Environment Agency response to SPP106: Assessment of local effects of HPC on the Hinkley Point fish assemblage

An analysis of the suite of Environment Agency (EA) technical briefs was provided by NNB GenCo (HPC) in July 2020 (BEEMS Scientific Position Paper SPP106 - Assessment of local effects of Hinkley Point C (HPC) on the Hinkley Point fish assemblage - Revision 03 HPC-DEV024-XX-000-RET-100xxx (SPP106)). SPP106 did not form part of the Applicant's submission for the WDA (EPR/HP3228XT/V004), but this paper is now being produced as part of the appeal documentation.

SPP106 compares the difference in approaches between the EA and NNB GenCo, using Atlantic cod (*Gadus morhua*) as an example and presents two 'reasonableness tests' for this species. SPP106 also provides an alternative approach to assessing effects on the local assemblage by comparing the predicted losses at HPC to Hinkley Point B (HPB) Routine Impingement Monitoring Programme (RIMP) impingement data.

SPP106 concludes that:

1. the EA has undertaken an unsuccessful approach to identify evidence of local stock identity for Atlantic cod;
2. the Equivalent Adult Value (EAV) calculation that the EA has used is inaccurate for Atlantic cod;
3. the reasonableness tests demonstrate that the EA's effects on Atlantic cod are not credible; and
4. the mitigating effects of the HPC's Low Velocity Side Entry (LVSE) intakes and Fish Recovery and Return (FRR) system coupled with the closure of HPB will result in HPC having no adverse effect on the local fish assemblage nor upon the specific qualifying fish interest features.

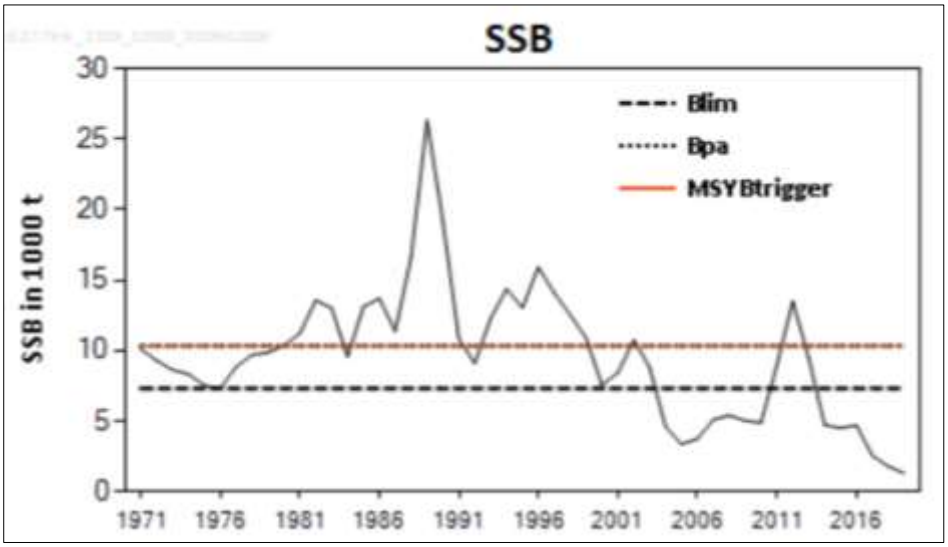
Upon analysis, the EA response summary to each point are:

1. the extensive literature review and analysis of stock identities undertaken by the EA (TB011) not only highlights significant uncertainties in the Applicant's approach but also present a credible and representative stock analysis relevant for an Environmental Impact Assessment (EIA) and Habitats Regulations Assessment (HRA) for an application in the Severn Estuary and Bristol Channel;
2. the Applicant has misinterpreted the Agency's approach to EAV calculations and can be easily explained;
3. both reasonableness tests rely on inaccurate assumptions of both how the intake structure will impact Atlantic cod stocks and the reliability of using RIMP data as a forecasting tool for HPC impacts; and
4. the EA do not agree with the level of effectiveness of the HPC embedded mitigation and the new information provided in tables 3-5 cannot be validated at this time without the supporting technical report (SPP105) and supporting data. Information in SPP106 regarding salmon and sea trout do not provide enough evidence to support a change in position. The salmon and sea trout feature impact assessments provide a detailed explanation of our position on these species.

Detailed response to each point is expressed below.

Point 1 - the EA has undertaken an unsuccessful approach to identify evidence of local stock identity for Atlantic cod

ICES data shows that the VIIe-k areas Atlantic cod stock has collapsed (see Figure 7 in TB011 and reproduced below, originally published in ICES, 2019). ICES have recommended zero catch in 2020 in ICES areas VIIe-k due to stock collapse (see TB011).



The author of SPP106 states that ICES have weighed up all stock analysis evidence for Atlantic cod and have found no weight to redefine stock areas. However as stated in TB011, ICES recognises that for Atlantic cod "*there is a very strong tendency to overestimate SSB*" (ICES, 2019). This uncertainty in SSB for Atlantic cod is not explored by the Applicant. Furthermore, TB011 highlights the risks posed by using a fisheries assessment for an EIA or HRA of an Application in the location of the Bristol Channel and Severn Estuary.

SPP106 also discredits the Agency's use of stock areas identified in Neat *et al.* (2014). One of the major challenges to the use of the results in this paper is that TB011 ignores the mixing of Atlantic cod from other areas. This is incorrect. TB011 uses the larger of the two ranges noted for Celtic Sea Atlantic cod in the paper. The paper also states that while Celtic Sea tagged Atlantic cod show complex migratory behaviours, *"but returning to roughly the same area during spawning time"* (Neat *et al.*, 2014). Further examination of Atlantic cod movements are explored in TB011. While the sample size was limited (*n*=18), tagged from the Celtic Sea (closest location to the Severn Estuary) travelled no further than around 100nm (see Figure 10 of TB011) and 66% not travelling further than 50nm. Trevose Head is around 120nm south west of the Bristol Channel.

The EA considers that despite the concerns raised in SPP106, the approach used to identify stock areas within our quantitative assessments for fish species are not considered to be overly precautious, and the evidence presented in TB011 justifies this.

Point 2 - the EAV calculation that the EA has used is inaccurate for Atlantic cod

The author of SPP106 considers that the EA have incorrectly interpreted how ICES uses values for natural mortality (M) in stock assessments in TB010, resulting in an EAV more than 5 times too large. Furthermore, the use of an SPF EAV is incompatible with ICES stock estimates.

For Atlantic cod in ICES Divisions 7.e-k (Celtic Sea), ICES use M values as follows for the population:

Natural mortality

In the assessments, natural mortality is assumed to be constant for the whole range of years and is age dependant The table below summarizes the values of M accordingly to age.

Age	0	1	2	3	4	5	6	7	8	9	10
M	1.12	0.51	0.37	0.30	0.269	0.247	0.233	0.223	0.216	0.210	0.207

From page 6 of:

http://www.ices.dk/sites/pub/Publication%20Reports/Stock%20Annexes/2016/Atlantic cod-7e–k_SA.pdf

Also used on Page 197 of:

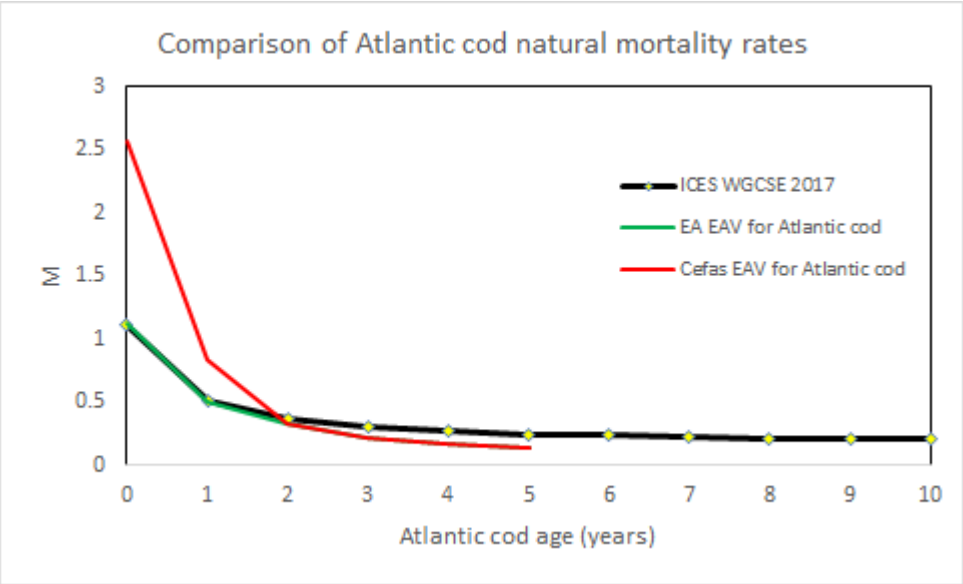
www.ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/acom/2017/WGCSE/01_wgcse_2017.pdf

These reports were the latest WGCSE report and Atlantic cod stock annex available when the WGCSE review was undertaken (probably late 2018). If an updated WGCSE report has been issued since then we would just need to check if different M values have been used. A quick search indicates that we don't think anything newer has been published yet though.

We used the same equation and values as Cefas to calculate M, but applied a greater correction factor for Age-0 and Age-1 fish M to match ICES estimates. We did not change the M values or correction factor for ages 2-5+, so they are the same as the Cefas values.

Once Cefas have seen the updated EAV excel workbooks then this should be evident as the changes are highlighted in there. The ICES M estimates are used in the calculation of the SSB and therefore as we are using a re-scaled SSB based on area, use of consistent M estimates with the ICES estimates are needed.

Comparison of M used by ICES, Cefas and the EA EAVs are below. As you can see, a closer match than the original Cefas method. As such, we consider that the critique of the EAV calculations do not warrant further concern and the original calculations we have used remain most accurate.



Following analysis of the data Cefas used to calculate natural mortality rates underpinning EAVs, for a number of the species under consideration, parameters were altered to values considered more appropriate (Dover sole, Atlantic herring, European plaice, thornback ray), For European seabass, lower mortality values have been published, which would have increased EAVs, but these were rejected upon consideration. Our consideration of appropriate mortality rates is summarised in TB010. In some cases alterations were made to other parameters involved in the EAV calculation, such as proportional maturity at age and models of length at age (also summarised in TB010).

SPP106 also states that the use of an SPF EAV is incompatible with ICES stock estimates unless both the station catch and the SSB/landings comparators are adjusted. This point was comprehensively addressed in our EAV clarification document (TB010, Appendix 1), which was supplied to the applicant but has not been referenced in SPP106. We believe the SPF is compatible with the ICES stock estimate, indeed, more so than the core method used by Cefas.

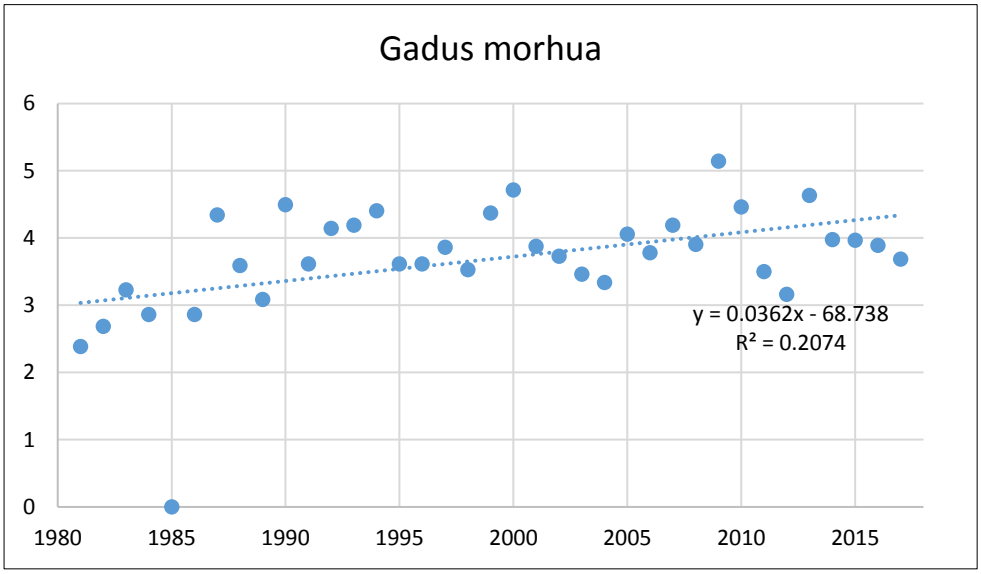
The last point relating to EAVs in SPP106 states that our method omits the effects of fishing mortality which would prevent most Atlantic cod from undertaking repeat spawning in future years

This point was also comprehensively addressed in our EAV clarification document, supplied to the applicant but not referenced in SPP106. Fishing mortality (F) is an important factor in determining how many impinged juveniles would otherwise have matured and spawned, then spawned again in successive years. The difficulties of determining an appropriate value for F were described in our EAV clarification document. We also described why it is important to consider what the impact of HPC will be in the absence of fishery mortality (F is reduced when stocks decline via adaptive fisheries management, so F = 0 represents the impact HPC could have when stocks are at their most vulnerable). It is important to note here that ICES have recommended zero take for Atlantic cod in areas VIIe-k in 2020 (if bycatch is considered F might not actually equal zero, but targeted fishing mortality would be 0).

Point 3 - the reasonableness tests demonstrate that the EA's effects on Atlantic cod are not credible

The first reasonableness test in SPP106 examines the existing HPB impingement data. Combining the EA estimated Atlantic cod mortality (for HPB) with the 'already high fishing mortality rate', the Atlantic cod stocks would have likely been pushed to stock collapse already. This would result in decreased impingement numbers at HPB. SPP106 summarises the RIMP trend analysis in TR456, that the Atlantic cod stocks have shown a significant positive trend over the period that HPB has been operational.

The use of RIMP impingement sampling data as a method for examining species losses is explored in TB019. Analyses indicate that its power of detection is limited due to the sampling methodology, which shows that losses of up to 50% of an SSB could be masked by the variability before it would be seen in the RIMP data. Furthermore, we do not agree with the trend analysis conducted in TR456, as described in TB019. The TR456 trend analysis compared the first five years and the most recent five years of the data set. Our own trend analysis appears to show an increase through time, but the variability in the data is such that there is only a weak relationship (as indicated by the R^2 value – the closer the R^2 is to 1, the better the relationship. Based on examination of the RIMP dataset, we are not able to conclude that Atlantic cod impingement has increased over time (R^2=0.21).



The second reasonableness test is to compare the predicted losses with the commercial fleet catch data. A quantitative analysis is of the combined Irish, French and UK fleet is undertaken in SPP106. The combined trawling effort is compared to the predicted losses of HPC as 'trawling effort'. There are many uncertainties in this quantitative analysis that the author of SPP106 ignores.

Firstly, SPP106 states that HPC intakes are not optimised for catching demersal Atlantic cod, as the intake are 1.5m off the seabed. But data from Cefas show that, "*the fish spent the day on the seabed and moved into the water column at night"* (Cefas, 2020). Furthermore, no evidence provided by the Applicant indicates that the fish present within the Bristol Channel are only within 1m of the seabed, juvenile or otherwise. This notion is not credible as at some points of the year, the species (made up mostly of juveniles) make up a large proportion of the total biomass of the system and as such it would be highly unusual that nearly all biomass in the Bristol Channel is to be found in a small proportion of the benthic section of the water column as they shoal. Therefore a quantitative analysis of this species in such a way cannot be supported or validated.

Point 4 – Section 2 of SPP106 proposes the mitigating effects of the HPC's LVSE intakes and FRR system coupled with the closure of HPB will result in HPC having no adverse effect on the local fish assemblage nor upon the specific qualifying fish interest features.

SPP106 provides some new information regarding predicted reductions in fish abstraction per cumec compared to HPB of 72.6%. This analysis is contained in SPP105, which was not submitted with the Application and was not submitted with the detailed calculations so we cannot properly review it. This factor also goes against the published literature which suggests that the LVSE intake head will not act as a mitigation measure on its own (see TB006). As part of the original assessment, the report "A synthesis of impingement and entrainment predictions for NNB at Hinkley Point" (Cefas, TR148, 2011) explains that "*Because of the usual high water turbidity at Hinkley Point and the consequent absence of visual clues, any mitigating effect of the low-velocity intake is only likely to be realised if it is combined with some form of artificial stimulus (e.g. an acoustic fish deterrent) to induce fish to swim away from the intake structure. Equally however, an acoustic fish deterrent is unlikely to be fully effective on its own if the intake velocity exceeds the swimming capabilities of the fish. For these reasons low-velocity intake and AFD need to be considered as a combined mitigation measure."*

The applicant has not provided any information to support a change in position in this understanding.

The new analyses also seem to be based upon the impact relative to the 'HPB effect' and/or the 'HPB and HPA effect', that we do not consider possible to discern from the RIMP dataset (see TB019). An additional consideration is that the RIMP data was collected over a period of decreasing abstraction in the Severn Estuary and therefore a decreasing pressure on fish in the estuary which may make any effect from HPA and/or HPB more difficult to see. Using the LVSE factor, derived in TB006, results in a higher impact from HPC than HPB alone contrary to that shown in SPP106. As such, we cannot conclude that there will be no adverse impact on the local fish assemblage with the reviewed information as stated in SPP106.

Conclusions for Salmon and Sea trout

SPP 106 also states that as far as we can ascertain the Environment Agency agree with the TR456 negligible effect assessment for sea trout. Our initial assessment is that we will be able to conclude no adverse effect on site integrity for sea trout. Predicted levels of impingement are similar to salmon, for which we are unable to conclude no adverse effect on site integrity.

Our background documentation (FIATs) explain how we are able to reach different conclusions given the same predicted percentage impingement – it boils down to differences in the biology and ecology of the species (most salmon spawn once then die, sea trout may repeat spawn, sea trout may be more prone to straying from their 'home' river, a large component of the trout population never migrate to sea (brown trout)).

With regards to salmon, SPP106 states that only 3 adult fish have been caught in the 37 year HPB impingement monitoring programme. These adults were kelts (adults returning to sea after spawning i.e. after making their contribution to the future SSB).

The salmon FIAT details our assessment of potential impacts for this species. TR456 records one of these as a 'returning adult' i.e. not a kelt and that is how we have treated it in our analysis. We have also included consideration of juvenile impingement, making use of a simplified EAV to do so.

Caution is needed when interpreting impingement data from HPB. No salmon were caught in any of the 40 samples collected during the one year CIMP sampling. RIMP data recorded only nine salmon over the 37-year period of the survey. However, migration of salmon smolts in rivers peaks during periods of high discharge, often at night, and seaward movements of smolts in estuaries is still primarily nocturnal and is associated with ebb tides. Atlantic salmon smolts will pass through estuaries quickly, perhaps to reduce predation risk. Smolt impingement could be missed if sampling times and dates did not coincide with these periods.

If a survey programme were to be designed to specifically examine impingement of salmon or sea trout at HPC, neither the CIMP nor RIMP would be the chosen design. Instead, sampling would be targeted at times when salmon would be expected to be migrating through the estuary. The majority of the smolt migration takes place during April and May – the two six hour RIMP monitoring periods taking place in these months represent monitoring of half the operating screens, for 0.8% of the 'gross' migration period (not accounting for times of peak migration within the wider two month period). Had a salmon-specific sampling programme taken place, the number of impinged salmon may have been higher than that recorded by the RIMP.

Hinkley Point C is scheduled to operate for sixty years. Any impact that the station has will be long-lasting, continuous over that period, and may begin when the River Severn, River Wye and River Usk populations are all categorised as being 'probably at risk'.

In 2019, the Welsh Government held an inquiry into NRW's proposed Wales Rod and Line (Salmon and Sea Trout) Byelaws 2017 and the Wales Net Fishing (Salmon and Sea Trout) Byelaws 2017. In answering an objection to the byelaw on the basis that only 1% to 2% of the spawner stock would be 'saved' by the byelaw, an expert witness from Cefas, independent from NRW, said '*every spawning fish matters*' and that ''*it's important to note that any additions to the spawning stocks are particularly valuable when stocks are at low levels. Even relatively small numbers of fish are crucial to recover stocks in as short a time as possible*'.

Although we are predicting a small percentage impact, our position of 'every spawning fish matters' for salmon is based on stock assessments, is consistent with NRW's position, and our own appropriate assessment written when considering the River Severn salmon fishery.

Referring to salmon and sea trout, the Conclusions section in SPP106 states that *'These species are so rarely impinged at Hinkley Point that it is impossible to draw any sensible conclusions on impingement trends'.* They are rarely recorded during monitoring but the monitoring programme is not designed to detect these species. Few records in a monitoring programme that is not designed and adequate to sample the species, does not provide adequate evidence to be able to conclude no adverse effect on that species in relation to the integrity of the site. This is explained in detail in the sea trout and salmon FIATs.

References

Cefas, 2020. Movements of Plaice and Cod. https://www.cefas.co.uk/publications/files/fish_movements.pdf. Accessed 15/09/2020.

ICES, 2019. Cod (*Gadus morhua*) in divisions 7.e–k (western English Channel and southern Celtic Seas). http://ices.dk/sites/pub/Publication%20Reports/Advice/2019/2019/cod.27.7e-k.pdf (accessed 11 November 2019).

Neat, F.C., Bendall, V., Berx, B., Wright, P.J., Ó Cuaig, M., Townhill, B., Schön, P.J., Lee, J. and Righton, D., 2014. Movement of Atlantic cod around the British Isles: implications for finer scale stock management. Journal of Applied Ecology, 51(6), pp.1564-1574.

SPP105 – Predicted performance of the HPC LVSE intake heads compared with the HPB intake - 2020. BEEMS Scientific Position Paper SPP105. Cefas, Lowestoft (2020).

SPP106 – Assessment of local effects of HPC on the Hinkley Point fish assemblage – 2020. BEEMS Scientific Position Paper SPP106. Cefas, Lowestoft (2020).

TB006 - Technical Brief: Low Velocity Side Entry Intake Design; effect of intake intercept area. Operations Catchment Services, Environment Agency (2020).

TB010 - Technical Brief: Converting impingement and entrainment numbers to Equivalent Adult Values and Spawning Production Foregone. The Estuarine and Coastal Monitoring and Assessment Service, National Fisheries Services and NNB HRA Team, Environment Agency and Marine Contractor, APEM LTD (2020).

TB011 - Technical Brief: Scale of assessment areas for marine fishes and assessment method comparing Sprat losses with Spawning Stock Biomass. The Estuarine and Coastal Monitoring and Assessment Service and NNB HRA Team, Environment Agency and Marine Contractor, APEM LTD (2020).

TB019 – Technical Brief: Investigation of the relationship between impingement at HPB and abstraction within the Severn Estuary and Bristol Channel. The Estuarine and Coastal Monitoring and Assessment Service and NNB HRA Team, Environment Agency and Marine Contractor, APEM LTD (2020).

TR148 – A synthesis of impingement and entrainment predictions for NNB at Hinkley Point – 2011. BEEMS Technical Report 148 Ed 2. Cefas, Lowestoft (2011).