Public Inquiry

into five proposals
for wind turbine generating stations and the
132kV Llandinam connection, known as
Conjoined Wind Farm Inquiry (Powys)

Rebuttal Proof of Evidence
on Curlew in relation to Llandinam Windfarm

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on behalf of Natural Resources Wales

Introduction

This rebuttal proof is in response to the evidence of Dr Whitfield submitted on behalf of Celtpower in relation to Llandinam Windfarm Repowering & Extension application.

1. The displacement effect

1.1. Whitfield assumes in his proof that the response of breeding birds to disturbance can *range from short-term disruption to their breeding success or, at the extreme, abandonment of the breeding territory* (3.2). He regards it as most *unusual that abandonment is permanent if the source of disturbance is only short-term, as in the construction of a development* (3.3), and that *the likely reason why breeding birds may abandon their territories is because they perceive the disturbance as a potential threat to their survival* (3.4). Whitfield elaborates on these assumptions in 4.8-4.9, using the resilience of curlew to trapping on the nest as indicating their resilience to disturbance in general.

1.2. In response to the fate of displaced birds, Whitfield suggests *in the matter before the inquiry, there is an essentially unrealistic 'worst-case' displacement scenario in that it has been assumed by all parties, simplistically, that any birds displaced in the long-term are, in effect, dead to the wider population and, consequently, will also make no further reproductive contribution to the population. This position, being 'worst case' is extreme and so unrealistic – for example, there should be ample suitable and unoccupied breeding habitat for curlew away from the environs of the Llandinam proposal* (3.6).

1.3. These assertions, that birds are abandoning their territories in response to perceived disturbance threatening their survival (4.9), and that displaced birds will, in effect, be able to continue as normal, breed successfully and continue to contribute to the wider population, are unsupported by any reference to scientific study in the proof, and as I shall outline in the following paragraphs, are in fact not supported by published studies on breeding waders.

1.4. The comparison between lapwing and curlew responses to nest trapping is unconvincing as an assessment of species' vulnerability to disturbance. Like curlew, golden plover are resilient to trapping on the nest (Yalden & Pearce-Higgins 2002 CD/CON/003/ORN/059), but yet are demonstrably vulnerable to disturbance (e.g. Yalden & Yalden 1990 CD/CON/003/ORN/058, Finney *et al.* 2005 CD/CON/003/ORN/001). Equally, contrary to Whitfield's assertion, in an experimental study of disturbance, lapwing breeding success has been shown unaffected by increased levels of human disturbance (Fletcher *et al.* 2005 CD/CON/003/ORN/060). Whitfield's comparison therefore does not seem to hold and more generally, I am unaware of any evidence of a strong link between sensitivity to nest trapping and sensitivity to disturbance. Indeed, as the effects of disturbance are likely to be more complex than Whitfield asserts, I would not necessarily expect there to be a link (paragraphs 1.5-1.7 below).

1.5. Detailed work on the effects of disturbance on golden plovers show that it is not disturbance during nesting that is important, but during the chick-rearing period (e.g. Yalden & Yalden, 1990). This has also been shown in other wader species (e.g. Ruhlen *et al.* 2003 CD/CON/003/ORN/061). This level of disturbance was sufficient to lead to the localised displacement of golden plovers away from disturbed areas (Finney *et al.* 2005), interestingly, by about the same amount as they are estimated to be displaced from turbines (Pearce-Higgins *et al.* 2009 CD/CON/003/ORN/049). Thus, it is not during the nesting period that at least some wader species are most sensitive to disturbance, but during the chick rearing period. This calls into question Whitfield's assumptions that any disturbance effect is simply a direct result of perceived predation risk by nesting adults. Potential impacts on chick survival are likely to be as or more important.

1.6. Part of the evidence of Whitfield *et al.* (2010) (CD/CON/003/ORN/051) is that they failed to find any detrimental effect of distance to turbines on curlew hatching success at Dun Law (a test which they admit had a sample size 'too small to detect anything but a major effect'). As an aside, our review of disturbance impacts emphasises that a lack of apparent effect of turbine proximity upon curlew nesting success would not eliminate the possibility that disturbance could detrimentally affect the species, for example through curlew chick survival.

1.7. The evidence on the effects of disturbance on breeding waders therefore points to the potential, or even a high likelihood, of disturbance during the chick rearing period (when it is much harder to study) as being the most important mechanism by which disturbance, including disturbance associated with wind farm construction, may affect breeding waders. It therefore seems at least possible, if not plausible, that territories in close proximity to wind turbines may suffer high disturbance during construction, and that that disturbance may result in reduced breeding success of those birds.

1.8. Whitfield argues that the consequence of any short-term disruption to breeding success is relatively unimportant, compared to the extreme of territory abandonment (3.2). What this omits is the evidence that links wader breeding success to the subsequent likelihood of the birds returning to re-occupy their territory in the following year. Thus, unsuccessful birds have been shown to abandon their territories more frequently than successful breeders across a wide range of wader species including redshank (Thompson & Hale 1989 CD/CON/003/ORN/062), piping plovers (Haig & Oring 1988 CD/CON/003/ORN/064), semi-palmated plovers (Flynn *et al.* 1999 CD/CON/003/ORN/072), ringed plovers and dunlin (Jackson 1994 CD/CON/003/ORN/070), spotted sandpipers (Reed & Oring 1993 CD/CON/003/ORN/066), and perhaps most relevant to this case, long-billed curlew (Redmond & Jenni 1982 CD/CON/003/ORN/068). The magnitude of this difference can be marked. In the latter study, 80% of adults with successful nests returned the following year compared to only 42% from unsuccessful nests. This large body of evidence would point to the strong possibility that at least part of the mechanism by which wind farms could displace breeding waders such as curlew, could be through territory abandonment following poor breeding success, a possibility completely neglected by Whitfield.

1.9. In the absence of such failure, most wader species show a high degree of site fidelity. For example, 95% of lapwings return to breeding in the same or adjacent field in subsequent years (Thompson *et al.* 1994

CD/CON/003/ORN/073). There is likely to be a strong advantage to this fidelity. In a recent paper looking at black-tailed godwits, Gunnarsson *et al.* (2012) (CD/CON/003/ORN/067) write '*Numerous empirical and theoretical studies have highlighted the costs of dispersal and the concomitant likelihood of selection for site fidelity'*. Whilst it may seem obvious that this could be a result of increased familiarity with a site leading to greater breeding success or survival, there is also increased recognition of the value of returning to the same location as a mechanism of preventing divorce between long-lived individuals with a strong pair bond, as in many waders. Pairs which remain together in the same place are much more successful in the long-term than pairs which divorce or move elsewhere (see 1.10 below).

1.10. Although many waders do not migrate together and winter at different locations, they show high mate faithfulness which is maintained by predictable arrival back on their breeding territories (Gunnarsson *et al.* 2004 CD/CON/003/ORN/071). Even in waders when males return first to reoccupy their territories, divorce occurs when the female fails to arrive on time (Handel & Gill 2000 CD/CON/003/ORN/065). In studies of wader breeding success across a wide range of species, reunited pairs with previous experience of a site tend to experience greater breeding success than newly-formed pairs, although disentangling age and experience from site and mate faithfulness can be difficult (Thompson & Hale, 1989., Handel & Gill 2000, Johnson & Walters 2008 CD/CON/003/ORN/063). In one study on western sandpipers that managed to achieve this and separated individual age from site-specific experience, individuals with greater experience of a site did achieve the expected higher breeding success than naïve individuals (Johnson & Walters, 2008). A pair of birds with no previous experience of a site was modelled to achieve less than 10% nesting success, compared to more than 90% when both individuals of a pair had bred at the site for four years.

1.11. To conclude, Whitfield firstly appears to doubt the mechanism by which disturbance could lead to the observed pattern of displacement of breeding waders away from turbines. Here, with reference to an extensive literature on breeding waders, I would suggest that it is possible, if not likely, that disturbance during construction could lead to the displacement of breeding waders by virtue of negative impacts on their breeding success, leading to subsequent territorial abandonment. Abandonment may of course also occur during territory establishment, as outlined in my original proof.

1.12. Secondly, Whitfield questions the extent to which any displacement may be detrimental. By making reference to studies on breeding waders which highlight their natural site fidelity, and the results of recent studies which demonstrate the negative consequences of failing to return to a traditional breeding site in terms of divorce and likely subsequent reductions in breeding success, it is clear to see how displacement may have significant negative consequences for the individuals involved. Published studies point to displaced birds being much more likely to divorce (or in a declining population, such as curlew, it is possible they could even fail to pair-up), and much more likely to experience reduced breeding success, than birds which are not displaced, with consequences for future breeding population size.

1.13. I recognise that we are both presenting proofs in the absence of detailed studies following the fate of marked birds through a period of wind farm construction and operation to test these hypotheses, studies which are much needed. However, there are peer-reviewed published observed reductions in curlew abundance on wind farms during construction (Pearce-Higgins *et al.* 2012 CD/CON/003/ORN/050) and their apparent large-scale avoidance of turbines (Pearce-Higgins *et al.* 2009). Whitfield appears to doubt the conclusions from this work, largely through an apparent belief that there is no plausible ecological mechanism to account for these observations, and that these published findings are ‘extreme and unrealistic’ (3.6). In this rebuttal, I have presented what I believe are plausible or likely ecological explanations for these observed findings, based again, on peer-reviewed published literature on breeding waders, and would therefore argue, as I do now in the section below, that they are robust.

2. Displacement of breeding curlew

2.1. Whitfield considers that '*the study of Pearce-Higgins et al (2009: CPL-ORN-008) has been largely superseded by later studies and/or contradicted by others for some species (Douglas et al. 2011 CPL-ORN-002, Fielding & Haworth 2012 CPL-ORN-004, Pearce-Higgins et al. 2012 CPL-ORN-009, Thomas 1999 CPL-ORN-011, Whitfield et al. 2010 CPL-ORN-014).'* (4.3). This directly contrasts with my own opinion set out in my proof of evidence, where I believe that the findings are supported by subsequent published studies. I will critically examine in more detail the reasons for this discrepancy.

2.2. Of these papers, Douglas *et al. (*2011) (on which I am also an author) and Fielding & Haworth (2012) (an unpeer-reviewed report) examine changes in golden plover distribution on two operational wind farms. Both show no evidence of changes in distribution and are supported by one of the key papers of interest (Pearce-Higgins *et al.* 2012) for the same species where there was little evidence of consistent declines in golden plover populations on wind farms. This suggests that the 200m avoidance of turbines by golden plover documented by Pearce-Higgins *et al.* (2009) may not have large consequences at the population level.

2.3. Therefore, and as outlined below, I consider the findings of Pearce-Higgins *et al.* (2012) to support those of Pearce-Higgins *et al.* (2009), rather than contradict it (see Annex, paragraph 5).

2.4. Thomas (1999) is an unpublished MSc thesis with limited analysis based only on 31 curlew sightings (see Annex, paragraph 7) whilst Whitfield *et al.* (2010) is an unpublished report that presents a range of evidence and criticisms of Pearce-Higgins *et al.* (2009) that are reviewed below (paragraphs 2.6-2.8 and Annex, paragraphs 1-5).

2.5 In summary, of the five pieces of evidence put forward by Whitfield as superseding or contradicting Pearce-Higgins *et al.* (2009) which presents the 800m displacement distance, two are peer-reviewed scientific papers. I am an author of both on these, and in the later of these (Pearce-Higgins *et al.* 2012), the discussion includes an assessment of how together, these papers support rather than contradict each other. The remaining three references cited by Whitfield are un-reviewed reports or student projects. I would therefore argue that the evidence outlined in my proof therefore remains the most recent and robust available, but address in detail the criticisms below.

2.6 Whitfield contrasts Pearce-Higgins *et al.* (2009) with another study that fails to find evidence for displacement (Whitfield *et al.* 2010). Whitfield *et al.* (2010), which has not been independently peer-reviewed, presented information about changes in curlew populations at five sites; three of which were included in Pearce-Higgins *et al.* (2009), and two of which contributed to the analysis of Pearce-Higgins *et al.* (2012). They described changes in curlew populations at each site in isolation, and found evidence for largely stable populations at two (Hadyard Hill and Dun Law). Declines between pre- and post-construction periods were recorded at three (Caton Moor, Black Law and Carno), although in the first two, the lack of shift of remaining territories away from the turbines was used to indicate these responses were not due to the wind farm (although no analysis is presented to consider the consequences of potentially confounding factors that may also have influenced curlew distribution). Only Carno was regarded as providing some support of immediate displacement.

2.7 The Whitfield study illustrates the variation that exists in the response of curlews to wind farms between sites, emphasising the importance of collecting data from multiple sites in order to estimate mean effects. This is the approach taken by Pearce-Higgins *et al.* (2012), based upon data from 15 sites where curlew were recorded. Whitfield *et al.* (2010) appears to regard his somewhat qualitative assessment from five sites with the same weight as the much more quantitative, peer-reviewed assessments of Pearce-Higgins *et al.* 2009, 2012. I would argue that one good quality, peer-reviewed multi-site and multi-species study published in a high quality journal should be regarded with greater weight than a number of unpublished, un-reviewed studies based on fewer data and with less rigorous analysis.

2.8 Whitfield also presents a number of criticisms of the Pearce-Higgins *et al.* (2009) study, which are summarised and commented upon in the Annex to this rebuttal proof.

Annex

1 ***A. The results conflict with a lack of displacement to 500 m by curlew from Thomas (1999) (CPL-ORN-011). They are dependent upon 'dubious reliance of one outlier'.***

There appears to be no discrepancy between the Pearce-Higgins results and the Thomas results. Both studies failed to find significant displacement of curlew away from turbines to 500m (the fine-scale analysis of Pearce-Higgins *et al*). The displacement observed by Pearce-Higgins *et al.* (2009) was up to 800m, and apparent only when data from the wind farm extending 1 km from the turbines and including the 'control' sites, were incorporated. In his proof, Whitfield also uses this discrepancy as a reason to render the conclusions of the Pearce-Higgins *et al.* (2009) study invalid (4.14). However, as is clear from my own proof, and the paper, there is a clear reason for the discrepancy between the two scales of analysis, which is that the magnitude of displacement observed (up to 800m) was greater than would have been detected during the fine-scale analysis. For the curlew result to be invalid, there must be a good reason for curlew to respond differently to the study design than the other six species for which the study design produced comparable results. I am not aware of such a reason.

2 It is also wrong of Whitfield *et al.* (2010) to claim that the results are down to 1 outlier component of the data. The larger buffers (600m -800m and 800m-1km) are actually the largest in area, and therefore the estimated densities in these are based upon the greatest numbers of individuals. Further, the fact that the residual densities for the outer-most buffer (likely to be most different from the centre of the wind farm) tend to match the residual densities for the control sites selected to be most similar to the centre of the wind farm (for curlew and almost all other species), suggests that the analytical approach has successfully teased apart the impact of other environmental gradients from turbine proximity.

3 It is also worth emphasising that two analytical approaches (hypothesis-testing vs information theoretic approach) were used in the paper to produce final models (and both produced comparable results – the most conservative with respect to turbine distance was presented in the main results). Indeed, the fact that Pearce-Higgins *et al.* (2009) specifically attempted to account for these potentially confounding effects should be seen as a benefit of the work. Whitfield *et al.* (2010) write '*Again, interpretation is facilitated if potential confounding influences on gradients in abundance, such as vegetation type, are accounted for* – Appendix 7-B, P3'. As far as I know, the Pearce-Higgins study was the only one of the studies quoted by Whitfield to do this. In addition, the magnitude of turbine avoidance was greater than potential avoidance of roads and power-lines. Were the results down to random variation and bias, then it is difficult to assess why avoidance of turbines should be apparently much stronger than these other infrastructure components, lending further support to the conclusions.

4 ***B. The 'reference / control' sites used were smaller than the wind farm sites, which could lead to area-density effects (i.e. apparently greater densities in small sites).***

Again, as outlined in my proof, the study of Pearce-Higgins *et al.* (2009) was designed to address a number of difficulties in identifying displacement from wind farms, and specifically the fact that wind farms are non-randomly located in the environment (on ridge and hill-tops which also tend to be favoured by waders). For this reason, additional data was collected from a 'control' location of 200ha in size selected to be as similar to the centre of the wind farm as possible. These were not selected to be comparable in size to the entire windfarm survey area, but to provide an area of hill-top comparable to that of the windfarm, but that lacked turbines. In this regard, in many cases, they were larger than the area of the central turbines plus a 200m buffer. However, there was the risk that these sites may be more different to the wind farm than other contiguous areas, which could lead to a bias in the results. For this reason, analyses were conducted at two spatial scales, as already discussed in 1. Fine-scale analysis was at a 100m resolution to 500m using only data from the wind farm which we might expect to make it more difficult to disentangle effects of displacement from other environmental gradients covarying with turbine proximity on the site. Large-scale analysis was conducted at a 200m resolution and incorporating data from these 'control' sites. For the seven species where both analyses were possible, the same results were identified from both approaches, apart from for curlew (see 2.5 above). Broadly the analyses therefore seemed to do what was required.

5 ***C. Some of the results are incongruous with the logical assumption that displacement should be more likely closer to turbines than further away, with some observed displacements greater than that apparent at 200m. Displacement of up to 800m is counter to expectation from the ecology of the species.***

Pearce-Higgins *et al.* (2009) accepted the limitations of the work in the paper, and emphasised the need to compare population trends between wind farms and non-wind farm control sites to validate these conclusions (p1330). Whilst, as outlined above and in my proof, curlew are apparently highly responsive to disturbance (Yalden & Yalden, 1989), these putative displacement distances are certainly large. Therefore to address this gap, further analysis was published in 2012, and showed evidence for significant reductions in curlew abundance on wind farms relative to control sites of approximately 40%. Counter to Whitfield who considers this study to have contradicted that of Pearce-Higgins *et al.* (2009), I, and the referees who independently reviewed the manuscript prior to publication, regarded it as supporting the conclusions of Pearce-Higgins *et al.* (2009).

6 The fact that these impacts appear to be greatest during construction provides an explanation for some of the discrepancies highlighted by Whitfield, in that if they do indeed occur as a result of construction, it is reasonable to expect that the distances over which such avoidance may occur could be much greater than might be intuitively expected based only on operational wind farms. It also accounts for the fact that Whitfield *et al.* (2010) failed to find any apparent reduction in curlew productivity (albeit based on nesting success, which may not be expected to be as sensitive to disturbance as chick survival) with distance to turbine. Although in his proof Whitfield fails to find a convincing

ecological explanation for these observed patterns, the first part of this rebuttal demonstrates a plausible mechanism by which such displacement may occur.

7 Whitfield *et al.* (2010) also cite an MSc thesis (Thomas 1999) as demonstrating no evidence of turbine avoidance by curlew. Whilst this study involved fieldwork on ten upland sites, and may therefore seem similar to Pearce-Higgins *et al.* (2009), only one survey visit was made to each wind farm site (as opposed to the five or six visits by Pearce-Higgins *et al.* 2009). Across these visits, only 31 curlew were seen which is the sample size of their curlew analysis. This is an order of magnitude fewer sightings than those included by Pearce-Higgins *et al.* (2009). Further, given the difficulties of allocating curlew to specific locations (the analysis of Pearce-Higgins *et al.* (2009) was based only on sightings of curlew which could be attributed to a location with a 100m accuracy), the likely power of this thesis to have detected any significant avoidance of the turbines would appear to be extremely small.