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Brief report

Low hunting efficiency of a naturally handicapped Common Buzzard

Andrzej Wuczy?ski* & Krzysztof Konieczny

*Polish Academy of Sciences, Institute of Nature Conservation, Lower-Silesian Field Station, Podwale St. 75, 50-449 Wroc?aw, Poland. (*E-mail: a.wuczynski@pwr.wroc.pl)*

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1. Introduction

Wild bird populations include some proportion of individuals showing departures from optimal morphology and such features as missing feathers or deformed legs can be considered "handicaps" (Sharp & Neill 1979, Dawson *et al.* 2001). The nature and behavioural consequences of naturally occurring handicaps are generally unknown, although experimental handicapping has been used in studies of parental care or sexual selection (Møller & Lope 1994, Sanz *et al.* 2000). The prevalence and consequences of morphological abnormalities among wild raptors were extensively documented only for the American Kestrel *Falco sparverius* (Murza *et al.* 2000, Dawson *et al.* 2001). However, the results were based mainly on birds with broken feathers. Only a small proportion of birds had permanent foot abnormalities, although this kind of handicap seems to be more important in determining the hunting ability and survival of raptors (Dawson *et al.* 2001), and will in the following be termed as "serious handicaps".

Although the Common Buzzard *Buteo buteo* belongs to the best-known European birds of prey, there are no data on physical abnormalities of wild buzzards. The only report deals with the food of one individual with a broken wing (Haensel 1967). In addition, there is only sparse information about the hunting efficiency of the species (Pinowski & Ryszkowski 1962, Møller *et al.* 1979, Wuczy?ski 2001), while for many other raptors, also those difficult to observe, the subject is worked out on the basis of hundreds of attacks (e.g. Hantge 1980, Temeles 1985, Toland 1986, Redpath *et al.* 2002). In this report we compare the hunting efficiency of one buzzard individual, which had a numb leg, with that of healthy individuals, using four different indices of efficiency. As the numbness must have been very influential, especially because buzzards catch and kill the prey with the toes and not with the bill (Csermely & Gaibani 1998), low efficiency values and, consequently, low survival of the handicapped birds were expected.

2. Methods

The observations were carried out on 24 February 1994 near the village of Karszów in SW Poland (50°46´ N, 17°01´ E). A 100-hectare field with a culture of winter rape *Brassica napus* attracted a great number of foraging raptors (up to 30 Common Buzzards, 2 Rough-legged Buzzards *B. lagopus* and 5 Kestrels *F. tinnunculus*). Most of them kept standing on the ground, but some perched on poles of electrical and telegraphic lines, which constituted the only accessible perches. Observations of consumption indicated that the main prey for these raptors was the Common Vole *Microtus arvalis*. Although the number of Common Vole available was not estimated, the great density of active burrows and the concentration of raptors indirectly indicated that the field was an exceptionally rich feeding ground.

We used the focal bird sampling method (Martin & Bateson 1994), following randomly chosen individuals continuously as long as possible. We noticed that one buzzard displayed difficulty while landing on poles, and jumped on one leg when moving on the ground; further observations confirmed that the other leg was completely inert. Judging by its plumage it was an adult bird (Forsman 2002). We were able to observe this bird during two periods, 10:33–10:46 a.m. and 2:25–4:23 p.m.; all the time the buzzard was actively foraging, based on its alert posture, frequent changes of perches and regular strikes.

The buzzards used two hunting techniques only, perch-hunting (attacks were launched from elevated perches) and ground-feeding (attacks were launched from the ground; ground sally-gleaning *sensu* Fitzpatrick 1980, equivalent to grubbing *sensu* Dare 1961). The following hunting efficiency indicators were used (Masman *et al*. 1988): strike success (proportion of successful strikes), strike rate (frequency of strikes), hunting yield (frequency of kills) and detection time (latency to attack *sensu* Murza *et al*. 2000). The latter was measured as the time (min) elapsed from landing on a perch or ground until launching an attack (Sonerud 1992). Small mammals were the objects in all the described attacks.

The efficiency of the handicapped buzzard was compared with the efficiency of six other individuals of Common Buzzard observed on the same day and place. As no morphological or behavioural abnormalities of the latter six birds were observed, they were assumed to be healthy. The observation times and the numbers of attacks undertaken by these birds were as follows: 123 minutes/1 attack (1 successful); 121 min/8 (4); 85 min/11 (3); 68 min/7 (1); 99 min/9 (1); 63 min/4 (1). Thus, total observation time of the six buzzards amounted to 559 minutes (mean 93 min).

The differences in strike success, detection time and frequency of hunting techniques were tested using two-tailed non-parametric tests and assuming independence of observations (strikes) from the same bird. When testing differences in strike rate and hunting yield a special case of t-test was used, suitable for comparison of a single observation with the mean of the sample (Sokal & Rohlf 1995: p. 228).

3. Results and discussion

During a total time of 131 minutes the buzzard with a numb leg undertook seven attacks, of which only one was successful. Therefore its strike success was 14%, and only half of the strike success for the control birds (Table 1). The handicapped bird looked out for prey three times longer than the control birds, thus its strike frequency was also lower. Consequently, the value of the hunting yield suggests that the handicapped bird obtained half as much food as the others. The values of efficiency were balanced in the control group,

Table 1. Hunting efficiency of the handicapped and of control Common Buzzards. Values are medians (lower and upper quartiles in parenthesis) and percentages in strike success.

	Handicapped	n	Control	n	Test statistics	P
Strike success (%)	14.3	7 [1]	27.5	40 [1]		0.66 [2]
Detection time (min)	11.0 (3.5; 15.5)	7 [1]	3.5 (2.0; 7.8)	38 [1]	95 [3]	0.23
Strike rate (strikes/hour)	3.2	1 [4]	5.0 (4.0; 6.0)	6 [4]	–0.56 [5]	0.60
Hunting yield (captures/hour)	0.5	1 [4]	0.9 (0.7; 1.7)	6 [4]	–0.94 [5]	0.39

[1]Num. of strikes; [2]Fisher's exact test, two-tailed; [3]Mann-Whitney U-test; [4]Num. of birds; [5]T-test, independent, two-tailed, df = 5.

except one bird which undertook only one attack during the 123 minutes of observation (both, strike rate and hunting yield amounted to 0.5). When this bird was excluded from calculations the medians of detection time, strike rate and hunting yield in control birds slightly changed (3.0; 5.5; 1.0 respectively), although the differences to the handicapped buzzard remained insignificant.

All the described birds used two hunting techniques only, ground-feeding and perching. In the case of the handicapped buzzard the ratio of these methods was 3 strikes (one successful) to 4 strikes, respectively, while for control birds it was 33 strikes (therein 9 successful and one of unknown effect) to 8 strikes (2 successful). Thus, the handicapped buzzard used ground-feeding to a smaller extent than did the other buzzards ($?^2 = 2.73$, df = 1, $P = 0.098$).

The differences of the described values suggest that the hunting efficiency of the handicapped buzzard was lower than that of the other birds on this feeding ground, although the differences were not significant (Table 1). Low strike rate and long detection time may suggest an energetically cheap foraging strategy of "expectation", i.e. greater selectivity by the decision to attack. This corresponds with the data of Murza *et al.* (2000) who tested whether handicapped American Kestrels are "prudent" in their selection of prey, i.e. they take longer to attack than healthy individuals, or in reverse, as poor foragers they are "needy" and launch an attack sooner. Handicapped males tended to have longer latency in attacks, thus they were rather "prudent" predators. In contrast, females seemed to be more affected by handicap considering their poorer condition and lower return rates (Dawson *et al.* 2001).

Detection time of the handicapped buzzard was affected by the prevalence of perching among its hunting techniques; perches offer a larger scanning area, and thus it takes longer (Village 1990, Sonerud 1992), but also gives more opportunities to attack. However, it is difficult to decide whether frequent application of this hunting method was an element of "prudent" strategy, or resulted from difficulty in moving around on the ground and keeping balance on one leg. Healthy birds moved on the ground by running, whereas the handicapped bird moved by jumping, which was surely more energy consuming. Moreover, ground-feeding is significantly more successful than perch-hunting (Wuczy?ski 2001) which gives additional evidence that the handicapped bird was forced to perching.

Even though long detection time suggests precise choice of attack, the handicapped buzzard was also impaired in the ability to capture or subdue its prey (low strike success). Capturing small mammals consists of a precise strike with the toes, quite often followed by a sequence of "extraction" of the prey from under vegetation — raking sod, jumps (own obs.). Such behaviour was observed also in the handicapped bird, and numbness of one leg constituted an obvious limitation. As a result, the hunting yield (which is the product of strike frequency and strike success and a critical determinant of survival) for the handicapped bird was only half of that of control birds. Especially in severe winter conditions, this would mean difficulties in satisfying energy demands, and thus small survival rate. Moreover, these demands were probably higher in the handicapped than in the control birds, because of both the atypical way of moving and the difficulties with landing on poles (electric wires were situated above the top of the pole). Frequent failure of landing means longer time in flight, which is the most energy consuming part of the activity budget (Masman & Klaassen 1987). It is probable that most individuals possessing similar serious handicaps die shortly after the event that caused the anomaly. This may explain the low frequency of serious morphological handicaps in wild bird populations. Among 1969 American Kestrels, barely 1.3% had foot abnormalities (lack of fingers and talons, broken leg), and all defects were healed. Females with such handicaps were in significantly poorer condition than control females (Dawson *et al.* 2001 and further references therein).

Handicapped individuals of generalist raptors, like Common Buzzard or Eurasian Kestrel, can theoretically switch to alternative food resources easier to obtain (insects, earthworms). Pellets from a Common Buzzard with a broken wing contained mainly invertebrates, probably caught on the ground by this non-flying bird (Haensel 1967). However, our study was done in winter, when such alternative prey are rarely accessible.

Our results indicate that different indicators should be used when analysing the consequences of handicaps in birds. In the case of the described

Common Buzzard, detection time suggested a prudent (cheap) strategy of "expectation". However, it was not confirmed by the final low capture rate. As a result, this raptor seemed to be a rather "needy" forager. Finally, if low hunting efficiency is a fact for individuals showing departures from optimal morphology, as this study implies, it may support the respective disadvantage theory of natural selection and explain the low proportion of this group of individuals in the population.

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Selostus: Yksijalkaisen hiirihaukan saalistustehokkuus

Artikkelin kirjoittajat havaitsivat yksijalkaisen hiirihaukan Puolassa, Karszówin kylän läheisyydessä sijaitsevalla 100 hehtaarin kokoisella syysrapsipellolla 24.2.1994. Samalle viljelyaukealle oli kertynyt paljon muitakin petolintuja: 30 hiirihaukkaa, kaksi piekanaa ja viisi tuulihaukkaa. Useimmat petolinnuista saalistivat maassa, vain osa istui alueella olevilla sähkö- ja puhelinlinjoilla. Petolintujen pääasiallinen saalislaji kyseisellä alueella oli kenttämyyrä. Kirjoittajat vertasivat yksijalkaisen hiirihaukan saalistustehokkuutta samalla pellolla ruokailleiden terveiden hiirihaukkojen saalistustehokkuuteen. Loukkaantunut hiirihaukka oli aikuinen yksilö. Yksijalkaisen hiirihaukan saalistusta seurattiin 24.2. sekä aamupäivällä että iltapäivällä yhteensä 131 minuutin ajan. Pellolla saalistavat hiirihaukat käyttivät kahta saalistustaktiikkaa: osa teki saalistussyöksyjä maahan korkealla sijaitsevilta tarkkailupaikoilta ja osa saalisti maassa. Kirjoittajat arvioivat hiirihaukkayksilöiden saalistustehokkuutta neljän indeksin avulla: onnistuneiden saalisiskujen osuus kaikista saalistusyrityksistä, saalistusiskujen kokonaismäärä, saalismäärä ja saaliin havaitsemiseen käytetty aika. Tarkkailujakson aikana yksijalkainen hiirihaukka teki seitsemän saalistusyritystä, joista vain yksi onnistui. Loukkaantuneen hiirihaukan saalistusyrityksistä onnistui vain 14%; terveillä yksilöillä onnistumisprosentti oli 28. Yksijalkainen hiirihaukka käytti kolme kertaa enemmän aikaa saaliin havaitsemiseen kuin terveet yksilöt. Vammautunut hiirihaukka teki myös vähemmän saalistusyrityksiä. Yksijalkaisen yksilön saama saalismäärä oli puolet pienempi kuin terveiden yksilöiden. Yksijalkainen hiirihaukka saalisti maassa harvemmin kuin terveet hiirihaukat. Maassa saalistaneet hiirihaukat saivat saalin useammin kiinni kuin muita saalistustekniikoita käyttäneet yksilöt. Terveet yksilöt saalistivat maassa juosten; yksijalkainen hiirihaukka joutui hyppimään. Oletettavasti maassa hyppiminen kuluttaa huomattavasti enemmän energiaa kuin maassa juokseminen. Terveiden hiirihaukkayksilöiden ja loukkaantuneen hiirihaukan vertailu viittasi siihen, että yksijalkainen hiirihaukka oli pakotettu käyttämään vähemmän tehokasta saalistusmenetelmää kuin terveet yksilöt. Yksijalkaisuudesta aiheutui ongelmia myös saaliin käsittelyssä. Kirjoittajat arvelevat, että vammautuneet petolintuyksilöt karsiutuvat pois populaatiosta, koska niiden saalistustehokkuus on alhainen ja niiden käyttämät saalistusmenetelmät kuluttavat runsaasti ylimääräistä energiaa. Tämän vuoksi vammautuneista petolinnuista tehdään vain vähän havaintoja. Arvioitaessa loukkaantumisen vaikutuksia yksilön menestyvyyteen, tulisi kirjoittajien mukaan käyttää useita eri indikaattoreita.

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