Flight Distances of Incubating Common Buzzards Buteo buteo are Independent of Human Disturbance

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Flight distances of incubating Common Buzzards *Buteo buteo* are independent of human disturbance

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In a Danish landscape with relatively high (134/km^2) but variable human density, 86% of 213 incubating Common Buzzards *Buteo buteo* flushed from the nest at distances of 0–200 m in response to a person approaching on foot. Flight distances were not conditional on nest site parameters despite considerable variation in human disturbance variables, lending no support for the hypothesis that Common Buzzards are more tolerant of humans in disturbed locations.

Key words: breeding, human disturbance, incubation, nest site, raptor

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There is an increasing global awareness of the adverse effects of human disturbance on avian reproductive success, habitat selection and population dynamics because birds perceive humans as potential predators and therefore react to human presence with costly anti-predator responses (Blumstein *et al.* 2005, Gill 2007, Schlesinger *et al.* 2008, Sutherland 2007). Accordingly, to minimise adverse impacts of outdoor activities on disturbance-sensitive birds, information is needed about tolerance thresholds under given conditions.

Flight distances generally increase with body size (Blumstein *et al.* 2005) and large species appear less willing to adapt to urbanized habitats than smaller species (Møller 2008), so larger-bodied species, such as many raptors, might be more susceptible to disturbance. Indeed, human disturbance has been reported to adversely influence reproductive parameters amongst several protected large raptor species (Arroyo & Razin 2006, González *et al.* 2006). The ability of large raptors to recolonise previously occupied habitats after cessation of persecution may therefore depend on their flexibility to tolerate humans during the most sensitive periods in their annual life cycle. The question is: to what extent can such species habituate to humans when no longer persecuted?

One way to assess the degree of behavioural flexibility to disturbance of a given species would be to study flight reactions over a gradient of increasing human presence, with the expectation that flight distance would decrease as function of increasing human presence. Here, we present data on the distance at which incubating Common Buzzards *Buteo buteo* take flight from their nests (hereafter 'flight distance') in a landscape with varying human density in Denmark. We tested whether flight distances were conditional on nest site parameters and indices of human activity measured around the nest site. Our main hypothesis was that if Buzzards habituated to human presence they would show shorter flight distances the more that nesting sites were exposed to greater human activity.

Due to its relatively large size and long lifespan, the Buzzard should be a good model to test the flexibility of tolerance to humans during the breeding season in larger raptor species. Under legal protection in Denmark since 1967, it has increased as a breeding species. It is now amongst the most abundant diurnal raptor species in Central Europe, occupying intensively cultivated landscapes in regions densely populated by humans. Tolerance of the Buzzard to humans might therefore serve as a model for predicting responses of other protected large or medium-sized raptor species where habitat satiation prevents further population growth.

Study area and methods

Since 1973, KS and other volunteers from Kolding Raptor Group have surveyed populations of Common Buzzards and other raptors in SE-Jutland (mainly Kolding municipality, 611 km^2, 55°29'N, 09°28'E), Denmark. The landscape consists of a mosaic of agricultural areas (69% coverage) interspersed with hedgerows, woodlots and woodlands up to c. 10 km^2 in extent (16% coverage: almost exclusively deciduous tree stands), and villages and towns up to 56 000 inhabitants in size (Kolding), with an overall human

Table 1. Variables characterising Common Buzzard nest sites when exposed to experimental human disturbance and log-rank test statistics of their apparent influence on flight distance.

Strata variables	Categories (*n*)			*n*	χ^2_1	*P*
Buildings <150 m	Present (42), absent (166)			208	0.41	0.52
Year	2007 (129), 2008 (84)			213	0.05	0.82
Habitat density	'dense' (56), 'open' (144)			200	1.19	0.28
Covariates	Mean	SD	0–5–95–100 percentiles			
Julian date	105	12	61–91–121–161	213	2.26	0.13
Nest height (m)	14	3	6–9–19–22	182	0.02	0.90
Distance to roads (m)	143	84	14–26–320–392	134	0.19	0.66
Road length (km) within 500 m	4.2	2.5	0.7–1.3–9.7–13.8	134	0.84	0.36
Road length (km) within 1 km	15.4	7.1	4.8–8.3–30.2–44.0	134	0.09	0.77
Distance to buildings (m)	281	173	36–77–608–1081	134	0.15	0.69
Buildings within 500 m	14	21	0–0–41–163	134	0.02	0.89
Buildings within 1 km	87	113	0–12–368–619	134	0.24	0.63

population density (Kolding municipality) of 134/km^2. The average breeding density of buzzards was 0.42/km^2 (0.36–0.49 in different years: census data from 323 km^2, 2000–06; K. Storgaard, unpubl. data). The study area thus represents a typical western European landscape with a dense, but spatially aggregated human population and 0.11–1.85 Buzzard pairs/km^2 (Bijlsma 1997).

Displaying pairs and their nests were mapped in February–March and again visited once in April (Table 1) to check for breeding attempts. Unless evidence for nest occupation could be established from a distance (≥ 200 m), the surveyor approached the nest on foot until a nesting Buzzard was observed (typically by standing up or flying off), after which the observer retracted. Because nest visits took place before leaves were on the trees, even nests in continuous dense stands of trees were visible from afar (no nests were located in closed conifer stands). Nests were visited again in late June/July (often after fledging) to check for signs of successful breeding (no data on breeding success available from 2007–08) and to collect prey remains. Apart from sporadic ringing activity in 1973–99 trees were never climbed. As occupied nest sites were only surveyed at most twice annually, each visit lasting for a few minutes and never involving climbing of the tree, no particular habituation (or sensitization) to humans in general or to surveyors in particular caused by the survey activities was apparent or seemed likely.

During annual nest surveys in 2007 and 2008, surveyors systematically registered the distance to 213 occupied nests at which incubating Buzzards flew off the nest. They also registered nest height, tree density (as 'open', i.e. exposed to open air on at least one of the sides, or 'closed', i.e. surrounded by trees on all sides, within a 20 m radius), and presence/absence of buildings within 150 m of the nest. From the geographical coordinates available for 134 of the nests, we extracted digital map information of the distance to nearest road, distance to nearest building and number of buildings and length of roads within a 500 and 1000 m radius as indices for the local density of humans from a Geographic Information System (ArcMap 9.3).

We modelled the incubating Buzzards' flight distance in response to the approaching person as a distance-to-event function based on Kaplan-Meier statistics, using [200-m observation distance] as distance variable, scoring flight responses as 'events' and incidences of Buzzard observed before flying off (after which no further approach was made) as right-censored cases. In addition to quantifying a baseline function over the distribution of flight distances, we tested whether the flight distance was conditional on year, date, microhabitat features and indices of exposure to human activity with log-rank tests. All analyses were carried out with the LIFETEST-procedure in SAS (9.13, Enterprise guide 3.0) software.

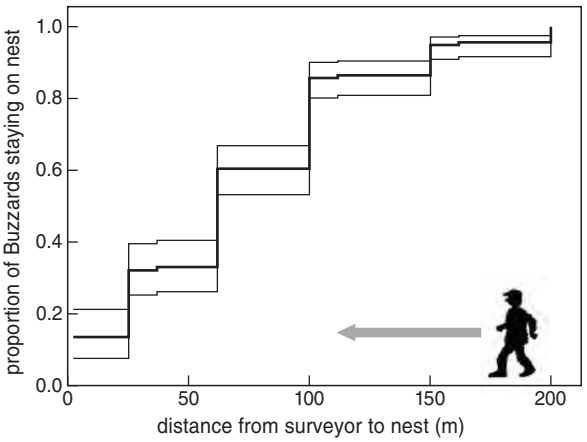

Figure 1. The proportion of 213 nesting Common Buzzards (thin lines indicate 95% confidence zones) remaining on their nest at a given distance from an advancing observer on foot starting >200 m away. The observer walked towards the nest until the presence of a nesting buzzard was verified (flying off in 137 cases, observed without flying off – after which the observer retreated – in 76 cases). The response distance curve was analysed as a survival function as described in the text. The curve's stepwise appearance is due to most distances being registered at 25-m intervals.

Results

Buzzards first flew off their nests at a distance of 200 m, 40% departed when an observer came within 100 m, 60% within 50 m, and 86% when the observer reached the tree (Fig. 1). Despite considerable variation in microhabitat, landscape and human activity across nests, flight distances were not significantly conditional on any of the tested variables (Table 1).

Discussion

There was considerable variation in flight distance between pairs, but this variation was not explained by any of the available explanatory variables. Hence, the hypothesis that Buzzards nesting adjacent to humans should have become more tolerant to observer approach than those nesting in more undisturbed areas was not supported. The lack of significant influence from explanatory variables cannot easily be dismissed as the result of insufficient statistical power, as the confidence zones around the estimated flight distance distribution are relatively narrow. Even moderate variations in flight

distances due to variation in landscape parameters should therefore have been picked up by the analysis. However, the possibility remains that an existing habituation effect on flight distances in more disturbed areas is confounded by a higher proportion of low-quality birds occupying these habitats that are less willing to stay at their nests. It is also possible that the stimulus of a person heading directly towards the nest in a beeline is so different from the stimulus of 'normal' pedestrians passing by nests that any difference in habituation to human presence would not be apparent in their response to the surveyors.

Because each nest was only visited once during the early breeding season each year, it is not possible from these data to quantify the observed variation in flight distances attributable to individual differences in sensitivity. In the light of the apparent lack of influence from environmental variables, quantification of the contribution of the individual component to flight distance should be the focus of any future investigation of flight distances of Buzzards or other larger raptors. Hence, if flight distance during incubation is partly a function of individual personality, natural selection might favour increased tolerance over the coming generations (as long as Buzzards are not persecuted), as personality traits are often highly heritable (e.g. Drent *et al.* 2003). Otherwise, the observed tolerance pattern might illustrate the limit of tolerance to humans of a medium- to large-sized raptor in human-dominated landscapes after 40 years of protection. Microhabitat selection patterns of nest sites used in 1973–2006, showing unaltered avoidance of forest areas 40–50 m from roads and paths through these 34 years (P. Sunde, P. Odderskær & K. Storgaard, unpubl. data), might suggest the latter.

The actual fitness costs of repeated disturbances remain to be quantified (e.g. Beale & Monaghan 2004, Sutherland 2007). Nevertheless, the results suggest that even in landscapes with relatively high human density and negligible persecution, incubating raptors of Buzzard size might be sensitive to human disturbance up to 200 m from their nest even after decades of protection from hunting. If this is a universal pattern for all larger raptor species, restricted human access to potential nesting areas might therefore be necessary in the longer term to secure breeding conditions for such species in areas with high human outdoor activity level.

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References

Arroyo B. & Razin M. 2006. Effect of human activities on bearded vulture behaviour and breeding success in the French Pyrenees. Biol. Conserv. 128: 276–284.

Beale C.M. & Monaghan P. 2004. Human disturbance: people as predation-free predators? J. Appl. Ecol. 41: 335–343.

Bijlsma R.G. 1997. Buzzard *Buteo buteo*. In: Hagemeijer W.J.M. & Blair M.J. (eds) The EBCC atlas of European breeding birds. Poyser, London, pp 160–161.

Blumstein D.T., Fernández-Juricic E., Zollner P.A. & Garity S.C. 2005. Inter-specific variation in avian responses to human disturbance. J. Appl. Ecol. 42: 943–953.

Drent P.J., van Oers K. & van Noordwijk A.J. 2003. Realized heritability of personalities in the great tit (*Parus major*). Proc. R. Soc. Lond. B 270: 45–51

Gill J.A. 2007. Approaches to measuring the effects of human disturbance on birds. Ibis 149: 9–14.

González L.M., Arroyo B.E., Margalida A., Oria J. & Sánchez R. 2006. Effect of human activities on behaviour and success of the Spanish imperial eagle. Anim. Conserv. 9: 85–93.

Møller A.P. 2008. Flight distance of urban birds, predation and selection for urban life. Behav. Ecol. Sociobiol. 63: 63–75.

Schlesinger M.D., Manley P.N. & Holyoak M. 2008. Distinguishing stressors acting on land bird communities in an urbanizing environment. Ecology 89: 2302–2314.

Sutherland W.J. 2007. Future directions in disturbance research. Ibis 149 (Suppl. 1): 120–124.

Samenvatting

Buizerds *Buteo buteo* kregen in Denemarken pas in 1967 bescherming. Tot die tijd mocht er op de soort worden geschoten. In het onderhavige onderzoek wordt de vluchtafstand van broedende Buizerds bekeken in relatie tot omgevingsvariabelen die met de aanwezigheid van mensen samenhangen. De verwachting was dat Buizerds die broeden in dicht met mensen bevolkte gebieden, mits niet vervolgd, een grotere tolerantie (kortere vluchtafstand) tegenover mensen zouden hebben dan in dunbevolkte gebieden. Het onderzoek werd uitgevoerd in het zuidoosten van Jutland, een overwegend agrarisch gebied met talloze houtwallen, bosjes en bossen. Mensen bereiken er een gemiddelde dichtheid van 134 per km^2, Buizerds een gemiddelde dichtheid van 0,42 paar per km^2. De vluchtafstand werd in 2007 en 2008 bij 213 bezette nesten bekeken door vanaf een afstand van 200 m rustig op het nest af te lopen tot de broedende vogel opstond of wegvloog. De meest rille Buizerds vlogen op zodra de waarnemer op 200 m afstand van het nest was, 60% van de broedvogels zat nog op het nest op het moment waarop de waarnemer op 100 m genaderd was, 40% wanneer de waarnemer op 50 m was en 14% tot de nestboom was bereikt. Hoewel de nesten in zeer uitlopende landschappen waren gelegen en de menselijke dichtheid eveneens sterk varieerde, hield geen van de gemeten variabelen verband met de vluchtafstand. Nestelende Buizerds hielden in dit gebied in de afgelopen 34 jaar consequent minstens 40–50 m afstand tot wegen en paden. Dit zou erop kunnen wijzen dat het waargenomen vluchtpatroon een afspiegeling is van wat Buizerds in dit type landschap hebben geleerd te tolereren. (RGB)

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