BIOLOGICAL CONSERVATION 141 (2008) 2708–2717

available at www.sciencedirect.com

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journal homepage: www.elsevier.com/locate/biocon

Expert opinion as a tool for quantifying bird tolerance to human disturbance

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ARTICLE INFO

Article history:
Received 24 January 2008
Received in revised form
14 July 2008
Accepted 7 August 2008
Available online 14 September 2008

Keywords:
Birds
Set-back distances
Buffer zones
Buffer areas
Protected areas
Human disturbance
Recreation
Fixed-slope rule
Expert opinion

ABSTRACT

Human disturbance can have several adverse effects on wildlife and therefore is increasingly seen as a threat. A common resolution of problems associated with encroaching human activities is to separate them from sensitive wildlife areas by protective buffer zones or set-back distances within which human activity is restricted. The most common method to establish such protective regimes is to record empirically the distance at which animals show signs of disturbance to human activity. However, a literature review for 26 bird species revealed that in only six of these species were there empirical measures of disturbance distances when breeding, but buffer zones had been recommended or designated in all species, often in several instances. This inferred prescription of buffer zones despite a severe knowledge gap. As a research stopgap, for the 26 species, we surveyed over 1000 expert opinions which generated estimates of alert distance (AD) and flight initiation distance (FID) in response to an approaching human during incubation and chick-rearing. Surveyed opinions on FID were not statistically significantly different to empirical measures of FID. Opinions on AD were much greater than predictions based on body mass derived from a previous study, but other evidence inferred a problem with predictions rather than opinions. The slope of the relationship between opinions on AD and FID conformed to the 'fixed-slope rule' (i.e. FID = 0.44*AD) for incubating birds, but was higher for chick-rearing birds. At both stages of the breeding cycle, however, FID was approximately half-AD, reflecting previous studies. The validation exercises therefore provided some encouragement that the expert opinion survey produced realistic results, but we recommend that their use should be temporary until more empirical measures of disturbance distances are gathered. We further recommend that existing monitoring schemes in which field surveyors routinely visit birds' nests should incorporate protocols to measure disturbance distances to amass such information rapidly and in quantity.

1. Introduction

Animals commonly move away from an approaching human or encroaching human activities such as recreation and this response can have adverse influences on factors such as their feeding success (Burger and Gochfeld, 1998; Fernández-Juricic and Tellería, 2000), range use (Andersen et al., 1990), reproduction (Giese, 1996; Miller et al., 1998), survival (Wauters et al., 1997; West et al., 2002) and abundance (Miller et al., 1998; Fernández-Juricic, 2000, 2002). Human disturbance is increasingly becoming a concern to conservationists because as human populations continue to expand, ecotourism is

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0006-3207/$ - see front matter
doi:10.1016/j.biocon.2008.08.007

increasing as a potential revenue source, and wildlife in diminishing areas of refuges are exposed to greater human recreational and other anthropogenic activities (Wight, 2002; Christ et al., 2003).

Whilst predicting the effects of humans on wildlife is difficult (Knight and Cole, 1995; Hill et al., 1997; Carney and Sydeman, 1999; Gill et al., 2001; West et al., 2002) one of the most frequently exploited tools used by land managers and policymakers when promoting co-existence of wildlife and people is the creation of 'buffer zones' (also referred to as set-back distances or protective/management zones) around potentially sensitive centres of wildlife activity (e.g. nest sites of rare, protected and uncommon bird species, or breeding colonies) within which human activity is, at least in principle, restricted or excluded with the objective of minimizing disturbance impacts (Holmes et al., 1993; Knight and Temple, 1995; Rodgers and Smith, 1995, 1997; Richardson and Miller, 1997).

Two broad steps have been commonly used to prescribe buffer zones (Knight and Temple, 1995; Richardson and Miller, 1997; Fernández-Juricic et al., 2005). In the first step the distance at which humans should be separated from wildlife (minimum approaching distance) is estimated, and then the areas where humans should not encroach to avoid displacing wildlife (buffer zones) are prescribed. Several methods have been proposed or employed to calculate minimum approaching distance (MAD) and buffer zones (e.g. Anthony et al., 1995; Rodgers and Smith, 1995). The most common method used to estimate MAD is to observe the reactions of subject animals to the approach of a single disturbance source, typically a pedestrian. One or two metrics are recorded: alert distance (AD), the distance between the disturbance source and the animal at the point where the animal changes its behaviour in response to the approaching disturbance source (specifically, in birds, when the head is raised in an alert posture: Fernández-Juricic and Schroeder, 2003), and/or flight initiation distance (FID), the point at which the animal flushes or otherwise moves away from the approaching disturbance source.

The performance of five methods which have transferred FID and/or AD measures to buffer zones was tested by Fernández-Juricic et al. (2005) using data from five grassland bird species with the conclusion that different methods gave radically different results and that managers should evaluate the assumptions and applicability of a given method before using it to calculate buffer zones. Rigorous detailed studies such as that of Fernández-Juricic et al. (2005) can undoubtedly contribute towards the development of scientifically defensible applications in practice, but a more fundamental issue is that designated buffer zones often have no obvious empirical basis in behavioural studies on the relevant species. Indeed, whilst the scientific literature on human disturbance is vast, surprisingly little is devoted to empirical measures of FID and/or AD (see Section 3).

To support recent changes in Scottish legislation on greater freedom of peoples' access to the countryside (Land Reform Act) and the protection of breeding birds (Nature Conservation Act) (see also Beale and Monaghan, 2004a), our study originated from a need to provide recommendations on disturbance distances for 26 bird species, and had five objectives:

1. To review the literature for published estimates of FID and/or AD for breeding individuals in our target species or their close relatives.
2. To contrast the availability of FID and/or AD measures with the frequency with which protective buffer zones have been suggested or designated for the target species.
3. To survey expert opinion for data on FID and AD, because gathering novel empirical data rapidly was practically impossible, but many scientists and experienced fieldworkers had previously routinely visited the nests of all species.
4. To compare the results of the expert opinion survey with predictions based on body mass (Blumstein et al., 2005) and with expectations from the 'fixed-slope rule' (FID = 0.44*AD) (Cárdenas et al., 2005; Gulbransen et al., 2006).
5. To compare empirical estimates of FID and/or AD for breeding individuals in our target species with predictions based on body mass (Blumstein et al., 2005).

2. Methods

Our survey covered 26 bird species considered as a priority by Scottish Natural Heritage, the government's statutory advisor on nature conservation in Scotland, largely based on breeding species which are either listed on Annex 1 of European Union (EU) Wild Birds Directive (79/409/EEC) or are otherwise rare in Scotland. To avoid undue repetition the full species list is given later (Results: Table 1): due to sample size and close ecological similarity, two species, common crossbill *Loxia curvirostra* and Scottish crossbill *Loxia scotica* were considered together. For two lekking gamebirds, capercaillie *Tetrao urogallus* and black grouse *Tetrao tetrix*, disturbance of both parental females and lekking males was considered.

Expert opinion was solicited from three main sources: authors of published literature on the survey species when breeding, members of Scottish Raptor Study Groups (SRSGs; fieldworkers with considerable experience in monitoring breeding raptors: see http://www.scottishraptorgroups.org/ and Hardey et al., 2006), ringing (banding) groups and British Trust for Ornithology (BTO) Nest Record Scheme recorders. Selected experts were asked to complete a questionnaire form which requested that they record the distance at which individuals of the species for which they had experience typically showed a 'static' and an 'active' behavioural response to a single pedestrian observer walking in full view towards an active nest or bird(s) with chicks. 'Static' disturbance distance was defined as the distance at which there was a static behavioural response to the disturbance stimulus (=observer), such as increased vigilance and/or alarm calling (i.e. AD). 'Active' disturbance distance was defined as the distance at which there was an active behavioural response to the disturbance stimulus (=observer), for instance taking flight, moving away from/towards the observer (i.e. FID). Potential respondents were asked to record separately the typical disturbance distances for incubating birds and for birds with chicks.

Hence, for each species, opinions on four distances were solicited, with the exception of capercaillie and black grouse when opinion was also garnered on AD and FID for lekking birds. By way of acknowledgement that the survey could not be precise, potential respondents were asked to record their opinion on each disturbance distance in one of 10 categories