

## **Summary of HPC cooling water system impact results on fish species without AFD November 2020**

### **Introduction**

In February 2019, the Appellant applied to vary the Operational Water Discharge Activity permit for Hinkley Point C (HPC) to amend or remove conditions relating to the design and operation of the AFD system.

As part of the EA's permit determination the EA has to undertake a Habitats Regulations Assessment (HRA). The EA's Appropriate Assessment (stage 2 of the HRA) includes consideration of the potential impacts of the permit variation on protected local fish populations of the Bristol Channel and rivers that run into it.

The approach taken to assess the numerical data and evidence, to predict the potential levels of fish that may be removed from the populations associated with the Bristol Channel is known as the 'Quantitative Impact Assessment (QIA) Model'. The model uses intake data from the existing Hinkley Point B (HPB) station, alongside survey data from the Bristol Channel, to estimate the potential fish losses. Uncertainty has been analysed at each step to ensure that conclusions drawn from the results are proportionate and reasonable.

The purpose of the Appropriate Assessment is to determine, beyond reasonable scientific doubt, whether it is possible to conclude that there would be no adverse effect on the integrity of the protected sites from the operation of Hinkley Point C without an AFD.

A summary of the QIA Model results and Appropriate Assessment provisional conclusions by fish species are provided in Table 1. Appendix 1 provides further explanation of the contents of Table 1.

A comparison between the EA's QIA Model results and the Appellant's results (from the original permit application and from permit application document TR456) is provided in Table 2.

A Summary of the EA's final Appropriate Assessment conclusions for each protected feature is provided in Table 3.

**Table 1 - Assessment Results - results of the EA's Quantitative Impact Assessment/summary of provisional HRA conclusions per species**

Species	A	B	C	D	E	F	G	H		HRA provisional Conclusion  (brief summary of provisional conclusion, based on quantitative assessment and qualitative narrative. The full assessment to be provided within HRA once finalised)
	No. of fish lost due to HPC Impingement	No. of fish lost due to HPC Entrainment	No. of equivalent adults lost due to HPC Impingement	No. of equivalent adults lost due to HPC Entrainment	Total No. of equivalent adults lost due to HPC Entrainment	Total Tonnes of equivalent adults lost due to HPC Entrainment	Population Unit  SSB(tonnes) / Fishery (tonnes)/ number of fish	Predicted value (best estimate)	95 <sup>th</sup> %ile / 99 <sup>th</sup> %ile value (worst case estimate)	
<b>Marine assemblage species for Severn Estuary SAC and Ramsar</b>										Species listed below are considered both quantitatively and qualitatively and the wider marine assemblage is considered by narrative
European sprat	1,322,637 (fish) 3,557,152 (larvae)	3,557,152 (larvae)	3,482,256	124,500	3,606,756	55.90	7,704	0.7%	1%	Predicted impact considered not of concern within the marine assemblage due to the healthy abundance of this species.
Whiting	1,708,720 (fish)		662,984		662,984	197.57	2,179	9%	23%	The EA has concerns over the level of impact predicted due to the high losses predicted and the value this species provides in the local ecosystem.
Dover sole	157,565 (fish) 324,176 (larvae)	1,106,693 (larvae) 991,212 (eggs)	170,362	0.02	170,362	60.14	809	7%	11%	Predicted impact considered not of concern within the marine assemblage due to healthy local population trends.
Atlantic cod	302,034 (fish)		51,648		51,648	245.12	1,118	22%	36%	The EA has concerns over the level of impact predicted due to the concerns of the sustainability of the local and wider population. ICES current advice is zero catch to allow the species to recover.
Atlantic herring	37,549 (fish) 221,128 (larvae)	193,487 (larvae)	114,464	267	114,731	7.46	157	5%	6%	The EA has concerns over the level of impact predicted due to the concerns of the sustainability of the local and wider population. The status of the stock in the Bristol Channel is uncertain and not assessed, but adjacent ICES stocks are considered to be at increased risk of fishing pressures and have a reduced reproductive capacity.
European seabass	23,626 (fish) 13,129,264(larvae)	6,108,346 (larvae) 9,456,586 (eggs)	14,401	0.0001	14,401	16.17	565	3%	5%	The EA has concerns over the level of impact predicted due to the concerns of the sustainability of the local and wider population and the important role it plays in the food web. ICES determine that stock development is decreasing over time and is presently functioning at a reduced reproductive capacity.
European plaice	1,446 (fish) 550,129 (larvae)	1,300,201 (larvae)	16,630	15	16,646	5.33	1,332	0.4%	0.3%	Predicted impact considered not of concern due to the very low impact levels predicted and abundance of this species.
Thornback ray	2,358 (fish)		1,457		1,457	4.78	122	4%	5%	Predicted impact considered not of concern within the marine assemblage due to healthy local population trends.
Blue whiting	7,375 (fish)		2,862		2,862	0.39	514,008	0.0001%	0.00015%	Predicted impact considered not of concern due to the very low impact levels predicted and abundance of this species.

Migratory assemblage and/or Annex II species for Severn Estuary SAC and Ramsar										
European Eel	341 (fish)	538,567 (larvae)	341	45,388	45,729	10.77	331,248 (entrainment assessment) 213,709 (impingement assessment)	3%	7%	The European Eel global stock is listed as Critically Endangered. The Impact from HPC is estimated to remove around 3% of Silver Eels leaving the local area (escapement). Currently the local area is well behind the Eel Management Plan aims to reduce anthropogenic pressures to increase this escapement level. The EA has concerns over the level of impact predicted.
Twaite shad	763 (fish)		117		117		86,696	0.1%	1%	The twaite shad has experienced a population decline over the last 40 years. Against this background of declining populations, with the feature currently in unfavourable condition, it is considered that these predicted losses could prevent the species from being maintained at, or restored to a sustainable level.
Allis shad	23 (fish)		9		9		1,083	0.9%	8%	The modelled losses at HPC are likely to put further pressure on this small and declining population, while also preventing population recovery. The predicted impact, coupled with the small population size, could prevent the feature from being maintained at, or restored to, a sustainable level
Sea lamprey	50 (fish)		50		50		15,269	0.3%	1%	The predicted impact levels are not considered to prevent the species from being maintained, or restored to a sustainable level. This is due to a low level of impact predicted and the healthy status of the population.
River lamprey	20 (fish)		20		20		116,109	0.02%	0.04%	The predicted impact levels are not considered to prevent the species from being maintained, or restored to a sustainable level. This is due to a low level of impact predicted and the healthy status of the population.
Atlantic salmon	76 (fish)		17		17		17,616	0.1%	2%	Recent cases (NLO for England and Wales) have concluded there is currently no exploitable stock of salmon within the Severn Estuary. This is a relatively low predicted impact but when stocks are at such low levels even relatively small numbers of fish are crucial to recovering stocks. The predicted impact could prevent the species from being maintained, or restored to a sustainable level.
Sea trout	8 (fish)		8		8		8,750	0.1%	0.4%	Predicted impact currently not considered to be at a level that would prevent the population being maintained or restored at a population level

Individual River Assessments - Annex II species										
Twaite shad - River Wye	763 (fish)		117		117		<b>43,348</b>	0.3%	N/A	The twaite shad has experienced a population decline over the last 40 years. Against this background of declining populations, with the feature currently in unfavourable condition, it is considered that these predicted losses could prevent the species from being maintained at, or restored to a sustainable level within both these rivers.
Twaite shad - River Usk	763 (fish)		117		117		<b>2,167,400</b>	0.5%	N/A	
Allis shad - River Wye	23 (fish)		9		9		<b>433.48</b>	2%	N/A	The modelled losses at HPC are likely to put further pressure on this small and declining population, while also preventing population recovery. The predicted impact, coupled with the small population size, could prevent the population from being maintained at, or restored to, a sustainable level
Atlantic salmon - River Wye	76 (fish)		17		17		<b>5,890.00</b>	0.3%	N/A	Recent cases (NLO for England and Wales) have concluded there is currently no exploitable stock of salmon within the Severn Estuary. This is a relatively low predicted impact but when stocks are at such low levels even relatively small numbers of fish are crucial to recovering stocks.
Atlantic salmon - River Usk	76 (fish)		17		17		<b>6,269.00</b>	0.3%	N/A	The predicted impact could prevent the population from being maintained, or restored to a sustainable level within both these rivers.
NB lamprey species population considered at estuary level therefore no separate quantitative results for individual rivers, however they will be consider as Annex II species for River Wye and Usk within the HRA										

**Table 2 - Annual Proportional Loss Predictions Comparison**

Species	Predictions from original permit application (2013)	Predictions from permit variation application (TR456, 2019)	Predicted values from EA's Quantitative Impact Assessment Model	
	Impingement only	Impingement only	Impingement only	Total entrapment
European sprat	<u>1665.5%</u>	-	0.7%	0.7%
Whiting	0.72%	0.090%	9%	9%
Dover sole	0.04%	0.217%	7%	7%
Atlantic cod	0.24%	0.145%	22%	22%
Atlantic herring	<u>0.2%</u>	<u>0.031%</u>	<u>5%</u>	<u>5%</u>
European seabass	-	0.011%	3%	3%
European plaice	0.00%	0.002%	0.4%	0.4%
Thornback ray	-	<u>0.118%</u>	<u>4%</u>	<u>4%</u>
Blue whiting	0.00%	0.000%	0.0001%	0.0001%
European eel	0.06%	0.039%	0.05%	3%
Twaite shad	0.00%	<b>0.011%</b>	<b>0.1%</b>	<b>0.1%</b>
Allis shad	0.00%	<b>0.017%</b>	<b>0.9%</b>	<b>0.9%</b>
Sea lamprey	0.27%	<b>0.077%</b>	<b>0.3%</b>	<b>0.3%</b>
River lamprey	0.01%	<b>0.008%</b>	<b>0.02%</b>	<b>0.02%</b>
Atlantic salmon	-	<b>&gt;0.0086%</b>	<b>0.1%</b>	<b>0.1%</b>
Sea trout	-	<b>&gt;0.0054%</b>	<b>0.1%</b>	<b>0.1%</b>

Results are expressed as an Annual proportional loss from either; an estimate of Spawning Stock Biomass (t) / predicted Fishery Landings (t) / **No. of fish with spawning population**

**Table 3 – Appropriate Assessment Results**

Protected feature	Conclusion	Justification
Assemblage of the fish species (117 species identified is part of the notable species sub-feature of the estuary feature)	When considering the target to ensure that the abundance of the notable estuarine species assemblages is maintained or increased it is <b>not possible to conclude no adverse effect</b> on the Severn Estuary SAC and Ramsar.	The EA has concerns about predicted impacts on 4 of the 9 marine assemblage species the EA assessed in detail (Whiting, Atlantic Cod, Atlantic Herring & European Seabass) and concerns about 4 of the 7 migratory fish species (Eel, Twaite and Allis Shad and Salmon). Many of these fish species' populations are currently showing signs of decline, reduced productivity or are approaching unsustainable levels.
Migratory fish assemblage	When considering the target to ensure that the size of the populations of the assemblage species in the Severn Estuary and the rivers which drain into it, is at least maintained and is at a level that is sustainable in the long term it is <b>not possible to conclude no adverse effect</b> on the Severn Estuary and Ramsar.	The EA has concerns about 4 of the 7 migratory fish species (Eel, Twaite and Allis Shad and Salmon) assessed. Many of these fish species' populations are currently showing signs of decline or are approaching unsustainable levels.
Twaite shad	When considering the predicted impact on the population within the Severn Estuary and the rivers draining into it is at least maintained and is at a level that is sustainable in the long term it is not possible to conclude no adverse effect on the Severn Estuary SAC. When considering the objective to ensure that favourable conservation status is achieved by maintaining or restoring the population of the River Wye SAC and River Usk SAC, and that the population of the feature in the SACs are stable or increasing over the long term, it is <b>not possible to conclude no adverse effect</b> on the River Wye SAC or River Usk SAC.	This species' population has declined over the last 40 years and is currently in an unfavourable condition, further losses could prevent it being restored to a sustainable level.
Allis Shad	When considering the objective to ensure that favourable conservation status is achieved by maintaining or restoring the population of the River Wye SAC and River Usk SAC and that the population of the feature in the SACs are stable or increasing over the long term, it is <b>not possible to conclude no adverse effect</b> on the River Wye SAC or River Usk SAC.	This species' population is small and declining, further losses are likely to prevent the population recovering to sustainable levels.
Atlantic Salmon	When considering the target to maintain or restore the populations of qualifying species it is <b>not possible to conclude no adverse effect</b> on the River Wye SAC and River Usk SAC.	This species' population is currently considered to have no exploitable stock, further losses are likely to prevent the population recovering to sustainable levels.
Natural Habitats (including typical species)	When considering the target to ensure the structure and function (including typical species) of qualifying natural habitats, it is <b>not possible to conclude no adverse effect</b> on the Severn Estuary SAC.	The EA has concerns about 4 of the 7 typical fish species (Eel, Twaite and Allis Shad and Salmon) assessed. Many of these fish species' populations are currently showing signs of decline or are approaching unsustainable levels.

## Appendix 1 - Explanation of Table 1 contents

**Column A. No. of fish lost due to HPC impingement** – this represents the number of individual fish or larvae impinged on the Band & Drum screens that are not returned to the estuary alive (impingement mortality), over a 12 month period. This was calculated from the Comprehensive Impingement Monitoring Programme (CIMP) data, producing estimates for 2009/10. Except for Salmon & Sea Trout which was calculated from the Routine Impingement Monitoring Programme (RIMP) data, producing an annual mean over several years. Larvae figures could only be calculated for certain species where adequate data was available.

**Column B. No. of fish lost due to HPC entrainment** – this represents the number of individual larvae or eggs passing through the Band & Drum screens that are not returned to the estuary alive (entrainment mortality), over a 12 month period. This was calculated from survey data from 2008/9, producing estimates for 2008/9. Except for European Eel which was calculated from newly submitted survey data from 2012/13, producing estimates for 2012/13. This analysis was only completed for a handful of species where adequate data was available.

**Column C. No. of equivalent adults lost due to HPC impingement** - each fish and each larvae is assigned a value which equates to how many spawning adults it would have produced (Equivalent Adult Value (EAV)) if it hadn't been lost from the population due to impingement mortality. This was calculated from the CIMP data, producing estimates for 2009/10. Except for Salmon and Sea Trout which was calculated from the RIMP data, producing an annual mean over several years.

**Column D. No. of equivalent adults lost due to HPC Entrainment** – Each larvae and egg is assigned a value which equates to how many spawning adults it would have produced (Equivalent Adult Value (EAV)) if it hadn't been lost from the population due to entrainment mortality. This was calculated from 2008/9 survey data, producing estimates for 2008/9. Except for European Eel which was calculated from survey data from 2012/13, producing estimates for 2012/13. This analysis was only completed for a handful of species where adequate data was available.

**Column E. Total No. of equivalent adults lost due to HPC Entrapment** – this represents the sum of the previous two columns, combining the impingement estimates with the entrainment estimates to give an overall entrapment estimate. This step was not presented within the permit variation application, but is essential for us to consider the full effect of the cooling water system.

**Column F. Total tonnes of equivalent adults lost due to HPC Entrapment** – the number of equivalent adults the EA estimates would be lost due to the cooling water system, converted in to the equivalent weight in tonnes. This is done by multiplying up by the average weight of an adult. This has only been done for certain species where populations are normally assessed as the weight of the spawning stock, so a comparison can be made.

**Column G. Relevant Population** - this represents the population estimate calculated to represent the population of that species the EA predicts the cooling water system will be removing fish from (NB; this is not an estimate of the current population). The total losses in Column F are compared against this size of population to produce the proportional losses in Column H. Depending on the availability of information, different population units were used. For the marine assemblage species, this is either: ICES\*\* Spawning Stock Biomass or ICES fisheries landing estimates which are then scaled to the appropriate area to provide an estimate associated with the Bristol Channel. For the migratory assemblage and Annex II species, estimates of local rivers and estuarine populations in numbers of fish are used. Except for eels, where an estimate of the silver eel escapement from local rivers is used as per the EA's reporting to the EU.

\*\* The International Council for the Exploration of the Sea (ICES) is an intergovernmental marine science organisation, meeting societal needs for impartial evidence on the state and sustainable use of our seas and oceans.

**Column H. Annual proportional loss from the population due to HPC entrapment** – this represents the percentage of the population that could be lost every year from the population / or proxy for it. The predicted value is the EA’s best estimate of what is most likely to be lost each year. The worst case value is produced from considering all of the variation and uncertainty around estimating such a value.

**HRA Provisional Conclusion** – these represent the EA’s current proposals for the EA’s HRA conclusions at the appropriate assessment stage of the HRA process (Stage 2). This expert judgement is based on consideration of the:

- quantitative assessment and resulting figures presented in this table; and
- prevailing environmental conditions and current population status; and
- conservation objectives for the sites.

**Marine Assemblage** – The marine fish assemblage is designated as a sub feature of the Severn Estuary SAC habitat feature and a Ramsar feature. It is unique within the UK, with over 110 species listed as contributing to the designation. The EA has carried out detailed assessment of those species most at risk from the cooling water intake. For the HRA the EA has to consider the conservation objectives for these sites. For this feature the EA has to ensure that “the abundance of the notable estuarine species assemblages is maintained or increased”.

**Migratory species assemblage and/or Annex II species** - The migratory fish species – Twaite and Allis Shad, Salmon, Sea trout, Eel, River and Sea Lamprey are part of the migratory fish species assemblage for both the Severn Estuary SAC and Ramsar site. In addition Twaite Shad and River and Sea Lamprey are designated as features in their own right (Annex II qualifying SAC features of the Habitats Directive). The conservation objectives for these features include “the size of the populations of the assemblage species in the Severn Estuary and the rivers which drain into it, is at least maintained and is at a level that is sustainable in the long term”.

**Individual River Assessments** - Several rivers that drain into the Severn Estuary/Bristol Channel are designated as SACs for the fish species Allis Shad, Twaite Shad, River Lamprey, Sea Lamprey and Atlantic Salmon. As these species have a freshwater as well as marine component to their lifecycle, it is important to understand the potential impacts of any development within the estuary on the riverine SACs. Of these SACs the Rivers Wye and Usk are of concern.