

OFFSHORE RENEWABLES JOINT INDUSTRY  
PROGRAMME (ORJIP) FOR OFFSHORE WIND



# Summary report of stakeholder engagement (WP3)

AssESs - Assessing the extent and significance of uncertainty in offshore wind  
assessments

December 2025



# ORJIP Offshore Wind

The Offshore Renewables Joint Industry Programme (ORJIP) for Offshore Wind is a collaborative initiative that aims to:

- Fund research to improve our understanding of the effects of offshore wind on the marine environment.
- Reduce the risk of not getting, or delaying consent for, offshore wind developments.
- Reduce the risk of getting consent with conditions that reduce viability of the project.

The programme pools resources from the private sector and public sector bodies to fund projects that provide empirical data to support consenting authorities in evaluating the environmental risk of offshore wind. Projects are prioritised and informed by the ORJIP Advisory Network which includes key stakeholders, including statutory nature conservation bodies, academics, non-governmental organisations and others.

The current stage is a collaboration between the Carbon Trust, EDF Energy Renewables Limited, Ocean Winds UK Limited, Equinor ASA, Ørsted Power (UK) Limited, RWE Offshore Wind GmbH, Shell Global Solutions International B.V., SSE Renewables Services (UK) Limited, TotalEnergies OneTech, Crown Estate Scotland, Scottish Government (acting through the Offshore Wind Directorate and the Marine Directorate) and The Crown Estate Commissioners.

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- Joint Nature Conservation Committee (JNCC)

- Natural England
- NatureScot
- Royal Society for the Protection of Birds (RSPB)
- Scottish Government Marine Directorate

This report was sponsored by the ORJIP Offshore Wind programme. For the avoidance of doubt, this report expresses the independent views of the authors.

## Who we are

Our mission is to accelerate the move to a decarbonised future.

We have been climate pioneers for more than 20 years, partnering with leading businesses, governments and financial institutions globally. From strategic planning and target setting to activation and communication - we are your expert guide to turn your climate ambition into impact.

We are one global network of 400 experts with offices in the UK, the Netherlands, Germany, South Africa, Singapore and Mexico. To date, we have helped set 200+ science-based targets and guided 3,000+ organisations in 70 countries on their route to Net Zero.

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## Abbreviations

<b>AEOI</b>	Adverse Effect On Integrity
<b>AssESs</b>	Assessing the extent and significance of uncertainty in offshore wind assessments
<b>BTO</b>	British Trust for Ornithology
<b>CEF</b>	Cumulative Effects Framework
<b>DAS</b>	Digital Aerial Survey
<b>Defra</b>	Department for Environment, Food & Rural Affairs
<b>EIA</b>	Environmental Impact Assessment
<b>ESRC</b>	Economic and Social Research Council
<b>HPAI</b>	Highly Pathogenic Avian Influenza
<b>HRA</b>	Habitat Regulation Assessment
<b>JNCC</b>	Joint Nature Conservation Committee
<b>MS</b>	Microsoft

<b>NE</b>	Natural England
<b>NGO</b>	Non-Governmental Organisations
<b>NRW</b>	Cyfoeth Naturiol Cymru/Natural Resources Wales
<b>ORJIP</b>	Offshore Renewables Joint Industry Programme
<b>OWEC</b>	Offshore Wind Evidence and Change Programme
<b>OWEKH</b>	Offshore Wind Evidence and Knowledge Hub
<b>OWIC</b>	Offshore Wind Industry Council
<b>PVA</b>	Population Viability Assessment
<b>RSPB</b>	Royal Society for the Protection of Birds
<b>SNCB</b>	Statutory Nature Conservation Bodies
<b>SPAs</b>	Special Protection Areas
<b>TCE</b>	The Crown Estate
<b>UKCEH</b>	UK Centre for Ecology & Hydrology

# 1. Executive summary

This document summarises findings from stakeholder engagement undertaken within the research project *Assessing the extent and significance of uncertainty in offshore wind assessments* (AssESs). The project explores how information on uncertainty in assessments of ornithological impact is translated into decision-making in the context of a precautionary approach in the UK offshore wind industry.

Active engagement with stakeholders involved in the offshore wind ornithological assessment process, including policymakers, regulators, Statutory Nature Conservation Bodies (SNCBs), consultants, developers and academics, has been key to this project. This report summarises findings from stakeholder engagement, which included an online workshop (see Appendix 3: Stakeholder Workshop Report) and individual interviews (n=9) with representatives working in consultancies, SNCBs/public sector, and industry organisations.

On uncertainty and precaution:

- *Uncertainty* is inherent in all aspects of marine assessment. How uncertainty is propagated through Habitat Regulation Assessments (HRAs) and Environmental Impact Assessments (EIAs) is challenging and at times unclear.
- *Precaution* is assumed to integrate and adopt a 'worst case scenario' approach at all times, rather than what some interviewees referred to as a more realistic, or more likely, scenario.
- Industry representatives highlighted questions about the application of precaution in assessments as being:
  - where in the process precaution is added (and where it is scientifically justified to add precaution), and,
  - the magnitude of precaution applied.
- SNCB/public sector respondents described the importance of applying precaution in assessments to enable them to rapidly identify parts of the assessment where there may be 'adverse' impact. In these instances, parameters values can be investigated further to identify whether additional evidence can be used to better inform the values, such as seasonal and site-specific information.
- The role of consultants is crucial, but while research projects and project steering groups often involve representatives from developers, academics, regulators and SNCBs, the consultants tasked with using increasingly complicated EIA tools are those with the least involvement in their development and testing. The potential for knowledge exchanges and shadowing, and ensuring consultants have time within project budgets for training and development were highlighted as potential solutions to allow for greater understanding.
- Concerns about over-precaution being built into calculations because of multiple 'worst case scenarios' or 'precaution on precaution on precaution' accumulating throughout the assessment process were discussed, with some respondents highlighting examples of situations where they regarded the results of this approach as highly biologically implausible; sometimes these figures lead to large compensation requirements on individual projects.

- Interviewees recognise the challenges of managing uncertainty through the assessment process, but would welcome more transparency about how uncertainty is propagated through tools.
- Interviewees talked positively of adopting a change in approach to understand areas of key impact and potential concerns at more a strategic, ecosystem level rather than the current 'piecemeal' project level. It is important that new evidence is evaluated and integrated in a timely manner. The rapid pace of development in the offshore energy sector and ongoing processes of consenting offshore wind projects means acting on the best available and most recent evidence in a timely manner is important.
- Stakeholders we spoke with are keen to work together to find a constructive way forward, recognising the urgency of the climate crisis and the importance of ensuring the continued deployment and development of offshore wind as an important means to provide renewable energy sources.

## 2. Stakeholder engagement

Engagement with stakeholders is an important part of the project *Assessing the extent and significance of uncertainty in offshore wind assessments*.

In the first instance, a **half-day, online workshop** was held (December 2024), to develop shared insights on key issues, and obtain a broad understanding of challenges and barriers stakeholders face in interpreting information on uncertainty in the context of a precautionary approach. A workshop report is available separately (see Appendix 3: Stakeholder Workshop Report, December 2025).

Insights from the workshop informed follow-up engagement with a smaller number of participants, through **semi-structured interviews**. The aim of these interviews was to further explore challenges experienced by stakeholders in dealing with uncertainty, and to consider opportunities for overcoming these challenges, recognising that barriers and potential solutions to the uptake of alternative approaches will vary between stakeholders.

Participants in the workshop, and/or in semi-structured interviews, included representatives from the following organisations. We apologise if we have omitted any organisations who participated. We would like to thank everyone who generously gave their time and expertise for this study.

- Cyfoeth Naturiol Cymru/Natural Resources Wales (NRW)
- Department for Environment, Food & Rural Affairs (Defra)
- EDF Renewables
- GoBe Consultants
- HiDef Aerial Surveying
- Joint Nature Conservation Committee (JNCC)
- MacArthur Green
- Natural England (NE)
- NatureScot
- NIRAS
- Ocean Winds
- Ørsted
- RenewableUK



- Royal Society for the Protection of Birds (RSPB)
- RWE
- Scottish Government
- Scottish Renewables
- SSE
- The Crown Estate (TCE)
- UK Centre for Ecology & Hydrology (UKCEH)

## 2.1 Research methodology – semi-structured interviews

Following a stakeholder workshop in December 2024, in-depth, semi-structured interviews were held to explore the barriers and potential solutions identified at the workshop in more detail.

These interviews explored questions around:

- current organisational approaches to uncertainty and precaution
  - understandings of the application of precaution and the precautionary approach
  - the potential for alternative approaches to the current context
  - barriers to adopting alternative approaches
  - plan-level vs project-level assessments
  - differences in approaches across the UK
  - ways to better incorporate academic work into improving the process

Semi-structured interviews are widely adopted in social science, using open-ended questions to gain depth of insight about a topic. Semi-structured interviews follow an interview guide, but maintain a relatively flexible approach, allowing interviewees to draw on their expertise and experience in their responses (Clark et al, 2021). Potential interviewees were discussed with the ORJIP Project Steering Group and approached via email. In total, fourteen organisations were invited to participate, and nine organisations agreed to be interviewed (a total of thirteen interview participants, as some interviews involved two people from an organisation). Interview participants represented three broad categories of actors characterising distinct perspectives and expertise in offshore wind assessments: SNCBs and the public sector; industry (i.e. those representing developers); and consultants. All participants were provided with a project information sheet (**Appendix 1: Participant information sheet**) which included a brief overview of the project, and the likely topics for discussion.

All participants gave consent to their organisation/company being listed as having participated in the project (see list at start of Section 2) but otherwise names of participating individuals or organisations would not be used; any direct quotes in this report are attributed to their broad organisational category (see Table 1, overleaf). The research was reviewed by the Research Ethics Committee of the James Hutton Institute (ref JHI-HRE-00298-562) prior to data collection beginning.

Interviews were undertaken online from February-April 2025, and lasted approximately an hour (mean = 0:58:58 mins). Interviews were recorded in Microsoft (MS) Teams or audio-recorded, and were manually transcribed by the research team.

Interview number	Organisation
1	Industry
2	SNCB/public sector
3	Consultancy
4	SNCB/public sector
5	SNCB/public sector
6	Consultancy
7	Industry
8	SNCB/public sector
9	Consultancy

**Table 1 - Interview organisation categories**

The interview data were analysed thematically, using NVivo 12 software. The research team adopted a deductive approach, with an analysis framework based on research questions and topics raised during the stakeholder workshop (see bullet points at the start of Section 2.1). The data were manually coded against this framework. *Coding* in qualitative research refers to the analysis process whereby data are labelled and categorised, with sections of text ‘coded’ to enable the identification of key themes within the data. The flexible nature of semi-structured interviews means topics raised in response to one question can relate to different themes, and some sections of a transcript can be coded to multiple codes. The coding process thus ensures all data are analysed and interpreted through the coding framework. Interview participants were also invited to review an early copy of this report, to enable them to check for accuracy.

## 3. Research findings – interviews

This section presents the main findings from the stakeholder interviews, and is split into the following sections:

- **Section 3.1** highlights **current approaches to managing uncertainty** in the offshore marine environment. Recognising uncertainty is inherent in all aspects of an assessment, calls were made for **more transparency about how uncertainty is propagated through tools**, and for more clarity about the application of uncertainty in cumulative (including in-combination) assessments.
- **Section 3.2** discusses questions about potential overlap between understandings of **uncertainty, precaution, and the precautionary principle** across the sector and in assessment processes, and highlights the importance across the sector of understanding where, and how much, precaution has been introduced into assessment processes.
- **Section 3.3** discusses the **potential for alternative approaches** to the treatment of uncertainty, including interviewee perspectives on consideration of how **plan-based approaches** could help to reduce uncertainty in assessment processes, and the importance of ensuring cross-sector acceptance of any potential changes.

- **Section 3.4** presents some **barriers to alternative approaches for reducing uncertainty** raised during interviews. Findings emphasise **resource limitations**, and **institutional and structural barriers**, such as the rapid pace of development of the offshore wind sector, and the time taken to gather and evaluate new evidence. **Knowledge/skills and technical barriers** highlighted in our study include concern that consultants are not regularly involved in the development of tools used in assessment processes, but are the people most likely to be using such tools, emphasising the importance both **of integrating consultants within project advisory groups**, and of **providing and funding training opportunities**.
- **Section 3.5** presents themes raised about how **SNCBs across the UK's** different jurisdictions are working together to understand where there might be opportunities for greater consistency in approaches to uncertainty, while recognising that there may be ecological, environmental, or biophysical differences, or diverse policy drivers, that mean some differences will remain.
- **Section 3.6** introduces stakeholder perspectives about how to **improve the interface between science, policy and practice**, recognising the importance of coming together across sectors to discuss and debate evidence to understand its implications.

The findings from the stakeholder engagement for this project feed directly into recommendations presented in the final project report (**AssESs – Recommendations and roadmap (WP4)**, December 2025).

### 3.1 Current approaches to managing uncertainty

The offshore marine environment, and understanding of potential impacts of offshore wind developments on ornithology, is always going to be inherently uncertain, given the complexities of the environment, spatially mobile species, and the expense and risks of researching and monitoring seabird populations and the marine environment. Seabird populations are also impacted by factors such as climate change (e.g. increasing frequency and intensity of marine heatwaves), Highly pathogenic avian influenza (HPAI), and other changes in the marine environment. As such, there was widespread recognition across our study that while there is a lot of support for reducing uncertainty, there will always be some uncertainty in this area, particularly as some sources of uncertainty cannot be reduced (e.g. environmental stochasticity).

Interviewees across the sector also raised the urgency of acting on climate change and building more renewable energy sources as key in and of itself, and some wrestled with dealing with uncertainty in relation to the impacts of offshore wind on bird populations, given the additional uncertainty unfolding about the impacts of climate change on bird populations.

There is substantial complexity within current approaches, which are challenging to apply. Interviewees highlighted the importance of maintaining the quality of assessments and the provision of key information for judgements to be made about risks of developments damaging seabird populations; but there are opportunities for the current system to be simplified or streamlined. Other issues identified in our study included:

- Uncertainty is inherent in all aspects of the assessment: from baseline calculations, and the “basic step” of capturing the number of birds using an area and why (where the birds come from, their life-stage, where they breed etc.), right through to collision risk and displacement analysis, and population viability analyses. **How uncertainty is propagated through Habitat Regulation Assessments and Environmental Impact Assessments is challenging and at times unclear.**
- Consultants and industry representatives discussed concerns about over-precaution due to accounting for uncertainty in a precautionary way throughout the assessment process, which can lead to calculations that produce results that were described as non-sensical (see section 3.2).
 

*“It’s not so much about the uncertainty, which is really important to understand; it’s about the way in which understanding of uncertainty is interpreted at different stages throughout the assessment.” (interview 01 – industry)*
- One industry representative described concerns that the current system has lost sight of the purpose of Habitat Regulation Appraisals (HRAs) and Environmental Impact Assessments (EIAs) in seeking, as part of the planning process, to provide an assessment of potential risks to protected seabird populations and to Special Protection Areas (SPAs) of consenting and developing a particular offshore wind project.
- Data collected as part of the consenting process such as Digital Aerial Survey (DAS) data, are contributing towards reducing uncertainty for some parameters (e.g. flight heights) using better modelling techniques.
- Consultants follow guidance provided by SNCBs, but sometimes feel that current guidance does not do a good job at correctly reflecting uncertainty. Some of the areas where respondents expressed a desire for more advice on some topics, included the following:
  - more transparency about how uncertainty is propagated through tools;
  - which approach to take in relation to combining (or not combining) deterministic and stochastic outputs e.g. when combining displacement and collision risk;
  - how to combine outputs from different tools into a population viability assessment (PVA); what the standard error of impact is related to; and how to correctly calculate it, especially when using the Displacement Matrix;
  - concerns about the application of uncertainty in cumulative (including in-combination) assessments, when estimated impacts from other wind farms (usually historic impact assessments) do not have a measure of uncertainty associated with them;
  - advice on whether to take the mean estimate, or upper limit of variation around that mean; but taking the upper limit is considered precautionary. In some cases, there are no data

to quantify the variation, so while there is a mean estimate, there is no variation around the mean.

- Challenges also relate to uncertainty in in-combination and cumulative assessments, which have been undertaken on a project-by-project basis by separate consultancies. The result means that

*"We start off with a digital aerial survey, and we have uncertainty in those estimates. And then we've got to put those into collision risk and displacement [analyses], and try and account for the uncertainty in those. But we're fixed in the tools that we use, in the methods. Each step: the collision risk model - we have to take the SNCB advice and use the the stochLAB base package, or the Shiny app, and that gives you an estimate. You could input uncertainty into that and it gives you a standard deviation and confidence interval outwith the estimates. So that's okay. But with displacement, we either do a Displacement Matrix approach or the SeabORD, and we struggled with how to pull uncertainty through the Displacement Matrix. SeabORD does give you an estimate of uncertainty but then the problem is, when we get to the population viability assessment, how do you then combine those two sources of mortalities and their uncertainty in a correct way?" (in relation to kittiwake and gannets; Interview 09 – consultant).*

multiple consultancies are undertaking in-combination and cumulative assessments. These contain outputs without uncertainty associated with them, and therefore they may use different approaches to deal with this challenge, producing potentially different results.

- One interviewee expressed a concern that because there is so much variability within input parameters, there could be significant amounts of precision error in parameter estimates, introducing 'false precision' into modelling in the assessment process.
- SNCBs provide generic guidance, referred to by one SNCB representative as "what we would be using for the more precautionary end, although not always". All SNCBs have signed up to generic guidance. The parameters applied may impact whether the output indicates 'adverse outcome' or not (i.e. acceptable level of impact or not), which is often a starting point for detailed discussion exploring more specific evidence in more detail to identify whether more informed parameters can be used.
- There is acknowledgement that there are underlying assumptions when determining whether an impact is considered 'adverse,' and significant uncertainty exists regarding both the scale of the impact and whether it should be classified as adverse. However, the question of 'Is there an adverse impact?' is an important starting point for SNCBs to evaluate assessments. Understanding the size of uncertainty then leads to discussion about the application of precaution.
- SNCBs described encouraging applicants to consider a range of parameters (for collision and displacement), resulting in a range of estimated impacts, and then applying precaution; also

*"I think it is useful to separate uncertainty and precaution... our approach is that we understand what is a likely impact; but also how confident are we in that? ... for us the first question is 'Is there an adverse impact or not?'. [...] depending on what that uncertainty looks like, and the size of that uncertainty, we then may want to apply precaution to the advice we give on the back of that; but that's a separate step."*  
(interview 02 – SNCB/public sector)

recognising that some uncertainty is propagated through, but being able to consider those ranges and different scenarios enables them to consider what the potential impacts are.

*"We factor in how much confidence we have got in the assessment; we factor in if there are parts of the assessment that maybe haven't followed our guidance, or if there are parts where we think 'this was extra-precautionary', 'we could have done that differently', or 'we're really concerned about how they've done that'. [...] And the other things we consider as well ... we take into account what we know about a population... if the population is declining, how recent the counts are, whether we think the modelling is reflecting that trend..."*

*And then when it comes to drawing conclusions, there are some that we can clearly say that whole range is at a level where we have no adverse effect, and that's fine and we can clearly state that. Sometimes it can be the other way, that it's clearly at a level where we have got adverse effect. And we have some where the impact lies within the range predicted. But depending on where it sits within that range you could either be okay or not okay. For those we use 'unable to conclude adverse effect' and that's where it becomes a policy decision. As far as we're concerned, we're taking the science as far as we can, and at that point there is a policy-level interpretation for what that impact means..."*  
(interview 05 – SNCB/public sector)

- If an outcome is considered adverse, the SNCBs seek to identify whether there is additional evidence that could be drawn on, for example, seasonality, location, or site-specific information that could help inform whether a more appropriate input parameter could be used. Such outcomes lead to discussion among SNCBs, and with consultants.
- There can be joint responsibility across SNCBs for Special Protection Areas (SPAs), e.g. for projects in offshore Welsh waters. As such, additional layers of discussion about uncertainty and where impact assessment values lie across SNCBs frequently happen, in addition to internal discussions within a particular SNCB.

## 3.2 Precaution and uncertainty

Questions about dealing with uncertainty inevitably lead to discussions about precaution, levels of precaution, and guidance on the application of precaution in an inherently uncertain context. Issues of precaution and uncertainty are relevant at multiple stages of the offshore wind consent process, including planning, construction and operational phases. The need to adopt a precautionary approach in decision-making specifically relates to the EU Habitats Directive, and in relation to designated sites/Special Protection Areas (SPAs). The precautionary principle in policy terms is considered an approach that is "useful in managing risk in situations where there is a lack of full scientific certainty about a specific issue" (Scottish Government, 2023, pp12-13), and "assists the decision-making process in the face of a lack of scientific certainty" (Defra, 2023) (see also European Commission, 2000).

Concerns about the conflation of uncertainty and precaution were raised in the stakeholder workshop, and in talking with experts in more detail through interviews, some clearer understandings were presented.

- Uncertainty is considered more 'scientific'; an evaluation that has the potential to be discussed, understood, and with further research and/or the development of new tools, could be reduced

or resolved. Different types of uncertainty (see Searle et al, 2025) affect calculations at different stages of the assessment process.

- Precaution, or the application of the precautionary principle (as it relates the environment), is considered more legislative, driven by requirements across Europe to adopt the precautionary principle in decision-making. Precaution also includes wider aspects such as organisational risk-taking appetite, precedence, and the provision of consistent advice across SNCBs, where possible.
- Guidance about the precautionary principle and its application is provided, but there are multiple definitions and interpretations, and different perspectives on how it is implemented in practice. In-depth understanding of the precautionary principle requires specialised knowledge of environmental case law.
- Some respondents commented they did not like using the term *precaution*, or preferred to use *precaution* rather than *the precautionary principle*, as precaution and the precautionary principle are seen as being less scientific and more judgement-based than uncertainty; *precaution* is assumed to integrate and adopt a 'worst case scenario' approach at all times, rather than what some interviewees referred to as a more realistic, or more likely, scenario.
- Some SNCBs emphasised that the precautionary principle comes into consideration at the stage of understanding potential impacts.

*"There is a precautionary principle and that does require that where there is uncertainty around the magnitude of impacts on a population, there should be a precautionary approach taken [...] Probably every person you speak to has a slightly different view on exactly what that means."* (Interview 01, industry representative)

## Over-precaution

Respondents across sectors discussed issues relating to the appropriate level of precaution that should be applied to assessments, and whether *over-precaution* is currently being applied (a term which, as one interviewee highlighted, "has very different reactions whether you're in an SNCB or whether you're a developer"). People across the sector are keen to work together, recognising the challenges of different perspectives, but trying to work together to reduce emissions and mitigate the impacts of climate change through the continued development of offshore wind power.

*"There is too much precaution; too much uncertainty; and challenges around the level of acceptability of precaution."* (interview 07 – industry)

- Participants from industry and consultancies recognise the challenges faced by colleagues in SNCBs of the necessity of adopting the precautionary principle in assessments; and the



substantial responsibilities they face in trying to make decisions, especially given the large amounts of uncertainty in the offshore environment.

- SNCB/public sector interviewees were aware of criticisms of being over-precautionary, but emphasised their need to be cautious and appropriately precautionary, given the importance of decisions being made. The levels and different types of uncertainty in the offshore marine environment also mean it is possible some of the impacts of offshore windfarms could indeed be towards the upper ranges of what could be anticipated.
- If predicted impacts are precautionary, SNCB representatives described how they go back and look in more detail, to identify where the precaution has been added. While concerns are expressed about being over-precautionary, they are adding the uncertainty in a precautionary way. As such, they are 'cautious' in the advice they provide but they are not over-precautionary, and try to look for solutions.
- There was a sense that different organisations are applying "different degrees" of precaution, with SNCBs/public sector inherently more precautionary than industry and consultants. One of the consultants in our study emphasised, in relation to collision risk, that they did not want to underestimate potential impacts in their calculations, instead describing approaches adopted by industry partners as still being "*on the right side of precaution*" (interview 03 – consultant).

*"At every single stage of the process, you would take a precautionary approach, so you are effectively adding precaution on precaution on precaution on precaution all the way through the process."*  
(interview 06 – consultant)

### Considering precaution and uncertainty in assessments

- Industry representatives explained that developers feel the degree of uncertainty should be reflected in the degree of precaution applied to assessment, something which at least one of the SNCB interviewees we spoke with said they tried to do. There is uncertainty on everything, but the interpretation of uncertainty, and how it is applied in practice, remains unclear.
- Industry representatives highlighted some of the main issues in relation to the application of precaution in assessments as:
  - where in the process precaution is added (and where it is scientifically justified to add precaution), and,
  - the magnitude of precaution applied.
- Concerns from industry and consultancies relate to the tools and calculations being used in undertaking assessments, and at what stage, and at what level, precaution should be applied. One industry representative expressed concern about an 'excessive' amount of precaution being applied because of how precaution accumulates through the assessment process by the application of a precautionary approach at multiple stages through an assessment, leading to what they described as non-sensical numbers.
- Another consultant similarly described their experience where, because there is a lack of definitive data and because research findings can be contradictory (e.g. in relation to % displacement figure



estimates for a particular species), that assumption of worst-case scenarios can produce large estimates of impact, which leads to higher levels of compensation being required.

- SNCB/public sector interviewees highlighted the genuine uncertainty about the offshore environment, and their efforts to find the right balance of precaution and pragmatism. It was also noted that while there are some areas of an assessment where a more precautionary approach is taken, there are also areas where a less precautionary approach is adopted, or where precaution is removed.

*"Our approach is that we understand what is a likely impact, but also how confident are we in that?" (interview 02, SNCB/public sector)*

- One consultant felt advice was at times based on contradictory evidence, in relation to studies on which parameters should be based on. Sometimes advice might be based on individual studies with different numbers of birds (giving an example of flight speed measurements); other times, advice might be given that a parameter has been based on a study with a small sample size.
- An SNCB/public sector interviewee also raised challenges with contradictory research, highlighting how uncertainty and precaution come together in assessments through such scenarios:

*"For example, if you've got a couple of studies that are showing birds are displaced at two different rates, unless we can be quite certain that the birds are displacing at the lower rate, we would probably end up using the higher rate. And that is one of the issues that we have in interpreting evidence coming forward is how applicable is that across the board. And that's where... uncertainty and elements of precaution are built into the assessment. (Interview 05 – SNCB/public sector)*

*"We really look at precautionary principle at the end; but we also need to look at it through the process to see where it crept in, or where it is perceived to have crept in..." (interview 05 – SNCB/public sector)*

- SNCB/public sector participants indicated their main concern is whether an assessment identifies negative impacts or not; and whether those impacts are considered to create an *adverse effect on the integrity* (AEIOI) of protected sites or species populations. Recognising that uncertainty will be part of identification of those impacts (e.g. about the scale of impact); depending on the size of uncertainty, if assessments indicate an adverse effect, it is at that point that precaution might be applied to the advice given.
- One SNCB/public sector interviewee (Interview 02) described finding it helpful if assessments always take the more precautionary stance "as their starting point" to understand where impacts are clearly *not* being shown as adverse. It would be likely that for some species, using precautionary input parameters would indicate some areas of concern, and that is then where the SNCB would want to focus and look at the evidence in more detail, looking through the parameters and considering where they might be refined, or whether there is any site-specific evidence that could be used to inform decisions. Discussions would lead to consideration of what is the most

likely impact, and whether it is adverse; and thus whether precaution still needs to be applied at that point.

- SNCB/public sector respondents also highlighted encouraging applications to consider a range of parameters, which result in a range of estimated impacts. For example, SNCBs have internal discussions about how confident they are in the level of displacement or of collision that has gone into a population viability assessment (PVA); what the most appropriate displacement or collision impacts might be, and then “might veer on the more precautionary side” if there was still quite a lot of uncertainty; but they would not necessarily take precautionary outputs from one stage of the process to the next.
- One interviewee described the practice of submitting a ‘Developer’s approach’ and a ‘Scoping approach’ in assessments. Considering the high costs associated with delays in project consent and construction, there was some suggestion of resignation and acceptance toward certain requirements. This outcome is because the costs of meeting compensation demands are viewed as lower than the potential additional expenses caused by risks or delays in new developments.
- Another consultant referred to the challenges of calculating likely impacts due to displacement or collision which might result in an outcome of *adverse effect on integrity* (AEOI) when carrying out an appropriate assessment; and that by integrating a precautionary approach at every stage of the process (baseline data; assessment (displacement or collision); apportioning of that assessment to SPAs; and then, if the outcome is AEOI, apply derogation such as calculating the compensation required) the experience is that by adding precaution throughout the process, the potential outcome could result in being required to compensate for much higher populations than might even exist at a particular site.
- Another consultant we spoke with raised a concern about precedent-setting. Given the costs of potential delays, if developers do agree to a precautionary approach being adopted in relation to a site in the context where it will be unlikely to cause problems for a project (and for example, agree to the use of a particular model for assessing compensation), that agreement could set a precedent leading to potential problems for subsequent projects.
- Some of the challenges of the consideration of uncertainty and the application of precaution relate to cumulative impact assessments. Given the continued expansion of UK offshore wind developments, if precaution continues to be applied using a similar approach, there is a possibility that outcomes predict an impact on population sizes multiple times larger than specific species populations, making the current system unfeasible into the future.

*“There might be half a bird that takes you over the cumulative limit and therefore you have to provide compensation. Maybe that’s an extreme example, but you have to be able to take a more pragmatic approach” (Interview 06 - consultant)*

Specific concerns raised by some of the people we spoke with included:

- A call for more clarity on how uncertainty is propagated through current assessments.

- A sense that the Displacement Matrix is 'crude' and by using mean seasonal peak abundance, overestimates displacement effects. There was a suggestion instead to adopt the mean seasonal abundance. However, the Displacement Matrix tool was also felt by some interviewees to be more transparent (and simpler) to use and interpret, in regard to its treatment of uncertainty.
- Being required to use the upper confidence interval (e.g. of seabird density) when applying a precautionary approach, which leads to outputs that seem highly precautionary.
- In-combination assessments, particularly if they have included application of the precautionary mortality and displacement rates for every wind farm, can lead to outcomes that are considered highly unlikely in assessments.
- Presenting applications that reflect 'figures and a range' but feeling SNCBs prefer adoption of upper confidence intervals and maximum displacement levels, rather than mean or median figures.
- Advice on how to undertake impact assessments not correctly reflecting uncertainty.
- A sense of 'false precision' with concern that there is a focus on the mean input parameter values that may have bias.
- One interviewee highlighted that SeabORD was considered highly sophisticated and complex, which is important for research and to explore different scenarios, but raised questions about its appropriateness for assessments and calculations for compensation requirements.

"There's so much that doesn't seem to make sense in the system, somebody could do with pragmatically going through it and agreeing where these more non-sensical elements lie and agreeing a position, whilst also obviously protecting really key habitats." (Interview 06 - consultant)

### 3.3 Potential for alternative approaches to be adopted

Stakeholders across sectors indicated support for alternative approaches to the treatment of uncertainty, especially if alternative approaches could reduce complexity in the assessment process, and/or introduce more pragmatism into the system, while still protecting bird species and populations. One SNCB/public sector interviewee (interview 08) commented that, while there is "no perfect solution ready to present itself", there is space for "innovative, practical and creative ways to look into uncertainty" and for simplifying processes to focus on what matters most for progressing low impact, sustainable, renewable energy.

Participants recognised it could be challenging to introduce changes, not least because of the continued rapid expansion of offshore wind and the numbers of projects currently in the assessment process, but also because of the need to ensure that there is widespread acceptance and understanding across stakeholders about how and when any changes to current approaches should be implemented. Some interviewees also emphasised challenges inherent in introducing and adopting alternative ways of doing things, recognising limitations of budgets and legislative structures, and training and skills needs.

- Many interviewees indicated a change in approach would be helpful given the increasing numbers of offshore wind projects and anticipated future challenges in relation to calculations for

cumulative assessments, as well as given contexts where windfarms are likely to be implemented in areas affecting SPAs relevant for multiple SNCBs.

- Some interviewees emphasised opportunities for change for example, through adopting a different approach for future leasing rounds, thereby minimising risks to projects currently in the assessment process. The timing of any changes would be key, noting that such marine planning should be undertaken ahead of leasing rounds, prior to leases being issued and applications being submitted.
- A number of interviewees, particularly from industry representatives and consultancies, called for a more pragmatic approach to dealing with uncertainty in assessments to be taken, noting the complexity of current systems, but emphasising the importance of still ensuring high-quality assessments and the availability of key information to support decision-making.
- One suggestion to avoid the accumulation of precaution through an assessment process was to adopt the 'most likely scenario' (or a measure of central tendency) at each stage, with a precautionary interpretation of the outputs (e.g. from the Population Viability Analysis) at the end of the process.
- A consultant suggested asking "how realistic are your estimates?" rather than "is this precautionary or not?" (interview 09). Whether estimates are 'realistic' would still ultimately relate to a discussion of levels of uncertainty, but would avoid situations where impacts are potentially overestimated by adoption of a precautionary approach at multiple stages.
- Industry representatives raised the importance of understanding what is happening at the

*"I think dealing with uncertainty and precaution outside of the EIA or HRA process for an individual project will be much more fruitful exercise than having arguments again and again on what sort of modelling should have been undertaken, or how surveys should have been designed, or so on. Because those things are very project specific and time bound, and they don't necessarily relate to how wider ecosystems work and emerging trends in the area, which can only really be considered at a strategic level."* (interview 07 – industry)

**ecosystem level**, rather than the project-by-project level, to enable better oversight of the whole ecosystem, rather than time-bound or project-specific HRAs or EIAs.

- Participants from across sectors suggested holding a workshop to bring stakeholders together to try and resolve challenges around uncertainty and precaution. Such a workshop might be similar in format or approach to the recent workshop on displacement of seabirds with the intention of updating guidance (hosted by NatureScot and the Scottish Government's Scottish Marine Energy Research (ScotMER) programme), followed by regular reviews, to keep driving knowledge forward and creating understanding of potential solutions, or of key areas to target, rather than letting things stagnate. The role of SNCBs in building on outputs of such a process would be crucial, given their role in the assessment processes.

There was broad support from interviewees across the sector that a move to a **plan-based approach** would be beneficial, particularly in relation to consideration of cumulative and in-combination impacts, for understanding which projects might have the biggest impacts, and how these can be addressed at scale. As one SNCB/public sector interviewee (interview 05) commented: "it's having that ability to take a step

back, and build in some perspective” rather than having multiple projects and different actors interpreting guidance differently, and ‘piecemeal’ work to address biodiversity impacts.

- Participants recognise that some plan-based work is already being undertaken, for example, The Crown Estate in England and Wales implemented a (desk-based) plan-level HRA for Leasing Round 4<sup>1</sup>, which gave early indication of potential adverse effects of developments on kittiwake. This assessment was not felt to resolve different outcomes from nature perspective. Impacts were left to the project-level assessment, and project-level mitigation (including compensation) requirements remain. Such an approach, even though it had limitations, was helpful in enabling SNCBs to give advice e.g. on individual project designs.
- Scotland adopts a National Marine Plan and has a Sectoral Marine Plan for offshore wind energy<sup>2</sup> (currently undergoing review). While sectoral marine planning can use submitted application assessments to inform its own process, timing often does not allow for overlap with submission of all expected project applications at each review period. Consequently, plans are subject to review, refinement and revision as rounds for offshore wind progress.
- Adopting a plan-level approach would potentially ensure strategic, overview-level knowledge for all vulnerable bird species, balancing responsibilities away from individual developers, and enable understanding and action at a more strategic level.
- It was recognised that a plan-level approach would require a better understanding of baselines, and would still require project-level assessments and actions, but was felt to offer opportunities for better dealing with uncertainty.
- A plan-level approach could:
  - Improve knowledge about potential adverse impacts on key habitats and species, and at an earlier stage, thereby enabling more strategic level approaches to compensation plans to be implemented (including what is required, for which species, and in what regions) and lowering the risks on individual projects. Such knowledge would for example, lead to upfront agreement of which e.g. critical bird species are going to be for a project, enabling stakeholders to work together to resolve concerns.
  - Improve marine spatial planning through ensuring developments are only planned in areas where there is low risk to birds and bird populations.
  - Ensure upfront agreement of critical bird species for individual projects to consider.
  - Enable uncertainty in relation to compensation to be dealt with in a more strategic way.
  - Help with issues in relation to cumulative uncertainty, with developers feeding in individual levels of impact into that cumulative amount (current calculations are based on previous applications, which may not reflect as-built numbers).
  - Help provide a meaningful in-combination assessment, one of the challenging areas for current assessments, potentially enabling SNCB staff resources to be focused more comprehensively on providing advice on other parts of the assessment processes.

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<sup>1</sup> <https://www.thecrownestate.co.uk/our-business/marine/round-4-plan-level-habitats-regulations-assessment>

<sup>2</sup> <https://www.gov.scot/publications/sectoral-marine-plan-offshore-wind-energy/>

- Understand impacts on birds at a higher level, using the same processes, but leaving more detail to be applied at the project level as needed.
- Potentially result in changes to project-level requirements (e.g. less detail might be necessary across all receptors, or there might be less uncertainty for some receptor), although these requirements might also be more specific or detailed (e.g site-specific issues that might need to be considered more; understanding of assumptions made at plan-level and the implications of that for project-level). Interviewees gave different perspectives about what might need to remain at project level should a change in approach be implemented.
- Potentially adopt the same sorts of assessments that are currently required at project-level.
- Help to ensure consistency across projects by considering impacts at a larger scale.

Interviewees also emphasised the importance of cross-sector acceptance of any changes, not least given the need to understand and approve any changes in approach within governance structures. The role of regulators and SNCBs in supporting any proposed change would be crucial, with clarity about what will need to be done at the plan-level, and clear understandings of the implications of a change in approach at the project level, including identification of any risks in changing to a new approach.

*"I think one of the key benefits of doing this detailed assessment at plan level is you've then got that earlier understanding of what level of compensation is required, and for what species, and in what regions, so that whole process can get started at the plan level rather than in individual projects having to start from scratch with their own compensation."* (interview 02 – SNCB/public sector)

### 3.4 Barriers to adopting alternative approaches

A number of challenges were raised by interviewees in relation to the potential for alternative approaches to be adopted, many of which relate to staffing and resource limitations, and capacity, including skills capacity, for undertaking empirical data collection as well as analysing and interpreting data created.

#### Resource barriers:

Resource limitations, particularly within SNCBs and the public sector, was identified as one of the biggest barriers to adopting alternative approaches to the treatment of uncertainty. Some interviewees felt resource limitations were a challenge across the offshore sector with "pressure everywhere", although most interviewees felt resource pressures are especially prevalent for SNCBs and public sector actors. One interviewee commented that the lack of resource "is a frustrating barrier for many, because it does slow things down, and it does limit expectations and results" (Interview 08 – SNCB/public sector). Resource limitations impact both the ability to undertake existing responsibilities, as well as to consider the implications of, and implement, any potential changes in approach.

- Officials need to be able to find time to assess, understand, and implement new systems or approaches, while evaluating existing assessments and staying up to date with new evidence, tools and methods. One SNCB/public sector interviewee emphasised their openness to new approaches, but highlighted that resource pressures could be limiting the adoption of new approaches because of struggling to find time and headspace to consider to trial new approaches alongside existing workloads, for example.
- Resource pressures on SNCBs and the public sector was also felt to be leading to SNCB/public sector officials being less accessible to consultants for discussions, with one interviewee highlighting “the concept of back-to-back meetings for a day is a real thing and being triple-booked for meetings is regular”.
- Resource limitations mean SNCB/public sector actors are less able to fully participate in steering groups for cross-sector research programmes, which one SNCB/public sector interviewee described as “absolutely critical” and important for delivering practical solutions “that give us something directly and immediately applicable”.
- Resource limitations mean that consultants are often not available to participate in research project boards or to access training on new tools as they become available.
- Resource barriers limit the ability to provide skills training and interpretation of tools developed through research projects, and funding limitations lead to challenges in maintaining and developing tools for continued use.
- As the industry continues to grow, the strain on SNCB/public sector resources is felt to have grown both within SNCBs/public sector organisations we spoke with, and commented on externally by consultants and industry representatives.
- Any work to change the current approach would require working with and across stakeholders but practical difficulties finding time for meetings involving multiple stakeholders often leads to delays that can prevent discussion of new approaches.

*“Honestly if we were to talk about the real barriers towards actually finding real solutions to this, candidly, it’s resource” (interview 08, SNCB/public sector)*

## Institutional/structural barriers

Potential barriers to changes in approach to dealing with uncertainty relate to the challenges of introducing any new systems within a large and complex industry, with projects at different stages of the consenting processes, and with many existing processes having been created before the offshore wind industry experienced the growth it now has.

- Some interviewees expressed concern that processes are slow to change, and can lead to assessment processes lagging behind the development of an industry that is happening at pace.
- There was a sense that, even when research findings are generated that could help reduce uncertainty, SNCBs are responsible for integrating evidence into updated guidance for assessments. The willingness and ability of SNCB and regulators to adopt an alternative approach to the treatment of uncertainty therefore will be key to the success of any potential changes.
- There can be frustrations relating to different uses of evidence in advice. SNCB/public sector officials emphasise the importance of evaluating the robustness of new evidence and ensuring its applicability to relevant contexts before it can be integrated into advice.



- Some interviewees raised concerns that moving to a plan-level approach would potentially increase uncertainty, given it would be based on assumptions about the actual numbers of turbines that would be built, and the design parameters, such that assumptions and uncertainty would still be integrated within a plan-level approach. However, one respondent highlighted that many of these challenges already exist.
- Across all sectors, driving the development of renewable energy with minimal environmental impact is a common concern. Even if solutions are generated, including from projects with cross-sector involvement, achieving cross-sector consensus on approaches to take can be challenging.

### Legislative or policy barriers

Legal and policy barriers were not frequently identified as barriers by participants we spoke with, however some key barriers did come up. The Offshore Wind Industry Council (OWIC) recently published a report<sup>3</sup> which discusses this topic in detail, in which they identified a challenge of there being no overall plan for offshore wind development that matches up all the different wind farm planning and delivery systems. Without such an overarching plan, addressing key issues is challenging.

- One consultant wondered whether SNCBs' ability to re-assess their positions based on the latest available information in a more pragmatic way was potentially a legislative barrier, relating to the necessity of SNCBs implementing the precautionary principle in carrying out their responsibilities (for example, given the lack of definitive data, if two pieces of research give different displacement figures, the sense is that some SNCBs might always adopt the 'worst case scenario' figure).
- A suggestion was made that work to reach a common understanding across HRA practitioners of the precautionary principle could be helpful, given the complexity of this area, and the role of case law and legal expertise in defining precaution in a legislative context.
- There is an opportunity for greater clarity in the provision of guidance on particularly complex projects.
- One respondent felt that advocating for different approaches to be adopted could take "a long time to get through the system of government" (Interview 04 – SNCB/public sector), especially if work is sometimes paused due to a change of minister, or of government. Another respondent however felt that changes can be integrated within the current policy/legislative landscape. Relatedly, one consultant used the example of the Marine Recovery Fund and work by DEFRA to lead that as good but slow, and mostly driven by developers, rather than DEFRA.
- One interviewee raised that the process of producing an EIA and SNCBs giving advice during casework is often not transparent. EIAs are reviewed by lawyers and other environmental consultancies, and so it can be unclear to the SNCBs which factors have been taken into account and the rationale behind those decisions.

### Knowledge/skills & technical barriers

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<sup>3</sup> OWIC (2024) Policy and Legislative Barriers to Offshore Wind Consenting.  
<https://www.owic.org.uk/media/itrporhd/5314-culpepper-owic-policy-and-legislation-report-v9.pdf>



Interview participants also highlighted potential technical or knowledge and skills barriers to adopting a new approach to the treatment of uncertainty:

- Handling uncertainty is increasingly complex and across key stakeholders there can be challenges with skills shortages in this complex area, with examples given including the application of statistical modelling, analysing and interpreting data, as well as skills for gathering empirical evidence.
- The complexity of the offshore marine environment means that expertise from elsewhere (e.g. in relation to consenting onshore wind farms) is sometimes drawn on, without understanding of the complexities, and thus the uncertainty, around the offshore marine environment.
- Questions were raised about whether existing tools would be able to manage the different scale of data parameters and/or would new tools need to be developed.
- Any change in approach would need to be trialled alongside existing systems to understand potential impacts.

*"We've had some approaches that might be ok for certain times of year or applicable to certain species but wouldn't be applicable all year round for different species; some models that are parameterised on certain locations that you can't then apply to other locations; and it's always figuring out how applicable a new bit of evidence or new tool to every scenario or the scenario that you are thinking about at a particular time" (interview 02 – SCNB/public sector)*

### 3.5 Working across different UK administrations

During the workshop that preceded the interviews in this study, stakeholders highlighted differences in guidance about approaches to dealing with uncertainty across the UK SNCBs as a concern. Where time allowed, we asked for perspectives on the topic during our interviews.

Some people we spoke with, across sectors, expressed a desire for greater consistency in approaches to uncertainty across the different UK SNCBs, and SNCB representatives indicated that discussions are ongoing about where greater consistency might be achievable. However, participants also emphasised that some divergence in approaches may be necessary for valid reasons. It was felt that there is a need to consider local circumstances in any drive for greater consistency, whether that be ecological, environmental or biophysical differences, or different policy drivers between different UK administrations; as such, there will be some situations where differences need to remain.

- Some interviewees expressed a sense that some of the SNCBs adopt more of a precautionary approach in dealing with uncertainty in assessments, whereas other SNCBs are considered more pragmatic, or 'solutions-oriented' in their approach.
- There are some areas where there is more divergence than others: one SNCB representative indicated for example that there is more divergence in relation to impacts on receptors other than ornithology.
- Efforts are being made to ensure greater consistency in relation to English Round 5 projects through the use of the Offshore Wind Seabird Assessment Tool, which has recently been trialled by Natural England, Natural Resources Wales and the JNCC.

- It was emphasised that a joint position statement and/or guidance is not always achievable, but does not always mean that SNCBs are being inconsistent. A cross-SNCB consensus around key issues is always considered, but where it is not possible, emphasis is placed on understanding reasoning for differences, and consideration of the impact it might have on advice across the UK.
- Greater consistency on approaches to uncertainty is a particular concern for developers in areas where impacts on an SPA need to be considered across different jurisdictions, including in some parts of the North Sea, and in the Celtic Sea leasing round. Such situations often lead to multiple layers of discussion in relation to where impact assessment values lie.
- Coordination in relation to cumulative impacts would broadly be welcomed, as cumulative impacts are shared across borders, and there are discrepancies in guidance in some projects that can lead to conflicting advice.
- It was also noted, in relation to compensation, that there is currently no ability to use sites in one jurisdiction that relate to a project in another jurisdiction.

Possible reasons behind some of the differences in approaches between SNCBs identified in our study included:

- The applicability of different research studies across different ecological habitats and bird populations around the UK coastline; for example, can findings from a study undertaken in the north of Scotland be applied to (and be considered to supersede) the evidence base drawn on for providing advice elsewhere in the UK.
- The location of proposed developments in proximity, or not, to designated sites.
- The scale of proposed projects
- The number of actors involved in decision-making in different UK administrations, in particular in relation to there being more organisations and people involved in England's planning and regulatory systems than elsewhere in the UK.
- The applicability of tools created using data from a particular site to other sites.
- Different SNCBs will have different histories of experiences and decisions, which may influence current positioning around particular aspects of advice.
- Flexibility in the treatment of evidence and uncertainty is necessary to account for variation in species biology across latitudinal and longitudinal gradients.
- Staff resource constraints with resultant challenges in finding time to agree on approaches or methods across multiple organisational contexts, or to be present within multiple ongoing research projects working to develop clear ways forward.

However, there is also awareness that differences in advice do not always lead to significant differences in impact assessment outcomes, and as such, there might sometimes be less incentive to change something that is considered common practice in a particular country.

One proposal for a way forward on this issue would be to **better understand where differences in guidance do occur** and why, and **more clearly communicate the reasons why** these differences exist. Undertaking such a task could help provide clarity across industry partners about why SNCBs might be adopting different approaches. A suggestion was made that JNCC could be asked to take on that responsibility, given their cross-UK role.

*“There is a lot to be said for having a common approach across boundaries, and developers are running into it pretty frequently. The area in which there might be impacts to the Flamborough and Filey coast SPA, as considered by SNCBs, runs all the way from Rampion wind farm in the south of England, all the way to projects in north-east Scotland; so it very much does have an impact where there are different approaches being taken.” (interview 07; industry)*

Similarly, when it is feasible, practical and timely, joint SNCB guidance and/or position statements can be considered: relevant examples include joint guidance on assessing collision risk and displacement assessments, which have been generated over many years of cross-SNCB engagement. SNCBs are continuing to explore opportunities for provision of future joint guidance and/or position statements. However, it is also important to note that the provision of joint guidance does require additional staff time, and given the complexities of receiving approval across all SNCBs, can be a slow process. One respondent reflected that generating high-level generic guidance, applicable across all countries but where the detail can be tailored to SNCBs, has worked well.

### 3.6 Improving the interface between science, policy and practice

Scientific research plays an integral role in the growth of the offshore wind industry, as scientific evidence is used to inform policy decisions and increase understanding about the environmental implications of offshore wind farms. Actors across the sector, including SNCBs, academics and funding bodies, all have a role to help make better use of existing research in guidance. Initiatives like ORJIP and the Offshore Wind Evidence and Change Programme (OWEC) are useful and deliver practical solutions but sometimes it can feel that the pace of integrating insights from such programmes in guidance and advice can be slow.

*“There needs to be some bridging between what comes out of research and what goes into practice for environmental impact assessments and habitats regulation assessments” (interview 07 – industry).*

Involvement in research project steering groups by all sectors, particularly SNCBs and public sector actors, is crucial for understanding emerging insights and developing new evidence, with many people taking part in multiple steering groups to optimise research to fill key evidence gaps and reduce duplication. Resourcing issues can make it hard to actively engage in all ongoing projects, but actors across the sector emphasise its importance.

People we spoke with emphasised the importance of coming together across sectors to discuss and debate evidence to understand its implications. While some of this debate might happen within project assessment discussions, many emphasised that bringing people together in contexts such as the regular ScotMER symposium (run by the Scottish Government’s Offshore Wind Directorate) and the autumn 2024 Displacement workshop is valuable.

- EIAs and HRAs are currently carried out by consultants who are often not able to access necessary training: keeping up-to-date with the latest knowledge and tools can be challenging, as their contracts do not necessarily include dedicated resource for training, and consultancies are

rarely represented on project steering groups. Working to support the work of consultants in incorporating new evidence in their assessments is important: one suggestion made was that SNCBs could help advise consultants where new evidence is available, or that the Offshore Wind Evidence and Knowledge Hub (OWEKH) could ensure attention is drawn to where positions have changed, and provide advice on better approaches to take.

- Another challenge for consultants is that, as part of their guidance, SNCBs require the use of certain tools in the application process to assess key indicators. However, some in the industry have found SNCBs can be “quite rigid in the tool they want us to use” and have highlighted the need for SNCBs to “tell us how they expect us to use them” (interview 09 - consultant). In project steering groups, even where there is developer representation, consultants are often left out and so **those tasked with using increasingly complicated tools are those with the least involvement in the development and testing of them**. The potential for knowledge exchanges and funded shadowing placements for academics and SNCB/public sector officials within e.g. consultancies or developers was mentioned as a potential solution to allow for greater understanding and increased knowledge across sectors.
- An industry representative (interview 07) highlighted the importance of understanding the **links between evidence, practice and policy** to achieve change, while recognising resource limitations on SNCBs/public sector, and highlighting the value of understanding impacts across the whole sector. This interviewee commented that “it’s really hard to see the overarching impact that uncertainty and precaution is having” unless you are able to see the bigger picture across the sector.
- Utilising new evidence is not always easy, both for SNCBs and policymakers. Evidence generated is often highly complex and requires expertise to unpick. SNCBs engage with researchers to make best use of new evidence to fully integrate their use in offshore wind, seeking understanding of how new evidence relates to existing knowledge, its robustness and applicability, and what the implications of emerging evidence might be.
 

*“More targeted research into each of the stages that add precaution in an assessment, such that actually the numbers that we come up with are much more evidence-based” (interview 06 – consultant)*
- Bridging the gap between academic research and its use in policy and practice could be improved through the publication of ‘explainers’, easier-to read summaries of research outputs specifically designed to make academic publications clearer for non-academic users.
- Particularly in situations where SNCBs were not formally involved in commissioning or steering of research projects, the integration of new evidence is often done through more informal channels. Funding mechanisms like ORJIP (and others) were highlighted as crucial, as those involved in the offshore wind sector are able to tailor research to best meet needs.
- One consultant in our study emphasised the importance of further evidence gathering, jointly with SNCBs, aimed at helping to reduce uncertainty in calculations, based on understanding that once evidence comes through, it will be used to try and reduce precaution overall.
- The evidence used in applications can also become difficult when those tasked with unpicking its significance are often generalists, leading to certain cases where findings can unintentionally be mischaracterised.

Existing structures pose some challenges, partly due to varying timescales in different sectors, with one consultant commenting that academics can sometimes fail to “*understand timelines of what developers need*” (interview 03, consultant), and another consultant emphasising the importance of collecting data and developing new evidence as soon as possible, given the importance of developing renewable energy sources to try and avoid some of the likely impacts of climate change.

- Peer review for academic publications can be a lengthy process, yet is often required by SNCBs for new evidence to be incorporated into guidance, introducing delays into any changes.
- The need for timely updates and production of outputs was even mentioned in reference to this study, given the pace of development of the offshore wind industry is substantial, and projects are always in the consenting process. As one industry representative (interview 01) commented “*if the research isn’t there in time, it’s obsolete*” – even a couple of weeks can make a big difference, and rapid timelines are encouraged to help introduce solutions and drive change.
- Interviewees were keen for the findings of research projects to be more rapidly integrated in advice, and for SNCBs to be encouraged to reappraise positions based on the latest evidence, and being more confident in the evidence to date, and emphasised the importance of insights from new evidence being rapidly integrated into advice.
- One respondent felt that even when research often funded by SNCBs and other funders to try and overcome some of the challenges dealing with uncertainty, findings from such research do not necessarily seem to be integrated in the provision of guidance.

As well as timelines, the priorities of academic researchers compared with SNCBs or developers and consultants can sometimes be conflicting. SNCBs having a role in steering projects can be constructive to optimise addressing evidence gaps, however there is an appreciation that this can reduce flexibility for researchers in their work.

*“We use the evidence-based science to get our answers and then, as with everything, there are different opinions at times”*  
Interview 03 – consultant

- One consultant highlighted the challenges in using some of the assessment tools developed by the academic community, and the practical complexity and difficulties in trying to understand what can and cannot be combined in an assessment, or whether advice seems to lead in different directions.
- One industry representative was keen for academics to propose research and monitoring approaches and projects that increase understanding impacts of offshore wind at an ecosystem level, such that greater understanding of environmental impacts and “the health of ecosystems” could be assessed. This would enable better understanding of impacts, and would also likely be a cost-saver compared to existing compensatory measures that are incredibly expensive (one interviewee suggested £100m per project is being quoted to adopt

*“Sometimes we’re trying to make those assessments of how applicable it [new evidence] can be but sometimes it would be useful to get a steer from the academics, who know that research inside out, to be able to give us their recommendation on how applicable that is to other locations”* Interview 02 – SNCB/public sector

measures to mitigate impacts on kittiwakes) and are not felt by some to be backed by science. Proposals would enable the allocation of funding at a more strategic level, and on a long-term scale to de-risk development, thereby also de-risking impacts to the marine environment.” Suggestions might include proposals for large-scale monitoring to ensure ongoing understanding of the impacts of windfarms, including at the cumulative level, as well as in relation to compensatory measures being implemented etc, as well as in relation to other impacts on the offshore environment, such as climate change, as well as how species respond to stressors.

Even with some of these challenges, cross-sector collaborations with industry, SNCB/public sector, academia, Non-Governmental Organisations (NGOs) (e.g, RSPB and the British Trust for Ornithology (BTO)) has been what one interviewee (interview 08) described as *“really fruitful”* in marine ornithology, and has enabled academic-led research projects to develop into industry-relevant insights through the *“ongoing and sustained building of relationships across key partner organisations and universities.”* Even with different perspectives, work across science and the wider offshore industry has demonstrated *“a joined-up mentality of progress”*. Research by academic scientists can be trusted across sectors, allowing for development in understanding and the incorporation of findings into guidance.

## 4. Conclusions

Given the importance of offshore renewable energy in the provision of energy security and in addressing the climate crisis, participants emphasised the necessity to work together to maximise the amount of power than can be generated while minimising environmental impacts. While the offshore marine environment is incredibly complex to understand and study, actors across the sector are keen to work together to continue resolving issues around uncertainty and precaution in the assessment process.

Yet there is substantial complexity within current approaches, which are challenging to apply. While raising the importance of maintaining the quality of assessments and minimising risks of developments damaging seabird populations, interviewees in our study highlighted questions about current approaches to assessments, and discussed opportunities for reducing uncertainty and gaining a wider understanding of the offshore environment to reduce impacts from offshore wind developments that take account of a wider, ecosystem or plan-level approach, rather than a project-by-project approach.

Some of the key challenges raised, and opportunities for potential solutions suggested through the stakeholder interviews included:

- Calls for greater transparency about how uncertainty is propagated through the tools used for undertaking Habitat Regulation Assessments and Environmental Impact Assessments.
- Concerns about situations in which over-precaution is perceived to occur through a lack of clarity about where in the assessment process precaution is applied, and the magnitude of precaution applied, and calls for actors across the sector to come together to co-develop way to address such situations.
- Recognising and addressing resourcing challenges, particularly within SNCBs and the public sector, to enable more rapid evaluation and incorporation of evidence into SNCB advice, and to ensure the effective participation of staff in relevant steering and advisory groups for cross-sector research projects and initiatives.

- Creating and enabling opportunities for consultants to actively participate in project steering groups for research projects where new tools and evidence are developed, to ensure greater opportunity for 'end-user' involvement at an earlier stage.
- Improving mechanisms and funding to train and support consultants in the use of assessment tools, and developing opportunities for knowledge exchange and shadowing, to allow greater understanding of the consultant/end-user experience by tool developers and SNCBs.
- Continuing to work together to investigate opportunities for greater consistency in the approach to uncertainty adopted by different SNCBs across the UK, and ensuring better understanding and clearer communication about where different approaches might need to remain, and why.
- Facilitating dissemination and evaluation of evidence around uncertainty, and more rapidly updating SNCB guidance in relation to new statistical approaches and tools. This could be achieved in part by ensuring that research findings include plain language summaries to help stakeholders assess the relevance and transferability of findings, and more clearly communicating assumptions, limitations and confidence levels within research findings.

## Next steps

Insights gained from stakeholders through this study have informed the development of the wider research project "Assessing the extent and significance of uncertainty in offshore wind assessments". Recommendations for improvements to the evaluation of uncertainty in ornithological offshore wind impact assessments, and for future research identified through the findings from the semi-structured interviews presented in this report, will be integrated into final reporting (**AssESs – Recommendations and roadmap (WP4)**, December 2025).



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## Appendix 1: Participant information sheet

25 November 2024

### Assessing the extent and significance of uncertainty in offshore wind assessments PARTICIPANT INFORMATION SHEET Stakeholder engagement



The James  
Hutton  
Institute

You are invited to take part in research about the different possible ways in which information on uncertainty can be used within the offshore wind assessment process, and the implications of these different approaches for decision-making, as well as barriers and potential solutions.

#### RESEARCH AIMS

The ORJIP project 'Assessing the extent and significance of uncertainty in offshore wind assessments' (AssESs) is conducting research to understand current levels of uncertainty across the assessment process in the evaluation of ornithological impacts (especially cumulative impacts) of offshore wind and quantify sensitivities of estimated impacts to different sources of uncertainty. As part of this study, we are approaching key organisations involved in the assessment process.

Discussions held as part of this research on the use and interpretation of uncertainty within assessments will contribute to co-production of a set of recommendations, relevant across devolved administrations, around the prioritisation of future research to reduce sources of uncertainty. This work builds on an update of a previous route map, and results of a sensitivity analysis.

This research is funded by ORJIP – the Offshore Renewables Joint Industry Programme through the Carbon Trust. ORJIP represents a consortium of funders.

#### WHO IS INVOLVED?

The project team is led by Dr Adam Butler, Stakeholder Management and Impact Lead for Offshore Renewables at BioSS, and includes colleagues from the James Hutton Institute, the UK Centre for Ecology & Hydrology (UKCEH), MacArthur Green, and the University of St Andrews. The lead researcher for this part of the study is Dr Alice Hague, Senior Social Scientist at the James Hutton Institute.

#### STAKEHOLDER ENGAGEMENT & COPRODUCTION

You have been invited to take part as a representative of an organisation with a key role in the assessment process of offshore wind in the UK. We acknowledge that we cannot cover everyone or everything but are keen to engage a wide range of stakeholder organisations.

We would like to invite you to a MS Teams meeting lasting 45-60 minutes. No preparation work will be necessary.

If you give permission, the interview will be video recorded, to ensure an accurate record of the discussion. The recorded interview will only be available to the research team and a professional transcriber, all of whom are bound by relevant data privacy and confidentiality agreements. We will not use your name or role in any reporting. With your permission, we would like to identify your organisation as having participated in this study.

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25 November 2024



The James  
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Institute

#### HOW WILL MY DATA BE STORED?

Any personal information will be confidential and will only be seen by the research team and transcriber. The data gathered will be used to inform our research and develop presentations, reports and academic publications.

Your contact information will be stored securely on Hutton systems for the purposes of this and potential relevant future contact on this topic.

#### DO I HAVE TO TAKE PART?

No. Participation is voluntary, and you can withdraw from the study at any point without giving reasons and without any negative consequences.

#### How can I withdraw from the study?

If you wish to withdraw from the study, please contact Alice Hague ([alice.hague@hutton.ac.uk](mailto:alice.hague@hutton.ac.uk)) within one week of the interview.

#### ETHICAL REVIEW

The project has been reviewed by the Research Ethics Committee of the James Hutton Institute. If you have any concerns about the way in which the project has been conducted, or you wish to make a complaint, please contact [humanethics@hutton.ac.uk](mailto:humanethics@hutton.ac.uk).

#### FURTHER INFORMATION

If you have any further questions, please contact Alice Hague ([alice.hague@hutton.ac.uk](mailto:alice.hague@hutton.ac.uk))

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## Appendix 2: Participant consent form

Information provided in correspondence. The weblink to the online consent form has now closed, but included an 'agree/disagree' to each statement below.

### **Consent to participate in research**

Please go to [weblink now closed] to give your consent to participating in the interview for research purposes, or reply to this email acknowledging you have read and agree to the statements below.

By participating in the interview for AssESs (Assessing the extent and significance of uncertainty in offshore wind assessments"), I confirm that:

1. I have read and understand the information sheet for "Applying precaution to uncertainty." I have had the opportunity to ask questions, and these have been answered.
2. I understand that my participation is voluntary, and I am free to withdraw at any time, without providing any reason, and without my legal rights being affected.
3. I understand the study is conducted by researchers from The James Hutton Institute and partner organisations, funded through The Carbon Trust/Offshore Renewables Joint Industry Programme (ORJIP).
4. I understand taking part will involve participating in co-production/stakeholder engagement activities that are audio-visually recorded on MS Teams, and the recording will be transcribed (without names) for notetaking purposes.
5. I understand my words may be quoted in publications, reports, and other research outputs in anonymised format (e.g. 'an industry representative', 'SNCB representative').
6. I agree my organisation's name can be included in a 'list of participants' in any outputs (e.g. reports/academic papers).
7. I agree my personal contact details can be retained in a secure database so that the researchers can contact me for future studies.
8. I agree to being contacted in the future in relation to this or other relevant studies.
9. I have read and understood the privacy notice (below).
10. I agree to take part in this study.

### **Privacy Notice**

The James Hutton Institute ("Hutton", "us" or "we") will use your personal data for the purposes of the research undertaken in the project 'AssESs' in accordance with our privacy notice at <https://www.hutton.ac.uk/privacy-notice>.

The James Hutton Institute is a data controller for the data collected in this study.

This project is part of a project funded by the Carbon Trust/Offshore Renewables Joint Industry Programme.

Personal data will be retained for a period after the completion of the project to allow further contact in relation to this and future relevant projects. Our main privacy notice will explain what we do with personal data in more detail as well as your rights.

If you have any queries about your personal data, you can contact our Data Protection Officer [dpo@hutton.ac.uk](mailto:dpo@hutton.ac.uk).

## Appendix 3: Stakeholder Workshop Report

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# 1. Executive summary

The AssESs (Assessing the extent and significance of uncertainty in offshore wind assessments) project is exploring the ways in which information on uncertainty in assessments of ornithological impact is translated into decision-making within the context of a precautionary approach.

A key element of this project is active engagement with stakeholders involved in the offshore wind ornithological assessment process, including developers, policymakers, regulators, SNCBs, consultants, and academics. This report is a summary of findings from the first stakeholder workshop held online on 6th December 2024.

Recurring comments in the discussions included:

- Challenges were reported in dealing with additional layers of uncertainty beyond statistical uncertainty.
- A differentiation between knowledge and linguistic uncertainty was made explicit in the conversations.
- Linguistic confusion between uncertainty and precaution was highlighted.
- The need for precaution to be informed by scientific evidence was highlighted, but it was noted that the choice of precautionary values might not be exclusively based on that scientific evidence.
- Current approaches were mainly described as being project-based, scenario-based approaches, with treatment of uncertainty involving model-based quantification of uncertainty but also requiring qualitative and narrative judgments.
- Considering multiple scenarios from each different project for use in in-combination cumulative assessment was reported as not currently feasible, with the usual approach being to take the 'realistic' worst-case scenario from each of the individual projects.
- A collection of barriers was highlighted, including:
  - Institutional barriers around communication, bureaucracy and transparency.
  - Practical barriers around time and resource constraints.
  - Scientific barriers around the potential danger for uncertainty assessment tools to become black boxes.
  - Legal barriers around the interpretation of "precaution" and the use of regional evidence.
  - Siloing between different elements of the assessment process.
- A variety of potential solutions to these barriers, particularly the practical and scientific barriers, were proposed by the workshop participants, with a specific focus on more effective communication of uncertainty.
- Moving towards addressing uncertainty within the context of a more plan-led approach, versus the current focus on uncertainty within the context of assessments for individual projects, was a potential solution that emerged strongly from the different discussions.

These discussions have informed subsequent stakeholder engagement within the project to gather more detailed information in relation to barriers to the use of alternative approaches and potential solutions.

## 2. Introduction

The AssESs project (Assessing the extent and significance of uncertainty in offshore wind assessments), funded by the Offshore Renewables Joint Industry Programme, aims to improve the treatment of uncertainty within the assessment process for ornithological impacts, in order to reduce risks and delays to the consenting of offshore wind developments.

A key motivation for the project is an urgent need to quantify current levels of uncertainty across the assessment process, and sensitivities of estimated impacts to different sources of uncertainty. This is delivered through a review of existing approaches to the treatment of uncertainty within assessments, and of the evidence base that informs these approaches, which is then used to structure a quantitative evaluation of the sensitivity of key metrics of impact to uncertainty in parameter values and model assumptions. The second key motivation for the project is a need to improve, via stakeholder engagement, the ways in which information on uncertainty is translated into decision-making within the context of a precautionary approach.

A workshop, involving a wide range of relevant stakeholders and informed by interim outcomes of the review and sensitivity analysis, was used to identify key barriers to alternative treatment of uncertainty within the assessment process, along with potential solutions. The workshop was designed to address the following specific objectives:

- Understand the ways in which stakeholders currently interpret the requirement for precaution when considering information on uncertainty within the context of the offshore wind assessment process.
- Identify potential alternative approaches to the treatment of uncertainty within the assessment process.
- Determine the extent to which the requirement for precaution imposes barriers to the potential for use of these alternative approaches.
- Investigate other barriers (technical, scientific, practical or institutional) to the use of alternative approaches.

This report describes the approach taken within this workshop, and summarizes the key findings from it. Within follow-up stakeholder engagement, individual interviews are subsequently being used to explore these barriers and potential solutions in more detail. The outcomes of these activities feed into recommendations for future research and improved treatment of uncertainty within the assessment process. Crucially, the process of stakeholder engagement, through this workshop and subsequent activities, is designed to ensure that recommendations from the project capture the perspectives and knowledge of the widest possible range of stakeholders from within the sector.

## 3. Methodology

The workshop adopted a participatory approach that was designed to ensure differing perspectives and approaches were heard. The aim of the workshop was not to establish consensus on the best approach to use in relation to uncertainty and precaution, but rather to share views on the context, key issues and potential solutions, and to gain a high-level understanding of the key challenges that stakeholders face in using and interpreting information on uncertainty within the context of a precautionary approach. A key

focus was on potential solutions to these challenges, and any barriers to the implementation of these potential solutions.

### **3.1. Approach**

Open questions were used to stimulate debate throughout, with a more targeted exercise where participants were divided in three breakout groups that each preserved a diversity of stakeholder organisations. Miro boards were used to determine specific barriers to alternative approaches to uncertainty treatment and potential solutions to barriers using anonymous notes that workshop participants could also expand on verbally if desired. These specific comments were sought to find common areas of concern and potential solutions, with an ultimate goal to inform the design of the follow-up stakeholder engagement via semi-structured interviews. Participants were also invited to leave comments in the MS Teams chat throughout the workshop.

Prior to beginning this round of stakeholder engagement, the research proposal was reviewed by the Research Ethics Committee of the James Hutton Institute (reference: JHI-HRE-0298-562) to ensure the workshop would be conducted in line with good practice ethical research guidelines and the workshop was carried out in line with the Economic and Social Research Council (ESRC)'s research ethics guidance for social research. Potential participants were sent an information sheet (Appendix 4: Stakeholder Workshop Report - Participant Information sheet) and prior to the workshop commencing, each participant was asked to sign consent form (Appendix 5: Stakeholder Workshop Report - Participant Consent form). The workshop participants agreed that 'Chatham House Rule' applied to the discussions, meaning that the topics of conversations could be shared externally, but not attributed to specific individuals.

The workshop was video recorded in MS Teams to allow the research team to facilitate the conversation and ensure an accurate record of the discussion. The recording and associated chats and Miro Board comments are only available to the research team, all of whom are bound by relevant data privacy and confidentiality agreements. This recording and documents will be deleted after the project is completed.

### **3.2. Structure**

The workshop was structured as a half-day online meeting with four facilitated sessions, and a scientific presentation on the initial results of the Sensitivity Analysis developed in WP2 as a further driver of discussion.

The meeting started with a presentation of the workshop context and remit by the project team. The presentation included an overview of the project and the overall remit of the workshop, as well as a brief summary of how evidence on uncertainty is currently accounted for (based on WP1), and a technical/scientific overview of possible alternative approaches to dealing with uncertainty was presented.

The first discussion session focused on current and historic treatment of uncertainty within the assessment process, with the following motivating questions to facilitate the discussion:

1. Which approaches to the treatment of uncertainty have been considered in assessments to date?



- a. Could you talk us through your perspective of the way that uncertainty is dealt with and presented in assessments?
- b. How has this changed over time in relation to new evidence?
- c. Are you aware of other approaches to uncertainty that could be used? - e.g. from different sectors, or internationally?

The second session aimed to explore potential changes to uncertainty treatment, with the following motivating questions:

2. To what extent is it desirable to change the way uncertainty is treated within the context of assessments? If so, why?
  - a. Are there specific parts of the process where you think uncertainty is currently treated well and less well?
  - b. Could the flow of uncertainty through the process be improved?
  - c. Which parts of the way uncertainty is currently dealt with do you think should be prioritised to change?

The third session explored different understandings of precaution. Motivating questions for this session were:

3. To what extent is the requirement for precaution a barrier to alternative approaches?
  - a. Can you define what you mean by precaution?
  - b. Do you see precaution as primarily a scientific or primarily a legal/policy term?
  - c. Do academics have a role in developing approaches to precaution?  
How do you select different metrics around uncertainty in the context of different types of evidence? How does precaution relate to this?

The final session focused on exploring barriers to alternative approaches. Facilitators also encouraged participants to provide potential solutions to the stated barriers. Most input from this session was in the form of Miro board notes, however, discussion was also encouraged when participants felt they wanted to add further detail or context to their otherwise anonymous comments. Motivating questions for this session were:

4. What other barriers exist to the use of alternative approaches?
  - a. Is there a perception that improved consideration of uncertainty may make decision making harder?
  - b. How can more sophisticated approaches (e.g. statistical) be communicated in a way that allows decision makers to make decisions in the context of precaution?
  - c. How to combine quantitative and qualitative sources of uncertainty?
  - d. How do you update cumulative impacts when new treatments of uncertainty are developed?

### 3.3. Participants

The workshop gathered over 20 stakeholders from the offshore renewables sector, including industry, consultancies, SNCBs, government and other public bodies, NGOs, and research organisations.

Expertise in the virtual room included participants from:

- EDF



- Joint Nature Conservation Committee (JNCC)
- MacArthur Green
- Natural England
- Cyfoeth Naturiol Cymru/Natural Resources Wales (NRW)
- NatureScot
- Ocean Winds
- Ørsted
- RenewableUK
- Royal Society for the Protection of Birds (RSPB)
- RWE
- Scottish Government
- Scottish Renewables
- SSE
- The Crown Estate (TCE)
- UK Centre for Ecology & Hydrology (UKCEH)
- UK Department for Environment, Food & Rural Affairs (Defra)

For the purposes of the workshop, project team members from MacArthur Green and UKCEH were classed as “participants”, and so participated fully within the discussions. Project team members from BioSS and the James Hutton Institute acted as facilitators and organisers.

## 4. Summary of findings from the workshop

The summary below has been drawn from notes from the discussion and chat comments, as well as postings on the workshop ‘Miro’ board in response to specific questions. This is a high-level summary of key themes, rather than a full description of everything discussed at the workshop. The notes are intended to reflect the balance of focus of discussion at the workshop.

### 4.1. Understandings of uncertainty

- Challenges in dealing with additional types of uncertainty beyond statistical uncertainty.
- Knowledge uncertainty around model structures, i.e., how well do the parameters, their estimates, and the models used to inform assessments, reflect the underlying real ecosystem?
- Linguistic uncertainty, e.g., differences between how developer-referred assessments and scoping opinions are considered.

### 4.2. Understandings of precaution

- Linguistic confusion between uncertainty and precaution; there needs to be a clear distinction between the two terms.
- Precaution is a legal/policy term that should be informed by scientific evidence, whilst the choice of precautionary values are also informed by narrative judgement (e.g., using realistic worst case scenarios).

### 4.3. Current approaches to treatment of uncertainty

- Project-led, scenario-based approaches including modelling-based considerations but also qualitative considerations and narrative judgments.
- Many scenarios can be considered for the project-level assessment, but there is usually an assumption of one single scenario for the in-combination assessment.
- Considering multiple scenarios from each different project in in-combination cumulative assessment is not currently feasible, and the usual approach is therefore to take the 'realistic' worst-case scenario from each of the individual projects, and to add those onto the project's worst-case scenario.
- Identifying a 'realistic' worst-case scenario versus a 'worst' worst-case scenario usually involves narrative judgement.

### 4.4. Potential alternative approaches

- One idea discussed was a move towards more focus on issues around uncertainty and precaution within a plan-led approach, rather than the current project-led approach, albeit with different opinions about what a plan-led approach would look like.
  - The complex aspects should be covered at a plan level: there is a large workload in the assessment pipeline and individual project-level assessment is increasingly complex.
  - If a strategic plan assessment level has already been carried out, when individual applications are submitted, it would potentially be possible to identify where they sit within that plan.
  - The Environmental Impact Assessment (EIA) process cannot be changed right now, but some of the complexity could be removed, particularly where it is not helping with ornithological risk (i.e. birds in SPAs).
  - A plan level approach could include information from post-consent monitoring and individual assessments could access information from the plan-level (all scenarios) for consideration.
- A suggested plan-led approach would ideally:
  - Facilitate strategic considerations.
  - Be comprehensive and rigorously scientific.
  - Propagate full uncertainty.
  - Consider uncertainty more holistically and transparently.
  - Identify high risk areas unsuitable for leasing due to identified impacts.
  - Allow early identification of key species/sites to be impacted and identification of scale of compensation that will be required.
  - Drive risk-based communication.
  - Bring transparency on assumptions and risks.
  - Translate into resources being applied directly to conservation actions.
- Seek consensus around the meaning of "realistic worst-case scenario"
- Another approach briefly discussed was centralised EIAs similar to those implemented by governments in European countries with developer-funded strategic aspects, which were felt to avoid the variation between applications that currently exists in the UK.

## 4.5. Barriers to alternative approaches

### 4.5.1. Institutional

- Challenges around the communication and understanding of uncertainty.
- Challenges around sourcing up-to-date project-level data in order to producing cumulative/in-combination assessments can add an additional source of uncertainty/error.

### 4.5.2. Practical

- Constantly changing environment (e.g., climate change, HPAI) makes it challenging to get robust evidence.
- Short timeframes of political cycles and disagreements between experts impose constraints on the speed at which Government and SNCBs can incorporate new evidence into guidance.
- Timelines for delivering on large renewable energy targets and political drivers to accelerate deployment may not align with the timelines for research work to reduce uncertainty.
- Resource constraints around revising approach to dealing with uncertainty and the development of guidance.
- Differences in understandings in applying and interpreting uncertainty.
- Time constraints around making meaningful changes to assessment processes.
- The impact assessment process is already complicated.
- Silofication across multiple aspects of the assessment process.
- Lack of guidance and training on, or access to, the most up-to-date approaches and tools.
- Differences in SNCBs guidance across countries.
- Differences between developer (project-level) and scoping approaches.

The following potential solutions to some of these practical barriers included:

- Use uncertainty to more directly quantify an appropriate level of precaution – e.g. a more linear relationship between uncertainty and precaution, with less subjectivity involved. Precaution would be added into parts of the assessment where there is less confidence or less evidence.
- Making the science understandable for non-expert policy/decision makers.
- Separating out scientific endeavour from the planning process in order to streamline the process.
- Greater consensus around the definition of “realistic worst-case” scenarios.

### 4.5.3. Scientific

- Challenges around distinguishing between uncertainty and variability.
- Differences in study design across countries can limit transferability.
- The tools for uncertainty assessment might turn into a ‘black box’ for those writing guidance and making decisions.
- Extensive technical understanding of the tools in use is required to appreciate and be able to communicate the uncertainty that exists within them.
- The more complex the tools used, the more of a burden of expertise there is on the people trying to communicate that; and you cannot expect the ultimate decision makers to have that expertise.
- Lack of a formalised and regular process to capture experts’ view of current best available evidence and level of uncertainty.
- Lack of functionality for dealing with uncertainty arising from extreme shocks to the system, e.g., HPAI or marine heatwaves.

The following potential solutions to some of these scientific barriers were proposed:

- Increased consistency in study design and analysis methods, including developing consensus between different countries surrounding the Greater North Sea (e.g. OSPAR Region II: UK, Belgium, Denmark, France, Germany, the Netherlands, Norway, and Sweden), to aid interpretation of the evidence around variability and uncertainty.
- Focus should be less on individual parameters, and more about overall consistency and transparency in the treatment of uncertainty.
- Updates to cumulative impacts when new treatments of uncertainty are available can be developed by having a fully supported, resourced and data-backed Cumulative Effects Framework (CEF).
- The CEF is seen as part of the answer, but it requires full ongoing funding to allow it to be maintained with up-to-date data.
- A trade-off is needed between the complexity of the tools and the ability to communicate associated uncertainty to decision makers.
- By propagating uncertainty and accounting for more sources of uncertainty, you will gain a better understanding of it. The estimated level of uncertainty will have changed numerically as a result, but in real life, it is still the same true uncertainty - you are just accounting for parts of it now that you had not before.

#### 4.5.4. Legal

- Timelines to update legislation/policy.
- Risk of judicial review could mean less willingness by decision-makers (and possibly applicants) to trialling different approaches to uncertainty.
- Consideration of how the outputs of novel approaches to treatment of uncertainty feed into requirements for compensation, where it is required.
- Issues around interpretation of the precautionary principle.
- Legal frameworks and their interpretations are potentially getting in the way of using regional evidence, given the importance that it would receive if you were looking at it purely from a scientific perspective.

## 5. Follow-up stakeholder engagement

Further stakeholder engagement in spring 2025 sought to gather further information around the topics identified above, especially in relation to barriers to the use of alternative approaches and potential solutions.

The outcomes from the workshop, follow-up engagement activities, and the review and sensitivity analysis, fed into the development of recommendations for (a) future research and data collection and (b) improvements to the treatment of uncertainty and precaution within assessments within Work Package 4.

## **Appendix 4: Stakeholder workshop report - participant information sheet**

### **APPLYING PRECAUTION TO UNCERTAINTY: PARTICIPANT INFORMATION SHEET**

#### ***Stakeholder engagement***

You are invited to take part in research about the different possible ways in which information on uncertainty can be used within the offshore wind assessment process, and the implications of these different approaches for decision-making, as well as barriers and potential solutions.

#### **RESEARCH AIMS**

We are conducting research to understand current levels of uncertainty across the assessment process in the evaluation of ornithological impacts (especially cumulative impacts) of offshore wind and quantify sensitivities of estimated impacts to different sources of uncertainty. As part of this study, we are approaching key institutions in the consenting process and in establishing requirements and standards in relation to post-consent monitoring data.

Discussions held as part of this research on the use and interpretation of uncertainty within assessments will contribute to co-production of a set of recommendations, relevant across devolved administrations, around the prioritisation of future research to reduce sources of uncertainty. This work builds on an update of a previous route map, and results of a sensitivity analysis.

This research is funded by ORJIP – the Offshore Renewables Joint Industry Programme through the Carbon Trust. ORJIP represents a consortium of funders.

#### **WHO IS INVOLVED?**

The project team is led by [Name], Stakeholder Management and Impact Lead for Offshore Renewables at BioSS, and includes colleagues from the James Hutton Institute, the UK Centre for Ecology & Hydrology (UKCEH), MacArthur Green, and the University of St Andrews. The lead researcher for this part of the study is [Name], socio-economic statistician at BioSS (for stakeholder workshop)/ [Name], Senior Social Scientist at the James Hutton Institute (for interviews/focus group).

#### **STAKEHOLDER ENGAGEMENT & COPRODUCTION**

You have been invited to take part as a representative of an organisation with a key role in the assessment process of offshore wind in the UK. We acknowledge that we cannot cover everyone or everything but are keen to engage a wide range of stakeholder organisations.

No preparation work will be necessary. This will be an online workshop, with opportunity to provide feedback on findings from the study to date, and to feed into the development of the recommendations for the reduction of uncertainty in ornithological assessment methods, and the treatment of uncertainty within ornithological offshore wind impact assessments.

The workshop will be video recorded (in MS Teams) to allow the research team to focus on the conversation and ensure an accurate record of the discussion. The recording will only be available to the research team, all of whom are bound by relevant data privacy and confidentiality agreements.

We will not use your name in any outputs or reporting. With your consent, we would like to have the option to list the organisations represented in the workshop (by organisation name) in the final workshop report.

#### For interviews:

We would like to invite you to a MS Teams meeting lasting 45-60 minutes. No preparation work will be necessary.

If you give permission, the interview will be video recorded, to ensure an accurate record of the discussion. The recorded interview will only be available to the research team and a professional transcriber, all of whom are bound by relevant data privacy agreements. We will not use your name or role in any reporting. With your permission, we would like to identify your organisation having participated in this study.

#### For smaller focus group/workshop (with representatives of four SNCBs – Statutory Nature Conservation Bodies)

We would like to invite you to an online discussion on MS Teams. No preparation work will be necessary. The meeting will be recorded in MS Teams, to ensure an accurate record of the discussion. The recorded interview will only be available to the research team, all of whom are bound by relevant data privacy agreements. We will not use your name or role in any reporting. With your permission, we would like to identify your organisation having participated in this study.

### **HOW WILL MY DATA BE STORED?**

Any personal information will be confidential and will only be seen by the research team and transcriber. The data gathered will be used to inform our research and develop presentations, reports and academic publications.

Your contact information will be stored securely on Hutton systems for the purposes of this and potential relevant future contact on this topic.

### **DO I HAVE TO TAKE PART?**

No. Participation is voluntary, and you can withdraw from the study at any point without giving reasons and without any negative consequences.

### **How can I withdraw from the study?**

If you wish to withdraw from the study, please contact [Name] [Email] within one week of the workshop or interview.

### **ETHICAL REVIEW**

The project has been reviewed by the Research Ethics Committee of the James Hutton Institute. If you have any concerns about the way in which the project has been conducted, or you wish to make a complaint, please contact [Name] [Email].

### **FURTHER INFORMATION**

If you have any further questions, please contact [Name] [Email].

## Appendix 5: Stakeholder workshop report - participant consent form

[The following 'standard' clauses were included at the bottom of the invite email, to which participants were asked to respond confirming their participation in the workshop. An alternative option was given to reply to the same clauses through an online form on Qualtrics, which was also shared during the workshop]

Please delete any lines below to which you do not give your consent:

[Email]

[Telephone]

By participating in the "Applying precaution to uncertainty" project workshop, I confirm that:

- I have read and understand the information sheet for "Applying precaution to uncertainty." I have had the opportunity to ask questions, and these have been answered.
- I understand that my participation is voluntary, and I am free to withdraw at any time, without providing any reason, and without my legal rights being affected.
- I understand the study is conducted by researchers from The James Hutton Institute and partner organisations, funded through The Carbon Trust/Offshore Renewables Joint Industry Programme (ORJIP).
- I understand taking part will involve participating in co-production/stakeholder engagement activities that are audio-visually recorded on MS Teams, and the recording will be transcribed (without names) for notetaking purposes.
- I understand my words may be quoted in publications, reports, and other research outputs in anonymised format (e.g. 'an industry representative', 'SNCB representative').
- I agree my organisation's name can be included in a 'list of participants' in any outputs (e.g. workshop reports/academic papers).
- I agree my personal contact details can be retained in a secure database so that the researchers can contact for future studies.
- I agree to being contacted in the future in relation to this or other relevant studies.
- I have read and understood the privacy notice (below).
- I agree to take part in this study.

### Privacy Notice

The James Hutton Institute ("Hutton", "us" or "we") will use your personal data for the purposes of the research undertaken in the project 'Assess' in accordance with our privacy notice at <https://www.hutton.ac.uk/privacy-notice>. The James Hutton Institute is a data controller for the data collected in this study.

This project is part of a project funded by the Carbon Trust/Offshore Renewables Joint Industry Programme.

Personal data will be retained for a period after the completion of the project to allow further contact in relation to this and future relevant projects. Our main privacy notice will explain what we do with personal data in more detail as well as your rights.

If you have any queries about your personal data, you can contact our Data Protection Officer [email].



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