Techniques of knowing in administration: Co-production, models and conservation law

Maria Lee, Lucy Natarajan, Simon Lock, Yvonne Rydin*

Abstract

Law frequently demands the production, sometimes effortful, of adequate knowledge for decision making. This article explores the challenging epistemic demands made by nature conservation law during approval processes for major offshore wind farms. It explores this area through the prism of co-production: not only are 'science' and 'facts' socially and legally constructed, but in addition, scientific and factual findings shape society, and law and governance. Models are used in planning law to assess whether bird deaths associated with a proposed wind farm shall have an adverse effect on the integrity of a protected site. As much as providing an accurate factual representation of the impact of a wind farm on biodiversity, the models contribute to the very possibility of governing the impact of these novel infrastructure developments on biodiversity.

Key words

Nature conservation law – planning – wind farms – knowledge – models – co-production – as if reasoning

INTRODUCTION

Law frequently makes challenging epistemic demands of administrative decision making, insisting on the production of adequate knowledge in circumstances where time is short and empirical data sparse. Conditions are imposed that can ostensibly be met only by finding facts and making predictions, underpinned by sources of legitimacy that are sometimes barely available: objective expertise and high quality science. Planning decisions on large wind farm projects provide a significant case study of these issues. The ways in which knowledge is constructed and asserted in the 'evidence deficient area' of offshore wind farms' ornithological impacts,[1] is both striking and intriguing. Computer modelling of the impact of the wind farms on birds is often central to the legality of a decision, as well as to the broader social justification of the decision. Discussion and debate around the models is an important feature of the process, as different actors strive to know enough to make lawful decisions.

* UCL. We would like to thank participants in our February 2017 UCL workshop on modelling for renewable energy. We are extremely grateful to Liz Fisher and Andrew Lang for their incisive comments on an earlier draft, and to the journal's referees. This paper was supported by ESRC funding (Award number 164522), *Evidence, Publics and Decision-Making for Major Wind Infrastructure.*

[1] Examining Authority Report and Recommendations, *Hornsea Project One* (2014) (*Hornsea One*) [5.177]. The documents discussed in this article are available at <https://infrastructure.planninginspectorate.gov.uk/>.

The models routinely used in legal processes are hugely varied, from computer simulations of the entire climate system, to less complicated modelling of smaller systems.[2] The 'Collision Risk Models' that we focus on here are a relatively simple model that attempts to simulate the number of birds that will collide with a proposed wind farm, and reach a conclusion on the effect of those deaths on the bird population at a protected habitat.[3]

Our purpose in this article is not to criticise the use of the models, or to open up the particular black boxes being introduced into the decision making process, although these could be productive lines of inquiry. Instead, we examine this area through the prism of Sheila Jasanoff's 'idiom' of 'co-production'.[4] We outline co-production in the section following this introduction, and illustrate it more richly in the detailed examination of our case study, taking seriously the proposition that knowledge and society (or facts and law) mutually constitute and shape each other, in the process of governing.

Nature conservation legislation requires in principle that a proposed wind farm be denied consent unless it can be 'ascertained that it will not adversely affect the integrity' of protected sites.[5] As discussed further below, this potentially rich notion of 'integrity' is reduced rather swiftly (we are not suggesting improperly) to separate discrete nature conservation issues, such as the disturbance of particular species of fish or sea mammals during construction or operation. Of these issues, the implications of the collision of protected birds with the proposed wind farm are especially instructive for current purposes, and a prominent feature of the decisions. An abstract legal or purely semantic definition of 'integrity', suitable for simple application to pre-determined facts in any case, is difficult to imagine. But straightforward pre-determined facts are just as difficult to imagine. The meaning of the legal requirement is not independent of the 'facts' as established through the models, but nor are the models or their outputs independent of the way we regulate. This sort of co-production could be tracked through a great deal of administrative law making.[6] The especially dense

[2] N. Oreskes, 'The Role of Quantitative Models in Science' in *Models in Ecosystem Science*, eds. C.D. Canham et al. (2003); D.A. Farber, 'Modelling Climate Change and Its Impacts: Law, Policy and Science' (2008) 86 *Texas Law Rev.* 1655; W. Wagner et al., 'Misunderstanding Models in Environmental and Public Health Regulation' (2010) 18 *NYU Environmental Law J.* 293.
[3] See B. Band, *Using a Collision Risk Model to Assess Bird Collision Risks for Offshore Windfarms* (2012).
[4] As an 'idiom' co-production is not a 'fully fledged theory', but 'a way of interpreting and accounting for complex phenomena', S. Jasanoff, 'The Idiom of Co-production in *States of Knowledge: The Co-Production of Science and Social Order* ed. S. Jasanoff (2004) 3.
[5] Directive 1992/43 on the conservation of natural habitats and of wild fauna and flora [1992] OJ L 206/7.
[6] See also E. Fisher, 'Expert Executive Power, Administrative Constitutionalism and Co-production: Why they Matter' in *Regulating Risks in the EU: The Co-Production of Expert and Executive Power*, eds. M. Weimer and A. de Ruijter (2017).

nature of co-production in our area illuminates the difficulty of identifying precisely and predictably where authority lies in the decision making process: legal, scientific and political authority are mutually dependent and mutually reinforcing.

Even at the end of the decision making process, uncertainty surrounds the impact of offshore wind farms on ecosystems and biodiversity, specifically on birds.[7] If collision risk models do not provide a prediction of bird deaths, still less an accurate factual representation of the integrity of a site, we need to think carefully about the work they are doing in legal reasoning. In part, this is precisely about co-production: law requires us to 'know', and so the models contribute to the very possibility of legitimate governance. Rather than thinking in terms of the failure of models to reflect the 'truth', we might consider them in terms of constructing and applying what Jasanoff calls 'serviceable truth',[8] a 'good enough' approximation of the truth. A related but distinct approach, drawing on Andrew Lang's discussion of 'as if' modes of reasoning, would see the models not in terms of representation of truth at all, but precisely about allowing us to act, to govern, in a particular field.[9] It is plausible that elements of both of these features of reasoning appear in the approach to the impact of offshore wind farms on birds in our cases. Whatever their relationship with 'truth', approximating it or 'wilfully [abandoning]' it,[10] the models make an important contribution to the aspiration to legitimate and acceptable governance. We argue that the models are not solely or primarily about facts, but about the process of decision making. Their iteration within the planning process provides a space for the inclusion of various actors in the negotiation of an understanding of the legality of a proposed wind farm.

After this introduction, we first outline and contextualise 'co-production', before briefly introducing the legal framework, and our 'cases'. Decisions on large offshore wind farms are made under the Planning Act 2008, which sets up a special regime for 'nationally significant infrastructure projects' (NSIPs).[11] The decisions must also comply with rules set out in nature

[7] We recognise that 'uncertainty' is a complex notion that should be used carefully, but we shall not expressly pursue that in this article (although it is implicit in our discussion). On sources of uncertainty in modelling, see e.g. D. Owen and J. Fine, 'Technocracy and Democracy: Conflicts Between Models and Participation in Environmental Law and Planning' (2005) *Hastings Law J.* 901; E Fisher et al., 'Understanding Environmental Models in their Legal and Regulatory Context' (2010) 22 *J. of Environmental Law* 251.

[8] S. Jasanoff 'Serviceable Truths: Science for Action in Law and Policy' (2015) 93 *Texas Law Rev.* 1723.

[9] A. Lang, 'Governing "As If": Global Subsidies Regulation and the Benchmark Problem' (2014) 67 *Current Legal Problems* 135.

[10] K. Knop et al., 'From Multiculturalism to Technique: Feminism, Culture and the Conflict of Laws Style' (2012) 64 *Stanford Law Rev.* 589.

[11] Discussed in more detail in M. Lee et al., 'Public Participation and Climate Change Infrastructure' (2013) 25 *J. of Environmental Law* 33.

conservation legislation. We use a small number of reports, issued on applications for a Development Consent Order (DCO) under the Planning Act 2008, to explore the ways in which knowledge of bird deaths is constructed to comply with nature conservation legislation. Core terms, for our purposes specifically 'integrity', are very open: not simply legally ambiguous, but only capable of being described through their application to a particular problem, within the decision making process. We do not claim that this is an extraordinary feature of nature conservation law. But it is rarely dwelled on by lawyers, and makes an interesting context for considering the construction of 'integrity' in our cases, the subject of the following section. We then turn more explicitly to co-production, examining the ways in which the courts understand the decision on integrity as containing elements of fact, law and judgment, and the ways in which the fuzzy nature of the decision makes for a blurring of authority among those responsible. Finally, we reflect on the significance of pervasive uncertainty in an area of law that strongly insists on clear knowledge. We argue that collision risk modelling can usefully be examined as part of the *process* of decision making, rather than as a technical way to provide decisive facts for the decision maker to use.

This article is on the one hand narrow: the role of particular models, to resolve a particular legal question, in a particular planning process, for a particular type of infrastructure development. Our exploration of the detail of our case study is however suggestive of the complexity and contingency of decision making and the use of evidence in large infrastructure planning, and contributes to the understanding of EU and English nature conservation law. Moreover, the issues in this article are not limited to wind farms, nature conservation, or even the use of models specifically. Law often requires the production of adequate knowledge, and the development of cognitive techniques is a necessary component of governance.[12] And often, as here, these epistemic demands are made in the context of limited empirical evidence, as well as challenges around monitoring and correcting data.[13] Understanding the work being done with and by different cognitive techniques and pieces of evidence in these circumstances, is, we argue, crucial to understanding legal reasoning and legitimate decision making. Although modelling is increasingly important to

[12] E.g. A. Lang, 'The Legal Construction of Economic Rationalities' (2013) 40 *Journal of Law and Society* 155. The legislative neglect of under-researched species / habitats by legislation, and conversely, the knowledge stimulated by regulation is often noted: S. Bryan, 'Contested Boundaries, Contested Places: The Natura 2000 Network in Ireland' (2012) 28 *J. of Rural Studies* 80; C. Rodgers, *The Law of Nature Conservation* (2013).

[13] A.S.C.P. Cook et al., 'The Avoidance Rate of Collision between Birds and Offshore Turbine' (2014) 5 *Scottish Marine and Freshwater Science* <http://data.marine.gov.scot/dataset/avoidance-rates-collision-between-birds-and-offshore-turbines>.

law,[14] and both co-production and uncertainty absolutely pervasive, the themes we develop in this article are relatively little examined in their detailed legal or regulatory context.[15]

CO-PRODUCTION

Jasanoff's 'idiom' of co-production is a rich and flexible[16] approach to science / society relations, building on decades of work in science and technology studies.[17] We do not think it would be helpful (or even honest) to attempt to create a tidy picture of the way in which co-production fits into a vast and unruly ('for good reason'[18]) broader literature on these issues. Consistently with other strands of science and technology studies,[19] co-production challenges and complicates well-used categories (such as fact and value, science and society, knowledge and political power), and the bright lines between those categories. Beyond science and technology studies, we might refer to the literature on knowledge production,[20] or on the role of knowledge, science or experts within policy making,[21] as well as the legal literature on expertise in regulatory decision making;[22] Susan Owens draws attention to the common ground between co-production and the exploration of 'policy learning' in political science;[23] David Kennedy traces co-production specifically to actor-network theory in science and technology studies.[24] Each of these bodies of work contains strands that recognise and engage with the complex interactions and relationships between science and society, in sophisticated ways. We might also note that the term 'co-production', literally making something together, has been used in other contexts. Co-production of knowledge is sometimes used simply to mean collaboration between different actors (scientists from different disciplines, policy makers, lay communities) to agree on certain factual propositions together. Elinor Ostrom's work on the co-production of public services is

[14] Fisher et al., op. cit., n. 7. There is a larger US legal literature.
[15] Much of the literature focuses on knowledge and *policy* making, rather than the detailed, repeated regulatory decisions explored here.
[16] She explicitly does not expect everyone to invoke it in the same way, 'Afterword' in op. cit., n. 4, p. 275.
[17] S. Jasanoff, 'Ordering Knowledge, Ordering Society' in op. cit., n. 4, reviews the literature working in the idiom of co-production.
[18] S. Owens, *Knowledge, Policy and Expertise: The UK Royal Commission on Environmental Pollution 1970-2011* (2015) 6.
[19] Generally e.g. J. Hackett et al. (eds.), *The Handbook of Science and Technology Studies* (2008); A. Irwin, 'STS Perspectives on Scientific Governance' in id.
[20] E.g. M.Gibbons et al, *The Production of New Knowledge: The Dynamics of Science and Research in Contemporary Societies* (1994)
[21] E.g. Owens, op. cit., n. 18; H. Collins and R. Evans, *Rethinking Expertise* (2009); R.A. Pielke Jr., *The Honest Broker: Making Sense of Science in Policy and Politics* (2007).
[22] Within which this paper sits, see the work cited herein.
[23] Op. cit., n. 18, pp. 9-13.
[24] D. Kennedy, *A World of Struggle: How Power, Law, and Expertise Shape Global Political Economy* (2016), 282.

based on the simple but profound idea that the production as well as the consumption of public services can require citizen participation.[25]

Two related features of Jasanoff's framework of co-production are important for current purposes. First, Jasanoff questions the separate existence, as 'discrete and distinctive spheres',[26] of the categories we use to think about science and society (including 'science' and 'society'), bringing 'knowledge practices and power practices into the same frame'.[27] Most pertinently for this article, co-production responds to the possible asymmetry of familiar approaches to the social construction of science.[28] Social constructionism stresses the social context and commitments of science, and rejects the autonomy of science and knowledge from society. But just as 'the facts' cannot be taken for granted, as something that exist independently of society, 'out there' and waiting to be discovered, nor can 'the social'. Not only are 'science' and 'facts' socially constructed, but 'the social' is also partially constructed by what and how we know about the world. Nor can 'aspects of the social',[29] such as interests or gender, be taken for granted, or assumed to be unproblematic. Law and governance may be understood here as an aspect of the social. Law is not 'a datum, a fact, unproblematic and one-dimensional',[30] and it too contributes to the shaping of knowledge, which in turn shapes law, until in some cases facts and law are barely distinguishable. Questions of authority and questions of knowledge are irredeemably intertwined in our case study: 'my ideas legitimate your power, your power enforces my ideas'.[31]

This article focuses on the mutual shaping of law and facts within a particular set of development control processes. We argue that the 'facts' and the methodologies by which they are known, are partially legally constructed (shaped by the law), and that simultaneously the meaning and demands of the law are shaped by the facts as found, and the methods available to construct those facts. We resist the temptation to prioritise either the legal or the factual, or to see either as unproblematically existing and waiting to be discovered. We argue that in the process of governing, knowledge of the world is demanded: this knowledge is shaped by the body of law for whose purposes it is generated; and the

[25] See e.g. E. Ostrom, 'The Comparative Study of Public Economies' (1998) 42 *The American Economist* 3; J. Alford, 'The Multiple Facets of Co-Production: Building on the Work of Elinor Ostrom' (2014) 16 *Public Management Review* 299.
[26] Owens, op. cit., n. 18, p. 13.
[27] Kennedy, op. cit., n. 24, p. 4.
[28] Jasanoff, op. cit., n. 17, p. 19; Irwin, op. cit., n. 19.
[29] Jasanoff, id., p. 20.
[30] C. McCrudden, 'Legal Research and the Social Sciences' (2006) 122 *Law Quarterly Rev.* 632, at 648.
[31] Kennedy, op, cit., n 24, p. 8; Weimer and de Reuijter, op. cit., n. 6.

output and the process of creation of the knowledge, simultaneously shapes the meaning and development of that body of law.

In co-production, Jasanoff's facts often take on significance beyond their own regulatory context, world-making more widely. The tight bond between knowledge-making and authority-making, facts and governance, which we explore here, is one significant element of Jasanoff's 'complex exercise in world-making',[32] which can be explored at different scales.[33] The consequences and stability of the planning world's understanding of the impact of wind farms on birds in the wider world are still to be seen, and examining that would be a different project from the current one. But by ensuring the authority to decide, the co-productive exercise in our cases ultimately contributes to the physical reality of large, innovative infrastructure, and to an understanding of that infrastructure as governable, knowable and controllable, even benign.

THE LEGAL AND DECISION FRAMEWORK

Frustration with processes for major infrastructure planning, which had been perceived by some to be slow and inefficient, led to the introduction of a new planning system by the Planning Act 2008.[34] 'Nationally significant infrastructure projects' (NSIPs), a category of development that includes offshore generating stations over 100Mw, are not subject to Local Planning Authority decision making, or to the public inquiry system that dominated large infrastructure planning before 2008. An application for a Development Consent Order (DCO) is made to an Examining Authority (ExA), appointed by the Planning Inspectorate, which makes recommendations and reports its 'findings and conclusions' to the Secretary of State.[35] Although not binding, it is rare for the Secretary of State to disagree with the ExA's recommendations. ExA Reports have significant authority within the system, and their reasoning and explanations are crucial in understanding and justifying the decision.

Decisions have to comply with EU nature conservation law, which means that bird mortality feeds directly into the lawfulness of any decision. Unusually, nature conservation law imposes substantive, as well as procedural, obligations to protect what in English law are called 'European sites' (and 'European marine sites'). 'European sites' include areas

[32] S. Jasanoff, 'Constitutions of Modernity: Science, Risk and Governable Subjects' in Weimer and de Ruijter op. cit., n. 6, p. 22, of risk regulation specifically.
[33] Jasanoff, op. cit., n. 4, p. 5.
[34] Lee et. al., op. cit. n.11.
[35] Planning Act 2008, s 74.

designated under either the EU Habitats Directive[36] (Special Areas of Conservation, SACs) or the earlier Birds Directive[37] (Special Protection Areas, SPAs).[38] The Directives have been transposed into the law of England and Wales by the Habitats Regulations 2010.[39] There are two key questions. First, is a project 'likely to have a significant effect' on a European site? If so, it must be subject to an 'appropriate assessment' (which the ExA Reports generally refer to as a 'Habitats Regulations Assessment', HRA) 'of its implications for the site in view of the site's conservation objectives'. Secondly, if an HRA was necessary, has it 'ascertained that [the project] will not adversely affect the integrity of the site concerned'?[40] If not, then unless demanding conditions are met, the project cannot go ahead.[41]

As well as being responsible for the final decision on the DCO as a whole, the Secretary of State is the 'competent authority' under EU nature conservation legislation, with responsibility for the final decision on integrity. The applicant 'must provide such information as the competent authority reasonably require' for the process.[42] The competent authority 'must … consult the appropriate nature conservation body and have regard to any representations made by the body'.[43] The nature conservation body also advises the ExA, for the purposes of its recommendations to the Secretary of State. The 'appropriate nature conservation body' is Natural England or Natural Resources Wales; because the offshore wind farms discussed here are English, for simplicity, we refer generically in this article to Natural England.[44]

Ornithological issues, and the development of techniques by which they might be understood, are not limited to European sites, but also arise with respect to national

[36] Op. cit. n. 5.
[37] Directive 2009/147 on the conservation of wild birds (codified version) [2010] OJ L 20/7 (Birds Directive).
[38] Sites at different stages in the designation process are treated as if they are European sites, as are internationally protected sites, see Conservation of Habitats and Species Regulations 2010, SI 2010/490 (Habitats Regulations) and National Planning Policy Framework (Department for Communities and Local Government, 2012) 28.
[39] Id., and (beyond the 12 nautical mile limit) the Offshore Marine Conservation (Natural Habitats, &c) Regulations 2007, SI 2007/1842, both as amended.
[40] Op. cit. n. 5, art 6. SPAs are subject to art 6, see Habitats Directive art 7.
[41] The project can be consented *if* it must go ahead for 'for imperative reasons of overriding public interest', *and* there are no alternative solutions, *and* appropriate 'compensatory measures' are taken; in the case of 'priority' habitats and species, either the imperative reasons are limited to human health, public safety and the environment, or the opinion of the Commission must be sought. Perhaps surprisingly, consideration of the exceptions has not been necessary in the cases discussed here. Their application is fascinating, see e.g. ExA Report and Recommendations, *Able Marine Park* (2013).
[42] Reg 61(2).
[43] Reg 61(3).
[44] The Joint Nature Conservation Council advises on UK-wide and international nature conservation. It takes primary responsibility for European sites in offshore waters; the protected sites in our discussion are all onshore breeding sites, although the wind farms themselves are out to sea.

designations, and non-designated sites and species. We are focusing on European sites because of the high level of substantive (rather than just procedural) protection provided by the EU legislation.[45] The formulation of the legislation (consent can only be granted 'having ascertained that [the project] will not adversely affect the integrity' of the site) effectively means that it is not for the regulator to prove adverse effects, but for the applicant to convince the regulator that there are no such adverse effects.[46] If the decision maker is 'unconvinced', it 'may – indeed must – refuse to make a DCO, irrespective of the cause of that deficiency'.[47] This concern of the applicant to counter all challenges and queries makes the role of evidence, and of debate and disagreement over evidence, especially visible.

All of the ExA reports on nationally significant wind farms contain rich discussions of ornithological issues. In this article, we focus in particular on the *Rampion Offshore Wind Farm*,[48] and *Hornsea Project Two*,[49] which raise some of the recurring issues around ornithological impact. *Rampion* was granted a DCO in April 2014 for up to 175 wind turbines, with a total generating capacity of up to 700 Mw, 13-25 kilometres off the Sussex coast. The applicant assessed the likelihood of significant effects for a number of European sites. Following multiple iterations of evidence, frequently prompted by Natural England, the applicant concluded that the project was not likely to have significant effects on any European site. However, Natural England insisted that when considered in combination with other wind farms, the proposal was likely to have significant effects on the Flamborough Head and Bempton Cliffs (FHBC) SPA. The ExA 'accepts and gives weight' to Natural England's advice, and so an HRA was carried out.[50] Ultimately, and again after a number of iterations of the models, the ExA concluded that there would be no adverse effect on the integrity of the FHBC SPA. *Hornsea Two* will be the second development within the 'Hornsea zone'. The application was for up to two offshore wind farms, with up to 360 generators and a total capacity of up to 1800 Mw, situated in the North Sea, 89 kilometres from the English coast. The applicant ultimately agreed that the development was likely to

[45] All law deriving from EU law, including the Habitats Regulations, is expected to survive the UK leaving the EU, including relevant decisions handed down by the Court of Justice of the European Union (CJEU), see European Union (Withdrawal) Bill, clauses 2-6. In any event, the underlying issues discussed in this article apply also in domestic nature conservation law, and hold lessons for the relationship between law, knowledge and decision making. And EU legislation continues to apply in the other 27 Member States of the EU.

[46] Case C-127/02 *Landelijke Vereniging tot Behoud van de Waddenzee* v. *Staatssecretaris van Landbouw* [2005] 2 C.M.L.R 31, Opinion of AG Kokott, [99].

[47] *R (on the application of Mynyyd y Gwynt Ltd)* v. *Secretary of State for Business, Energy and Industrial Strategy* [2017] Env. L.R. 14. This is a judicial review of the Secretary of State's refusal to grant a DCO for the Mynyyd y Gwynt onshore wind farm, due to the impact on birds (and hence on the integrity of a European site).

[48] ExA Report and Recommendations, *Rampion Offshore Wind Farm* (2014).

[49] ExA Report and Recommendations, *Hornsea Project Two* (2016).

[50] Id. [5.65].

have a significant effect on eleven European sites,[51] and so carried out an HRA for each of those sites. Natural England and the RSPB disagreed with the applicant's conclusion on integrity, on a number of grounds.[52] The negotiation of mitigation between Natural England and the applicant included changes to the design of the wind turbines and a reduction in the number of turbines to three hundred.[53] Natural England concluded that there would be no adverse effect on integrity.[54] The RSPB continued to argue that there would be an adverse effect on the integrity of the FHBC SPA.[55] The ExA expressed 'concern' that 'some parties are being over-precautionary',[56] concluding, 'on the basis of its Examination and objective scientific evidence, and the summary advice of [Natural England]', that there would be no adverse effect on integrity.[57]

The decision documents (especially the ExA Report and the Secretary of State letter) for *Rampion* and *Hornsea Two* are our primary source for this article. We shall also refer occasionally to other applications, especially the *Navitus Bay Offshore Wind Farm*,[58] an application that was unsuccessful, largely on landscape grounds,[59] and *Hornsea Project One* (where the discussion of ornithological issues is strikingly similar to *Hornsea Two*).[60] We are interested in 'integrity', and specifically the assessment of bird mortality, which is often 'a central theme' of the HRA.[61] That is far from exhausting even the ornithological issues in the reports, or the issues arising in European sites, let alone broader nature conservation issues. But this focus allows careful reflection on the relationship between law and knowledge in this highly uncertain area.

CONSTRUCTING 'INTEGRITY'

As outlined above, any project 'likely to have a significant effect' on a European site must be subject to an HRA; and consent can only be granted, subject to stringent exceptions, having ascertained that the project will not have an adverse effect on the integrity of the protected site. Whether an assessment is necessary, and what it means to ascertain that there are no adverse effects on integrity, have both been interpreted by the CJEU in a precautionary

[51] Secretary of State decision letter [4.24].
[52] [6.7.43]. Note also the discussion of the inclusion of the displacement figures in the assessment.
[53] [6.7.29]-[6.7.30].
[54] [6.7.41], [6.7.45], [6.7.46].
[55] Summarised at [6.7.47].
[56] [6.7.48].
[57] [6.7.49], on kittiwake specifically.
[58] ExA Report and Recommendations, *Navitus Bay Wind Park* (2015).
[59] M. Lee, 'Landscape and Knowledge in Nationally Significant Wind Energy Projects' (2017) 37 *Legal Studies* 3.
[60] Op. cit. n. 1.
[61] *Hornsea One* [5.25].

manner, particularly in the well-known *Waddenzee (Cockle Fishers)* decision.[62] 'Likely' to have a significant impact, in this EU context, does not imply the high level of probability that we would expect in English law.[63] A project is 'likely' to have a significant effect, 'if it cannot be excluded, on the basis of objective information, that the project will have a significant effect on that site'.[64] The low threshold for the obligation to carry out an assessment has been emphasised by the Court of Justice and the national courts.[65] The assessment must identify impacts affecting the site's conservation objectives 'in the light of the best scientific knowledge in the field'.[66] The project can be authorised only if the decision maker has 'made certain' that there will be no adverse effect on integrity, which means that 'no reasonable scientific doubt remains as to the absence of such effects'.[67] We might ask whether the language in *Waddenzee* really takes the impossibility of certainty seriously. The ExAs are evidently cautious about ensuring the lawfulness of their decisions under *Waddenzee*, but they are not paralysed by the CJEU's demanding approach, and take a pragmatic approach to looking for a 'real (rather than hypothetical) risk',[68] language taken from another line of EU cases on the precautionary principle.[69] And even in *Waddenzee*, Advocate General Kokott describes the assessment as 'of necessity, subjective in nature', in the sense that the decision makers can 'from their point of view, be certain there will be no adverse effects even though, from an objective point of view, there is no absolute certainty'.[70]

'Integrity' is a legal term, with a legal meaning in the hands of the CJEU. According to Advocate General Sharpston in *Sweetman*, integrity means 'the continued wholeness and soundness of the constitutive characteristics of the site concerned'.[71] It is difficult to imagine a judicial or legislative definition wholly determining the way integrity works in every case, rather than being part of a process of interpretation and application by scientists, alongside the legal and policy community.[72] Although it is dealing with a different part of the Habitats Directive ('deliberate disturbance' rather than 'integrity'), the Supreme Court decision in

[62] *Waddenzee* op. cit. n. [46]46.
[63] On the different language versions, not all of which include the degree of probability inherent in 'likely', see *Waddenzee*, id. Opinion of AG Kokott, [69] and *Sweetman* v. *An Bord Pleanála* ECLI:EU:C:2012:743 Opinion of AG Sharpston, [46].
[64] *Waddenzee*, id. [45] (Court).
[65] *Sweetman*, op. cit., n. 63, Opinion of AG Sharpston [49]; *R (on the application of Champion)* v. *North Norfolk DC* [2015] UKSC 52; [2015] 1 W.L.R. 3710 [12].
[66] *Waddenzee*, op. cit., n. 46, [61] (Court).
[67] Id., [61].
[68] *Mynydd y Gwynt*, op. cit., n. 47, [20(iii)].
[69] The line of cases emerging from Case T-13/99 *Pfizer Animal Health SA* v. *Council* [2002] E.C.R. II-3305 addresses risk regulation.
[70] Op. cit., n.46, [107].
[71] *Sweetman*, op. cit., n. 63, [54].
[72] See Y. Epstein, 'Favourable Conservation Status for Species: Examining the Habitats Directive's Key Concept through a Case Study of the Swedish Wolf' (2016) 28 *J. of Environmental Law* 221.

Morge is revealing.[73] The Court says it would be 'unrealistic'[74] to aspire to more than 'broad considerations'[75] of legal interpretation. This case has been interpreted as prioritising scientific over legal judgment: 'no amount of judicial thinking can assist', and instead we must turn to 'scientific opinion'.[76]

Even if the Supreme Court in *Morge* could have provided further, helpful legal definition,[77] and more might reasonably be said about the legal content of 'integrity', semantic refinement of 'integrity' cannot provide something entirely prior to and independent of the factual context to which it applies. Advocate General Sharpston's further legal guidance on 'integrity' clarifies the boundaries that are imposed by law. Because the legislation requires the assessment to be carried out 'in view of the site's conservation objectives', so 'the constitutive characteristics of the site that will be relevant are those in respect of which the site was designated and their associated conservation objectives.'[78] A site's 'conservation objectives' should be set out at the time of designation of an SPA or SAC, a process with an important role for Natural England. The conservation objectives of the FHBC SPA, as set out and discussed in both *Rampion* and *Hornsea Two*, are worth quoting:

> 'Avoid the deterioration of the habitats of the qualifying features, and the significant disturbance of the qualifying features, ensuring the integrity of the site is maintained and the site makes a full contribution to achieving the aims of the Birds Directive.
>
> Subject to natural change, to maintain or restore:
>
> - The extent and distribution of habitats of the qualifying features;
> - The structure and function of the habitats of qualifying features;
> - The supporting processes on which the habitats of the qualifying features rely;
> - The distribution of the qualifying features within the site.'[79]

The circularity of the definition of 'integrity' (integrity is defined in part by reference to conservation objectives, which are defined in part by reference to integrity), emphasises the difficulty of seeing this as a simply factual or a simply legal question.[80] The conservation objectives constitute what we have elsewhere termed 'prior institutional knowledge', by which we mean knowledge that has been absorbed within the system in an earlier process,

---

[73] *R (Morge)* v. *Hampshire County Council* [2011] W.L.R. 268.
[74] Id. [25].
[75] Id. [79] (Lord Kerr, dissenting, but not on this issue).
[76] L. Warren, 'Bats or Buses: A Battle for a Beeching Cast-off – *R (on the application of Morge) v Hampshire CC*' [2011] *Environmental Law Rev.* 205, 213. See also C. George and D. Graham, 'After *Morge*, Where Are We Now? The Meaning of "Disturbance" in the Habitats Directive' in *The Habitats Directive: A Developer's Obstacle Course?*, ed. G. Jones (2012) 58.
[77] George and Graham id.
[78] *Sweetman*, op. cit., n. 63, [56]. See also on the importance of the conservation objectives European Commission, *Assessment of plans and projects significantly affecting Natura 2000 sites Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC* (2001).
[79] *Rampion* [5.69]. Note that these were updated in 2014, see *Hornsea Two* [6.7.3].
[80] See also *RSPB* v. *Secretary of State for the Environment, Food and Rural Affairs* [2015] Env. L.R. 24 (CA) on the interpretation of conservation objectives, [21].

and need not be reopened.[81] For current purposes, the conservation objectives provide prior institutional knowledge on the site's nature conservation interest. Prior institutional knowledge routinely provides stability within legal reasoning. It both simplifies and enriches the factual and legal context for a decision; in this case simplifying by sidestepping a lot of complicated discussion about what constitutes integrity, and enriching by being wholly specific to the idiosyncracies of a particular site.

Most importantly, the conservation objectives confirm the centrality of birds to assessing the 'integrity' of the FHBC SPA: the 'qualifying features' referenced in the quotation above are kittiwake and gannet.[82] Whilst other ornithological (for example bird displacement) and biodiversity (for example the effect on marine mammals) issues are addressed in the examinations and the reports, the ExA reports demonstrate very little curiosity about any possibly more expansive or profound meaning to 'integrity'. We concentrate on the discussion of bird deaths by collision, as illustrating clearly the issues we discuss in this article, and as the 'most debated' ornithological issue in our cases.[83]

The National Policy Statement on Renewable Energy explicitly provides that collision risk modelling 'may be appropriate' for assessing the impact of a wind farm on birds.[84] This sort of 'official' approval is always important to the ExA.[85] The 'Band' model is the 'current methodological standard for [collision risk modelling]',[86] and there can be lengthy discussions of the most appropriate 'version' of Band.[87] It is worth noting that the Band model was created for the Crown Estate, and so explicitly for the purposes of governing.[88] To describe the approach as highly specialist and technical is an understatement.

There are several steps to the assessment of the impact of the applicant's proposal on birds. We draw this somewhat simplified description of the modelling from the reports, and from Band. An initial requirement is to identify the excess deaths from the wind farm that the relevant population of birds (and so the protected site) can tolerate: 'Potential Biological Removal' (PBR) modelling and 'Population Viability Analysis' (PVA) are two methods used in

[81] Lee, op. cit., n. 59.
[82] [5.70]. The seabird assemblage was also a qualifying feature, [5.71].
[83] The quotation is from *Hornsea Two*, [6.7.42], but it is a fair analysis of the other reports.
[84] DECC, *National Policy Statement on Renewable Energy Infrastructures (EN-3)* (2011) [26.104].
[85] See e.g. on landscape, Lee, op. cit., n. 59.
[86] *Hornsea Two* [6.7.12]. Band, op. cit., n. 3, which makes the extent of uncertainty and simplification very clear.
[87] See the discussion of the different approaches in *Hornsea Two*, [6.7.12]-[6.7.15]. The four options vary according to assumptions about bird flight data, and the availability of site specific information.
[88] Simplifying, the Crown Estate leases wind farm capacity at sea.

our cases.[89] PVA calculations 'use simulation modelling of population processes and population size',[90] often to estimate 'the probability that a population … will persist for some particular time in a particular environment'.[91] In our cases, estimates of what would happen to the population without the wind farm, including expected population *growth*, contribute to the assessment of the wind farm's impact. PBR modelling is designed 'to determine levels of incidental mortality that will not lead to population decline, setting upper and lower thresholds for mortality through use of different population recovery factors.'[92] It defines 'headroom', that is 'the additional mortality margin forecast as possible without affecting integrity.'[93] Sometimes this whole process is called 'collision risk modelling', but that phrase also applies to the next step in the process, which calculates the number of birds that will collide with the wind farm per month or year.[94] This is then assessed against the mortality that the relevant population can tolerate, according to PBR modelling or PVA. Surveys of birds at protected sites gather initial evidence to feed into the PBR or PVA, and surveys of the proposed development site gather 'flight data', on the number of birds at the site and the proportion that fly through the site at rotor height.[95]

It swiftly becomes apparent on reading the ExA reports that each step of this process can be subject to contestation and discussion, and that negotiation between the applicant and statutory bodies (and occasionally others) are, as discussed below, crucial to streamlining areas for discussion. The applicant in *Hornsea Two* had used PBR, but Natural England and the RSPB 'advocated the use of PVA'; as a result of these discussions, the applicant also produced a PVA report.[96] Disagreement remained over whether the applicant's data on the relevant bird population was sufficiently robust to use the version of PVA that it did;[97] the applicant and Natural England agreed a methodology, with a range between an upper threshold and a lower threshold of bird deaths that would not adversely affect conservation status.[98] The accuracy of the applicant's boat based observations of the height at which birds fly through the project site, and their extrapolation into the model, were also contested

[89] A Biologically Defined Minimum Population Scale (BDMPS) is discussed in some reports (e.g. *Hornsea Two, Navitus*). This assesses populations during the non-breeding season, rather than counting breeding pairs, R.W. Furness, 'Non-Breeding Season Populations of Seabirds in UK Waters: Population Sizes for BDMPS' (2015) *Natural England Commissioned Reports No 164.*
[90] *Hornsea One* [6.7.23].
[91] L. Gerber and M. Gonzalex-Suarez, 'Population Viability Analysis: Origins and Contributions' (2010) 3 *Nature Education Knowledge* 15.
[92] *Rampion* [4.220].
[93] [5.80].
[94] Band, op. cit., n. 3.
[95] Band, id.
[96] [6.7.24].
[97] *Hornsea Two* [6.7.25].
[98] [5.79].

in *Hornsea Two*, by both Natural England and the RSPB.[99] The applicant ran multiple versions of the model. Again, Natural England and the applicant were able to agree a Statement of Common Ground on the outputs of the final model.[100]

A central and contested assumption within the final step of collision risk modelling 'proper' is the 'avoidance rate' (AR). This describes the proportion of birds currently using the relevant area which are expected to avoid colliding with the turbines. Band says that 'for the foreseeable future, it seems likely that the uncertainties surrounding bird avoidance behaviour are likely to dwarf the other errors and uncertainties arising from an inexact collision model or variability in survey data'.[101] Altering this parameter can however directly affect the outcome.[102] In *Rampion*, Natural England preferred a 98% AR for gannet, the applicant a 99% AR. The mortality by collision rate is halved by a 99% AR, from a predicted annual gannet mortality of fourteen birds to seven.[103] These are low numbers, but even so, depending on the way in which the impacts of other wind farm projects are taken into account, can make the difference between exceeding the 'headroom' or not. The ExA emphasises that 98% 'would include a precautionary element', but that 'insufficient convincing evidence was presented … to demonstrate that a 98% avoidance rate is so exceedingly precautionary as to be unrealistic.'[104] So the ExA prefers Natural England's 98%,[105] but explicitly 'recognises it will be for the [Secretary of State] to determine which avoidance rate to use in the appropriate assessment'.[106] Every element of the decision is indeed ultimately for the Secretary of State, who however makes that decision largely on the basis of the evidence and recommendations provided by the ExA.[107] The ExA, notwithstanding its approach to the AR, ultimately recommends that the Secretary of State can conclude that the integrity of site will not be compromised,[108] and that a DCO can be granted.[109] More straightforwardly, the Secretary of State simply uses the 99% AR, 'on the available evidence, which documents greater avoidance of wind farms by gannets than for

[99] [6.7.16].
[100] [6.7.16].
[101] Op. cit., n. 3, [88], cited in *Hornsea Two* [6.7.12]. See also Band, id., [82].
[102] *Rampion* [5.82]; *Hornsea Two* [6.7.36].
[103] [5.81].
[104] [5.104].
[105] [5.104], [5.131].
[106] [5.104].
[107] Although the Secretary of State can seek further evidence.
[108] [5.7]. The ExA says on a number of occasions that it is unable to rule out an effect on integrity, but the intention is probably to refer to the first stage of the legal process, i.e. that a significant effect cannot be ruled out.
[109] The lower (not the upper) threshold is exceeded by only one bird, [5.117], although see the Environmental Assessment Report appended to the *Letter of the Secretary of State*, 16 July 2014, suggesting that there needs to be sufficient precautionary headroom to allow for the various assumptions and uncertainties required to reach the numbers used, [6.23].

many other species',[110] removing any question of 'too much' bird mortality. Although it is less contested in some subsequent cases,[111] the AR is instructive of the ways in which detail matters. It is however far from the only contentious assumption. The 'cumulative impact' of wind farms in various stages of proposal, consent or construction is as pivotal as the AR, and as difficult. The table below is slightly adapted[112] from the Environmental Assessment Report appended to the Secretary of State's *Rampion* letter. It indicates both the significance of assumptions, and the deceptive simplicity of the 'output' of the models. *[Table 1 here]*

[110] Secretary of State, id., [23]. See also Environmental Assessment Report, id., especially Table 4 and [6.22].
[111] But much discussed in *Hornsea Two*.
[112] For clarity, largely to avoid fresh acronyms.

TABLE 1

Predicted cumulative gannet and kittiwake adult mortality at the Flamborough Head and Bempton Cliffs SPA.

	Gannet 98% AR	**Gannet 99% AR**	**Kittiwake 98% AR**
Already consented wind farms adult mortality	199	100	91
EA One wind farm (with the Secretary of State, not yet consented) additional adult mortality	74	37	104
Rampion adult mortality	14	7	22
Total	**287**	**144**	**217**
Lower PBR threshold	286	286	250
Total adult mortality before Rampion	273	137	195
Headroom before Rampion (lower PBR)	**13**	**149**	**55**
Headroom after Rampion (lower PBR)	**-1**	**142**	**33**
Upper PBR threshold	361	361	350
Total adult mortality before Rampion	273	137	195
Headroom before Rampion (upper PBR)	**88**	**224**	**155**
Headroom after Rampion (upper PBR)	**74**	**217**	**133**

We have necessarily simplified the debate that takes place within the process, and its reflection in the lengthy ExA reports. But even from this relatively thin outline, the constant negotiation is clear, adding to the sense that 'integrity' does not exist independently of the process, out there waiting to be discovered, but is fundamentally part of that process. Discussion and agreement between Natural England and the applicant is a crucial part of interpreting and complying with requirements on integrity; we return to Natural England's role below. Interestingly, whether 'integrity' might imply something more than bird mortality in the particular case[113] is not generally subject to discussion in the ExA Reports. This is the first and most impenetrable black box in the use of models, and largely comes before the models themselves. The prior institutional knowledge implied by listing some sites and not others is taken for granted;[114] the interesting features ('conservation objectives') of these sites is also unproblematically incorporated into the reason giving process, as something 'known' about the world.[115] This reliance on prior institutional knowledge is not at all surprising, and allows difficult questions to be settled in an earlier process – with obvious benefits and disadvantages. The way that this prior institutional knowledge allows the meaning of 'integrity' to be sidestepped is nevertheless intriguing. For the purposes of getting on with a decision, 'integrity' is boiled down to the 'viability' (rather than, for example, flourishing) of the particular bird population,[116] in turn boiled down to a simple (to describe, not assess) question of bird deaths through collision with the turbines. And ways of 'knowing' bird deaths have been constructed, notwithstanding 'a dire lack of monitoring evidence, and a high level of uncertainty'.[117] The ExA reports end up being able to display a table presenting the number of predicted bird deaths alongside the number of 'acceptable' bird deaths (itself presumably determined by reference to an unspoken assumptions about acceptable risks of

[113] Conservation objectives for different sites vary.
[114] Op. cit., text at n. 81; see further Lee, op.cit., n. 59.
[115] Which is not to assert a total acquiescence by (especially) local NGOs to the level of protection accorded to particular sites and species. Further, in *Hornsea Two*, areas and species that had not yet been made subject to protection were assessed; also *RSPB*, op. cit., n. 80, challenging the interpretation of conservation objectives.
[116] It is possible to construct a legislative line between 'integrity and 'viability', via the definition of favourable conservation status (FCS). A species achieves FCS inter alia if the 'population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats…', Habitats Directive, op. cit., n. 5, art 2. The conservation status of habitats and species are intimately connected, and the FCS of a habitat requires FCS of its typical species. FCS pervades the Habitats Directive, but does not appear in the Birds Directive, which refers to the maintenance of populations 'at a level which corresponds in particular to ecological, scientific and cultural requirements', art 2. The Commission reads FCS into the Birds Directive. For a fascinating discussion, see Epstein, op. cit., n. 72. Note that in *Sustainable Shetland* v. *The Scottish Ministers* [2015] Env. L.R. 23 the Supreme Court takes the view that there is nothing in the Directives to link FCS with art 2 of the Birds Directive (leaving open article 4 on SPAs), [20].
[117] *Hornsea Two* [7.3.1].

failure). Our intention is not to criticise the lawfulness or broader legitimacy of this approach, simply to observe what happens when law demands that decisions be made.

AUTHORITY AND CO-PRODUCTION

The discussion above already points towards the co-production of science and law: the cognitive techniques, and their outputs, are shaped (even demanded) by law; simultaneously, the limits and potential of those cognitive techniques shape what law means and demands. We also see the beginning of a similar phenomenon in terms of authority, which we explore further in this section. How and what we know is tightly linked with who governs and how, with epistemic and legal authority mutually reinforcing each other.[118] Emma Lees' insightful discussion of decision making on European sites discusses a 'triumvirate' of 'decision-makers', composed of the judiciary, scientific advisors and administrative bodies, with authority depending on whether the nature of the decision is identified as being a question of law, fact or judgment respectively (although neither she nor we suggest that these terms can be neatly separated).[119] Whether 'integrity' is a matter of law, fact, or value judgment is a difficult question to answer satisfactorily, and that has important substantive implications for who makes decisions, and how.

In addition to the judiciary, key actors in the NSIP process include the Secretary of State, the ExA, Natural England and the applicant. The Secretary of State is the equivalent of Lees' 'administrative authority', a role that, given the strength of the ExA's advice, is shared. Although the Secretary of State remains responsible, he or she is highly dependent on the quality of the work done by the ExA. The primary 'scientific' advisor in respect of nature conservation is Natural England, who advises both the ExA and the Secretary of State, although of course value judgments pervade these technical exercises. The NSIP process also includes public participation. As discussed below, specialist nature conservation NGOs engage vigorously in some cases, although they find it difficult to have a decisive impact on the decision.

Natural England clearly plays a very influential role in the specific decision on 'integrity', and the ways in which models are used in that decision. As a statutory body, constituted

[118] M. Weimer and A. de Ruijter, op. cit., n. 6, most explicitly in the editors' introduction; C. Waterton and B. Wynne, 'Knowledge and Political Power in the European Environment Agency' in Jasanoff, op. cit., n. 4; Irwin, op. cit., n. 19.
[119] E. Lees, 'Allocation of Decision-Making Power under the Habitats Directive' (2016) 28 *J. of Environmental Law* 191.

amongst other things to provide advice to public authorities on nature conservation and biodiversity, it enjoys a certain institutional authority.[120] The influence of Natural England is partly attributable to the ExA's strong preference for agreement between Natural England and the applicant. The applicant is required to consult Natural England prior to making its application for a DCO,[121] and the Planning Inspectorate advises the applicant to confirm 'where appropriate' in the application that Natural England 'supports the conclusions',[122] and to seek Statements of Common Ground with Natural England.[123] It would be hard to overestimate the importance of agreement between the applicant and Natural England, in narrowing the scope of debate and resolving specific issues.[124]

But even when Natural England and the applicant do not agree, the role of the statutory nature conservation body remains a strong one.[125] The High Court in the Welsh onshore wind farm case of *Mynydd y Gwynt*, citing earlier case law throughout, found that the Secretary of State 'was bound to give considerable weight' to the advice of Natural Resources Wales that an *onshore* nationally significant wind farm was 'likely to have a significant effect' on a European site, 'unless there was good reason not to do so'.[126] Given the Secretary of State's 'wide discretion in the matter', she was, further, 'clearly *entitled* to follow that advice, even if others (e.g. the ExA) disagreed'.[127] The Supreme Court decision in *Morge* is also striking: 'Where … Natural England express themselves satisfied that a

[120] Natural Environment and Rural Communities Act 2006.
[121] Planning Act 2008, s. 42(a); The Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009 SI 2009/2264.
[122] Planning Inspectorate, *Advice Note 10: Habitats Regulations Assessment relevant to Nationally Significant Infrastructure Projects* (2013), 7.
[123] Id. 8.
[124] See further Y. Rydin et al., 'Black-boxing the Evidence: Planning Regulation and Major Renewable Energy Infrastructure Projects in England and Wales' *Planning Theory and Practice*, forthcoming. These agreements do not formally prevent the ExA hearing disagreement, but they are highly influential.
[125] Which is not to say that the ExA never disagrees with Natural England. E.g. in *Hornsea One*, the ExA disagrees with Natural England's conclusion on integrity, inter alia because its 'rigid' approach to the AR 'is considered over-precautionary' [5.109].
[126] [67(xi)]. See also *Smyth* v. *Secretary of State for Communities and Local Government* [2016] Env. L. R. 7, [81]; *R (on the application of Akester)* v. *Department of Environment, Food and Rural Affairs* [2010] Env. L.R. 33, [112].
[127] [67(xi)], emphasis added. The Secretary of State faced a difference of opinion between its two advisors, the specialist nature conservation advisor and the specialist planner; she followed the advice of Natural Resources Wales, and the High Court upheld her decision. *Secretary of State for Environment, Food and Rural Affairs* v. *Downs* [2010] Env. L.R. 7 is perhaps the leading environmental case on conflicting advice. The legislative context is always significant, but in *Downs*, a deferential standard of review is applied to the Secretary of State's decision, so that as long as the choice was *Wednesbury* reasonable, the Court shall not interfere. *R (Mott)* v. *Environment Agency* [2016] 1 W.L.R. 4338 is slightly different, focusing on the standard of judicial review of Environment Agency decision making (rather than the influence of Agency advice on another body's evaluation), but emphasises the difficulty of concluding that a prediction, based on expertise and experience plus the balancing of interests, is irrational.

proposed development will be compliant … the planning authority are to my mind entitled to presume that that is so'.[128] The legal framework in *Morge* is importantly different from the Planning Act, since the planning authority was not required to make its own assessment, simply to 'have regard' to the relevant legal provisions. The Secretary of State in our cases clearly is required to decide for herself. *Morge* speaks nevertheless to the scientific authority of Natural England. The influence of Natural England and Natural Resources Wales is more generally implicit in the emphasis by the judiciary on the external authority provided by science. According to the Court of Justice, the assessment must be based on 'the best scientific evidence in the field';[129] 'complete, precise and definitive findings and conclusions capable of removing all reasonable scientific doubt'.[130]

The strong place for Natural England in decision making on offshore wind farms reinforces the 'scientific', 'factual' presentation of the integrity question, just as that scientific understanding reinforces the authority of Natural England. The legal obligation in the Habitats Regulations is however to 'have regard' to Natural England's advice, not necessarily to follow it. This leaves clear space for evaluation by the ExA and the Secretary of State, and the Courts are careful to avoid giving expert advisors the final say. The Court of Appeal has confirmed that 'the views of Natural England may – though not must – be given considerable weight' in habitats cases.[131] A court will look behind the expert evidence, and in one extreme case, when Natural England's advice 'could not be supported on logical and empirical grounds', the decision relying on it was unreasonable in *Wednesbury* terms.[132] But more importantly than identifying error, asserting the authority of the final decision maker is about asserting that the nature of the decision is not (could never be) wholly scientific. The decision 'clearly requires evaluative judgments to be made';[133] and the task of 'judging what is an "acceptable" level of risk' is 'an eminently political responsibility'.[134]

---

[128] Op. cit., n. 73, [30]. *R (on the application of Devon Wildlife Trust)* v. *Teignbridge District Council* [2015] EWHC 2159 (Admin), 'Natural England's opinion should properly be given particular weight', [78(c)(viii)].
[129] *Waddenzee*, op. cit., n. 46, [54].
[130] *Sweetman*, op. cit., n. 63, [44]; also Lees, op. cit., n. 119. Since that article was written, see also *Mynydd y Gwynt*, op. cit., n. 47; *R (On the application of DLA Delivery Ltd)* v. *Lewes District Council* [2017] Env. L.R. 18.
[131] *DLA*, id., [30]. This might simply be more careful wording than the cases in the previous note.
[132] *Wealden District Council* v. *Secretary of State for Communities and Local Government* [2017] EWHC 351, [101]. *ClientEarth* v. *Department for Environment, Food and Rural Affairs* [2016] EWHC 2740 (Admin); [2017] Env LR 16 indicates that the courts are willing to look behind the 'markedly optimistic' assumptions made in air pollution modelling, in an extreme situation where it was acknowledged that '"emerging data" were undermining the models', [86] and [85]. Also *Smyth*, op. cit., n. 126, [83].
[133] *Smyth*, id., [78], citing AG Kokott in *Waddenzee*, op. cit., n. 46.
[134] *Smyth* id., [100]. Also *Waddnezee*, id.

The inability to sustain tidy lines between these different categories is however at the heart of the critique posed by co-production. The vanishing line between fact and value is familiar in legal scholarship, and their mutual shaping often acknowledged. The space for law is equally important to the construction of evidence, and to the determination of where authority lies. It is clear that the legal meaning of integrity 'cannot be understood without engagement with the facts'.[135] Integrity is defined in part through the prior institutional knowledge contained in the conservation objectives – but nor are they self-executing.[136] Integrity is, for a particular site, defined in the process of governing. The important insights of 'co-production', that social and natural worlds are mutually constitutive, applies also to law: the facts are partially legally constructed, and law does not exist independently of and prior to the facts. 'Mixed' questions of fact and law are a routine feature of law,[137] but are especially challenging here. Law demands the governance of 'integrity'; collision risk modelling renders bird populations, and in turn integrity, ostensibly governable. The collision risk models fill out the 'institutional mandate'[138] of integrity, in this case both describing as well as applying the institutional mandate.

It is not easy to pull the nature of the decision or the associated allocation of authority cleanly out of the cases. 'Integrity' is a legal term, with a legal meaning and legal implications; but it is also a mixed question of fact and evaluation. Holders of all of those different types of authority exercise power within the process, but in a mutually dependent way. Courts interfere with findings of fact, judgment and law very differently, so that contentious exercises of line drawing could be normatively meaningful. The collision risk modelling, a cognitive technique fortified by legal requirements, does not just provide an output, to be fed into a decision. It provides a process for constructing legal meaning and legal compliance, avoiding in most cases hard questions of who has authority. In the process, the models provide legal authority to the applicant's proposal, through evidence sufficient to satisfy legal tests constructed within the process of governing. This is the subject of the next section.

---

[135] Lees, op. cit., n. 119.
[136] Text at op. cit., n. 80.
[137] See e.g. T. Endicott, 'Questions of Law**'** (1998) 114 *Law Quarterly Rev.* 292**.** Indeed this seems a very apposite description of the legally ubiquitous 'reasonable person'. Whether the 'reasonable person' standard has been complied with is purportedly a question of fact, subject to spare legal definition, but the finding is clearly normative. By contrast with integrity, the 'reasonableness' of the reasonable person is self-consciously accessible to (often dependent on) lay judgment, and both fact and law are determined by the private law judge. When the activities of the reasonable person become more exotic and less accessible to common sense (e.g. the reasonableness of medical treatment), fact finding becomes more complicated (see also M. Lee, 'The Sources and Challenges of Norm Generation in Tort Law' *European Journal of Risk Regulation* forthcoming). In our case of administrative decision making, there are greater challenges for specifying authority.
[138] Fisher et al., op. cit., n. 7.

UNCERTAINTY, PROCESS, AND THE ROLE OF COLLISION RISK MODELLING

Co-production of fact and law, as in the previous section, is an important part of the puzzle here, contributing both to the definition and identification of integrity in any particular case, and to the sharing and assigning of authority between different actors. Collision risk models are part of making practical progress notwithstanding the challenges; of allowing everyone to step through hard to sustain distinctions. Profound uncertainty pervades discussion of the impact of offshore wind farms on ecosystems and birds, and is perhaps inherent to such a densely co-produced knowledge. More data (for example on how well birds avoid wind turbine blades) or better models, will only reduce, not eliminate, the uncertainty. When the factual predictions are less uncertain (including for onshore wind farms, where researchers have had the advantage of being able to collect and count dead birds), this whole story will be less dramatic. But in our cases, the NSIP process becomes primarily a space for making decisions in conditions of uncertainty. In this context, it is as important to interrogate the models for their contribution to process values as for their contribution to questions of fact.

The models discussed here are not naively regarded as 'truth machines',[139] and the 'spurious level of precision'[140] that they provide seems not to be taken unduly literally by Natural England or the ExA (or possibly even by the applicant, whose approach is being criticised in this quotation). This seems fairly apparent from the general discussion, and for example from the occasional appearance of fractions of a bird.[141] In *Rampion*, the outputs of the model are described as 'predicted mortalities',[142] but in *Hornsea Two*, possibly more accurately, as 'collision risk estimates'.[143] More directly, in an interesting piece of boundary work,[144] the applicant in *Rampion* argues that disagreement on ARs (and as discussed above, ARs feed directly into the 'answer') is not a 'scientifically based' uncertainty, but a policy uncertainty, arising out of 'the absence of [a] clear policy view'.[145] Natural England apparently concurred to at least some degree, stating that 'in the absence of strategic guidance', the inability to agree ARs 'is likely to remain a difference in professional opinion

[139] Fisher et al., id.
[140] *Hornsea Two*, bird flight-height data [5.57].
[141] See e.g. *Rampion's* Report on Impact on European Sites.
[142] Eg [5.79], table 5.2.
[143] Eg [6.7.41].
[144] Irwin, op. cit. n. 19.
[145] [5.5].

and a matter not agreed'.[146] Instrumentally, the insistence that 'lack of certainty [derives] from matters other than those which are scientific'[147] avoids triggering *Waddenzee* precaution (which we might call 'factual' precaution).[148] But it is based on an understanding that judgment of how many birds will be killed by turbine blades is not purely factual.

Nor are the courts naïve about the elusiveness of straightforward facts in respect of habitats protection. Even in *Waddenzee*, that most demanding case, AG Kokott acknowledges that a decision maker might be 'subjectively' certain, even when certainty 'from an objective point of view' is impossible.[149] She also acknowledges that 'if no certainty can be established even having exhausted all scientific means and sources, it will consequently be necessary also to work with probabilities and estimates. They must be identified and reasoned'.[150]

The inability of the models to provide truth (about bird deaths, about integrity) should be uninteresting, especially if recognised by those within the process. 'Proof' is rarely available,[151] and incomplete information is absolutely routine in planning and conservation. Administrative bodies habitually turn to different cognitive techniques, including modelling, for a 'good enough' solution.[152]

The ExA in our cases does not engage in an unrealistic search for 'truth pure and simple' (the decision in *Waddenzee* notwithstanding), but 'serviceable truth'.[153] Serviceable truth is a 'state of knowledge that satisfies tests of scientific acceptability and supports reasoned decision making, but also assures those exposed to risk that their interests have not been sacrificed on the altar of an impossible scientific certainty'.[154] Not only are facts that *are* 'good enough' for the purpose of governance shaped and created within the examination, in debate and agreement, but so is *what* good enough means. The need to take a decision within especially strict time limits (six months for the examination) contributes to the construction of the meaning of good enough,[155] as does the highly precautionary legal

[146] [5.59].See also the discussion of the need for an authoritative resolution of the cumulative issue, [5.124]-[5.126].
[147] [5.5].
[148] *Waddenzee*, op. cit., n. 46.
[149] Id., [107].
[150] Id., [97].
[151] N. Oreskes, 'Science and Public Policy: What's Proof Got to do With it?' (2004) 7 *Environmental Science and Policy* 369.
[152] E.g. R.L. Glicksman, 'Bridging Data Gaps through Modelling and Evaluation of Surrogates: Use of Best Available Science to Protect Biological Diversity under the National Forest Management Act' (2008) 83 *Indiana Law J.* 465.
[153] Jasanoff, op. cit., n. 8, p. 1725.
[154] S. Jasanoff, *The Fifth Branch: Science Advisers as Policymakers* (1990) 250.
[155] Owen and Fine, op. cit., n.7, p. 155, in respect of air pollution modelling.

context provided by the Habitats Directive. Although uncertainty is recognised in cases like *Waddenzee*, it is little tolerated, rendering ideas of 'merely' serviceable truth especially tricky. Doubt is supposed to be resolved by rejecting the application for development, although the question immediately becomes, again, working out what doubt means in the particular case. This may be one of those areas where law is 'doing the impossible, knowing full well that it is impossible'.[156]

Acceptance that models do not reveal the world is not to say that the quality of the models is irrelevant. [157] A model that said either that no birds will avoid the wind farm, or that they all will, is less rigorous than a model estimating how many will do so, an estimation that may be refined over time by observation. The energy devoted to arguing about the models reminds us both that what constitutes 'good enough' knowledge is contentious, and that the substance of the models matters. The model needs to 'credibly pass as objective in a particular context, for certain purposes, and only for now', not for all purposes and all time.[158]

What Andrew Lang calls '"as if" knowledge practices' is also a useful way of working through the role of the models in decision making in our cases. 'As if' knowledge practices have 'very little aspiration to facticity: they do not seek to accurately represent the world, but rather to offer themselves as a tool for action within it'.[159] This suggests that we should assess our models not in terms of the certainty or accuracy of their outcomes, but in terms of their contribution to the task of legitimate governance. Lang examines the role of the 'market' as a benchmark of legitimacy in the global regulation of subsidies, and argues that in this context, the 'market' is not a factual (economic), but a legal, construct. Taking a legal approach to the 'market' enables decision makers to 'cut short debates about the adequacy and accuracy of economic expertise, by reference to an alternative set of techniques, and criteria of validity, and through the production of legal fictions'.[160] Lang's markets are a matter of law, effortfully resisting a 'factual' determination. 'Integrity' may share a certain non-facticity with Lang's markets. We do begin with a legal construct (integrity) rather than a question that even purports to exist out there in the world (integrity?). And yet, as discussed above, the courts insist on the scientific content of integrity, suggesting at least a factual element. Moreover,

[156] Knop et al., op. cit., n. 10 , at 645 (of conflicts of law).
[157] N. Oreskes, 'Evaluation (not Validation) of Quantitative Models' (1998) 106 *Environmental Health Perspectives* 1453; Fisher et al., op. cit., n. 7. See e.g. *Hornsea Two*: 'Notwithstanding the uncertainties and complexities involved in the predictive modelling … the Panel wishes to acknowledge the considerable value to its Examination of the efforts and outputs which were devoted to several rounds of the task to further refine and clarify offshore ornithological issues' [6.7.8].
[158] A. Lang, 'New Legal Realism, Empiricism, and Scientism: the Relative Objectivity of Law and Social Science' (2015) 28 *Leiden J. of International Law* 231, at 254.
[159] Id.166.
[160] Id. 150.

once we have decided that birds are what matter, 'birds' and 'markets' are very different things. Adding to the complexity, 'as if' reasoning is closely related to the notion of the 'legal fiction',[161] which is generally thought to apply to 'questions of fact' rather than 'questions of law',[162] or perhaps 'a legal conclusion … that takes the form of a factual statement'.[163] A lengthy digression on whether we are dealing with legal fictions in our cases would not really advance our reasoning very far. But this fluidity of fact and law is perhaps appropriate where law and fact are, as discussed in the previous section, as densely co-produced as they are here. The 'fiction', if there is one, is in speaking 'as if' we 'know', both what integrity means and whether it will be adversely affected by the proposed development. This extends fiction very far into legal reasoning.

This idea of 'as if' reasoning resonates very strongly with the discussion of integrity in the reports. No one needs to believe that the ExA's conclusions on bird mortality and the integrity of protected sites literally reflect the state of the world, or that when they do not come to pass, an error must have been made. But they allow a decision to be made. Perhaps paradoxically, whilst not 'truth machines', models may (eventually, after contestation and iteration) be seen as 'answer machines',[164] providing a single answer to the legal question. Rather than 'acting on our belief', the models determine 'our actions',[165] in this particular context, *as if* they are able to answer the question about integrity. This is especially the case if the model methodology or output has been agreed between the applicant and Natural England, as a sufficient basis for action. The ExA Reports, whilst acknowledging uncertainty, proceed to a resolution as if they know how many birds will die, and what the implications of that are. Uncertainty and disagreement are simply folded into the reasoning.

'Good enough' and 'as if' modes of decision making are quite different in some respects, particularly in the sense that one seeks to approximate the 'truth', whilst the other 'wilfully abandons it'.[166] But they are clearly related, and like 'as if' reasoning, 'serviceable truth' is primarily interested in the *purpose* of fact finding.[167] In neither case is the process fixated on discovering truth, but on reaching legitimate, more or less acceptable, decisions for the

[161] There is a long history. See eg L.L. Fuller, 'Legal Fictions' (1930) 25 *Illinois Law Rev.* 363 and 513.
[162] K. Campbell, 'Fuller on Legal Fictions' (1983) 2 *Law and Philosophy* 339.
[163] A. Riles, 'Is the Law Hopeful?' *Cornell Law Faculty Working Paper* 1-1-2010, pp. 15-16. See also op. cit., n.137.
[164] Wagner et al., op. cit., n. 2, although note that answer machines and truth machines may be more or less synonymous for their purposes.
[165] Lang, op. cit., n. 9.
[166] Knop et al., op. cit., n. 10.
[167] Jasanoff, op. cit., n. 8, p. 1725.

immediate purpose of governing. And they can occupy the same ground: both resonate with our reading of the ExA reports. The striving for better data speaks to 'serviceable truth', as does the apparent confidence of the courts in the ability of science to provide the answer. The silence on the meanings at stake in integrity, and the pervasive complexity of deciding, speaks to the latter. Lang also acknowledges that the 'functionalist' mode, where law 'borrows' objectivity from an external perspective can coexist with the transformation of bird deaths into a legal (rather than factual) concept; or for our purposes a co-produced concept, not neatly legal, factual or evaluative.

In any event, we move away from seeing the models as simply, or primarily: true or false; right or wrong.[168] Instead, we focus on 'the practical necessity of arriving at a resolution',[169] and how the models assist with that. It would be an overstatement to describe the approach to collision risk modelling that we have seen in the Examinations as deliberative, but the opportunity for negotiation and collaboration, at least between certain privileged parties, is significant.[170] The models provide artefacts around which discussion can orient itself, 'apertures' for 'learning'.[171] The iteration of the models in communication between the various parties is a constant theme of the ExA reports. The applicant and Natural England are negotiating the best lawful way to think about the impact of wind farms on birds, in the context of considerable time constraints. The ExA plays an active role in that, and the Secretary of State's oversight can be active and disruptive (as demonstrated by *Mynydd y Gwynt*). Specialist NGOs contribute energetically, and may be partially successful in framing the debate. The RSPB was profoundly engaged in *Hornsea Two*, for example, and clearly contributed to the shaping of the evidence. But whilst 'differences between Natural England and the Applicant … did narrow' during the examination, '[the] narrowing in differences was much less between the positions of the Applicant and the RSPB'.[172] Ultimately, the RSPB's conclusion that there would be an adverse effect on the integrity of European sites was rejected by the ExA, which preferred the agreement between the applicant and Natural England.

---

[168] Avoiding 'strategic games' between parties (Wagner, et al., op. cit., n. 2), or constant efforts to 'deconstruct each other's positions instead of deliberating effectively' S. Jasanoff, 'Technologies of humility: Citizen Participation in Governing Science' (2003) 41 *Minerva* 223, at 237).

[169] D. Sarewitz, 'How Science Makes Environmental Controversy Worse' (2004) 7 *Environmental Science and Policy* 385 – although we do not need to go so far as he does, in the very different context of the disputed Gore / Bush election results.

[170] Fisher et al., op. cit., n. 7, discuss 'regulatory strategy' models, 'tools for networking public and private actors into collaborative decision-making' and a 'vehicle for collaborative deliberation', p. 256.

[171] S. Owens et al., 'New Agendas for Appraisal: Reflection on Theory, Practice, and Research (2004) 36 *Environment and Planning A* 1943, at 1950. Fisher et al., id.

[172] [6.6.3] Also *Hornsea One* [5.28].

The question becomes how or whether the models (or any other techniques) contribute to the task of legitimate governance of a phenomenon we do not (and for now at least cannot) really understand. Legitimacy is a complex idea, and the subject of an enormous literature.[173] But fundamentally, and sufficiently for current purposes, legitimacy is concerned with the acceptability of the substance, the legality and the process of a decision, to the various communities (lay and professional) involved. We are not suggesting that legitimacy requires everyone to be happy; and that is far from the case in the decisions we have examined.[174] But the modelling contributes to the hard work of constructing the legitimacy of some aspects of these decisions:[175] an approximation to the facts contributes to epistemic legitimacy;[176] the space for negotiation potentially contributes both to process legitimacy and to approximating the facts; and in a framework of co-production, the entire exercise allows for formal legal requirements to be satisfied.

If we see models as contributing to the legitimacy of a process for decision making, the sufficiency of representation in our cases raises enough questions for at least another article.[177] The lay public is notable by its absence in the discussion of birds, presumably in part precisely because of the highly technical nature of the discussion. Diverse forms of highly localised, less formal expertise, such as that found in bird watching groups may also be sidelined from the crucial discussions around the modelling.[178] Taking part in the intense six month process of constantly evolving evidence that constitutes an Examination is onerous.[179] Alongside these practical and epistemic challenges, the difficulty of unearthing and challenging assumptions embedded in the output is a perennial barrier to inclusive processes around technical methods. Some assumptions in our cases are very 'visible', including for example the *Rampion* ARs. But in later cases, the 99% AR used by developers is accepted by Natural England, and the ExA, citing a review of the evidence prepared for

[173] See the analysis of the literature in J. Black, 'Constructing and Contesting Legitimacy and Accountability in Polycentric Regulatory Regimes' (2008) 2 *Regulation & Governance* 137.
[174] L. Natarajan et al, 'Navigating the participatory processes of renewable energy infrastructure regulation: A 'local participant perspective' on the NSIPs regime in England and Wales' (2018) 114 *Energy Policy* 201.
[175] Black op.cit., n. 173.
[176] Jasanoff, op. cit., n. 8, p. 1723.
[177] Wagner et al., op. cit., n. 2.
[178] See e.g. the disagreement around the exclusion of the local expertise of members of the Christchurch Harbour Ornithological Group in *Navitus*, [20.4.4]-[20.4.8]. But note the inclusion of evidence from a range of participants.
[179] Y. Rydin et al., 'Local Voices on Renewable Energy Projects: The Performative Role of the Regulatory Process for Major Offshore Infrastructure in England and Wales' *Local Environment* forthcoming.

Marine Scotland Science.[180] That crucial assumption could easily '[fall] out of sight'.[181] We might also note that the energy devoted to birds, the detailed and lengthy discussion, whilst easily explicable in legal terms, is striking when set alongside the relative lack of concern spontaneously expressed by local people for birds.[182]

This article is not primarily about participation in the NSIPs process, although we do discuss these issues elsewhere.[183] Our intention here is to observe the *work* that the collision risk models are doing in the ExA's reasoning, and in the processes around that reasoning. Models are not simple mirrors to the world. But their discussion, negotiation and iteration is a significant element of the Examination, and intense if not inclusive.

CONCLUSIONS

Although patently unable to reveal the 'truth' about integrity, in moreover a legal context that is exceptionally intolerant of uncertainty, collision risk modelling has become an important part of the process for consenting novel infrastructure. Models provide a space within which 'good enough' evidence can be negotiated, and a pragmatic tool that allows for regulatory action to be taken. They are also part of the co-production of law and knowledge, and of the authority associated with law and knowledge, and that co-production is a significant feature of the determination of integrity in our cases. The legal framework seems to demand knowledge that is frankly unattainable. But the legal meaning of 'integrity' is no more a 'fact' out there waiting to be discovered than the impact of a wind farm on the integrity of a European site. What integrity means, and what knowledge the legal framework demands, are each partially constituted during the process of decision making. Jasanoff argues that co-production, the 'deep entanglement of knowledge, materiality and norms' is most visible at times of change, 'at times of emergence, contestation, standardisation and importation of ideas from one source into other contexts … the "new natural" [gets] built into core elements of social order'.[184] Both the Planning Act and innovative large offshore wind farms create new sets of institutional arrangements and institutional demands. This allow us to see the

[180] Cook et al., op. cit., n. 13, describing the AR as a 'fudge factor' within the models, p. 7. Natural England do not always accept the ARs in this paper without reflection, see e.g. *Hornsea Two*, [6.7.35].
[181] P. Pascual et al., 'Making Method Visible: Improving the Quality of Science-Based Regulation' (2013) 2 *Mich J. Envtl & Admin L* 429, at 432. In *Navitus Bay*, not only was the 99% AR adopted, but predicted bird deaths from other wind farms were updated with a 99% AR for the 'cumulative' assessment.
[182] M. Aitken et al., 'Locating "Power" in Wind Power Planning Processes: The (Not So) Influential Role of Local Objectors' (2008) 51 *J. of Environmental Planning and Management* 777.
[183] See e.g. op. cit., nn. 11 and 179.
[184] Jasanoff, op. cit., n. 17, p. 23.

complex processes of co-production in even apparently banal regulatory settings, and how they allow for the governance of large wind farms in our marine environment.

As indicated in the introduction, the purpose of this article is not to critique the models. A critique of the models would explore their social embeddedness, their contingency and obfuscation. It would highlight the profound uncertainty that remains after their absorption into the decision, and may even challenge the legality of the decisions. Such critiques can be valuable and important. The co-production lens used here, however, offers a different perspective on regulation, allowing us to ask a different set of questions about the role the models play in our story, and to focus on how we govern.