Devon and Severn IFCA

Response to NNB Generation Company (HPC) Ltd (NNB) Pre-Application Consultation on a Development Consent Order Material Change

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1. Introduction and Scope of Response

The Inshore Fisheries and Conservation Authorities (IFCAs), including Devon and Severn IFCA (D&S IFCA), are statutory regulators. The IFCAs are responsible for the sustainable management of sea fisheries resources in English waters from baselines out to six nautical miles. D&S IFCA 's District includes waters from baselines to six nautical miles on the south and north coasts of Devon and north Somerset, and the waters of the Severn Estuary out to the median line with Wales (as shown in Figure 1). As the Hinkley Point C Project is within those boundaries, and the project may generate effects which interact with D&S IFCA's core role, it is appropriate that D&S IFCA comments on the proposals.

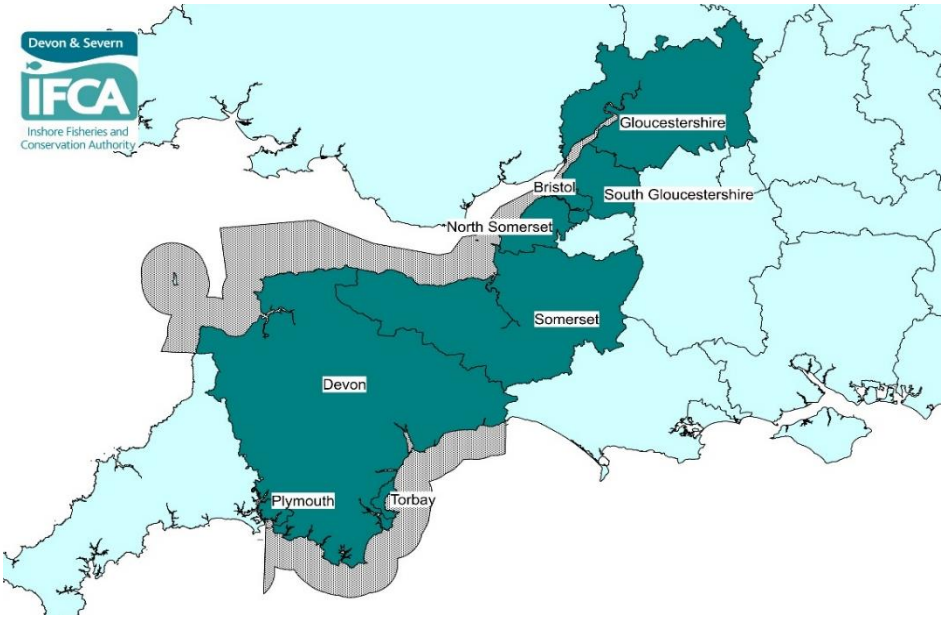

Figure 1. Map of Devon and Severn IFCA's District, showing in grey the sea area from baselines to 6nm (or the median line with Wales).

The ten regional IFCAs have a shared vision: "*Inshore Fisheries and Conservation Authorities will lead, champion and manage a sustainable marine environment and inshore fisheries, by successfully securing the right balance between social, environmental and economic benefits to ensure healthy seas, sustainable fisheries and a viable industry*."

The powers and duties of the IFCAs are provided by the Marine and Coastal Access Act (2009; the Act). The IFCAs' main legal duties are described in section 153 of the Act. They must manage the exploitation of sea fisheries resources in their Districts, balancing the social and economic benefits of exploiting the resources of sea fisheries in their Districts with the need to protect the marine environment, or help it recover from past exploitation.

Under section 154 of the Act, IFCAs must seek to ensure the conservation objectives of any MCZs in the District are furthered. IFCAs are also deemed Relevant Authorities for marine areas and EMS, under the Conservation of Habitats and Species Regulations 2017. D&S IFCA is therefore a Relevant Authority, for example, for the Severn Estuary Special Area of Conservation (SAC).

Under Section 153(2c) of the Marine and Coastal Access Act (2009) IFCAs must also take any other steps which in the authority's opinion are necessary or expedient for the purpose of making a contribution to the achievement of sustainable development when performing its duty to manage the exploitation of sea fisheries. Furthermore, the IFCA Vision includes championing inshore fisheries, which rely on healthy, sustainable inshore populations of fish.

D&S IFCA has identified the need for an Ecosystem Approach to the management of all activities in the marine environment, including consideration of marine developments in (or otherwise affecting) its District. D&S IFCA's primary role in such matters is to ensure that fisheries, fish and fish habitat are considered thoroughly and meaningfully by marine managers and developers.

Hinkley Point C (HPC) is a development occurring within D&S IFCA's District, and previous estimates have suggested that operation of HPC will result in very large annual losses of fish over the 60-year lifetime of the Project. Given the substantial evidence of potential harm to fish populations and protected sites in D&S IFCA's District, this response outlines D&S IFCA's concerns in relation to the consultation, in line with the context provided above. To set out D&S IFCA's points most clearly and with least repetition, it has not been possible to respond to individual consultation questions. However, this response relates to questions 2 – 4, and 10 – 13 of the consultation.

At several points in this response, D&S IFCA refers to the Inspector's Report (IR) to the Secretary of State on case EPR/HP3228XT/V004 – APP/EPR/573 (the WDA permit inquiry held in 2021). These references are denoted, e.g. "IR11.87" to denote a reference to section 11.87 of the IR. In addition, due to the timing of the transposition of the Habitats Directive as the Habitats Regulations, and the need to refer to Case law from before this date, D&S IFCA's response at times refers to both pieces of legislation. Therefore, for the purposes of this response, and insofar as they are equivalent in meaning, references to Articles 6(3) and 6(4) of the Habitats Directive can be understood to have the same meaning as references to regulations 63 and 64, respectively, of the Habitats Regulations. Similarly, in the context of England and Wales, references to the Natura 2000 Network may be construed as referring to the National Sites Network (NSN).

2. Availability of appropriate technologies and feasibility of the AFD

The consultation documents set out that advice received by NNB leads to the conclusion that current Acoustic Fish Deterrent (AFD) and Remotely Operated Vehicle (ROV) technology is not sufficient to enable the safe and reliable installation, operation, maintenance and repair of AFD at the HPC cooling water intakes, at least not without endangering human divers. This is the basis for NNB's proposal to remove the requirement to install AFD systems on the cooling water intake heads of HPC. However, these arguments appear to be flawed, as set out below.

In the Consultation Overview Document, NNB state that they "*have continued a process of detailed design which has included […] adoption of the latest engineering and construction techniques*". However, this does not appear to be the case for AFD or ROV technologies, despite apparently having received expert advice on the viability of such technologies.

Discussions with relevant companies reveal that NNB does not appear to have accounted for the latest engineering and technological innovations, which would allow installation, operation, maintenance and repair of functional AFD systems at the HPC cooling water intakes, and negate the need for human divers to undertake these tasks by utilising the latest developments in ROV technology. ROV technology could also be further refined between now and the newly-delayed commission dates, and during the lifetime of HPC. Some relevant information on this is summarised below.

Given that this information appears to conflict with the limited relevant evidence supplied by NNB during this consultation, it is D&S IFCA's position that between now and the submission

of the DCO material change application, the SNCBs and SoS should independently investigate the current state of applicable technologies in order to independently evaluate NNB's case for removal of the AFD, and that NNB should engage meaningfully to evaluate the suitability of new technologies.

D&S IFCA has been informed that:

(i) Since NNB worked with Fish Guidance Systems (FGS) on the Optioneering Phase of the planning of the AFD, FGS has continued to develop its systems, including the development of the Active Pressure Compensation System (APCS), specifically designed to compensate for the large tidal (and pressure) variations associated with installing and operating a system in the Bristol Channel.

(ii) The Active Pressure Compensation System constantly monitors the pressure inside the Internal Housing of the sound projector relative to the external water pressure, and automatically increases or decreases the pressure inside the sound projector to the optimum setting. The system uses a recirculating reservoir of air, thereby reducing the potential requirement to repressurise the sound projectors, as well as extending the life of the internal components of the Sound Projectors. The result is that:

(iii) service periods can be extended from the current 18 months to 24 months, or even longer, reducing the time (and cost) required to maintain the system.

(iv) APCS units have been deployed elsewhere since 2019, and so FGS have demonstratable experience of deploying and operating an APC system.

(v) FGS are in a position to work with NNB to work with NNB to demonstrate the suitability of the APCS, and could have a test system available within a timescale of several months.

(vi) FGS continues to develop and enhance its systems, and is currently upgrading the communication systems to provide enhanced communications, both internally between different system components as well as remotely, enabling real-time monitoring and operation of the systems anywhere in the world.

(vii) While the existing communication systems are suitable for long distances, over 3km, the new communication systems will provide faster and more reliable communication, enhancing the systems that could be installed on the intake heads.

With regard to ROVs, D&S IFCA have been informed that:

(i) FGS continue to discuss the maintenance of the AFD system with a number of ROV companies, and while NNB has claimed that there is nothing suitable, this has been refuted by an ROV company that continues to confirm it can provide an ROV that will be able to maintain the system, and thereby remove the need for divers to maintain the AFD and associated infrastructure.

(ii) FGS are in a position to progress the design of an ROV maintained system with NNB and an ROV company.

(iii) FGS have installed systems in other estuaries, and accept that an AFD hasn't been installed 3km offshore, and while there are challenges associated with the harsher conditions experienced in the Severn Estuary, these are primarily associated with accessing the intake heads, and maintaining position of vessels over the intake heads for service work to be completed.

D&S IFCA understands that:

(i) Other AFD and ROV developers may be available for use, but D&S IFCA has focused on the AFD systems developed by FGS due to their historic involvement with HPC, accessibility of their relevant information, and their published track record of delivering effective AFD systems in the past. D&S IFCA has no vested interest in specific AFD or ROV developers, and is simply trying to establish the facts associated with AFD feasibility.

(ii) NNB has expressed concern about the distance of the intake heads from the shore in relation to power and communication systems, yet was aware of these challenges during the optioneering phase and decision making regarding intake location.

(iii) While tidal power was considered for the AFD, NNB had decided that power would be taken from on-shore facilities.

(iv) There does not appear to be any evidence against the feasibility of installing a suitable power and communications platform close to the intake heads, and that

(v) A tried and tested power and communication hub exists with 100% redundancy built into the unit, which is intended for deployment in locations which are less accessible. With such hubs, if any issues develop it is possible for them to be switched to an internal backup system, ensuring the AFD can continue to work and reducing the need for unscheduled maintenance visits, while helping to extend the service interval of the system. This system was developed by FGS three years ago, and they have undergone extensive testing since then, culminating in 16 dual-redundant hubs deployed in a system in the Sacramento River since last autumn, which is inaccessible over the winter due to flows too high to enable divers to access the system. In the intervening time, none of the 16 hubs have had to switch to the backup system.

(vi) AFD systems can also be powered and controlled from the shore, with possibly more components underwater.

(vii) Regarding previous delivery of AFD systems, an FGS system has demonstrated 94.7% and 87.9% effectiveness in deterring herring (*Clupea harengus*) and sprat (*Sprattus sprattus*) respectively, while over 75% of sea bass (*Dicentrarchus labrax*) were deterred (Maes *et al.*, 2004). This system was developed and applied to Doel power station in 1997. Though the situation of this power station is different to that of HPC, it is understood that the technology has also advanced dramatically in the 27 years since 1997. The WDA Inquiry Inspector, at IR11.209, noted that the use of AFD in other situations has demonstrated approximate levels of deterrence of 55% for Atlantic cod and whiting, 38% for sea bass and up to 95% for herring.

(viii) Additional information regarding AFD capabilities and implications for diver safety are contained within a number of third party representations to the WDA permit inquiry, including the representation submitted by FGS, though technology may have improved since that was written.

Given that NNB has repeatedly confirmed at public meetings that the intake heads are “AFD ready”, the apparent technological advancements made by relevant companies mean that installation, operation, maintenance and repair of an appropriate AFD system remains a viable solution. Therefore, there does not appear to be a suitable case for removal of the AFD.

Also, given that this information appears to conflict with the limited relevant evidence supplied by NNB during this consultation D&S IFCA would like to reiterate its position that between now and the submission of the DCO material change application, the SNCBs and

SoS should independently investigate the current state of applicable technologies in order to independently evaluate NNB's case for removal of the AFD. For transparency, it would also be beneficial if NNB could release the "expert advice" that they have received in relation to the AFD and ROVs, and outline how this advice has accounted for the most recent advancements in such technologies following up-to-date discussions with providers.

A further point on AFD feasibility relates to the key considerations for operation of an AFD that NNB outlined in 10.3.85 of the HRA report. This includes highlighting the challenges associated with the tidal range at the site being "*more than 10m between high and low tide*", with fast current velocities "*up to 1.8 metres per second at the intake head locations*", which mean there is limited maintenance time at slack water. However, 10.3.108 shows that ROVs can already operate in velocities far exceeding these, and NNB only appear to be considering a worst-case spring tide scenario, yet the tidal range (and associated current velocities) are much lower at other points in the tidal cycle. Given the availability of appropriate back-up systems (see above) reducing the need for unscheduled maintenance, installation and maintenance could be scheduled for favourable tidal states.

In the HRA evidence report, NNB also outlines some of the risks to divers in the context of the other works required to be carried out by divers in relation to the Project. Though D&S IFCA does not have expertise in commercial diving operations, for the purpose of clarity D&S IFCA would like to outline some questions in regard to this, to better understand the constraints of AFD maintenance. For example, divers have been used to explore potential unexploded ordnance (UXO) on the seabed and to assist with recovery of objects from the seabed, in addition to other tasks. Do these operations not necessarily have greater task-associated uncertainty (e.g. in terms of object position, stability etc.) than operations taking place on a pre-designed structure like the intake heads at HPC, the dimensions and layout of which would be well-known? In addition, the AFD infrastructure would be located above the level of the seabed, whereas UXO and other objects were on the seabed; closer to the seabed, wouldn't sediment loads be expected to be higher than at the level of the AFD, therefore affecting visibility? In addition, as outlined in a third-party response to the WDA Inquiry, is it not the case that the low velocity of the intakes would negate the risk of diver tethers/umbilicals being entrained? These aspects are not clear in the consultation document, but appear to be important to the justification of the proposals.

3. Relevance of evidence (of impacts to fish) used to inform the assessments and consultation

In volume two of the PEIR (5.5.21) and section 7.7.2 of the HRA evidence report, NNB outline how "*an extensive desk-based study was undertaken looking at the numerous studies which had been conducted examining fish within the Severn Estuary and the Bristol Channel*". NNB have also recognised (PEIR volume two section 5.8.49, and HRA evidence report para. 6.2.58) that "*whilst the HPB monitoring provides a powerful tool for HPC predictions, differences between the impingement rates between HPB and HPC would be expected because of the intake designs and distribution and behaviour of fish relative to the heads*". NNB then claim that "*These considerations are factored into the assessments of effects for each fish species*".

However, it is clear that NNB have not accounted for the new data on acoustic tracking of shad in the Severn Estuary, which are known to have been made available to NNB well in advance of the consultation. Instead, in relation to diadromous fish species, the HRA

evidence report (e.g. section 7.2.9) focuses on how many diadromous fish were observed in the RIMP and CIMP sampling, without acknowledging the implications of the new shad data, while section 5.109.4 of PEIR volume two states that "*the intake is over 10 km to the south of the main channel of the Severn Estuaries, where tidal velocities are at their greatest. This means the chance of diadromous fish associated with the Rivers Wye, Usk and Severn are highly unlikely to be swimming close to the Hinkley Point C intake*".

This is the position taken by NNB at the WDA Inquiry (2021), where NNB concluded (in relation to twaite shad, Atlantic salmon and sea trout that "*The distance from the main channel and the surface migratory pattern means that none of these species would be expected to be impinged in any significant numbers at either station*." These conclusions were based on expert opinion (e.g. Simon Jennings' Statement of Case) in the absence of actual data. However, these statements are directly contradictory to the new data known to have been reported to NNB by the researchers from Swansea University.

Without accounting for these new data, NNB have failed to precisely identify the damage to the site and, as stated in C-304/05 (Commission v Italy) (paragraph 83), "*in order to determine the nature of any compensatory measures, the damage to the site must be precisely identified*". Therefore, there is currently no means for a derogation case to be considered, and the implications of the new shad data must be fully considered in the DCO material change application.

The shad data collected by Swansea University and their research partners demonstrates that twaite shad move up and down the estuary and specifically that high proportions of fish use Bridgwater Bay for feeding (Clarke *et al.*, 2023). Distribution and depth data from tagged shad indicate a higher risk of shad entrapment at the HPC intakes than at the HPB intakes (Clarke *et al.*, 2023). These patterns have been detected despite relatively short detection ranges of the acoustic receivers which collected the data from acoustic tags implanted in the fish. This has large implications for our understanding of the potential impacts of HPC cooling water intakes, and how appropriate it is to scale up HPB impingement to predict impingement at HPC.

PEIR volume two (section 5.8.18) outlines that the "scaling of impingement rates at Hinkley Point B to predict impingement at Hinkley Point C assumes that the density of fish at the location of both intakes is approximately equal and that there is a linear relationship between abstraction volume and impingement". The latter point will be dealt with below but first it is necessary to focus on the assumption that the density of fish at the location of both intakes is approximately equal.

In the HRA evidence report and elsewhere, NNB present entrapment estimates for a range of fish species and sites, while in TR592 and the other consultation documents, estimates of fish production from the different habitats are provided (TR592, Section 3), focussing particularly on the four marine species of concern at the WDA Permit Inquiry: European sea bass, Atlantic cod, whiting, and Atlantic herring.

The estimates of entrapment of all species, and subsequent calculations of compensatory habitat requirements, are based on the above assumption that the density of fish at the location of the HPC and HPB intakes is approximately equal.

However, the new shad data demonstrate that twaite shad space use in the estuary is contrary to this assumption, and contrary to the expert advice relied on at the WDA Inquiry. Twaite shad are clearly at higher risk of impingement at HPC than at HPB, meaning that the assessment of adverse effects on this species is flawed. Due to such unexpected differential

space use in the estuary, it is therefore entirely plausible that other species may also be more at risk than previously identified.

Seven species identified by the Environment Agency in their Appropriate Assessment as being of concern in relation to the removal of the AFD formed the focus of the WDA Permit Inquiry. These were the marine species European sea bass, Atlantic cod, whiting, and Atlantic herring, and the Annex II / Ramsar Criteria 4 migratory species Atlantic salmon, allis shad, and twaite shad.

Given the points made above, D&S IFCA would therefore question:

(a) whether these seven species may be considered to be at greater risk than has previously been assumed (necessitating additional precaution in assessments and degree of compensation), and

(b) whether additional species should now be scoped into Appropriate Assessment.

In IR11.81 to IR11.87, the Inspector outlined the uncertainties associated with assuming a linear (rather than a power) relationship between abstraction volume and impingement. The Inspector concluded that the significant variability of relevant findings from other stations lend some credence to the argument that adoption of a linear relationship is not a conservative approach, and that the adoption of a linear relationship can be considered a practical approach "*for quantitative assessment purposes, although some uncertainty must be accounted for in terms of potential real-world performance of an intake operating at such significantly higher flows*." This further reinforces the need for precaution in both the assessment and compensation processes.

It also seems to be implicit in the assessments that there will be no aggregating effect of the intake structures on fish; however, these structures appear likely to attract fish in the absence of an AFD, as is observed for manmade infrastructure elsewhere (Løkkeborg *et al.*, 2002; Soldal *et al.*, 2002; Wieland *et al.*, 2009; Lindeboom *et al.*, 2011; Raoux *et al.*, 2017; Fowler *et al.*, 2020; Wright *et al.*, 2020). The aggregating effect may occur to a greater degree at HPC than at HPB given the size differences between the intake structures. This further counters the assumption of equal fish densities between the two intake locations, and may cause higher entrapment of predatory fish and fish that preferentially associate with structurally complex habitats. These aspects should be accounted for in future Appropriate Assessments, the need for which is also outlined below.

4. NNB's 'Derogation Case'

Based on the available evidence, it is not clear that installation, operation, maintenance and repair of an AFD system at HPC is unviable. However, in the interests of setting out its position based on the remaining consultation documents, D&S IFCA has also considered NNB's derogation case, as outlined below.

4.1 Validity of progressing to the derogation case

As set out in the judgment of the Court in Joined Cases C-387/15 and C-388/15):

> "*In order to determine the nature of any compensatory measures, the damage to the site concerned must be precisely identified. Knowledge of those implications in the light of the conservation objectives relating to the site in question is a necessary prerequisite for the*

application of Article 6(4) of the Habitats Directive, since, in the absence of those elements, no condition for the application of that derogating provision can be assessed. The assessment of any imperative reasons of overriding public interest and that of the existence of less harmful alternatives require a weighing up against the damage caused to the site by the plan or project under consideration (see, to that effect, judgment of 14 January 2016 in Grüne Liga Sachsen and Others, C-399/14, EU:C:2016:10, paragraph 57 and the case-law cited)".

This means that Article 6(4) of the Habitats Directive can apply only after the implications of a plan or project have been analysed in accordance with Article 6(3) (supported e.g. by Case C-239/04, paragraph 35; C-258/11, paragraph 35; Case C-404/09, paragraph 109), and it is established fact that the Appropriate Assessment conducted in accordance with Article 6(3) cannot contain lacunae.

However, it is clear from the data presented in the HRA evidence report that the Appropriate Assessment is not complete, and that it contains lacunae in having not relied on the most up to date available evidence. By extension, nor has it considered the implications of that evidence. This must be rectified in the evidence considered for the DCO material change application before a derogation case can be set out.

In particular, it will be important for NNB to account for the most recent available evidence on the behaviour and geographic distribution of twaite shad that have been acoustically tagged in the Severn and nearby rivers. This point is explored in more detail in section 3, above.

Under Article 6(4) of the Habitats Directive a plan or project can only proceed provided three sequential tests are met: (1) There must be no feasible alternative solutions to the plan or project which are less damaging to the affected European site(s), (2) There must be "imperative reasons of overriding public interest" (IROPI) for the plan or project to proceed, and (3) All necessary compensatory measures must be secured to ensure that the overall coherence of the network of European sites is protected. These three steps are considered sequentially here.

4.2 "No alternative solutions"

As outlined above, it is not clear that alternative solutions are required, due to the suitability of current AFD and ROV technology to deliver the Project with a functioning AFD system in place. Even if ROV technology cannot fulfil all of the requirements, the longlist of alternative solutions does not appear to include the use of divers to, for example, investigate the integrity of AFD lifting frames and using secure attachment points to allow vessel-directed lifts of AFD for surface repair. Section 10.3.87 of the HRA evidence report outlines that removable AFD systems were considered but concluded not to be practical. No supporting evidence is provided for this assertion. This kind of evidence is important to support effective consultation and consideration of alternative solutions.

It is also important to note that case law demonstrates that there is no logic in undertaking the examination of alternative solutions if there is no conceivable IROPI. As set out below (sections 4.3 and 4.4), this appears to be the case here.

If AFD is truly not feasible following constructive engagement with designers, manufacturers and SNCBs, D&S IFCA would encourage consideration of a broader set of alternative solutions which should re-evaluate whether the proposed abstraction of cooling water still represents an application of Best Available Technology in the absence of AFD. This is likely

to be especially important after updating the Appropriate Assessment to account for the implications of the new twaite shad acoustic tracking data.

4.3 The IROPI case (1)

NNB have identified an *urgent* need for new nuclear power, and state that further delays to Project delivery would be unacceptable in that context; this forms a significant part of their IROPI case. However, in the Consultation Overview document (p. 56) section 6.2.2.1 (and elsewhere), NNB have set out that there would be 'indefinite' delays while an AFD system was developed and installed, because of no engineering precedent "*for fitting an AFD system to open water intake heads, such as those at Hinkley Point C, in waters with a comparable tidal range and currents*". This forms a significant part of the basis for NNB's IROPI case.

That same Overview document sets out how "*NNB made the decision in 2017 not to proceed with the AFD system*", and it is well known that NNB proceeded to install the intake heads (without an AFD system installed) in the tidal waters of the Severn Estuary at a time when a functional AFD was still a requirement for future HPC operation (in line with condition CW1 of the DCO).

Section 10.3.17 of the HRA evidence report outlines that "*The construction already undertaken includes the installation of the water intake heads on the seabed of the Severn Estuary*[183]". Footnote 183 in that document explains that the decision (to install the intake heads *before* receiving relevant permissions to operate the cooling water system in the absence of an AFD) "*was made in order that the commissioning of HPC could remain on schedule so that the operational phase could commence in mid-2027*", while 10.3.98 of the HRA evidence report outlines the challenges that this has caused:

> 10.3.98 First, the technical challenges associated with the installation of an AFD system (or other fish deterrent system) at this location are made more difficult now that the water intake heads have been installed (installation took place in the summer of 2022). This means that technical solutions must be bespoke to the installed infrastructure, increasing the complexity of the work and limiting options. These complexities will mean that it will take longer to design and install such a bespoke system. Overcoming these challenges would lead to indefinite delays before HPC could become operational.

NNB have therefore engineered a situation (intake heads installed on the seabed without AFD) from which they claim that subsequent installation of an AFD would cause '*indefinite delays'*, while also claiming that the Public Interest aspect of the IROPI case relies on "*clear urgent (imperative) and significant public interest reasons for approving the Project and avoiding an indefinite delay to the commissioning and operational phases of Hinkley Point C"* (6.3.4.3 of the Consultation Overview document).

If the installation of an AFD to *in situ* intake heads was clearly a known engineering challenge to NNB (as outlined above), there does not appear to be a clear good-faith reason to explain why NNB installed the intake heads on the seabed prior to receiving permission from the relevant regulators to operate those intakes without a functional AFD.

NNB appear through their own actions to have manufactured the grounds for an IROPI case; therefore, D&S IFCA does not believe that delays associated with AFD design and installation should be a material consideration in any related derogation case. This is particularly the case given that WDA Inquiry documents appear to state that NNB did not

work with AFD designers post-2017, yet in the seven years since then there were opportunities to make significant progression in system design, testing and installation to avoid Project delays.

4.4 The IROPI case (2)

As set out in 6.3.4.3 of the Consultation Overview document (and elsewhere), "*For the delivery of the Project to be 'in the public interest', there must be clear public (as opposed to private) interest associated with the delivery at a national, regional or local level, which should also be long term*" (D&S IFCA's emphasis). However, elsewhere in the consultation documents, NNB have argued that the environmental impact of the Project is not "*long term*" because it will 'only' occur over the 60-year lifetime of the Project.

If that is the case, then it is not clear to D&S IFCA how NNB can claim that the public interest associated with Project delivery is "long term", since the public gains and environmental impacts will occur over the same time scale. On the other hand, if the public interest is long term, that implies the same for the environmental impacts of operating HPC without an AFD, which changes some interpretations of the effects on site integrity. This should be reflected going forward.

Furthermore, while there may be public interest in generation of nuclear power by HPC, it is not clear that IROPI remains in specifically delivering HPC in the absence of AFD. This is especially the case given that both AFD and ROV suppliers have indicated the viability of AFD use without endangering divers (as discussed above). Residual private interests in delivering HPC in the absence of an AFD cannot be considered grounds for an IROPI case.

4.5 Compensatory measures

Step 3 of a derogation case under Article 6(4) of the Directives requires the identification, assessment and adoption of compensatory measures. Once it has been fully ascertained and documented that there are no alternatives less harmful to the site and that IROPI is justified, all compensatory measures to ensure the protection of the overall coherence of the National Sites Network must be taken. At this stage, it is not clear to D&S IFCA that NNB can justify progressing to step 3 of the derogation case, but it is considered here in light of the consultation documents.

As set out in Commission Notice 2021/C 437/01 and elsewhere, compensatory measures constitute measures specific to a plan or project, additional to the normal duties stemming from the Birds and Habitats Directives. These measures aim to offset *precisely* the negative impact of a plan or project on the species or habitats concerned. They constitute the 'last resort' and are to be used only when the other safeguards provided for by the Directives are exhausted and the decision has been taken to consider a plan/project as nonetheless having a negative impact on the integrity of a site or when such an impact cannot be excluded.

Compensation should refer to the site's conservation objectives and to the habitats and species negatively affected in comparable proportions in terms of quality, quantity, functions and status.

4.5.1 Proportionality and ecological functionality of the compensatory measures to ensure the coherence of the National Sites Network

As set out in section 6.5 of the Consultation Overview document (and elsewhere), a key component of any derogation case is that the compensatory measures are achieved in order to ensure that the overall coherence of the National Site Network is maintained. In relation to this point, NNB have quoted the following advice from Natural England and NRW in relation to ensuring overall coherence: "*We advise that compensatory measures are targeted at the designated habitats or species of the site which would be adversely affected by the project and are informed by the site's conservation objectives, the nature and extent of the adverse effects, and the contribution of the site to the FCS of the affected habitats and/or species*."

This advice is clear that the compensatory measures should specifically be targeted given the "*nature and extent of the adverse effects*" of the Project. Conversely, NNB has argued against specific targeting of measures, arguing that "the '*overall coherence'* test is a '*broad test*' and that "*As explained by the Advocate General (adviser to the Court) in a Court of Justice of the European Union case (C-521/12), the compensatory measures should offset or counterbalance the risk of harm* '*through different, positive effects with a view to, at the very least, avoiding a net negative effect (and, if possible, achieving a net positive effect) within a wider framework of some description'."*

NNB go on to argue that this means that compensatory measures used by NNB "*are not required to negate the precise nature of the risk to site integrity presented by the project or to replace through numerical equivalence every fish that will be impinged by Hinkley Point C*". Though the underlined text above may be a quote from the Advocate General in that case, it appears that the context and meaning of this wording has not been entirely understood.

While NNB have interpreted this statement as relating to the type/nature of the compensatory measures, and go on to argue that it means that integrity of the overall Estuaries feature (of which the marine fish assemblage is a sub-feature) can be maintained by improving the condition of the waterfowl and vascular plant assemblages. However, the underlined text above actually relates to the *timing* of the compensatory measures, and the implications of this for whether they should be considered as mitigation or compensation (and, by extension, whether those same measures should be considered under delivery of Article 6(3) or article 6(4) of the Habitats Directive).

Specifically, the case Briels and Others v Minister van Infrastructuur en Milieu (C-521/12) considered whether the creation of replacement (and additional) protected 'molina meadows' habitat, part of which was proposed to be destroyed by a motorway project, would constitute mitigation under Article 6(3) or compensation under Article 6(4) of the Habitats Regulations. At paragraph 31 of the judgement the Judges said "*It is clear that these measures are not aimed either at avoiding or reducing the significant adverse effects for that habitat type caused by the A2 motorway project; rather, they tend to compensate after the fact for those effects. They do not guarantee that the project will not adversely affect the integrity of the site within the meaning of Article 6(3) of the Habitats Directive*."

In that case, the court had no hesitation in distinguishing measures aimed at mitigating the harm to ensure that there was no likely significant effect on the SAC, and the provision of alternative habitat following the destruction of the originally protected area. The court ruled that such replacement habitat measures were not mitigation and amounted to 'compensation' within Article 6(4) (subject to the Article 6(4) criteria being met). This is supported by rulings for example in Case C-164/17. The same issue was considered by the

Court of Appeal in Smyth v Secretary of State for Communities [2015] EWCA Civ 174, which also ruled on the distinction between mitigation measures under article 6(3) and offsetting compensatory measures delivered under article 6(4).

Overall, it is important to recognise that the ruling in C-521/12 has a different interpretation to that provided by NNB. Paragraph 36 is key on two points here: *"[…] The assessment of any IROPI and that of the existence of less harmful alternatives requires a weighing up against the damage caused to the site by the plan or project under consideration. In addition, in order to determine the nature of any compensatory measures, the damage to the site must be precisely identified*".

Furthermore, as laid out in Commission Notice 2021/C 437/01, when considering the proportionality of compensatory measures, "*Maintaining the overall coherence of the Natura 2000 network [NSN] means ensuring that the compensatory measures proposed address the habitats and species in proportions comparable to the adverse effects caused on the site. The competent authorities must therefore determine the relative importance of the Natura 2000 features affected and the negative impacts on them according to quantitative and qualitative criteria. This sets the baseline for compensation*.".

The notice goes on to state that "*Compensation ratios are best set on a case-by-case basis. They must be initially determined in the light of the information from the Article 6(3) appropriate assessment and must ensure ecological functionality. The ratios may then be redefined according to the results observed when monitoring the effectiveness. The final decision on the proportion of compensation must be justified*"

and that

"*There is wide acknowledgement that ratios should be generally well above 1:1. Thus, compensation ratios of 1:1 or below should only be considered when it is shown that with such an extent the measures will be fully effective in reinstating structure and functionality within a short period of time (e.g. without compromising the preservation of the habitats or the populations of key species likely to be affected by the plan or project or their conservation objectives).*"

The above is supported by Defra guidance (Defra, 2021), which sets out that "*Compensatory measures must address the impact of the activity in comparable proportions depending on issues such as certainty of success, time for recovery or distance from the area of loss. Ratios can be determined on a case-by-case basis but, given the lack of evidence surrounding marine compensatory measures, ratios of 1:1 are only likely to be acceptable in exceptional circumstances in agreement with the SNCBs. As a general rule, compensation should be delivered at a ratio higher than 1:1. The application of higher ratios will increase confidence in site conservation objectives being achieved and the coherence of the MPA network maintained. All projects must be considered on a case-by-case basis in close liaison with the SNCBs. As a minimum, and depending on the project under consideration, the following factors should be considered:*

a. *The extent of the impact – the number and status of the features affected;*
b. *The environmental value and function of the affected feature;*
c. *The environmental value and function of the proposed compensatory measure;*
d. *The location of the proposed compensatory measure;*

e. How quickly compensatory measures are expected to be functioning and contributing to the network; and

f. The confidence in the measure being entirely effective and the ability for its success to be monitored and managed accordingly."

NNB have suggested (e.g. at 12.2.10 of the HRA evidence report) that compensatory measures do not have to be like-for-like and, at 12.7.12 of the HRA evidence report, have highlighted Defra's best practice guidance for compensatory measures which states that "*The underlying principle is that compensatory measures that benefit the same feature which is impacted by the development will be the most preferable […*]".

NNB's interpretation of this is that "*The 'same feature' in the case of the typical fish species assemblage, is the Estuaries qualifying habitat feature*".

Elsewhere, NNB have stated that the compensatory measures will "*benefit other aspects of the qualifying Estuaries feature such as the wildfowl species assemblage and the vascular plant species assemblage*", and argue that "*This is appropriate in this case because […] compensatory measures are not required to replace the precise numbers and species of fish impinged and also because the qualifying feature of the Severn Estuaries SAC acknowledged to be at risk from the removal of the AFD requirement is the Estuaries habitat. Accordingly, the Estuaries qualifying habitat feature is in this respect the focus of the compensatory measures approach*".

However, it is important to note that the Defra guidance sets out a 'Hierarchy Approach', stating that: "*As it will not always be possible to deliver compensatory measures in a like-for-like capacity as is accepted terrestrially, Defra has created a framework to help advisors' regulators and developers to explore and develop compensatory measures. The underlying principle is that compensatory measures that benefit the same feature which is impacted by the development will be the most preferable as they balance the damage caused by the development*".

However, the guidance continues, stating that "*Each step down the hierarchy moves away from like for like measures and therefore may decrease the certainty of success, and therefore increase the extent of compensation required. The key is to ensure the biological structure and function of the network is maintained. The more significant the impact to the protected feature or species, the more important it is that compensatory measures are developed within steps 1 and 2 of the Hierarchy of Compensatory Measures*."

There are four steps in the hierarchy, which are:

(1) Address the same impact at the same location,

(2) Address the same ecological function at a different location,

(3) Address a comparable ecological function at the same location (where "comparable" means provision of ecological functions and properties that are comparable to those that originally justified the designation, relating to a similar feature to that which will be lost), and

(4) Provide a comparable ecological function at a different location.

It is clear that compensating for other (ecologically dissimilar) components of a feature is not part of this hierarchy since those ecologically dissimilar components (e.g. vascular plant assemblage or waterfowl assemblage) do not address the same ecological functions, nor can it be ecologically justified that improving condition of waterfowl and vascular plant

assemblages will "*ensure the biological structure and function of the network*" in regard to the fish assemblage, as required by the guidance.

The main aim of compensatory measures is to maintain overall coherence of the National Sites Network. Consequently, two aspects that determine the design and implementation of compensatory measures must be addressed: proportionality and ecological functionality. These two principles set the scope and level of ambition of the measures required to compensate the plan or project's adverse effects. Compensation measures should also aim to *outweigh* the worst-case scenarios of likely adverse effects.

In order to ensure the overall coherence, the compensatory measures proposed for a project should therefore: (a) address, in comparable proportions, the habitats and species negatively affected; and (b) provide functions comparable to those which had justified the selection criteria for the original site.

D&S IFCA therefore considers it vital that NNB focuses more effort on providing compensatory measures that ensure delivery of greater than 1:1 compensation for the assemblage of fish species which has been identified as at risk of harm by the Project. This is important since, when there is no guarantee of the effective restoration or reinstatement of damaged habitats and species, compliance with Article 6(4) is not ensured. This is also important for the diadromous fish species. In particular, three of the UK's four twaite shad spawning catchments are likely to be affected by the Project, which presents a real risk not only to the integrity of individual sites, but also to the coherence of the NSN with regards to this priority species.

According to the calculations presented by NNB in TR592, the proposed compensatory habitat does not even approach the minimum 1:1 ratio, despite the context above. Instead, the proposed "compensatory" habitat is projected to offset just 15.7% of the losses (TR592, Table 4). Though NNB considers this to be a "conservative estimate", the Habitats Regulations require a precautionary approach, and D&S IFCA considers this level of ambition in offsetting to be unacceptable in any context. Further to this, this level of offset is relative only to the annual fish loss to impingement, rather than attempting to offset the equivalent adult value of the fish lost.

NNB should be aiming to offset the equivalent adult value of the fish lost at *at least* a 1:1 ratio for the additional losses due to removal of the AFD. Though the concept and application of marine net gain is less well-developed than its terrestrial counterpart, an approach that truly values the natural environment would also seek to at least offset a proportion of the other losses due to entrapment.

It has been outlined elsewhere that there are uncertainties in which species are likely to benefit from each of the habitat types, and NNB have used this to suggest that it would be too difficult to compensate precisely for those losses. However, if compensation aims to offset more than 100% of the relevant losses (as required by the 1:1 compensation ratio), then even if the offsetting effect falls short it will have a much greater offsetting effect than the current proposals. The methods used by NNB for calculating the proportion of losses offset by any future compensatory habitat proposals should also be discussed in further detail with the SNCBs and Environment Agency in order to establish the most appropriate way forward to meet the requirements of the Habitats Regulations.

4.5.2 Timing and additionality of compensation

Time is a crucial dimension in the planning of compensatory measures as they should be in place, fully operational and effective before the damage on the site occurs. While the guidance reflects that timing of measures calls for a case-by-case approach, the schedule adopted must provide continuity in the ecological processes essential for maintaining the structure and functions that contribute to the overall coherence of the NSN. This depends on issues such as the time required for habitats to develop and/or for species populations to recover or establish in a given area.

Commission Notice 2021/C 437/01 also sets out that "*other factors and processes must also be considered:*

- *A site must not be irreversibly affected before compensation is in place;*
- *The result of compensation should be operational at the time the damage occurs on the site concerned. Under certain circumstances where this cannot be fully achieved, overcompensation would be required for the interim losses;*
- *Time lags might only be admissible when it is ascertained that they would not compromise the objective of 'no net losses' to the overall coherence of the Natura 2000 network;*
- *Time lags must not be permitted, for example, if they lead to population losses for any species protected on the site under Annex II to the Habitats Directive or Annex I to the Birds Directive; priority species listed in Annex II to the Habitats Directive merit special attention."*

The notice also species that:

"Specific measures to outweigh interim losses that would occur until the conservation objectives are met may be advisable. All technical, legal or financial provisions needed to implement the compensatory measures must be completed before the plan or project implementation starts, so as to prevent any unforeseen delays that may hinder the effectiveness of the measures.

The time required for upgrading, restoring or reinstating ecological functionality depends on the biology and ecology of the habitats and species. This needs therefore to be assessed on a case-by-case basis and may require investigation or searching for evidence of restoration from similar situations.

The design and implementation of the compensatory measures must be comprehensive and scientifically sound, i.e.:

—*The conservation objectives, key features and ecological functionality to be compensated are targeted in the correct proportion.*

—*The accompanying measures required, including technical, administrative and financial, have been incorporated.*

—*The timetable for implementing the individual tasks within each measure, including provision for maintenance works and monitoring, is sufficiently detailed.*

—*The scientific basis proving the effectiveness of each compensatory measure is explained and evidenced specifically for the impact it aims to offset.*

—*The time scale for accomplishing the expected results from each of the proposed measures is stated.*

—*The prioritisation of the measures' implementation is justified based on the Conservation Objectives and scientific evidence."*

The above is supported by PINS advice note ten on HRAs, for example paragraph 3.32: "*compensatory measures should be in place and effective before the negative effect on a European site(s) could occur*" and paragraph 3.33: "*The Secretary of State […] will need to be satisfied that all necessary arrangements for securing the compensatory measures are in place before consent could be given*".

It is also supported by the NE and NRW advice to NNB (some of which is summarised on pages 687–688 of the HRA evidence report), though this advice does recognise that "*there may be circumstances where damage may occur before compensatory measures are fully functioning: for example, where measures will take a long time to become fully-functioning (e.g. re-creation of saltmarsh)*", provided that "*the necessary permissions and legal assurances to secure compensatory measures have been obtained, with the expectation being that measures are in place to ensure coherence will be restored*" .

The advice also recognises that "*Compensatory measures should be in place 'in time' to provide fully the ecological functions that they are intended to compensate for. Where delivery 'in time' is not fully achievable, compensatory packages should consider additional measures for the interim where this would serve a sound ecological function*".

There are several consequences of the above. The first is that more clarity is required for timing of compensation especially for species such as twaite shad. The NE/NRW advice appears to contradict that provided in Commission Notice 2021/C 437/01 which (as set out above) states that "*Time lags must not be permitted, for example, if they lead to population losses for any species protected on the site under Annex II to the Habitats Directive or Annex I to the Birds Directive; priority species listed in Annex II to the Habitats Directive merit special attention*".

Secondly, as outlined below, it is likely that the compensatory habitat for species of the marine fish assemblage will not be fully 'functional' prior to commissioning of HPC.

Furthermore, as a general rule, any positive effects of the future creation of a new habitat, which is aimed at compensating for the loss of area and quality of that habitat type in a protected area, are highly difficult to forecast with any degree of certainty or will be visible only in the future (see, to that effect, judgment of C-387/15 and C-388/15 and the case-law cited). In this situation, all of the relevant guidance demonstrates that time lags in delivery of operational compensation necessitate provision of additional compensatory measures for affected species. Therefore, the compensatory measures identified by NNB appear to be inadequate.

4.5.3 Is habitat limiting?

As outlined in NNB's consultation document TR592: "*The application of habitat-based compensation to offset losses from the typical fish assemblage species of the Estuaries qualifying feature of the Severn Estuary SAC is underpinned by the assumption that existing habitat is a limiting factor for fish production, and that recruitment to the system is sufficient to 'fill' any new habitat. These are reasonable assumptions for the assemblage over the longer term, and habitat restoration projects are likely to alleviate a bottleneck leading to higher biomass and overall productivity*".

NNB do not appear to provide support for these assumptions, yet this assertion (that habitat is limiting) is made in several places.

The habitats identified in the compensation package by NNB are critical coastal habitats that can support high densities of juvenile fish and invertebrates. However, there remain significant uncertainties regarding which species are enhanced via these habitats, and to what degree (zu Ermgassen *et al.*, 2021). The complex structures these habitats provide can increase survival and growth of recently settled fish and invertebrates, while juvenile fish are often found at high densities in such habitats (Lefcheck *et al.*, 2019; zu Ermgassen *et al.*, 2021). Where structured nursery habitats have been lost, habitat quality and availability may be limiting to population growth of structure-dependent species (Folpp *et al.*, 2020; zu Ermgassen *et al.*, 2021). In such cases, habitat protection, restoration or enhancement can potentially support population growth.

However, it is important to note (i) that the processes underlying density dependence in coastal and estuarine habitats remain poorly understood, making it unclear how and where additional habitat will reduce pressures on existing fish populations (Saulnier *et al.*, 2020), (ii) that these habitats are not used equally by the fish species of interest to this consultation, and (iii) that targeting structurally complex benthic habitats will provide little, if any, benefit to pelagic species with limited habitat-dependency.

Overall, it is not clear that habitat is limiting for some species, or indeed that the proposed compensatory measures are likely to support higher biomass and productivity of some of the affected marine species, particularly those with a more pelagic habit such as whiting and, to a degree, sprat and herring.

This is demonstrated by several reviews and studies on the value of coastal habitat for marine fish species (e.g. Green *et al.*, 2009; Bertelli and Unsworth, 2014; Seitz *et al.*, 2014), which suggest very limited utility of these habitats for pelagic species such as whiting and sprat. A limited role for seagrass as spawning habitat has been identified for herring, and this habitat may be used more frequently by juvenile herring (Bertelli and Unsworth, 2014). Juvenile herring and sprat have also been observed in saltmarsh habitats in relatively high numbers, though Green *et al.* (2009) noted that the sudden spring influx of herring "*was only observed in marshes on the Blackwater and Colne estuaries, as the herring spawning site, Eagle Bank* [an area of coarse pebbles, shell breccia, and gravel]*, is in the mouth of the Blackwater*" (Green *et al.*, 2009; Seitz *et al.*, 2014). This highlights the importance of considering habitat connectivity, but also some of the challenges associated with using habitat restoration to support populations of certain marine species.

Some species-habitat associations are, however, better quantified. For example, Green *et al.* (2009) found that only the common goby and the sea bass had an almost constant presence in a saltmarsh throughout the year, which supports the theory of Cattrijsse *et al.* (1994), that the common goby and sea bass could be considered the only two fish species in north west Europe to fully utilise salt marshes as nursery sites throughout the year and throughout their entire larval and juvenile stages (Cattrijsse *et al.*, 1994; Green *et al.*, 2009).

At section 5.5.44 of PEIR volume two, NNB identify that "*some species have a lower tolerance to changes in winter temperatures than to summer temperatures and therefore it is possible that higher winter temperatures will mean that some species may have to abandon fidelity to long established spawning locations which could provide a rapid reduction in the number of recruits to the estuary*".

Though the converse is also noted ("*spawning of species favouring warmer temperatures may become more prevalent, with greater numbers of juveniles recruiting to the estuary*"), a rapid reduction in the number of recruits due in part to climate change would present a situation in which (a) habitat availability is not the limiting factor, and (b) it will be important to reduce exogenous pressures on the population so as to improve resilience to such perturbations. Both indicate a need for at-source reduction in pressure on the population, such as in the form of an operational AFD at the cooling water intakes.

TR592 recognises that "*There is also the assumption that larval recruitment is not limiting […]. In years of high recruitment, creation of additional habitat may support additional production, whereas in years of low recruitment fish may make less use of the created areas.*" Taken to its logical conclusion, this situation could lead to the perverse outcome that higher impacts from cooling water abstraction could make the compensatory habitats less and less effective: high entrapment rates causing lower recruitment to habitats, meaning that fish populations get less benefit from the habitats. As this progresses, habitat becomes less limiting and recruitment becomes more limiting. This does not appear to be an acceptable possibility with regards to ensuring coherence of the NSN.

There is no adaptive management approach for HPC that would be able to respond to variation in recruits; by contrast, adaptive fisheries management relies on, and responds to, accurate stock assessments to manage fishing pressure at a level that ensures the spawning stock biomass remains above specified thresholds. For stocks known to be below such levels, adaptive management approaches can swiftly relieve fishing pressure. There is no comparable adaptive management approach for entrapment in HPC abstraction (ie. ceasing abstraction due to poor stock assessments). For related reasons, it is important that NNB's Appropriate Assessment continues to assume a fishing mortality of zero (zero F) for the relevant stocks. This is dealt with in section 6 of this response.

On a separate point, the Project proposed by NNB does not appear to be a Project that will affect fish habitat availability or quality directly but will instead affect movement to and settlement in the habitats (via entrainment removing eggs, larvae and juveniles), and (via impingement) affect movement from nursery or feeding habitats to the adult population. Continued entrapment reduces viability of habitat as a compensatory measure and this ongoing pressure on any additional production resulting from compensatory habitat should be considered as justification for 'overshooting' in terms of securing compensatory measures.

4.5.4 Restoration principles

In addition to the points raised in 4.5.3, it is not clear whether restored habitats function similarly to established habitats, and this should be quantified to inform habitat restoration and management. This is addressed in part by this response in section 4.5.2 (timing of compensatory measures) and in sections on specific compensatory measures, but it is also important to consider the context-dependence of fish-habitat interactions.

In this respect, it is important to note that concepts related to essential fish habitat do not always adequately capture context-specific pathways by which habitats support fish populations; consequently, habitat-based management actions could lead to targeting incorrect habitat for the protection of a species, particularly where those actions are based on research from different contexts to the focal system (Bradley *et al.*, 2020).

As outlined by Bradley *et al.* (2020), "*Transferring knowledge between different tidal, climatic and geomorphological zones is risky and must therefore be supported by empirical evidence. Although we may not be able to generalize our understanding of habitat relationships universally, we may be able to set meaningful, quantifiable limits on our understanding of particular predictable nearshore habitat relationships.*"

Within those limits, it is important that NNB commits not only to create and restore habitats, but aims to meaningfully compensate for impacts to fish species by establishing, restoring and maintaining the nuanced and context-dependent ecological functions that support the fish populations (Sheaves *et al.*, 2015; Bradley *et al.*, 2020).

A failure to achieve ecological functionality will likely prevent the compensatory measures proposed by NNB from having their intended effects. This is supported by NE/NRW advice to NNB, which stated that "*Compensatory measures should be in place 'in time' to provide fully the ecological functions that they are intended to compensate for*" (D&S IFCA emphasis).

The degree to which additional habitats enhance fish and invertebrate productivity can be affected by adjacent habitat quality and landscape setting (Grabowski *et al.*, 2005; Schloesser and Fabrizio, 2019; zu Ermgassen *et al.*, 2021). For example, previous research found that oyster reefs located adjacent to seagrass and salt marsh areas do not necessarily enhance juvenile fish abundances. This lack of enhancement may be due to functional redundancy of oyster reefs to adjacent habitats, or could relate to carrying capacity of existing habitats in which habitat was not the limiting factor (Grabowski *et al.*, 2005; Geraldi *et al.*, 2009). However, other studies have identified the importance of inter-habitat connectivity (e.g. Nagelkerken *et al.*, 2015).

Overall, there are substantial uncertainties as to the ecological functioning of additional habitats; these uncertainties may be reduced by targeted research; Section 5 of this response sets out some examples of how targeted research could assist in determining whether ecological functionality is being achieved. These uncertainties also necessitate additional precaution in estimates of the scale of compensatory habitat required, as outlined below.

Firstly, additional production (of fish numbers/biomass) is likely to lead to additional entrapment, due to the proximity of the compensatory habitat (or newly accessible migratory fish spawning locations) and the cooling water intakes. This is particularly the case where the intake heads interrupt the movement of individuals between spawning/nursery and adult habitats, or between foraging and other habitats (as demonstrated for example for twaite shad tagged by Swansea University, which are known to move between the Tywi and Bridgwater Bay for feeding).

Secondly, as noted in case C-521/12 (para 32) *"[…] as a rule, any positive effects of a future creation of a new habitat which is aimed at compensating for the loss of area and quality of that same habitat type on a protected site, even where the new area will be bigger and of higher quality, are highly difficult to forecast with any degree of certainty and, in any event, will be visible only several years into the future*".

D&S IFCA has provided some relevant information on this for specific habitats below, but it is important to note here that there is significant uncertainty associated with compensatory habitats and the timescale over which they will begin to support the fish assemblage to the same extent as established habitat. Fish habitat quality mediates the density dependence of fish populations and thereby determines the carrying capacity of the habitat; newly restored

habitat quality (and therefore carrying capacity) is typically lower than that of established habitat and can take many years to reach equivalence. Therefore, the scale and ambition of the proposed compensatory habitat should be much greater to account for this.

As outlined in this response, there are significant uncertainties regarding the scale of effects of the cooling water intakes on fish populations, and the effectiveness of compensatory habitats. There are also many specifics of the compensatory measures that NNB needs to decide with SNCBs prior to the DCO Material Change application. Given these uncertainties, and the consequent lack of a suitably updated Appropriate Assessment, D&S IFCA has not provided an exhaustive response in relation to the specific habitat measures at this stage, but some initial observations are included below.

These observations should be read in conjunction with the Defra guidance highlighted in section 4.5.1, which supports D&S IFCA's argument that NNB should be aiming for substantially greater compensatory habitat because "*given the lack of evidence surrounding marine compensatory measures, ratios of 1:1 are only likely to be acceptable in exceptional circumstances in agreement with the SNCBs. As a general rule, compensation should be delivered at a ratio higher than 1:1. The application of higher ratios will increase confidence in site conservation objectives being achieved and the coherence of the MPA network maintained […] As a minimum, and depending on the project under consideration, the following factors should be considered:*

a. The extent of the impact – the number and status of the features affected;

b. The environmental value and function of the affected feature;

c. The environmental value and function of the proposed compensatory measure;

d. The location of the proposed compensatory measure;

e. How quickly compensatory measures are expected to be functioning and contributing to the network; and

f. The confidence in the measure being entirely effective and the ability for its success to be monitored and managed accordingly."

(Defra, 2021)

Points (c), (d), (e) and (f) above are all directly relevant to the compensatory habitats proposed by NNB, and to the points made by D&S IFCA below.

4.5.5 Proposed saltmarsh

The HRA evidence report (section 12.5.19 onwards) discusses Pawlett Hams in the context of the timescale to ecological functionality of compensatory habitat, and is clear that the estimated time within which the saltmarsh will be achieved is hard to predict. NNB anticipate that the "*vegetation develops rapidly and fish should populate areas between two to five years following engineering works*", and acknowledge that "*Ecological functioning of created marshes has been estimated to take 15 years*", but argue that "*ecological functioning occurs at varying time scales for different trophic levels and ecological parameters*".

This section of the HRA evidence report is supported by evidence from Cwm Ivy Marsh and the managed realignment at Steart Marshes. In particular, NNB cite a study by Stamp *et al.* (2023), identifying that "*within three years of flooding, the marshes provided feeding opportunities for European sea bass, thin-lipped grey mullet, and gobies, although not to the*

same extent as established marshes". It is important to note that the study by Stamp *et al.* (2023) identified that mullet feeding rates were 16% lower on realigned sites than established sites, and sea bass feeding rates were 31% lower. Furthermore, bass diets differed significantly between established and realigned marshes, typically differing in the relative abundances of dominant prey items.

Although realigned sites can provide feeding habitats for fish, these results "*suggest that while there are similarities in fish prey availability between realigned and established saltmarshes, differences in the abundance of key prey species drive variation in feeding activity and foraging success within realigned and established saltmarsh sites*" (Stamp *et al.*, 2023).

Stamp et al. (2023) also highlight that "*Despite the common and growing use of managed re-alignment or managed retreat, it has been estimated that even after a period of 50–100 years these novel habitats do not resemble their natural/established counterparts (Garbutt et al., 2006; Mossman et al., 2012). In particular, within Northern Europe re-aligned sites often lack the biological complexity of established saltmarsh and are generally characterised by pioneer plant communities (Mossman et al., 2012). This is thought to be a result of the macrotidal environment combined with construction designs*", which should therefore be considered carefully both in terms of site design but also in terms of inferring fish production from habitats with different tidal and structural characteristics to those found or created in the Severn (Ziegler *et al.*, 2021).

Based on the evidence provided during the consultation process and the issues discussed in this response, it is not clear why NNB has concluded that approximately 340 ha of saltmarsh will be sufficient compensation. A comparable project in the United States aimed to deliver compensatory habitat at a scale more than an order of magnitude greater: in 1994 Public Service Electric and Gas of New Jersey (PSE&G), now Public Service Enterprise Group (PSEG), proposed and implemented a program to offset egg, larvae and fish losses at the cooling water intake at Salem Generating Station. The wetland restoration program used ecological engineering principles to restore approximately 4550 ha. It also protected upland buffers and other lands for a total of over 8700 ha, in addition to eight fish ladders (Balletto *et al.*, 2005).

4.5.6 Proposed native oyster reefs

The compensatory native oyster reefs are an interesting proposal. D&S IFCA recognises that in the right circumstances, this may be beneficial to some fish species, and that it will be important for NNB to learn from the range of relevant organisations outlined in the consultation documents. This process can also be assisted by engagement with aquaculturists and researchers. For example, a recent study undertook a three-round Delphi process to determine the most important factors to consider in site selection for European native oyster habitat restoration projects (Hughes *et al.*, 2023). This study guides site selection by identifying: "*a shortlist of measurable factors which should be considered; the relevant data to collect; topics for discussion in participatory mapping processes; information of interest from the existing body of local ecological knowledge; and factors underpinning supportive and facilitating regulatory frameworks*" (Hughes *et al.*, 2023). In addition, the Native Oyster Restoration Alliance (NORA) was formed by partners from science, technology, nature conservation, consultancies, commercial producers and policy-makers to develop best practice recommendations and to promote knowledge and technology

exchange. NORA members agreed on a set of joint recommendations and strongly advise that any restoration measure should respect and apply these recommendations: The *Berlin Oyster Recommendation* is presented in a paper by Pogoda *et al.* (Pogoda *et al.*, 2019).

D&S IFCA often engages with aquaculturists in its District and from further afield to discuss challenges and opportunities facing the sector. From these conversations it is clear that native oyster restoration has good potential but also a range of significant challenges that mean there is substantial uncertainty regarding whether delivery of oyster restoration can ensure coherence of the NSN is maintained.

In particular, site selection and other considerations will be key to avoid a range of disturbances and stressors, as native oysters can be difficult to grow unless the conditions are right. Though it may be possible to establish native oyster reefs there are likely to be significant challenges in conserving the reef and its associated ecological functions over the 60+ year lifetime of the Project.

Native oyster seed supply is currently a major bottleneck in scaling up habitat restoration efforts; long-term, strategic investment in research and production are needed to overcome these bottlenecks and meet restoration targets (zu Ermgassen *et al.*, 2023a). Specific demands of restoration generate additional challenges for the production of native oyster spat in a hatchery setting; for example, habitat restoration efforts may require more emphasis than commercial harvesters on broodstock genetics to maintain genetic diversity in restored populations, and in many areas there will be a need to maintain disease resistance, particularly to *Bonamia ostreae* (zu Ermgassen *et al.*, 2023b). The Bristol Channel is currently free of this particularly virulent disease, but strict biosecurity protocols would be required for introduction of native oysters to the area. These may constrain NNB's ability to source sufficient spat or broodstock. Ermgassen *et al.* (2023b) also identified that "*A key element in increasing the reliability in hatchery production is to address mass mortality events (crashes), which are widely identified as being a perpetual problem in hatchery production*", and which "*remain largely unexplained*".

As outlined in NNB's consultation documents, concerns also remain regarding the time taken for restored oyster reef to reach ecological functionality comparable to that of established healthy reefs. This relates not only to the introduction/restoration of sufficient numbers of oysters to an area but also to the development of a mixed age and size structure, resilience of individuals allowing for long-term retention of healthy stock in the habitat, colonisation of interstitial space by other biota that provide food for fish species, and self-sustaining spawning and colonisation of nearby substrate to sustain the population. Each of these areas will have challenges and opportunities, but the latter may prove difficult over the long term in the macro-tidal conditions of the Severn Estuary and Bristol Channel, unless local water movement patterns promote retention of early life stages in the vicinity of the broodstock or enable sustainable transport to otherwise suitable areas.

4.5.7 Proposed seagrass

In section 12.5.50 of the HRA evidence report, NNB states that seagrass beds are currently present within the Severn Estuary. However, the source cited for this information links to an online map which does not show seagrass present in the area. An updated information source would be useful here.

In section 12.5.54 of the HRA evidence report, a seagrass restoration project in Pembrokeshire is cited:

Timescale to Ecological Functionality

12.5.54 The estimated time for seagrass habitat to reach ecological functionality is variable and will need to be considered carefully as part of the AMMP. NNB intend to conduct feasibility and trial studies to identify areas where seagrass habitat creation will be most successful, taking a scaling up approach once suitable areas(s) are identified. Seagrass enhancement projects have been established in several locations across the UK. In 2019, Swansea University, Project Seagrass and Pembrokeshire Coastal Forum successfully planted 2 ha of seagrass bed in Dale Bay, Pembrokeshire, with evidence that plants have developed into mature clumps, expanding in density and length over time[313].

However, the relevant report that is referred to in that section states that "*Seagrass shoot density in this restoration area in Dale remains low and is not at the levels that the project had hoped to achieve by this point"* and, though "*seagrass in Dale is increasing in density and now exists throughout the restoration area*", it is also recognised that "*It will be many years until we understand the true impact of this project, this will require further work to assess the seagrass and to begin to assess its role in supporting biodiversity*."

In this and other cited projects (e.g. LIFE Recreation ReMEDIES), there is not yet any evidence available on fish community impacts. There is also limited evidence on the resilience of restored seagrass to environmental stressors, and therefore uncertainties regarding the longevity of seagrass as a functional compensatory measure. Though seagrass is known to support some fish species, and some projects have demonstrated that restoration is possible from a technical point of view, it does not appear to be a simple or reliable process, which requires significant investment and further proof of beneficial biodiversity impacts.

With this in mind, it would be beneficial if NNB could provide further evidence on these aspects, and also consider whether the scale of proposed restoration is sufficient to counter the uncertainties associated with delivery of ecological functionality through localised restoration projects.

Regarding section 11.2.10 of the PEIR volume 3, in which NNB outline issues to be considered within the assessment of seagrass restoration, D&S IFCA would suggest that these issues should be restricted to those relevant issues that directly affect fish (e.g. not coastal protection), as the documentation should focus on aspects that aren't incidental to the compensatory measures but are instead key aspects important for offsetting (compensating for) damage to the fish assemblage affected by the Project.

4.5.8 Proposed kelp

Kelp has been identified as a structured habitat that can be important for some species such as pollack and sea bass, and it can be used by cod (Jackson-Bué *et al.*, 2023). As is the case with seagrass, populations of structure-reliant, habitat-limited or demersal species may have the most to gain from this kind of habitat. However, as with the other compensatory habitats proposed, there is very limited benefit to pelagic species such as whiting, sprat and herring. Habitat is less likely to be limiting for pelagic species, which reinforces the need to install and operate an AFD.

In section 12.5.69 of the HRA evidence report, NNB refer to the Sussex Kelp Recovery Project and Sussex IFCA, which passed a byelaw protecting areas of seabed from trawling. NNB suggest in 12.5.69 that this project "*can be used to guide the approach to be taken within the Severn Estuary*". It is important to recognise that the use of mobile fishing gear is

already prohibited by D&S IFCA in English waters of the Severn Estuary, and that tidal conditions in the inner Bristol Channel preclude this kind of fishing in the vicinity of the SAC.

NNB have identified other potential areas to be targeted for kelp restoration or enhancement work, those being Morte Point and the coast around Hartland in North Devon. Under current proposals, the MCZ sites with which these areas co-locate are set to be closed to fishing with dredges. In addition, D&S IFCA analysis of inshore vessel monitoring system data and fishers' target species indicates that mobile gear is not used in the vicinity of the rocky seabed that is likely to host kelp populations in these areas. Therefore, unless other pressures on kelp have been identified, it is likely that kelp already exists in areas of the Bristol Channel where the hydrological and ecological conditions are suitable.

While D&S IFCA recognises the value of healthy kelp habitat to some fish species, and in principle supports appropriately-targeted restoration efforts, it is not clear from the consultation documents how NNB will be able to restore or enhance kelp at an ecologically meaningful scale.

In section 12.5.70 of the HRA evidence report, NNB identify that seven of the kelp forest restoration sites operated by Operation Crayweed are now self-sustaining. While these successes should be recognised and learned from, it is also important to learn from the remaining nine Operation Crayweed sites that have not had this success. Kelp restoration is clearly an uncertain approach and, in the face of this uncertainty, much research is needed to refine techniques, while the proposals for restoration should be more ambitious and appropriately geographically-targeted in order to mitigate against project failure.

5. Monitoring

D&S IFCA is encouraged by the inclusion of an adaptive monitoring and management plan (AMMP), including impingement monitoring. D&S IFCA also welcomes the opportunity to contribute to the AMMP advisory group (AMMPAG), as proposed in the consultation documents.

At 12.6.8 of the HRA evidence report, NNB outlines that the recommended impingement monitoring includes 40 x 24-hour samples per annum but, by 12.6.9 (the next paragraph), already begins to outline why this may not be feasible. NNB should commit to undertaking at least the recommended level of impingement monitoring to better understand the impacts of HPC on fish ecology, particularly given the various uncertainties associated with scaling from HPB to HPC impingement estimates (e.g. related to the location of the intake heads).

It may also be useful to consider whether additional focussed sampling effort should be undertaken during sensitive periods for given fish species. Can NNB commit to being guided on this by the proposed AMMPAG? Section 12.6.17 of the HRA evidence report goes some way towards this commitment, and also sets out more information on AMMPAG governance in 12.6.28. Can NNB clarify to what extent it will commit to following the advice of the AMMPAG, to ensure that the impingement and compensatory habitat performance are monitored and managed in line with that advice?

Furthermore, has an appropriate power analysis been undertaken in order to establish what level of monitoring would be required to (for example) reliably detect changes in impingement and establish potential impacts of HPC?

At Salem Generating Station (Balletto *et al.*, 2005), the biological monitoring program has provided data on the Estuary, and has resulted in the publications that are advancing the

knowledge about the Estuary and fish populations. This has been assisted by the operator making data available to regional agencies for studies and decision making on the use and management of the fish populations (Balletto *et al.*, 2005). Can NNB commit to similar transparency with the raw data collected, at timescales as close to real-time as possible?

Sections 12.6.17 to 12.6.20 of the HRA evidence report outline challenges and some objectives for the monitoring of the compensatory habitat measures. In their proposals, NNB appear to be proposing compensatory habitats for specific purposes, for example to provide nursery grounds to some marine fish assemblage species. The associated monitoring should be developed with these purposes in mind, rather than simply be focused on the extent and condition of the habitats themselves.

For example, a nursery habitat is an area that has higher fish density, growth and survival than other coastal and estuarine areas (Beck *et al.*, 2001; Nagelkerken *et al.*, 2015; Lefcheck *et al.*, 2019). It is also physically connected to adult habitats and thus is a major contributor to recruitment to the adult stock. Fish density alone is not a sufficient proxy for these important aspects of nursery ecology. In practice, however, habitat quality is usually assessed simply from the abundance of fish they contain: functional indicators that reveal how a habitat supports growth, survival and movement back to the adult population are often overlooked. These functional indicators can be difficult to measure but are critical to understanding the role of an area as a fish nursery. Therefore NNB should also commit to robust monitoring of these indicators to ensure that the compensatory habitats are fulfilling their intended roles.

Ongoing projects investigating the contribution of essential fish habitats to the adult stock can provide important information to guide such research. For example, D&S IFCA is collaborating on a project with the University of Plymouth, University of Essex and Ocean Ecology to develop novel tools for measuring key functional indicators of juvenile fish habitat quality, and field application of these tools to understand habitat needs of the common sole *Solea solea*.

This research, being led by Marion Lefebvre du Prey, builds on the core expertise of researchers at the Universities of Plymouth (Dr Ben Ciotti and Professor Emma Sheehan) and Essex (Dr Anna Sturrock) in molecular growth indices as indicators of habitat quality, DNA metabarcoding for diet characterisation and biogeochemical tracers for trophic and connectivity reconstruction.

For example, chemical composition of fish tissues may be used to estimate the habitat use, diet, condition and growth rate of fish across estuarine habitat mosaics and link this to variation in adult production.

The University of Plymouth (e.g. Professor Emma Sheehan, Dr Thomas Stamp) also has relevant expertise in monitoring species and habitats over large spatial and temporal scales (using underwater video, acoustic telemetry and mark-recapture) to quantify habitat use and residence time, and to inform ecosystem based management, in addition to experience in studying gut fullness and diet composition for related questions. All partners have capacity for the netting surveys required to collect samples.

D&S IFCA is also aware of other projects seeking to explore the value of restored and compensatory habitat for biodiversity, which could be built upon to deliver the evidence needs for habitats and species identified in NNB's consultation.

There is also an opportunity now to gain baseline data to contribute to our overall understanding of the use of different nursery and feeding habitats and to understand how

things may change as habitats are added to the system (including to estimate whether there is additional biomass or whether it is being redistributed). The level of ambition of monitoring and research should scale with the level of impact, which here is shown to be high.

It will also be important to establish a robust before/after research design to quantify the benefits of barrier easement, for example in terms of the number/proportion of fish passing barriers, the time taken to do so, and the energetic and fitness costs associated with barrier pass (and hence the costs ameliorated by barrier easement).

In the consultation documents, NNB has also set out potential monitoring of waterfowl, vascular plants and other wider ecosystem services associated with delivery of the compensatory habitats. Though D&S IFCA is reluctant to discourage scientific monitoring of the natural environment, this additional monitoring should not come at the expense of monitoring of the key species identified as being adversely affected by the Project, and the habitats intended to support them.

As set out elsewhere in this response, D&S IFCA's position is that improvements to the condition of the overarching Estuaries feature of the Severn Estuary SAC via the wildfowl and vascular plant assemblages cannot compensate for adverse effects to the assemblage of fish species, which provide ecologically dissimilar functions, nor can improving condition of waterfowl and vascular plant assemblages "*ensure the biological structure and function of the network*" in regard to the fish assemblage, as required in the guidance.

D&S IFCA would also like to request that NNB outline their plans for monitoring of entrainment at HPC. Though previously-available detection methods for entrained organisms were associated with large temporal data gaps, and manual destructive analysis, recent advances in imaging and deep learning allow application of a technique known as digital holography to rapidly detect fish larvae at flow rates exceeding those found in cooling water intake systems (Sanborn *et al.*, 2023).

Digital holography systems are capable of larval detection at 97% accuracy even in the presence of detritus and air bubbles (though it is not clear what impact sediment load would have on the system). Sanborn *et al.* (2023) highlight that "*These results demonstrate the potential of in situ holographic imaging for monitoring endangered larval fish species at power plant intake structures, and for high-fidelity, real-time applications in monitoring aquatic ichthyoplankton*."

ICES has set out that the forecasted stock size of cod (*Gadus morhua*) is highly dependent on the size of incoming year classes, and has recommended zero catch in the stock area surrounding HPC. Entrapment of early life stages of cod is especially problematic in this context, and increased monitoring of HPC entrainment impacts may prove beneficial for this and other species.

6. Further points

Given the short consultation period, extensive documentation and limited resources, D&S IFCA is not in a position to provide an exhaustive point-by-point commentary on all aspects of the many consultation documents. However, there are several additional points that D&S IFCA is able to note at this stage.

1) The newly available data on shad distribution in the Severn Estuary have cast serious doubt over some key assumptions in the Appropriate Assessments carried out to date. In particular, these assessments have assumed that the density of fish at

the locations of the HPB and HPC intakes is approximately equal, and therefore impingement at HPC can be predicted by scaling the impingement rates at Hinkley Point B.

This assumption is clearly wrong for twaite shad and this calls into question the relative distributions of other species. Therefore, future Appropriate Assessments should take a much more precautionary approach to consideration of impacts of entrapment on the migratory fish species as well as the assemblage of fish species. This should include additional consideration of fish species other than cod, herring, sea bass and whiting.

2) D&S IFCA understands that the Environment Agency and others will be able to comment on the weir/barrier removal and bypass proposals put forward by NNB. D&S IFCA has therefore not responded directly regarding these proposals.
3) In 12.7.22 of the HRA evidence report, NNB outline some 'direct benefits for intertidal mudflats': "*Saltmarsh promotes in-situ sediment deposition, and thereby over time increases the sediment surface elevation allowing the formation of mudflats at the lower fringe of the saltmarsh*[338]*. The removal of part of the existing sea defences at Pawlett Hams, along with the expansion of the spatial extent of saltmarsh, will therefore increase the extent of the intertidal mudflat qualifying feature of the SAC, directly benefiting this Annex I qualifying feature (which also falls within the Estuaries qualifying feature […]*".

   As highlighted above regarding the waterfowl and vascular plant assemblage, improvements to the condition of other components of the Estuaries feature should not be assumed to be able to improve the ecological function of the assemblage of fish species, except that in this case there may be measurable benefit to those fish species that use intertidal mudflats for feeding.

   However, fringing mudflats at Pawlett Hams may be deemed to affect navigability of the Parrett, for example to/from Combwich Wharf. Can NNB confirm that the benefits of additional intertidal saltmarsh will be allowed to accrue at/adjacent to Pawlett Hams, and that navigational dredging of these sediments will not be required? If navigational dredging is required, this will affect the value of this habitat.
4) PEIR volume two outlines what NNB has identified as likely significant effects on fish species. In sections 5.9.10 – 5.9.16, NNB justifies their overall (ie. community-level) assessment of sensitivity/significance and magnitude of effects, but the justification set out does not appear to be appropriate. In section 5.9.16, there is a seemingly arbitrary downgrading of the significant minor to moderate effects on the community to a minor (insignificant) effect, with no evidence provided to justify this. This should be clarified in the ES.
5) In addition, it would be beneficial for NNB to take into account the differing life histories and ecologies of the fish species when determining the likely significant effects, as some species and/or life stages may be recognised as having particular value in terms of the community, ecosystem functioning and/or foodweb stability. Recent analyses from other systems have demonstrated that a group of apparently ecologically-similar species exhibit significant differences in relative isotopic niche metrics, highlighting that trophic redundancy both within and between-species is likely to be unexpectedly limited and therefore the unsustainable removal of certain species or sizes of certain species and/or life stages could have far-reaching consequences for the ecosystems that they inhabit (Henly *et al.*, in press).

   This calls into question the text at 5.9.61 of PEIR volume two, which states that "*whilst the relative contributions of different species to each functional group may*

change, the overall functional groups of fish utilising the estuary would unlikely be impacted by the operation of Hinkley Point C with each group remaining represented by a number of species within the community." The implications of Henly *et al.* (in press) are that interannual variation in the species composition of functional groups may alter the ecological functionality, and perhaps stability, of those functional groups, because even ecologically-similar species do not necessarily provide trophic redundancy for one another.

6) Between sections 5.9.61 and 5.9.63 of PEIR volume two, NNB determine that "*the magnitude of change in relation to the assemblage structure is considered to be low, resulting in an overall effect on the Estuaries qualifying feature of minor (not significant)*." This is partly justified by NNB because species classed as 'estuarine residents' comprised a relatively small proportion of the impingement dataset, and that the dominant group was the 'marine migrants', which were composed of 'marine straggler' and 'marine juvenile' groups.
   However, the classification of marine juveniles as marine migrants makes the marine juvenile groups appear to be a transient component of the estuarine fish assemblage. In reality, this is not the case: populations of individual marine juveniles are likely to persist for months or years depending on their life histories and mortality rates, with those leaving being replaced by newcomers. Therefore, the marine juveniles are a long-term and vital component of the estuarine fish assemblage.
7) Section 3.6.2 of PEIR volume three establishes that the proposed weir works are above mean high water springs and that therefore marine ecology receptors can be scoped out of further assessment. It is not clear that this is an appropriate approach given what is known about source-sea connectivity, and the potential risk of contaminants etc during construction works impacting on marine ecology receptors. There may also be relevant cumulative/in-combination effects to consider here.
8) In 6.2.784 of the original Hinkley Point C Project Report to Inform Habitats Regulations Assessment 2011, NNB recognised 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 (AFD)[…]) to induce fish to swim away from the intake structure*" Therefore, LVSE can't be considered to be a fish protection measure. In addition, at section 2.2.6 of PEIR volume one, NNB state that "*the extent to which the LVSE design features reduce impingement in practice remains uncertain and is not agreed despite being Best Practice. The Environment Agency position is that the use of an LVSE in the absence of an AFD provides no deterrent cue, and there is no behavioural stimulus to elicit avoidance behaviours. Therefore, the Environment Agency considers that reduced intake velocities in the absence of an AFD offer no mitigation. Consequently, during the WDA Permit inquiry, both NNB and the Environment Agency applied a factor of 1.0 when scaling impingement rates at Hinkley Point B to predict impingement at Hinkley Point C*." Therefore, it is established that reduced intake velocities in the absence of an AFD provides no mitigation. Given this context, it is unclear why EDF continues to cite the low velocity intakes as fish protection measures. For example, in the online news item at https://www.edfenergy.com/energy/nuclear-new-build-projects/hinkley-point-c/news-views/hinkley-point-c-sets-out-plan-create-somerset-saltmarsh (4th January 2024), the text includes the following: "Hinkley Point C is still the first power station in the area to have any fish protection measures in place – including a fish recovery and return system and low velocity water intakes." Similar

statements are included in the consultation documents, and are misleading given the context above.

9) On page 54 of the Consultation Overview document, NNB included a factbox (with no context) that states that "*In 2022 UK fishing vessels landed 640,000 tonnes of sea fish*". Given the immediate juxtaposition, this factbox was presumably intended to contextualise the data shown in Table 11 (pages 53–54), which show the predicted number of equivalent adults and equivalent adult weight that would be lost annually through entrapment by HPC. D&S IFCA would like to take this opportunity to note that this factbox is inappropriate as context to Table 11 given the differences in scales.

   The predicted entrapment of fish at HPC (which provides no nutritional, social or economic benefit) occurs from a single fixed point in a very small area of coastline that has almost no commercial fishing, whereas the UK vessels referred to are landing fish from ICES areas spanning 3.09 million km^2, in order to source high-quality sources of protein and support over 10,000 fishers on 5,541 UK registered fishing vessels, in addition to processing and other related employment.

   At a more relevant scale, UK vessel landings into the nearest ports (Minehead and Lynmouth) totalled only 0.7 tonnes of whelk landed over 2022 (with no finfish reported), while UK vessel landings of bass, cod, herring and whiting (the species identified by NNB as being of interest to the consultation) into the four relevant nearby ports in England (Clovelly, Appledore, Bideford, and Ilfracombe; themselves between 70 – 100 km round the coast from HPC and landing fish from a broad geographic range) totalled just 6.4 tonnes of landings over 2022, which supported local small-scale fishers and communities with a first-sale value of £53,000.

   Furthermore, fishing mortality varies from year to year and can be controlled by fisheries management, with low, or zero, fishing mortality being required when fish stocks are recognised as being fished at unsustainable rates. By contrast, there is no comparable adaptive management of the abstraction required by HPC, which will also entrain vulnerable life stages of a range of fish species.

10) Section 5.8.24 of PEIR volume 2 states that: "*The exclusion of fishing mortality means that more fish are predicted to survive to maturity than would occur if some were fished. As some fish species are exploited in targeted fisheries or caught as bycatch, the application of the Environment Agency EAV-SPF extension excluding fishing mortality gives estimates of the equivalent numbers of adults lost to impingement that are precautionary. The Environment Agency EAV-SPF extension exacerbates the precaution of excluding fishing mortality ('F') as F typically increases with age in exploited stocks. In the Inspector's Report for the WDA Permit inquiry (at paragraph IR11.74), the Planning Inspector concluded that "The project will extend for 60 years, nonetheless, under the current environmental conditions and the stock strength of the relevant species, it is undoubtedly precautionary, but in my view necessary, to assume zero F". In respect of the WDA Permit inquiry outcome, F is not calculated within the assessment. However, to illustrate the level of precaution assessments can be undertaken with F included, based onthe assumption that F in the Environment Agency rescaled International Council for Exploration of the Sea('ICES') stock areas is consistent with that across the ICES stock area. In the case of species such as European seabass and Atlantic cod, accounting for F results in approximate 30 %-70 % reductions in the EAV-SPF factor, and thereby the predicted population level effects of Hinkley Point C*."

As stated by D&S IFCA in its representation to the WDA Inquiry, and by others, there are good reasons to assume zero fishing mortality (zero F) and, as identified by NNB, the Inspector concluded that "*it is undoubtedly precautionary, but in my view necessary, to assume zero F*". NNB's consultation documents are lengthy and could be shortened to the benefit of all by removing references to scenarios which contradict positions established by the Inspector, and for which there is no additional evidence to refute those positions.

As set out by D&S IFCA at the WDA Inquiry, D&S IFCA's position is that, by calculating EAVs without including fishing mortality, the assessments represent reasonable worst-case scenarios for Atlantic cod, whiting, European seabass, Atlantic herring, and the shad species, as required when taking the necessary precautionary approach to this assessment of an impact that will be continuous for sixty years. There are substantial difficulties associated with incorporating fishing mortality in the EAV calculations, either for the core or extended approach. The principal difficulty is that fishing mortality is not constant but varies from year to year, due to a range of factors including management interventions. The reason for using an EAV is to contextualise impingement losses over the whole operational life of the power station, which is expected to be around 60 years. Applying a fixed level of fishing mortality to the EAV calculation may result in impacts being overestimated in some years and underestimated in others. In terms of Habitats Regulations Assessment (HRA), a method which underestimates impacts in some years would not be consistent with the precautionary principle.

- Fishing mortality is controlled by fishery managers, such that when stocks are declining, targeted fishing pressure can be reduced or even removed. For example, ICES have recommended zero catch of cod in 2020 in the western English Channel and southern Celtic Seas to allow the species to recover. When these conditions occur, HPC impacts will continue unchanged and so we need to understand the effect that the station has under conditions of zero catch for commercial species. As such, the extended method EAV calculated using natural mortality alone, is a relevant figure to refer to in assessing the potential impact of entrapment, particularly so within the context of Habitat Regulations Assessment, as low or zero fishing mortality will occur as a result of management action taken when stocks are below levels where sustainable commercial fishery exploitation could be achieved.
- In addition to difficulties in choosing an appropriate temporal range from which to draw an estimate of fishing mortality, there are difficulties with regard to determining fishing mortality for an appropriate geographic area. Many marine fish stocks exhibit a complex meta-population structure, with species showing little population structure being the exception rather than the rule (Kerr *et al.*, 2017) - a topic the EA explored in depth in TB010 [WDA Inquiry Core Document Ref. 8.8]. Fishing mortality rates used by ICES are calculated for the entire stock area and fishing effort (and thus fishing mortality) might not be uniform across the whole of this area. If fishing effort is concentrated in an area distant from the power station under consideration, then the published value of fishing mortality may not be representative of fishing mortality on the local sub-population that is being impacted by entrapment. Fishing mortality across the Bristol Channel and Celtic Sea is not uniform with fishing pressure being lower in Division 7f compared to other areas of the

Celtic Sea, Irish Sea and North East Atlantic. Fishing effort in the Severn Estuary SAC is almost non-existent. Fishing mortality rates used for ICES stock assessments are drawn from across the whole of the stock unit, so for example from across the Irish Sea, Celtic Sea and North Sea for European seabass. Therefore, fishing mortality rates cannot be used directly from ICES stock assessments.

- Fishing mortality varies from year to year and can be controlled by fishery management, with low, or zero, fishing mortality being required when fish stocks are recognised as being fished at unsustainable rates. Consequently, EAVs calculated without including fishing mortality need to be considered when taking a precautionary approach to assessing the potential impact of a new power station over the course of its operational life.

7. Next steps

NNB have outlined that the Material Change application is expected to be submitted during Q1 2025, with a minimum 28 day period for representations to the Secretary of State for Energy Security and Net Zero. D&S IFCA would like to request that the consultation/ representation period is substantially longer than the 28 day minimum, in order to allow stakeholders to engage effectively with this process. For organisations and individuals with limited resources, full engagement with these consultations is very difficult given the volume of documentation provided by NNB, and the complexity of the relevant legislation and third-party scientific evidence that stakeholders need to consult.

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