Bulletin of the Chartered Institute of Ecology and Environmental Management

CIEEM

inpractice

Issue 88 | June 2015

Monitoring and Measuring Mitigation Success

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Animal Welfare Implications of Mitigation Schemes

Ecological Monitoring using Wildlife Detection Dogs

Welcome

Successful Mitigation: Are We Striving for the Impossible? Was Ignorance Bliss?

CIEEM's 'Guidelines for Ecological Impact Assessment' states that 'evidence should be provided of the effectiveness of recommended mitigation... measures and to what extent their success can be guaranteed' (paragraph 5.5). Unfortunately, guaranteeing the success of mitigation is difficult, if not impossible, in many scenarios. However, those designing mitigation measures, and those giving consent to developments, have a duty to consider their likely effectiveness – whether they are 'appropriate', 'technically feasible' and 'likely to achieve desired outcomes' (paragraph 8.1e of the British Standard on Biodiversity BS42020). Despite this, there is a lack of evidence for the likely effectiveness of many of the mitigation measures recommended or implemented as part of development projects.

Mitigation can only succeed if it is based on a sound knowledge of the relevant ecological processes and how they will be affected by a development project. Yet, increasingly I'm finding myself having to assess the likely effects of a project and design mitigation without this information. The quality of the ecological surveys undertaken to inform an assessment is also vitally important, yet there are gaps in our knowledge of appropriate survey techniques in many cases. And some species groups are rarely surveyed at all, such as invertebrates, fungi, lower plants, and some of the less regularly encountered or unprotected mammal species – so how do we even know if there is an impact that requires mitigation?

As professional ecologists, we need to be pragmatic but aware of the limitations of our knowledge. It is vital that we improve the evidence base for the effectiveness of mitigation measures, in order to protect biodiversity from the impacts of development, and to improve the image of ecology as a profession. In some cases this can be achieved through post-construction monitoring schemes but these must be designed to answer the right questions – something that is frequently overlooked, as monitoring is often seen as a 'tick box' exercise. Robust data collection may be beyond the scope of post-construction monitoring where longer-term research projects are needed, or where the costs of the studies would be disproportionately expensive. Partnerships with research scientists might be the way forward in such cases.

One of the major frustrations we have as practising ecologists is the knowledge that someone else has almost certainly faced the same issue that we have to tackle, possibly coming up with a bespoke mitigation solution, and maybe even having done some monitoring to determine its effectiveness, but unless the outcomes are shared we end up having to reinvent the wheel. The Professional Standards Committee is discussing the options for a web-based platform where information and experiences about survey design, the effects of impacts, and the success of implementing mitigation can be shared by the membership. Its development is in its infancy, and needs help from CIEEM members to make sure it delivers what we need it to. There are key questions to answer, such as:

- Are there appropriate host websites we could build on?
- What file type would be best for upload? Should there be standard form or free form?
- How confident are our members in deciding for themselves the efficacy of information uploaded?
- To what extent should our uploads be subject to peer-review?
- How should a website be organised so that relevant information can be found easily?
- Should members be able to add comments on uploaded material?

We would welcome your feedback on these questions, and your input if you have expertise that could help us.

CIEEM also needs to improve our links with those in academia, to encourage research into the effectiveness of mitigation measures, and to collaborate with other nature conservation organisations over the production of survey and mitigation guidelines (such as a proposal to develop such guidance for invertebrates in partnership with Buglife).

As an industry we must set ambitious targets to aim for – improving the evidence for the effectiveness of mitigation measures is a challenge, but not an impossible one. And knowing that something doesn't work, or might not work, is surely better than recommending mitigation measures without any evidence to back them up.

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Information

In Practice No. 88
June 2015
ISSN 1754-4882

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In Practice is printed on paper using 100% post-consumer, de-inked waste. This is manufactured by an ISO14001 and EMAS accredited company.

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Buzzard found in short grass beneath single turbine, Co. Derry (decapitated). © John Clarke.

A Review of Bird Strike Mortality at Irish Onshore Windfarms

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Keywords: bird monitoring, carcass search, Ireland, statistical bias, turbines

This article reviews bird strikes at Irish onshore windfarms based largely upon unpublished accounts and expert opinion. The level of carcass searching is estimated and the effectiveness of carcass searching methodologies is assessed. A standardised method for carcass searching is recommended for Ireland and the UK.

Background

Since the construction of the first windfarm at Bellacorrick, Co. Mayo, in 1992, a wide range of bird surveys have been undertaken at proposed windfarm sites on the island of Ireland ('Ireland' hereafter includes Northern Ireland and the Republic of Ireland), primarily in support of planning applications. However, neither the amount of bird survey work at operating windfarms nor estimates of actual bird fatalities have been documented in Ireland (or the UK) to date, despite their obvious value in monitoring and measuring mitigation success.

Percival's seminal paper *Birds and Windfarms in Ireland* (Percival 2003) assessed potential rather than actual effects and did not comment on whether collisions and/or carcass searching were reported in the Irish peer-reviewed literature or 'grey' literature. No Irish bird monitoring reports were cited in the global reviews by Langston and Pullan (2004) and Hötker *et al*. (2006), although numerous British windfarms were cited in both reviews. Only two published studies have reported suspected or observed bird strikes at Irish windfarms. Scott and McHaffie (2008) were the first to publish carcass searching results. They reported several scavenged carcasses near turbines (cause of death unknown) at a windfarm in Co. Antrim, as well as a hen harrier *Circus cyaneus*, common buzzard *Buteo buteo*, several hooded crows *Corvus cornix*, and a raven *Corvus corax* carcass found near turbines with severed wings and other physical injuries consistent with force trauma. In 2010, Cullen and Williams reported the first observed fatality from a turbine strike, of a Eurasian sparrowhawk *Accipiter nisus* on an unnamed Co. Tipperary windfarm.

In neighbouring Great Britain, by way of contrast, with its broadly similar avifauna, there are many more published records of turbine strikes. For instance, Percival twice reviewed collisions on British windfarms from the peer-reviewed and grey literature (Percival 2000, 2005). A more recent study

by Duffy and Steward (2008) in Scotland, published on the website of the Natural Research Group (www.natural-research.org), recorded several probable passerine, raptor and game bird turbine fatalities during carcass searches over a 12-month period at the Braes of Doune windfarm. Newton and Little (2009) published a review of studies of shoreline bird carcass searches near the coastal Blyth Harbour windfarm and collated data spanning an unparalleled 11-year period which indicated mostly gull and some eider *Somateria mollissima* turbine fatalities.

The review reported in this article is the first to assess bird strikes at windfarms in Ireland. Due to the sparse published record, this study relied heavily on unpublished accounts and expert opinion from professional ornithologists. This study also estimates the amount of carcass searching that has or is being conducted on Irish windfarms, and assesses the methodology.

Objectives

1. Assess the relative value of different methods of gathering data on turbine strikes on birds.
2. Generate a species list of probable/ confirmed turbine bird fatalities on Irish windfarms (excluding possible strikes) for the period up to November 2013.
3. Estimate the amount of carcass searching effort on the c. 193 windfarms operational in Ireland at the time of this review (Irish Wind Energy Association 2013).
4. Critically assess carcass search methods with reference to the use of dogs, survey effort, and correction for searcher efficiency and carcass removal by scavengers.

Methods

Four methods were trialled to collect carcass data and information on search methodology.

1. Publicly available, online sources were searched for peer-reviewed, government and other reports.
2. Online, local authority planning portals in the Republic of Ireland were used to search for planning reports from a random selection of operational windfarms listed on the Irish Wind Energy Association (IWEA) website.
3. A data request was sent to the British Trust for Ornithology's (BTO) Ringing Scheme for historical ringing recoveries of dead or injured birds in Ireland assigned the circumstance code *'Found Dead at Site of Wind Turbine'*.
4. An extensive consultation exercise included:
    - Distributing questionnaires at a Northern Irish BTO conference (November 2012) and an Irish Raptor Study Group (IRSG) conference in Dublin (February 2013);
    - Consulting ornithologists in the Irish wind energy sector using CIEEM's online Professional Directory using search terms relating to renewable energy and bird survey;
    - Consulting the Northern Ireland Environment Agency's (NIEA) Ornithology Officer, who receives carcass search reports on a nationwide basis for Northern Irish windfarms; and
    - Consulting a number of public authority Biodiversity Officers and Heritage Officers, and National Parks & Wildlife Service (NPWS) staff in the Republic of Ireland (RoI) to request carcass search reports (a small 'random' selection responded to requests for data).

Reliability of 'Strike' Records: Where carcasses were reported from windfarm sites, the likelihood of each bird fatality having been caused by a turbine strike was determined as either 'confirmed', 'probable', or 'possible' by questioning respondents in accordance with the following criteria:

- Confirmed – Turbine strike observed or post-mortem indicated turbine strike.
- Probable – Carcass found with evidence of trauma consistent with turbine strike.
- Possible – Injuries to carcass unknown or carcass scavenged.

'Possible' turbine fatalities were considered unreliable and excluded from subsequent analysis.

Carcass search methods: The following details were recorded:

- Were dogs used to find carcasses?
- What was the search effort (i.e. frequency of search visits)?
- Were scavenger trials conducted (i.e. use of 'dummy' corpses to measure removal rate)?
- Were searcher efficiency trials conducted of human and/or canine surveyors?

Carcass information: The following details were recorded:

- Species of bird carcass or lowest taxonomic rank where only partial remains were available.
- Evidence of trauma ('unknown', 'none evident', 'broken bones', 'severed body parts').
- Evidence of scavenging (Yes/No).
- Post-mortem examination (Yes/No).

Results & Discussion

1. Value of different data gathering methods

Most data came from consultation with ecologists, and the Ornithology Officer of the Northern Ireland Environment Agency. The remaining data were from the peer-reviewed literature, and Non-Governmental Organisations (Figure 1). The public authorities consulted in the Republic of Ireland, which included the Birds Unit of the National Parks & Wildlife Service (NPWS), had no data.

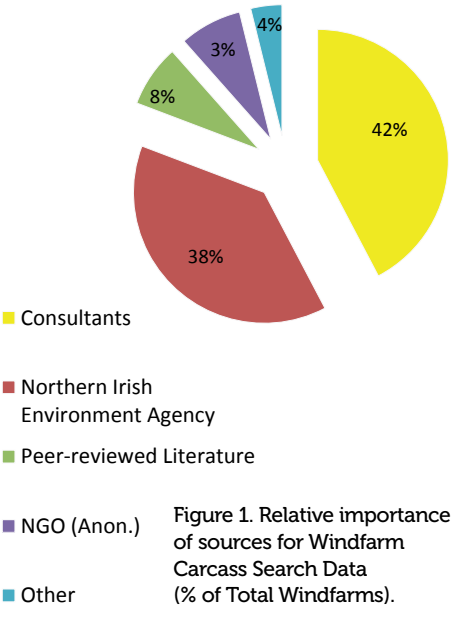

Figure 1. Relative importance of sources for Windfarm Carcass Search Data (% of Total Windfarms).

Searches of RoI planning portals yielded a sample of eight windfarms for which bird monitoring was a planning condition. Conditions required that monitoring reports be submitted to a variety of different recipients, namely: both the NPWS and planning authority (n=5); the planning authority alone (n=1); and Birdwatch Ireland (n=1). The planning condition for one windfarm specified no recipient for the monitoring reports. It was known that at least one year's monitoring had been completed at one windfarm (planning authority also known) and the report had documented bird strikes. No monitoring reports, including carcass-search reports, were available on the Local Authority planning portals either for this windfarm or the other seven windfarms.

No data were found in 'grey literature' available online. No BTO ringing recoveries in Ireland were *'Found Dead at Site of Wind Turbine'* from 1992 to 2012. Thereafter, the records and expert opinion of consultant ornithologists working in the wind energy sector was adjudged the best source of data.

2. List of turbine strikes

Including records from Scott and McHaffie (2008) and Cullen and Williams(2010), a total of three 'confirmed', 22 'probable', and 12 'possible' turbine fatalities were recorded (Table 1). The proportion of fatalities by taxonomic group (i.e. family or order) is shown in Figure 2. Carcasses in the 'possible' strike fatality category included some uncommon species in Ireland (e.g. ring ouzel *Turdus torquatus*) and some species of little or no known vulnerability to turbine strikes (e.g. Eurasian curlew *Numenius arquata*; EC 2010). However, these records were considered unreliable and were not considered further.

3. Amount of carcass searching in Ireland

Formal carcass searches were reported from 22 windfarms in 14 counties, equating to 11% of all windfarms in operation at the time of the study (n=193 windfarms; IWEA 2013). The actual number of Irish windfarms searched is unknown. However the broad reach of the consultation exercise is considered likely to have captured most carcass search data.

Table 1. Bird Fatalities from 25 windfarms (probable and confirmed combined). Colour-coded for Conservation Concern in Ireland (Red = High; Amber = Medium; Green = Low; Colhoun & Cummins 2013)

Species	Scientific name	No. carcasses	% Total
White-tailed sea eagle	*Haliaeetus albicilla*	2	8
Black-headed gull	*Chroicocephalus ridibundus*	1	4
Kestrel	*Falco tinnunculus*	5	20
Snipe	*Gallinago gallinago*	2	8
Hen harrier	*Circus cyaneus*	1	4
Merlin	*Falco columbarius*	1	4
Starling	*Sturnus vulgaris*	1	4
Buzzard	*Buteo buteo*	2	8
Chaffinch	*Fringilla coelebs*	1	4
Hooded crow	*Corvus cornix*	3	12
Raven	*Corvus corax*	1	4
Redwing	*Turdus iliacus*	1	4
Rook	*Corvus frugilegus*	1	4
Sparrowhawk	*Accipiter nisus*	2	8
Willow warbler	*Phylloscopus trochilus*	1	4
	Total	25	100%

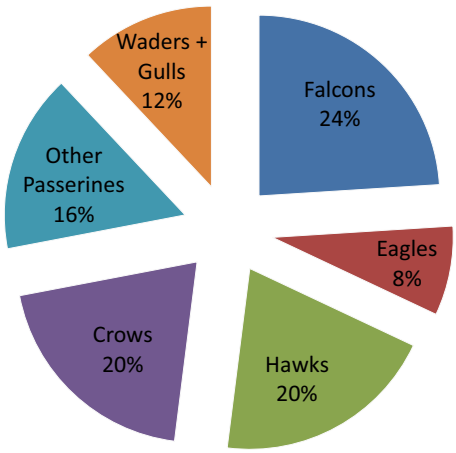

Figure 2. Turbine Fatalities by Taxonomic Group. Probable + Confirmed carcasses combined (n=25).

4. Critique of carcass search methodologies

Dogs were used to search for carcasses on three of the 22 windfarms (13%) assessed in this review.

Dogs are significantly more efficient than humans at finding carcasses (Paula *et al*. 2011) but are likely to result in additional expense and will impose some constraints on survey design (e.g. landowner concerns regarding risks to cattle, disturbance to nesting birds). Trials in Portuguese scrublands using a trained German shepherd dog detected 96% of bird and bat carcasses, compared to a detection rate of 9% by humans alone (Paula *et al*. 2011). Hunting primarily by scent, a dog's search efficiency is generally likely to be much less affected by vegetation density compared to humans (Homan *et al*. 2001), although dogs cannot safely search some habitats (see Stanhope, pp. 29-32 this issue). Many windfarms in Ireland, including at least half of those assessed in this review, are dominated by densely vegetated moorland or forest habitats.

Although the results of human and dog searches were not compared directly, it appears likely that carcass numbers reported in this review (Table 1) are underestimates because dogs were not used on 77% of windfarms. Furthermore, it is likely that additional bird species would have been reported if dogs had been used more widely, particularly smaller birds which are frequently overlooked by humans searching denser vegetation (Smallwood 2007).

Springer spaniel used in carcass search on windfarm in Republic of Ireland.
© INIS Environmental Consultants Ltd. Photo by Howard Williams.

The carcass search effort across the 22 windfarms varied widely (Figure 3), with the majority searched weekly or fortnightly (52%). Evidence from bat carcass searches in Europe and the United States (reviewed in Jones *et al*. 2009) indicated that weekly searches provide reasonable survey effort. Where searches are conducted less frequently than weekly, (i.e. 73% of Irish windfarms reviewed), there is a risk that scavengers will remove significant numbers of carcasses.

Searcher efficiency trials were conducted on nearly a third of windfarms reviewed (29%) and scavenger removal trials were conducted on 16% of windfarms. Respondents were not asked about other important aspects of the methodology, such as the size of the search plot and whether the order in which turbines were searched was randomised to minimise search-effort bias (see also Stanthorpe, pp. 29-32 this issue, in relation to dog 'enthusiasm').

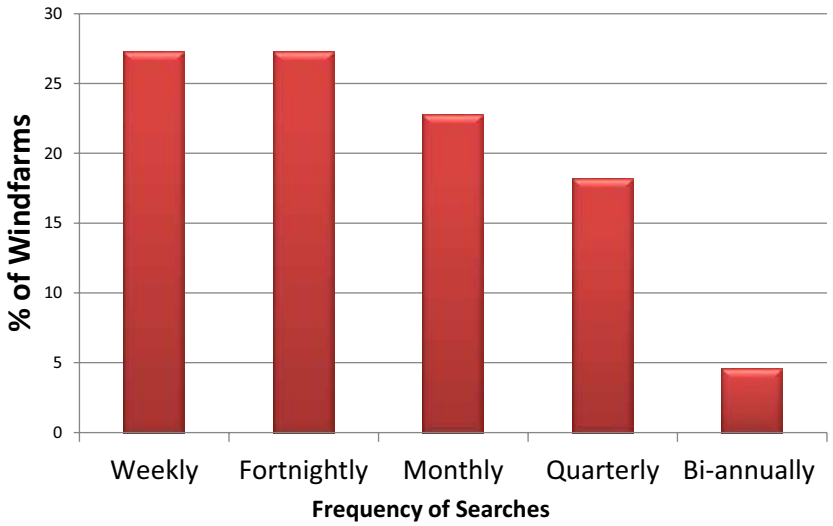

Figure 3. Carcass Search Effort (n=22 windfarms).

Conclusions and Recommendations

The analysis carried out in this review identified the following key points:

1. There is no centralised repository for bird monitoring reports In the Republic of Ireland, where searching of planning portals was inefficient and fruitless in the author's experience. In Northern Ireland, all monitoring reports are held in a central repository by the NIEA Ornithology Officer. This greatly facilitates assessments of carcass searching.
2. The evidence base could be increased if an anonymous bird strike recording system was adopted in Ireland or UK-wide, based on that used by Scottish Natural Heritage (SNH 2015).
3. Search methods should be standardized in Ireland and the UK. The excellent SNH guidance on carcass searching (SNH 2009) could be revised to prescribe more clearly, if possible:
    a. when carcass searching is needed;
    b. when to use dogs, and what dog breeds and/or training are needed;
    c. the minimum survey effort for searching, both temporally and spatially;
    d. minimum standards for scavenger- and searcher-efficiency trials

Dog searching windfarm.
Photo by Howard Williams.

4. If search methods in Ireland and the UK were standardized, statisticians would have access to a large sample size to robustly assess the effect of windfarm design on bird strikes. This would be invaluable in designing future mitigation strategies.
5. Based on published research in Europe, the USA, and the UK (this issue), the use of dogs is likely to be a critical factor in detecting bird carcasses, particularly in dense vegetation. Importantly, dogs are likely to greatly reduce the risk of obtaining 'false zeros' which underestimate windfarm impacts, but cannot be corrected using values for searcher efficiency or scavenger removal rates.

Acknowledgements

Robert would like to sincerely thank Dr Peter Gilchrist MCIEEM, Phil Shepherd MCIEEM, and Ryan Wilson-Parr MCIEEM, whose significant input helped to improve this article. Robert would also like to thank all those who kindly contributed carcass search methodologies and bird strike records.

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