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The degree and causes of destruction of endangered Great Bustard (Otis tarda) nests in Hungarian populations*

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The degree and causes of destruction of Great Bustard nests were studied in eastern Hungary in 1990–1993. 29.5% of 95 known clutches hatched successfully, 17.9% were predated, 49.5% were unsuccessful due to other reasons mainly including the nest desertion and success of 3.1% was unknown. The main egg predators were Hooded Crow, fox and dog. Buffer zones of various sizes were created around some nests during mowing. It appears that areas of at least 900m^2 of standing vegetation around nests gave the best chance of successful hatching in spite of the predation risk and disturbance. It seems likely that the degree of incubation has an effect on nest desertion.

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1. Introduction

It is well known that the Hungarian Great Bustard population has undergone a considerable decline. In 1941, 8557 individuals were counted (Fodor *et al.* 1971). In the last few years only about 1100 birds have been censused (Fatér unpublished data).

Nowadays, a large part of the population lives in agricultural areas. Cultivated crops may be attractive resources. For example, lucerne can provide a good animal food supply in the reproductive season (Faragó 1988). However, nesting in cultivated lands is dangerous to the species, because agricultural work, such as the harvesting of lucerne, destroys a considerable number of nests. Ena *et al.* (1987) found that 50% of nests in Spain were destroyed, mainly by farm machinery. In Hungary this destruction was estimated to be 70% (Sterbetz 1980).

This great population decline prompted the Hungarian Ornithological and Nature Conservation Society to start a Great Bustard protection project. In the present study we report some results of this project. Answers were sought two main questions: i) What is the degree of destruction of endangered clutches? ii) What factors contribute to such nest destruction?

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2. Material and methods

The nests studied were in Borsod–Abaúj–Zemplén, Heves, Jász–Nagykun–Szolnok and Hajdú–Bihar counties in Eastern Hungary (Fig. 1), from 1990–1993. 82% of the nests were found during agricultural work performed by farm machinery.

When it was possible the previously informed workers left a "buffer zone" around the nests during harvesting. Such nests were checked and if a bird did not come back to the nest for a long time or the situation was very dangerous, the eggs were substituted by artificial ones and placed in an incubator. Later, females which were sitting on artificial eggs received hatching real ones. This procedure often shortened the incubation period, because eggs of other nests, which hatched earlier, were often put under females. We did not find that females left the clutch because of this changing of eggs. Breeding results were recorded.

We also studied the causes of breeding failure: egg predation, desertion, death of female.

We assume egg predation when broken eggs were found or the nest was empty before the end of the incubation period. The term "desertion" is used only if the female ceased to incubate in spite of having eggs (even artificial ones), except in cases when we had evidence of the death of the bird.

To study the relationship between the potential reasons and success of nests, we measured the following parameters at each nest: distance from the margin of the vegetation unit, diameter of the vegetation unit, size of buffer zone, vegetation type,

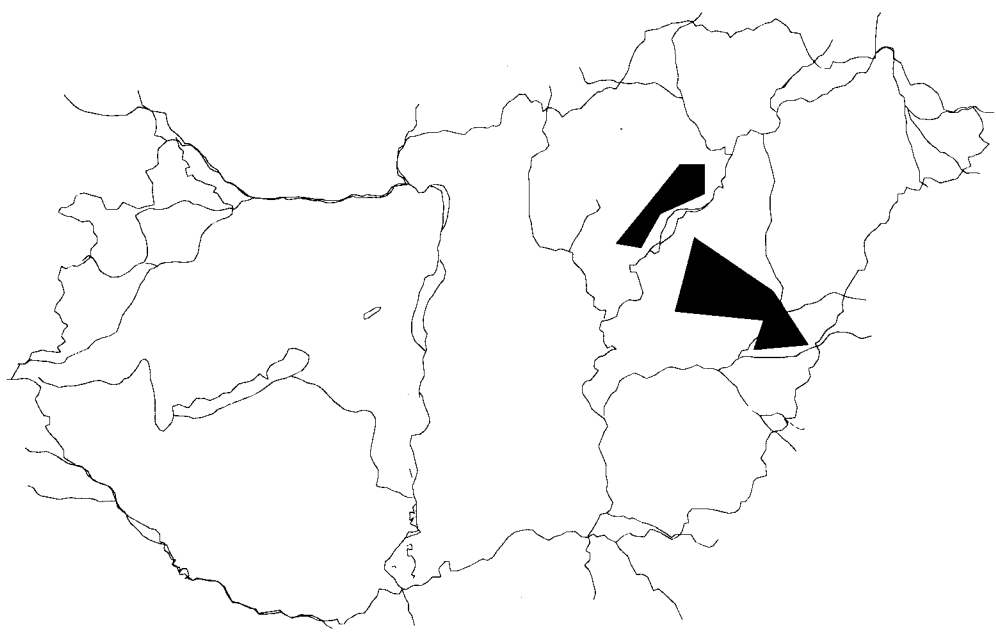

Fig. 1. Map of Hungary showing the location of the study areas.

intensity of vehicle traffic on the nearest track, intensity of pedestrian traffic on the nearest track, number of known rousings, human presence within 1km.

These parameters may be related to predation risk and disturbance. Therefore the features of predated and abandoned clutches were compared with the characteristics of successfully hatched clutches.

We assumed that the incubation investment had an effect on nest desertion. Therefore we compared the degree of incubation (at the time of nest finding) of clutches hatched successfully in the field with clutches which were abandoned immediately. The degree of incubation (in days) was calculated from the known hatching times and the results of water tests (Sukhanova *et al.* 1992). The average incubation period was considered to be 26 days (Faragó 1983, Johnsgard 1991).

Statistical analysis used were the chi-square test and the Fisher's exact test (Vargha 1990).

3. Results

3.1. Breeding result

Altogether 95 nests were found in four years. 55.8% of nests were in lucerne, 28.4% in pasture land or hay fields, 12.6% in cereals and 3.2% in other vegetation.

Only 29.5% of these hatched successfully, 17.9% were destroyed by predators and 49.5% of breeding attempts were unsuccessful due to other reasons including clutch desertion. In 3.1% of cases the success was unknown.

3.2. Predation

The Hooded Crow (*Corvus corone cornix*) was the predator in 9 nests where we found the eggs destroyed. This was verified by field observations. Large animals such as foxes and dogs were responsible for 7 missing clutches and one dead female was found near her destroyed eggs.

Tab. 1. Effect of the studied parameters on egg predation and nest desertion.

Parameter	Predated vs. successful nests	Deserted vs. successful nests
Distance from the margin of the vegetation unit	ns	ns
Diameter of vegetation unit	ns	ns
Size of buffer zone	$p<0.05$	$p<0.05$
Vegetation type	ns	ns
Distance to the nearest used track	ns	ns
Intensity of vehicle traffic on the nearest used track	ns	ns
Intensity of pedestrian traffic on the nearest used track	ns	ns
Distance to the nearest settlement	ns	$p<0.05$
Number of known rousings	ns	ns
Human presence within 1km	ns	ns

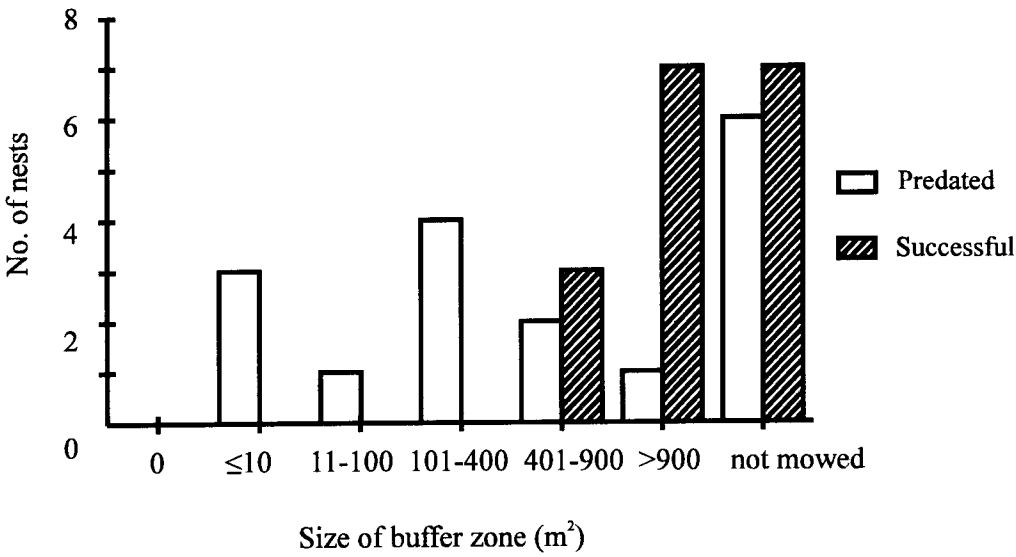

Fig. 2. Frequency distribution of predated and successful Great Bustard nests in different size of buffer zones.

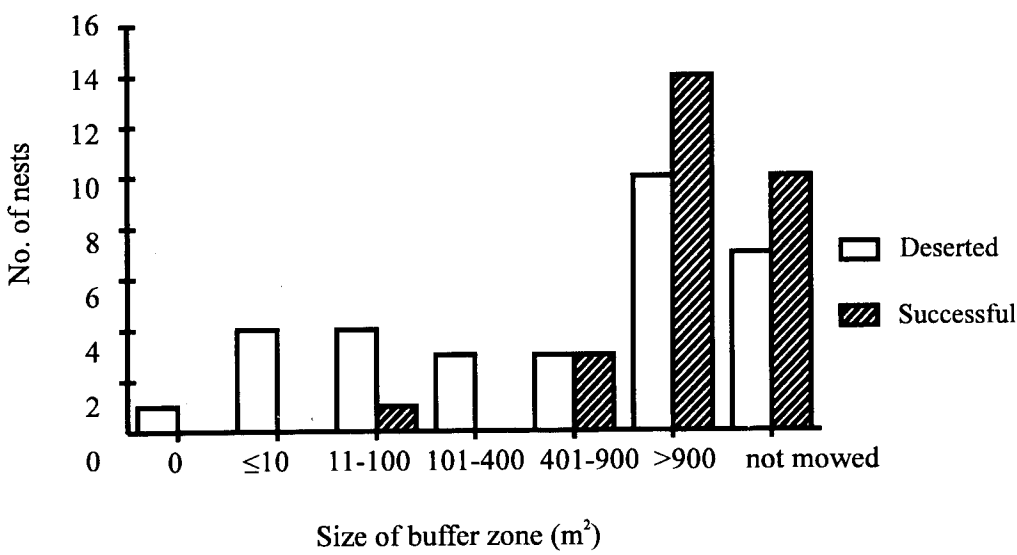

Fig. 3. Frequency distribution of deserted and successful Great Bustard nests in different size of buffer zones.

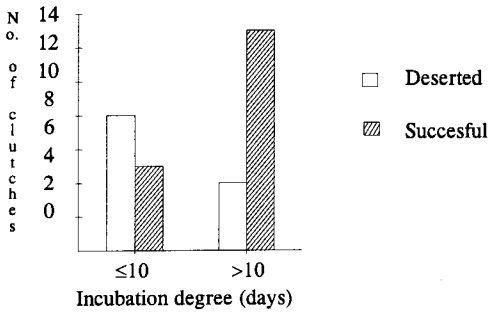

Fig. 4. Incubation degree of immediately deserted and successfully hatched Great Bustard clutches at the time of finding.

Comparing the parameters of predated and not substituted successful clutches we found significant differences only in the size of the buffer zone (χ^2_{1corr}=4.48; $p<0.05$) (Tab. 1). The majority of successful nests had buffer zones larger than 900m^2 or were in unmowed vegetation (Fig. 2).

3.3. Nest desertion

We have no evidence of disturbance by conspecifics. The cause of nest desertion was the death of a female in one case, when the bird was killed by a mowing machine.

A significant difference was found between the deserted and successful nests in the size of buffer zones (χ^2_{1corr}=5.90; $p<0.05$) and in the distance of the nearest settlement (χ^2_1 =4.76; $p<0.05$) (Tab. 1). The majority of successful nests were in buffer zones larger than 900m^2 or in unmown vegetation (Fig. 3). Contrary to our expectations, the successful nests were closer to settlements.

Difference was found between the incubation degree (at the time of finding) of successful and immediately deserted clutches (χ^2_{1corr}=2.99; $p<0.05$). The majority of successful nests were found later than 10 days incubation (Fig. 4).

4. Discussion

However, we know only a lesser part of really existing nests on the studied area (approx. 170 females) we think that the proportion endangered by human activities is considerably larger. Certainly, conservation measures played important role in success of 29.5% of nests. Distribution of discovered clutches in different vegetations shows that the most dangerous habitats were lucerne and grassland due to mowing.

In cases of both predation and nest desertion, the size of the buffer zone seems relevant. A great proportion of studied nests went through mowing which produced a vegetation island around it. Later gathering work takes place close to nests which can also be found easily by predators. It is likely, that the effects of disturbance and predation risk prevail through the size of the vegetation island – although nests were often on the margin of it – and most of the other parameters lose their importance. However, successfully hatched clutches were closer to settlements, sizes of their buffer zones were larger. According to our opinion this fact also verify the previous statement.

Considering the difference between the incubation degree of deserted and successful clutches, and that we have experienced the desertion of just hatching eggs only on one occasion, it seems likely that increasing incubation investment could reduce the probability of nest desertion.

The results provide an opportunity to draw practical conclusions. It appears that

the ideal required size of buffer zones, which gives chance the nests to reach the hatching, is bigger than 900m^2. This size is guaranteed only, when the borders of it have been marked out before mowing. According to our experiences incubating females often tolerate the short time presence of 1–2 persons from a distance of 20–30 meters. This procedure necessitate accurate observations about nesting birds which sometimes very difficult. Therefore exact information of agricultural workers is very important. On the other hand, the postponement of harvesting for a few days could reduce the probability of nest desertion.

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Összefoglalás

A fészek-pusztulások mértéke és oka magyarországi túzok (*Otis tarda*) populációkban

Kelet-Magyarországi vizsgálati területünkön a túzok fészkek pusztulásának mértékét és okait tanulmányoztuk 1990–1993 között. Kilencvenöt ismert fészekből 29,5% kelt ki sikeresen, 17,9%-t ragadozók fosztottak ki, 49,5% más okok miatt volt sikertelen, elsősorban a fészkek elhagyása miatt. Az ismert fészkek 3,1%-nak sorsa ismeretlen maradt. A fő predátorok a szürke varjak, rókák és kutyák voltak. Egyes fészkek körül különböző méretű puffer (nem bolygatott) zónák lettek kialakítva a kaszálás során. Eredményeink szerint legalább 900m^2 érintetlen vegetáció szükséges a fészkek sikerének biztosításához a predáció és zavarás ellen. Valószínű, hogy a kotlottság mértékének is hatása van a fészkek elhagyására.

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