Public Inquiry

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

Summary proof of Evidence on Curlew in relation to Llandinam Windfarm

of James Pearce-Higgins BSc (Hons), PhD

on behalf of Natural Resources Wales

1. Introduction

1.1. I am Dr James Pearce-Higgins and since March 2010, have been a principal ecologist at the British Trust for Ornithology (BTO), an independent charitable research institute.

1.2. At the BTO I lead on the climate change work and am responsible for the research programme associated with the BTO/JNCC/RSPB Breeding Bird Survey (BBS). I manage the Population Ecology and Modelling team, which comprises five post-doctoral researchers.

1.3. Prior to my employment at BTO, from March 1999 to 2010, I worked for the Royal Society for the Protection of Birds (RSPB), running a wide range of research projects on upland birds. Before this, I obtained a PhD from the University of Manchester, and a first-class Honours Zoology degree from the University of Nottingham.

1.4. I have so far published over 60 peer-reviewed scientific papers, four book chapters and have just drafted a book on birds and climate change for publication by Cambridge University Press in 2014. In addition to these core activities, I am a member of the board of Trustees and Conservation Advisory Committee of A Rocha UK and of the Scientific Advisory Committee Expert Panel for Scottish Natural Heritage (SNH). I am an honorary lecturer for the School of Biological Sciences, University of East Anglia, and associate editor of the scientific journal, Ibis.

2. Personal experience and background of wind farm research

2.1. This witness statement is largely based upon the science presented in two papers, (Pearce-Higgins *et al.* 2009 [CD/CON/003/ORN/049], 2012 [CD/CON/003/ORN/050]). These are amongst the largest-scale studies of displacement of birds from wind farms anywhere (both in terms of the numbers of sites and numbers of species covered). They were both published in the *Journal of Applied Ecology*, which is one of the highest ranking ecological journals, where they were independently reviewed by at least two other scientists, as well as by the journal editor, and regarded as of sufficient quality for publication. The 2012 paper was selected as the Editor's choice in the April 2012 issue.

2.3. Pearce-Higgins *et al.* (2009) examined the extent to which wind farms affect the distribution of upland breeding birds using a single year's data from 12 wind farms.

2.4. Pearce-Higgins *et al.* (2012) presented analysis of pre- and post-construction monitoring data from 18 wind farms, to see whether there was any evidence that bird populations declined at wind farms during construction or operation.

2.5. I therefore present what I believe to be the most recent and robust evidence currently available with which to assess the impacts of wind farms on British upland birds, and specifically, on curlew.

3. Scope of this evidence

3.1. My evidence will address the impact that the proposed Llandinam Windfarm Repowering and Extension development, if carried out, would have on breeding Eurasian Curlew *Numenius arquata*.

3.2. Specifically, I will address the evidence relating to three areas that underpin the outstanding objection that Natural Resources Wales (NRW) hold against the Breeding Birds Protection Plan proposed in relation to the development. These are that:-

- the buffer around territories should be 800m,

- that uncertainties associated with the mechanisms underpinning the putative detrimental impacts of wind farm construction on curlew mean that it cannot be concluded that the disturbance caused by construction is limited to the turbines alone, and
- that construction activity after 15th February may risk disturbing curlew returning to the breeding grounds.

4. The Pearce-Higgins *et al.* 2009 study

4.1. The 2009 study involved surveying 12 wind farm sites in Scotland and Northern England on multiple visits.

4.2. The distribution and abundance of moorland birds is heavily influenced by a range of habitat factors. As wind turbines are non-randomly located with respect to these factors (being primarily placed on hill and ridge-tops), there is the potential for spurious relationships between proximity to turbines and species' occurrence to occur if these confounding factors are not accounted for.

4.3. To do this, each wind farm site was divided into grid-cells (squares), within which quantitative information about vegetation composition and structure were recorded in the field, whilst additional environmental information was obtained from GIS data.

4.4. To maximise our ability to separate turbine proximity from habitat factors likely to be correlated with turbine proximity, we utilised data from additional non-wind farm or control sites that were selected '*to be as similar as possible to the habitat of the immediate turbine footprint.'* (Figure 1).

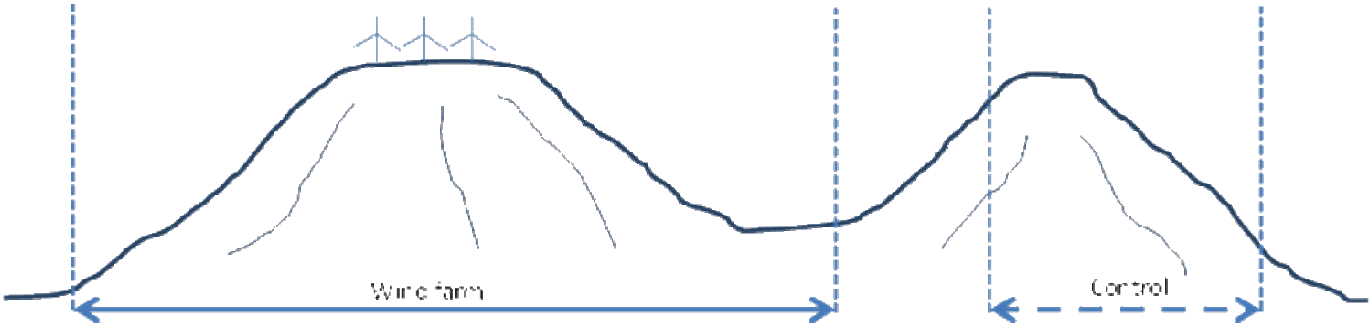

Figure 1. Schematic to illustrate the selection of wind farm and control areas to minimise the degree of correlation between habitat gradients (such as topography or vegetation type) and turbine proximity. In this example, without the control site, all high altitude hill top areas would be close to turbines.

4.5. Given the potential difficulties of teasing apart the effects of turbine proximity upon bird occurrence from these potentially confounding influences, we took a conservative approach to the analysis. First, we used a statistical model to predict the occurrence of birds in each grid-cell as a function of habitat. Only then, did we additionally consider whether any of the unexplained variation in where birds were recorded from, could be accounted for by distance from turbines. We also conducted a range of additional tests to further check that our results were not a consequence of a number of potential statistical biases.

4.6. Many more species showed evidence of significant turbine avoidance than expected by chance. The magnitude and frequency of this avoidance was greater than that of tracks and power-lines. Curlew was one of the species shown to avoid the turbines, with 42 % fewer curlew recorded within an arbitrary 500m buffer around the wind turbines than would otherwise be expected from the habitat.

4.7. The distance over which birds showed some avoidance of wind turbines was estimated by examination of the residual probabilities of species' occurrence in distance bands away from the turbines, after accounting for the potentially confounding effects of other factors. Curlew show relatively low levels of occurrence from 0-200m to 600-800m (with limited variation over the first

500m), and then significantly greater likelihood of occurrence in the 800-1000m and control sites distance bands (Figure 2). This is the basis for the 800m avoidance distance for curlew.

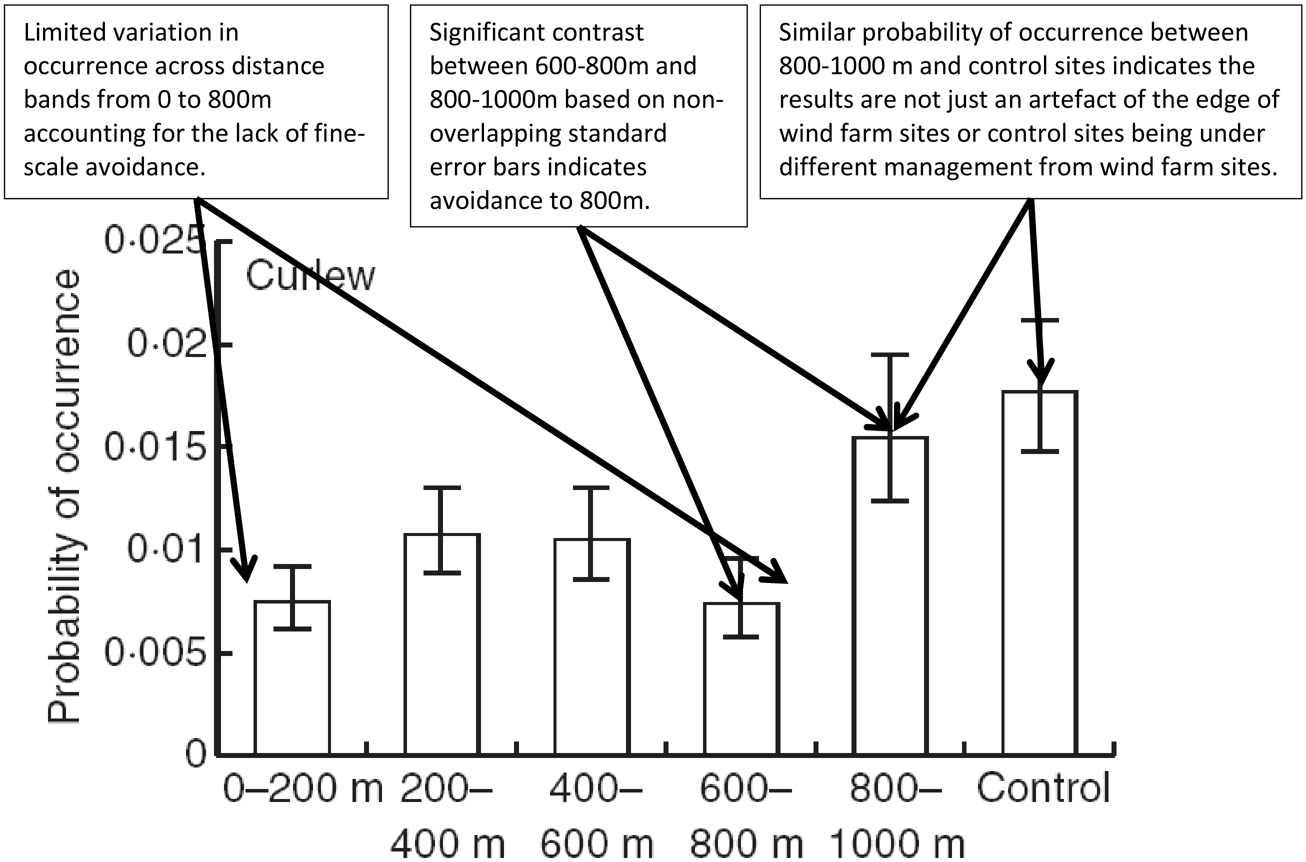

Figure 2. The probability of occurrence is an estimate of the mean likelihood of curlew being recorded in each 200x200m cell on any one visit after accounting for potentially confounding variables (taken from Figure 1 of Pearce-Higgins *et al.* (2009) annotated for the purposes of this proof). The error bars indicate the standard error associated with each estimate; non-overlapping standard errors can be used to approximate statistically significant differences.

5. The Pearce-Higgins *et al.* 2012 study

5.1. Pearce-Higgins *et al.* (2009) did not examine whether populations actually changed on wind farms. To test whether this occurred either during construction or operation, we collated and analysed post-construction monitoring data, largely collected by industry, from 18 upland wind farm sites across Britain and where monitored, their associated control sites (Pearce-Higgins *et al.* 2012).

5.2. Across all of the studies and tests performed, there was much more evidence for statistically significant changes in bird density on wind farm sites (11/30 tests) than expected by chance, and much more than recorded on control sites (2/30 tests).

5.3. Densities of three species, red grouse, curlew and snipe, were significantly reduced on wind farms during construction, although red grouse populations appeared to recover by the first year of operation. Importantly, for curlew, this drop in density also contrasted with trends on the control sites, leading to significantly fewer curlew recorded on the wind farm after construction than previously, and also compared to densities on the control sites (Figure 3).

5.4. There are three important implications of this work. Firstly, the Pearce-Higgins *et al.* (2012) study provides important support for the conclusions of Pearce-Higgins *et al.* (2009). The species with the greatest turbine avoidance from the 2009 study were the species with the greatest evidence of population decline reported in 2012.

5.5. Secondly, the apparent magnitude of reduction in curlew populations as a result of wind farm construction, which averaged 36% across the sites surveyed is very similar to the reduction expected from the models in Pearce-Higgins *et al.* (2009) used to underpin the 800m avoidance distance.

5.6. Thirdly, Pearce-Higgins *et al.* (2012) demonstrated that these population declines appear to occur during construction, rather than wind farm operation, a result which appeared relatively consistent across the species affected. There was no evidence of more negative curlew population trends on operational wind farms relative to control areas. One potential caveat to this is that almost half of these sites were monitored for fewer than three years, which is a relatively short time period over which to assess population trends in a long-lived wading bird.

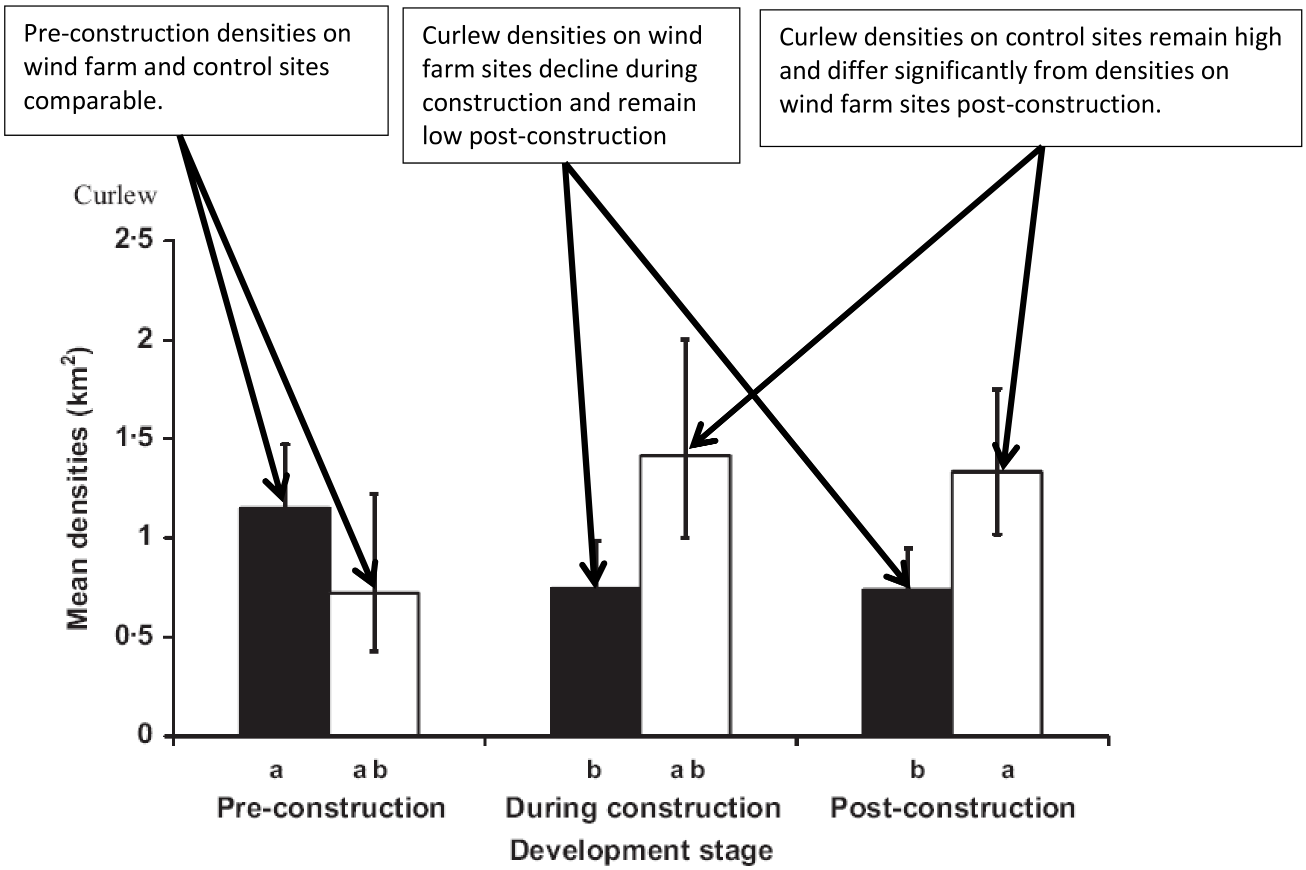

Figure 3. Average curlew densities on wind farms (black bars) and control sites (white bars) in relation to different periods of wind farm development. Individual letters link bars that do not differ significantly. Differences between pairs of bars with all non-matching letters are therefore statistically significant. The error bars indicate the standard error associated with each estimate.

6. Information about the potential mechanisms by which wind farm construction may disturb curlew

6.1. Of the upland wader species covered by this work, curlew is probably the species which is the most sensitive to disturbance (Yalden & Yalden 1989

[CD/CON/003/ORN/011], Pearce-Higgins *et al.* 2006 [CD/CON/003/ORN/015]). It is my best judgement is that it is the disturbance associated with construction activity itself that drives the apparent turbine avoidance of curlew.

6.2. The impact of disturbance associated with the decommissioning of turbines is likely to be similar to that of wind farm construction.

6.3. The literature on the responsiveness of waders to disturbance suggests that they are less sensitive to predictable disturbance associated with footpaths than unpredictable and novel disturbances (Finney *et al.* 2005 [CD/CON/003/ORN/001]). It is possible that the main elements of disturbance associated with wind farm construction will not be the use of construction traffic along roads, but the less-predictable, periodically intense construction activity associated with the turbines themselves and the associated infrastructure.

7. The likely timing of curlew arrival to the breeding grounds

7.1. Curlew appear to lay their eggs from mid-April onwards, with the majority of individuals having completed egg-laying by early May. Nesting dates have become earlier since 1970 (Austin & Crick 1994 [CD/CON/003/ORN/024], Moss *et al.* 2005 [CD/CON/003/ORN/026]).

7.2. Curlew return to their breeding grounds from mid-February onwards, depending upon the weather. It is likely to be the males which return first to establish their breeding territories against potential competitors. The majority of territories are occupied between late February and mid-March. (Bainbridge & Minton 1978 [CD/CON/003/ORN/022], Wernham *et al.* 2002 [CD/CON/003/ORN/021], Moss *et al.*2005).

7.3. There is a risk that construction activity from mid-February may disturb returning curlew and prevent their settlement on their usual breeding locations.

7.4. Evidence from wintering waders suggests that displaced birds perform poorly (Burton *et al.* 2006 [CD/CON/003/ORN/057]). This is likely to be the case for breeding birds also.

8. Summary of likely impacts of wind farms upon curlew

8.1. I believe there is good evidence, supported by two recent peer-reviewed published studies (Pearce-Higgins *et al.* 2009, 2012) using largely separate sources of data, analysed in completely different ways, both of which were independently refereed by a high ranking ecological journal, that the presence of a wind farm is likely to reduce the abundance of breeding curlew at a site.

8.2. The magnitude of that reduction appears relatively consistent between these two studies. This appears to result from fewer curlew occurring within 800m of the turbines than would otherwise be expected.

8.3. This reduction appears to occur during wind farm construction, and probably as a result of direct disturbance associated with the construction activity.

8.4. It is unclear precisely which elements of construction activity may disturb curlew but it is possible that the unpredictable but intensive construction activity around turbines and other infrastructure may be responsible.

8.5. Curlew appear to return to their breeding territories from mid-February onwards, depending upon the weather. At this point, they are likely to be vulnerable to disturbance that could lead to displacement away from previously occupied or favoured areas.

8.6. Displaced birds are likely to survive or breed less well than they otherwise would.

9. Likely implications for a breeding bird protection plan

9.1. In order to minimise the risk of disturbance associated with construction, activity should be avoided in breeding areas during the period when they will be occupied (likely to be from as early as mid-February to as late as end-July).

9.2. The scale of this disturbance can extend to 800m, based upon the residual probabilities of curlew occurrence in different distance bands away from turbines (Figure 2).

9.3. The impact of any restriction of construction activity during the breeding season should be monitored to test whether it successfully reduces the negative impact upon birds.