS changes the outcome of the Original Development ES then further assessment is required.

It is assumed that in this context 'further assessment' would require that the impacts on salmon be scoped in to the Revised Development ES.

A thorough review of the new evidence will be undertaken and comparison made with the conclusions of the ES. If this review finds that the conclusions of the Original Development ES were understated then a further assessment of salmon will be undertaken. If the new evidence is deemed not to change the outcome then full rationalisation will be given in order to demonstrate that no further assessment is required.

Scoping Opinion Point 5: The Scottish Ministers agree, with the exception of diadromous fish, that the existing fish and shellfish baseline and proposed updates are appropriate to the potential level of impact from the Revised Development

This point is considered to be the same as Point 1 made by MSS and will therefore not be considered further.

3. Findings

A review of the six recently published documents highlighted by MSS was undertaken. A summary of each study and their conclusions have been provided below.

3.1. Adult salmon routes to the coast during migration

Godfrey, JD Stewart, DC Middlemas, SJ and Armstrong, JD (2015) Depth use and migratory behaviour of homing Atlantic salmon (Salmo salar) in Scottish coastal waters. ICES Journal of Marine Science, 72: 568–575; and

Godfrey, JD, Stewart, DC, Middlemas SJ and Armstrong JD (2014) Depth use and movements of homing Atlantic salmon (Salmo salar) in Scottish coastal waters in relation to marine renewable energy development. Scottish Marine and Freshwater Science. Volume 5 Number 18

In 2013 and 2014, one hundred and thirty five adult salmon (50 and 85 respectively) were captured and subsequently released at Armadale on the North coast of Scotland and fitted with pop-up satellite tags in order to track their migration routes and behaviours.

It was found that all salmon performed some diving activity however some spent extensive time at depth. The tagged salmon were predominantly surface oriented with over 80% of their time in the upper 5m. The tagged salmon scattered in all directions from the release site and while they broadly stayed near the coast it was not always the case.

The conclusions of Godfrey *et al.* (2014) were that adult salmon do not appear to have well defined migration routes to their natal rivers, and that although they predominantly spend most time in the upper 5m, they do use the full extent of the water column.

In Godfrey *et al.* (2015), the 2013 data only was examined for diving depth and showed that although fish spent most of their time at the surface (72-86% of their time at 0-5m), all fish also dived to greater depths (6-9 % of their time was spent at greater than 20m) with a mean dive depth of 63.9m. Individuals appeared to remain deeper at night, although salmon in the coastal zone were predominantly surface dwelling. It was also reported that there was a net westerly bias from the release point and that these salmon tended to swim at depth more than those which moved east from the release location.

The paper agreed with Godfrey *et al.* (2014) in that it also concluded that salmon mostly stay near the surface but will use the full extent of the water column. Based on the recovery locations of the tags, it was considered that salmon do not have well defined migration routes and that the migration of salmon to their natal rivers is not strictly coastal in its distribution.

3.2. Coastal migration of salmon smolts

Lothian AJ, Newton M, Barry, J, Walters M, Miller RC and Adams CE (2017) Migration pathways, speed and mortality of Atlantic salmon (Salmo salar) smolts in a Scottish river and the near-shore coastal marine environment. Ecology of Freshwater Fish

In April 2016 fifty Atlantic salmon smolts were tracked using acoustic telemetry in the river Deveron, Scotland and adjacent coastal area (Banff Bay).

A greater mortality was found whilst the smolts were in freshwater with no mortality observed in the marine migration. It appeared that greater speed during the freshwater migration had a positive relationship with marine survival. The study found that smolt speed had a negative relationship with noise in the bay. It was hypothesised that this may be due to disorientation which then increased predation risk.

Smolts preferred to enter the bay at night with low lunar light during a flood tide. They remained closer to the middle of the bay indicating they do not follow geographical features and possibly follow water currents. The smolts migrated in a north east direction towards the North Sea which may indicate underlying navigational mechanisms.

3.3. The importance of geomagnetic navigation post-smolts in migrating to sea feeding grounds and by returning adult salmon in homing to their natal rivers

Putman, NF, Lohmann, KJ, Putman, EM, Quinn,TP, Klimley, AP and Noakes, DLG (2013) Evidence for Geomagnetic Imprinting as a Homing Mechanism in Pacific Salmon. Current Biology 23, 312–316

A 56 year fisheries data set on Fraser River sockeye salmon (*Oncorhynchus nerka*) which must detour around Vancouver Island was analysed along with the earth's magnetic fields to test the hypothesis that salmon imprint on the magnetic field that exists where they first enter the sea and later seek the same field on their return. This study was for first year sockeye salmon which all die after spawning.

It was found that direction choice of adult salmon returning to the Fraser River (north and south around Vancouver island) was in part predicted by changes in magnetic field (intensity and angle) caused by geomagnetic drift (16 %), sea surface temperature (22 %) and a combination of the two (28 %).

The conclusion of this study was that sockeye salmon appear to use geomagnetic cues to guide the open-sea portion of their spawning migration.

Putman,NF,Scanlan,MM, Billman,EJ, O'Neil, JP, Couture, RB, Quinn, TP, Lohmann,KJ and Noakes, DLG (2014) An Inherited Magnetic Map Guides Ocean Navigation in Juvenile Pacific Salmon. Current Biology 24, 446–450

This study experimentally tested juvenile Chinook salmon (*Oncorhynchus tshawytscha*) of less than one year old from the Willamette River Basin in Oregon (USA) for evidence of orientation preferences that would indicate use of an inherited magnetic map. The fish were tested at the hatchery where they were bred in fourteen opaque circular buckets which served as orientation arenas. A magnetic field was generated by two orthogonally arranged four coil systems connected to a DC power supply.

It was found that fish tested in the northern magnetic field were significantly oriented towards the south-southwest and those tested in the southern magnetic field were oriented north-northeast. This capacity to use two magnetic parameters (magnetic intensity and inclination angle) to navigate without prior experience has been dubbed an 'inherited magnetic map'. There was no change in orientation behaviour when only one magnetic parameter was used.

In conclusion this study shows that juvenile Chinook salmon appear to possess orientation responses necessary for successful ocean migration prior to migrating towards the sea. This allows them to navigate to offshore feeding grounds and also return with precision to their natal site for reproduction.

3.4. The timing of salmon smolt movement across Scotland

Malcolm, IA, Millar CP and Millidine KJ (2015) Spatio-temporal variability in Scottish smolt emigration times and sizes. Scottish Marine and Freshwater Science. Volume 6 Number 2

This study analysed existing data on smolt emigration times and sizes from fisheries trusts, fisheries boards, universities and private companies.

It was found that the existing literature suggests that smolt migration to coastal waters is between day 103 and 145 of the year (approximately mid-April to late May). It was shown that there was an overall trend from year to year which showed a gradual decline in early migration (April) with migration dependent on river and ocean temperature, discharge and the lunar cycle. There was no evidence that latitude, longitude, coast and distance around the coast would provide any predictable special variability. It was identified that smolt size was important however the study could not indicate how long the smolts stayed in the coastal waters after they migrated.

In conclusion smolt migration was found to be from mid-April to May however the data suggested the run is getting later. Smolt migration is dependent on environmental factors such as temperature, river flows and lunar cycle.

4. Validation of Existing Baseline

In order to fully address MSS comments to the Offshore Scoping Report a thorough review of the baseline environment presented within the Natural Fish and Shellfish chapter of the Original Development ES has been undertaken regarding salmon. The baseline within the Original Development ES makes the following statements regarding salmon:

- These migratory fish enter and leave these SACs and may therefore pass through the Development Area and/or Offshore Export Cable Corridor during the marine phase of life (ICOL 2013, Section 13.4.3, page 19).
- As no definitive migratory routes exist for Scottish east coast Atlantic salmon it must be assumed that some individuals migrate through the Project area en-route from or to their natal rivers (ICOL 2013, Section 13.4.3, page 20).
- There is a lack of detailed, evidence-based knowledge on the migration of Atlantic salmon smolt leaving Scottish east coast rivers, however they are likely to travel in a northerly and easterly direction en route to feeding grounds around Greenland (Malcolm *et al.,* 2010). Smolt are believed to leave the rivers in late spring. Malcolm *et al.,* (2010) found no evidence of coastal migration and it is assumed that smolt may migrate over a broad area unless there are areas of strong coastal currents (ICOL 2013,Section 13.4.3, page 20).
- Salmonids are likely to utilise EMF for navigation purposes during long distance migrations, which occur at specific stages of their life cycle (Gill *et al.,* 2005) (ICOL 2013, Section 13.4.4; Table 13.9 page 28).
- No Atlantic salmon or sea lamprey were recorded during site specific surveys, however as these species are rarely captured at sea through trawling, this is not an indication that they do not migrate through the Development Area (ICOL 2013, Section 13.4.5, page 35).
- As the migrational routes of these salmon and sea lamprey are not fully established, the assumption, must therefore be made, that these SAC qualifying species may pass through the Development Area during migrations to and from natal rivers (ICOL 2013, Section 13.4.5, page 35).
- As the migration routes of these three species (salmon, sea and river lamprey) are not fully established, the precautionary assumption must therefore be that they may pass through the Offshore Export Cable Corridor during migrations to and from natal rivers (ICOL 2013, Section 13.4.6, page 39).

On reviewing the baseline it is clear that salmon were given due consideration. The likelihood of salmon being present in or migrating through the Development Area is discussed throughout the document. The precautionary principle that salmon may be in the Development Area has been adopted due to lack of evidence to the contrary and key references used e.g. Malcolm *et al.*, (2010).

Scoping Opinion Point 2: MSS list the relevant reports which should be reviewed and note that this information provides more evidence to support the assumption from the Original Development ES that salmon are present in the Development Area.

MSS state that the references they have listed provide more evidence to support the assumption from the Original Development ES that salmon are present in the Development Area.

There are several points of relevance that can be taken from the new evidence to confirm this statement.

- Godfrey *et al.* (2014 and 2015) found that salmon do not have defined migratory routes, thereby reinforcing the baseline of the Original Development ES where it states that '*As no definitive migratory routes exist for Scottish east coast Atlantic salmon it must be assumed that some individuals migrate through the Project area en-route from or to their natal rivers* (ICOL 2013, Section 13.4.3, page 20)'.
- Lothian *et al*. (2017) found that smolts do not show a coastal navigation route, however may follow water currents. This finding reinforces the statement in the Original Development ES that '*Malcolm et al. (2010) found no evidence of coastal migration and it is assumed that smolt may migrate over a broad area unless there are areas of strong coastal currents'* (ICOL 2013, Section 13.4.3, page 20).
- The timing of smolt migration is identified by Malcolm *et al.* (2015) who suggests that this occurs from late April - May with a gradual decline in early migration (April). The baseline also identifies the smolt timing as 'late spring' (ICOL 2013, Section13.4.3, page 20) which is directly comparable with this new evidence.

These papers therefore supports the assumption made in the Original Development ES that salmon may pass through the Development Area.

The two studies by Putman *et al.* (2013 and 2014) identify that sockeye salmon use the geomagnetic cues to guide the open-sea portion of their spawning migration and that juvenile Chinook salmon possess orientation responses to magnetic fields for successful ocean migration. It should first be noted that these studies are for Pacific salmon and not Atlantic salmon. Armstrong *et al.* (2015) conducted a similar tank based experiment on Atlantic salmon (both large adult salmon and post-smolts) exposing them to magnetic (B) fields of up to 95 µT. The results observed showed exposed Atlantic salmon elicited no significant changes in swimming behaviour in comparison to control groups. In addition, Putman *et al.* (2013 and 2014) strongly emphasised that all returning salmon die after spawning unlike Atlantic salmon where a proportion will live after spawning. This illustrates the differences in physiology and life cycle between different species of salmon.

Despite this it is accepted that Atlantic salmon may use geomagnetic cues to navigate offshore and therefore be present in the Development Area, which supports the assumptions made in the Original Development ES baseline regarding salmon.

Scoping Opinion Point 3: *MSS consider that the Original Development ES understated the likelihood that salmon will be present and that this new evidence provides more detail regarding where salmon are likely to be.*

After reviewing the baseline in the Original Development ES it is evident that salmon have been considered as a significant receptor throughout the document. They have been classed as a Species of Conservation Importance (ICOL 2013, Section 13.4.3, page 19) and assigned to the receptor group 'SAC qualifying feature species' along with lamprey species and freshwater pearl mussel (ICOL 2013, Section 13.4.3, page 24). It is therefore considered that the presence of salmon has not been understated.

Point 3 also suggests that the new evidence may provide more detail regarding salmon presence. After reviewing the publications it can be concluded that the information presented within the baseline section of the Fish and Shellfish chapter of the Original Development ES and the new evidence are consistent. These similarities have been presented in response to Point 2 above.

It can therefore be concluded that the baseline within the Original Development ES does not understate that salmon will be present. In addition, the new evidence referred to by MSS does not increase the certainty above that which is already stated in the Original Development ES of where salmon are likely to be.

5. Validation of EIA Conclusions

Scottish Ministers have commented that the new information highlighted by MSS may change the outcome of the original Development ES:

Scoping Opinion Point 4: Scottish Ministers highlight that as the information noted by MSS has been published since the previous assessment the Scottish Ministers advise ICOL to consider whether it changes the outcome of the Original Development ES and, if so, carry out a further assessment. Scottish Ministers highlight that if ICOL consider no further assessment is required they must provide justification of their reasons.

In order to fully address Scottish Minister's comments, a thorough review of the conclusions made within the Natural Fish and Shellfish chapter of Original Development ES has been undertaken in light of the new evidence provided by MSS (Table 5.1). The Original Development ES included salmon within the SAC qualifying feature species receptor group (ICOL 2013, Section 13.4.3, page 24) and the review of the Original Development ES shows that salmon were fully assessed against all the impacts likely to arise from the construction, operation, maintenance and decommissioning of the Inch Cape Wind Farm.

As salmon are an SAC interest feature the Original Development ES also included a Habitats Regulations Appraisal (HRA) which identifies that a Likely Significant Effect exists for the River Teith SAC, River Tay SAC and River South Esk SAC which cite salmon as an interest feature (ICOL 2013, Section 13.13.2, page 148 – 167).. An Appropriate Assessment (AA) was therefore also undertaken. The Appropriate Assessment concludes that the project will not affect maintenance of the integrity of the site (ICOL 2013, Section 13.13.3, page 175 – 183).

It is, therefore clear that salmon are given due consideration within the Original Development ES against all of the potential impacts of the Inch Cape Wind Farm; and after a thorough review of the new information it is clear that the conclusions support the information presented in the Original Development ES. It is therefore considered that further assessment is not required for the Revised Development ES.

Table 5.1: Summary of Original Development ES conclusions and provision of new evidence

Impact	ES Conclusion	New Relevant Information	Validation
Direct Temporary habitat disturbance	Salmon may potentially use the Development Area for foraging, however will not be reliant on seabed habitats within the Development Area as feeding grounds, as this will be a small proportion of the overall available resource on their migratory route. None will use the Development Area as nursery or spawning grounds. Therefore, while there is scope for salmon to be impacted by temporary habitat disturbance it is considered to be negligible in magnitude.	Godfrey *et al.* (2014 and 2015) identified that salmon do not have well defined migration routes and mainly use the top 5m of the water column.	The studies by Godfrey *et al.(*2014 and 2015) suggests that salmon may use the Development Area during their migration. Salmon were identified as being present in the Development Area within the Original Development ES and have been fully assessed. Therefore no further assessment is required.
Indirect disturbance as a result of sediment deposition and temporary increase in SSC	Suspended sediment levels, and resulting increased turbidity, are reported to affect salmonids, with effects including avoidance predicted. All diadromous species spend time within the river and estuary environments where SSC levels are considerably higher than those present within the open sea, and as such they are likely to have an increased tolerance to suspended sediments. The sensitivity of this receptor group is defined as high therefore, combined with a negligible magnitude, a minor/moderate impact is predicted.	Godfrey *et al*. (2014 and 2015) identified that salmon do not have well defined migration routes and mainly use the top 5m of the water column.	None of the new evidence discuss the impacts of suspended sediment on salmonids. However the studies by Godfrey *et al.(*2014 and 2015) suggests that salmon may use the Development Area during their migration. Salmon have been identified as being present in the Development Area within the Original Development ES and have been fully assessed. Therefore no further assessment is required.
Barrier effects, disturbance or physical injury associated with construction noise	Noise modelling conducted for the Development Area (for impact pilling) indicates injurious effects are likely to occur less than 0.1 km from source Therefore, the magnitude of this effect on salmon is judged to be negligible, as the effect will be intermittent and no wider effects on the size or structure of salmon stocks that represent qualifying features of local SACs is predicted. The sensitivity of this receptor is judged to be high due its designation as a qualifying feature for	n/a	None of the new evidence discuss the impacts of noise on salmonids. However the studies by Godfrey *et al.* (2014 and 2015) identified that salmon do not have well defined migration routes and mainly use the top 5m of the water column. Therefore no further assessment is required.

Impact	ES Conclusion	New Relevant Information	Validation
	local SACs, therefore combined with a negligible magnitude, a minor/moderate impact is predicted.		
Long term loss of Original habitat	The long term loss of habitat within the Development Area will have a very limited impact on this receptor group as species such as salmon are not thought to rely on the specific habitats within the Development Area for any particular ecological function, such as spawning or even feeding. The sensitivity of this receptor to all effects is high, therefore when combined with a negligible magnitude a minor/moderate impact is predicted	Godfrey *et al.* (2014 and 2015) identified that salmon do not have well defined migration routes and mainly use the top 5m of the water column.	Although the conclusions in Godfrey *et al.(*2014 and 2015) may suggest that salmon are using the Development Area due to them having no defined migration routes salmon have already been considered and does not change the outcome of the assessment. Therefore no further assessment is required.
Behavioural responses to EMF associated with cabling	Concerns exist due to potential effects on migration routes from magnetic fields that may inhibit the ability of individuals to navigate. salmon are reported to predominately swim in the upper 10 m of the water column (Malcolm *et al.,* 2010), and it is considered that EMF impacts to salmon from subsea cables will not be present in water depths greater than 20m due to the attenuation of EMF in seawater (Gill and Bartlett, 2010). Any interaction between migratory species and magnetic fields produced during energy transmission in inter-array cabling will be unlikely and is supported by modelling of subsea cables in the Moray Firth which indicates B fields will remain below that of the Earth's geomagnetic field at seabed level and reduce to negligible levels beyond. This assumption is supported by a review of salmon data from the Solway Firth in relation to the construction and operation of the Robin Rigg Offshore Wind Farm which concluded that the wind farm had no significant impact on the salmon populations of the local river (Thorley, 2013). The magnitude of EMF effects to salmon from the inter-array cabling are considered to be negligible. With a	Putman *et al.(*2013) discuss pacific salmon migration by magnetic fields. Godfrey *et al.* (2014 and 2015) identified that salmon do not have well defined migration routes and mainly use the top 5m of the water column.	The most relevant study identified by MSS for review relating to EMF reviewed were Putman *et al.* (2013 and 2014) who found that Pacific salmon use the earths electromagnetic fields to migrate whilst at sea. The relevance of these studies is questionable as Pacific salmon are a different species to Atlantic salmon and Armstrong *et al.* (2015) found no evidence of effects of electric fields on Atlantic salmon. The studies by Godfrey *et al*. (2014 and 2015) identifies that salmon spend the majority of their time in the upper 5m of the water column which correlates with the ES. The Original Development acknowledges that salmon may be in the Development Area and that they are likely to use EMF for navigation. None of the new information changes the outcome of the assessment. Therefore no further assessment is required.

Impact	ES Conclusion	New Relevant Information	Validation
	high sensitivity of this receptor this results in a minor/moderate impact.		
Disturbance associated with operational noise	The species specific noise modelling undertaken for the Development Area showed salmon to be the least sensitive of the fish species modelled for operational noise, and as for the other species, operational WTG noise is not estimated to exceed 75 dBht (Species) at the point of emission at the WTG tower and SPEAR modelling predicted an avoidance range of less than one metre from the WTGs. The very small areas potentially affected by avoidance noise levels results in the magnitude of this effect being classed as negligible. The sensitivity of SAC qualifying feature species is high, therefore a minor/moderate impact is predicted.	Godfrey *et al*. (2014 and 2015) identified that salmon do not have well defined migration routes and mainly use the top 5m of the water column.	None of the new evidence discuss the impacts of noise on salmonids. However the studies by Godfrey *et al.* (2014 and 2015) identified that salmon do not have well defined migration routes and mainly use the top 5m of the water column. Salmon have already been considered in the Original Development ES and the new information does not change the outcome of the assessment. Therefore no further assessment is required.
Reduced fishing activity within Development Area	The creation of new habitat is not predicted to affect salmon therefore no impact is predicted on this receptor group	n/a	Salmon have already been considered therefore the new information does not change the outcome of the assessment. Therefore no further assessment is required.
Creation of new habitat due to presence of project infrastructure	Receptor group not sensitive to effect	Godfrey *et al*. (2014 and 2015) identified that salmon do not have well defined migration routes and mainly use the top 5m of the water column.	Studies by Godfrey *et al.* (2014 and 2015) identified that salmon do not have well defined migration routes and mainly use the top 5m of the water column. Salmon have already been considered in the Original Development ES and the new information does not change the outcome of the assessment. Therefore no further assessment is required.
Temporary habitat disturbance from O&M activities	It is assumed that the significance of impacts predicted on fish and shellfish receptors via temporary habitat disturbance via O&M activities would be no greater than those predicted from construction activities.	n/a	Salmon have already been considered therefore the new information does not change the outcome of the assessment. Therefore no further assessment is required.

6. Conclusion

The Scoping Opinion requests made by both MSS and Scottish Ministers have been fully addressed within this document. The publications identified by MSS have been reviewed and found that the conclusions were consistent with the information in the fish and shellfish chapter within the Original Development ES.

The Original Development ES baseline and assessment adopted the precautionary principle and considered that salmon were likely to be in the Development Area. Their presence was therefore considered within the assessment. The publications and information reviewed do not provide greater certainty on salmon location, especially in relation to the Development Area. The information in Godfrey *et al.* (2014 and 2015) has identified a swimming depth (>5 m) for salmon which is shallower (and therefore less conservative) than that in the Original Development ES (>10 m) (ICOL 2013, Section 13.6.2, page 80).

Salmon were fully assessed in the Original Development ES against all the impacts likely to arise from the construction, operation, maintenance and decommissioning of the Inch Cape wind farm and no significant effects were found. As the new information does not alter the baseline information the conclusions of the Original Development ES are still valid and therefore no further assessment on salmon is required in the Revised Development ES.

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