

CLUTCH SIZE OF THE GREAT BUSTARD (*OTIS TARDA*) IN HUNGARY

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Abstract

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The study of the 858 clutches found in Hungary between 1974–1990 and transported to Dévaványa may be summarized as follows.

No decisive environmental factor could be found to explain what influences the yearly variation of average clutch sizes.

On the basis of the data at our disposal we may state that in populations with higher density the clutch size is somewhat smaller than in the more vivacious, strong populations living on the peripheries. Therefore, productivity is likely to be determined by factors of population ecology as well.

It may be stated unequivocally that the clutch size in the nesting habitats of culture areas is larger than that of the original, ancient nesting habitats, which may be explained by the density of food (Arthropoda), and through this with the change in habitat.

Within the nesting period there isn't a difference in the clutch size of the first clutch and the following clutch.

Altogether on the basis of 858 nests the average clutch size of the Great Bustard in Hungary between 1979–1990 was 1.93 eggs/clutch.

Introduction

In the case of endangered animal species such as the Great Bustard the question of reproduction is of fundamental importance. This is especially true for birds as the development of the embryo takes place outside the maternal body, in the egg, exposed to all kinds of environmental influences. Studies on this primary reproductive ability are of great importance, as after all, it is this that plays the leading role in the survival of populations. The latter fact can be observed in the case of bird species which reproduce themselves by laying a small number of eggs (eagles, bustards etc.) Therefore I consider it necessary and important to clarify this question and to make a comparison with data available from other countries.

References

Regarding the size of clutches, studies published in the area investigated show great variations. *Jourdain (1906)* found clutches with three eggs to be dominant in Spain, but according to his observations, four eggs per clutch also occurred occasionally. In the opinion of *Rey (1912)*, in the case of three eggs per clutch, the third egg was laid by another hen, proved by its different shape and colour. According to *Krause (1906)*, clutches with more than two eggs are possessed by more than one hen. *Quintin (1904)* and *Gewalt (1959)* came to the conclusion – based on enclosure breeding – that hens laying an egg for the first time are not willing to breed. On the basis of this observation, they state that hens living under natural conditions lay only one egg for the first time, and abandon it immediately when they are disturbed (*Gewalt, 1959*). Incidentally, *Gewalt (1959)* considers clutches consisting of two or three eggs as the most common. In the Brandenburg area for example, in the course of one year's investigation, the percentage of three eggs/clutch never got below 30%. A hen, raised by him, had clutches of three eggs both in the 5th and 6th years of its life. *Glutz-Bauer-Bezzel (1973)* consider clutches with 2–3 eggs regular, while the single egg/clutch is mentioned as characteristic of the late, and usually very young hen's first clutch. Based on sources by *Haller, W.* and *Dornbusch, M.* he writes that from the 24 clutches found at the Sachsen locality, two contained one egg/clutch, 21 contained two eggs/clutch and one three eggs/clutch. *Makatsch (1974)* mentions 2, sometimes 3 eggs, and refuses that a different hen lays the third egg. To support his statement he mentions five nests with eggs of his own collection, having 3 eggs each, where all three eggs were laid by the same hen. The latest data is available the FRG data gathered by *Ludwig (1983)*. From the 134 clutches found at the Notte-Niederung, 20 (14.9%) had one egg, 104 (77.6%) had two and 10 (7.5%) three eggs in the period from 1962. to 1982. This gives an average of 1.93 eggs/clutch. Similar to the above, *Bereszynsky (1977)* gives the egg/clutch number as 1–3 in Poland. Out of 20 nests 9.5% had a single, 76.2% two and 14.3% three eggs. According to Czechoslovakian authors (*Necas-Hanzl, 1956*) bustards lay two, rarely one egg. *Poliak (1980)* at the „Bustard Reservation” of Zlatna na Ostrove, in the period 1973–1976 found that out of the 14 clutches observed, two (14.3%) had one egg, ten (71.4%) two, and two (14.3%) three eggs. The average clutch size here is 2.00/clutch. Several authors – apart from *Jourdain (1906)* mentioned here – remark on nests containing more than three eggs. From Spain, information has been received on clutches having four (*Irby-Verner-Lilford*) and five (*Lilford*) eggs (quoted by *Glutz-Bauer-Bezzel, 1973*) and this, – based on studies by *Gewalt (1964)* on captive birds – could be evaluated as more than one hen laying its eggs into the same nest. According to the latest investigations, average clutch size has proved to be 2.47 eggs/clutch (*Ena-Martinez-Thomas, 1987*). *Grosse (1949)* and *Harrison (1975)* also consider 4 eggs/clutch as a possibility. Clutches of 5–6 eggs/clutch are considered by *Spangenberg (1951)* and *Glutz-Bauer-Bezzel (1973)* without a doubt as laid by two or more hens.

Incidentally, *Spangenberg (1951)* states the two eggs/clutch as typical in the Soviet Union, the 3 eggs/clutch as rare, and the single egg/clutch as even more unique. Regarding the Eastern sub-species he had no data for evaluation.

At the Zoological Institute of the Polish Academy of Sciences I had a chance to inspect 3 nests (5 eggs) collected by *Taczanowski* in the Ukraine in 1871. From these, two had one egg and one had three. I also inspected four clutches of the Eastern sub-species, *Otis tarda dybowskii Taczanowski*, collected by *Benedykt Dybowski* himself in 1863 around Darasuny (Dauria). From these there were two two eggs/clutch, and two three eggs/clutch.

In Hungary *Chernel (1899)* mentions 2 eggs/clutch and more rarely 3 eggs/clutch and this is supported by *Lovassy (1927)*, adding that the latter are possessed by older, while the single eggs/clutch by the younger hens. *Fodor (1974)* on the basis of 94 clutches found 15.5% of the bustard nests to be one egg/clutch, 43.3% two eggs/clutch and 41.3% three eggs/clutch.

Faragó (1983) from the 276 nests with eggs found between 1979–1982, found 15.9% of them had one egg, 62.3% two, and 21.8% three eggs.

Material and methods

My studies were based on the 858 clutches taken to the Great Bustard Station at the Dévaványa Nature Conservation District between 1979–1990. On the basis of the registerbook drawn up there, (*Faragó, 1985a, 1989*) all data concerning the nesting ecology and biology was noted by me, and kept in a register form.

In certain instances I refer to some earlier inspections, which I quote in the given place.

Yearly variations in clutch size

The yearly variation of the clutch size has been known for a long time, but is still unexplained. In the surroundings of Ürbő, *Schenk (1934)* found the majority of the Great Bustard nests to have three eggs. This was an outstanding result, therefore he considered it worth publishing. Data for evaluation has only been available for the past few years, based on *Fodor (1968)* resp. my results, for the years 1958–1966 and 1979–1990.

The 954 clutches (1872 eggs) available for evaluation gave an average of 1.96 eggs/clutch. The yearly occurrence and deviation from the average is given in Table 1 and Fig. 1. The yearly average given by *Fodor (1968)* is surprisingly high, and the deviations from the average are accordingly considerable. Although the yearly number of clutches varied from 5 to 14, – thus being less representative than the latter ones – the difference can still be seen. The volume is also considerable, as in 1960. (12 nests) the average number of eggs/clutch was only 1.67, while in 1963 (5 nests) it was 2.40 eggs/clutch, which gives a deviation of 0.73. There are not such high values

Table 1. The yearly variation of average clutch size between 1958–66 (Fodor, 1968) and 1979–1990 (Faragó)
 1. táblázat. Az átlagos fészekaljnagyság évenkénti alakulása 1958–66 (Fodor, 1968) és 1979–1990 (Faragó) között

Year Év	Total clutches		Összes fészekalj		First clutches		Első fészekaljak	
	Clutch number Fészek száma	Egg number Tojás-szám	Average clutch size Átlagos fészekaljnagyság	Deviation from average Eltérés az átlagtól	Clutch number Fészek száma	Egg number Tojás-szám	Average clutch size Átlagos fészekaljnagyság	Deviation from average Eltérés az átlagtól
1958	10	23	2,30	+0,34	10	23	2,30	+0,31
1959	11	25	2,27	+0,31	11	25	2,27	+0,28
1960	12	20	1,67	- 0,29	12	20	1,67	- 0,32
1961	14	32	2,29	+0,33	14	32	2,29	+0,30
1962	9	19	2,11	+0,15	9	19	2,11	+0,12
1963	5	12	2,40	+0,44	5	12	2,40	+0,41
1964	13	31	2,38	+0,42	13	31	2,38	+0,39
1965	10	23	2,30	+0,34	10	23	2,30	+0,31
1966	12	28	2,33	+0,37	12	28	2,33	+0,34
1979	50	97	1,94	- 0,02	32	61	2,00	+0,02
1980	100	231	2,31	+0,35	57	131	2,30	+0,32
1981	50	92	1,84	- 0,12	18	33	1,83	- 0,15
1982	76	149	1,94	- 0,02	27	57	2,11	+0,13
1983	145	264	1,82	- 0,14	97	167	1,72	- 0,26
1984	83	159	1,92	- 0,04	39	81	2,08	+0,10
1985	86	152	1,77	- 0,19	36	61	1,69	- 0,29
1986	100	200	2,00	+0,04	43	87	2,02	+0,04
1987	36	70	1,94	- 0,02	18	35	1,94	- 0,04
1988	37	71	1,92	- 0,04	22	41	1,86	- 0,12
1989	38	69	1,82	- 0,14	23	44	1,91	- 0,07
1990	57	105	1,84	- 0,12	30	53	1,77	- 0,21
Total Összes	954	1872	1,96	-	538	1064	1,98	-

between 1979–1990. Between the minimum of 1.77 (1985: 86 nests with eggs) and the maximum of 2.31 (1980: 100 nests with eggs), the difference is only 0.54. The latter, due to the greater number of samples and the more uniform method of sampling, should be closer to reality. *Fodor (1968)* mainly collected first clutches because for breeding performed in zoological gardens he needed eggs of greater biological value. According to his observations, first clutches were larger than following clutches. Therefore we compared the trend of sizes of first clutches and we, too, found that in the period 1979–1990. average sizes of first clutches were smaller than previously. Concerning this, even if we find an explanation for the difference between the two results, we should not exclude the possibility of some degradation in genetic ability – observable in reproduction as well – although this may not be proven at the present level of knowledge.

There is also no explanation for the yearly change. It was not possible to establish any kind of relation between any ecological factor and the clutch sizes. In the case of most species the clutch size shows some correlation with the trend of food availability. In the case of the Great Bustard this should be

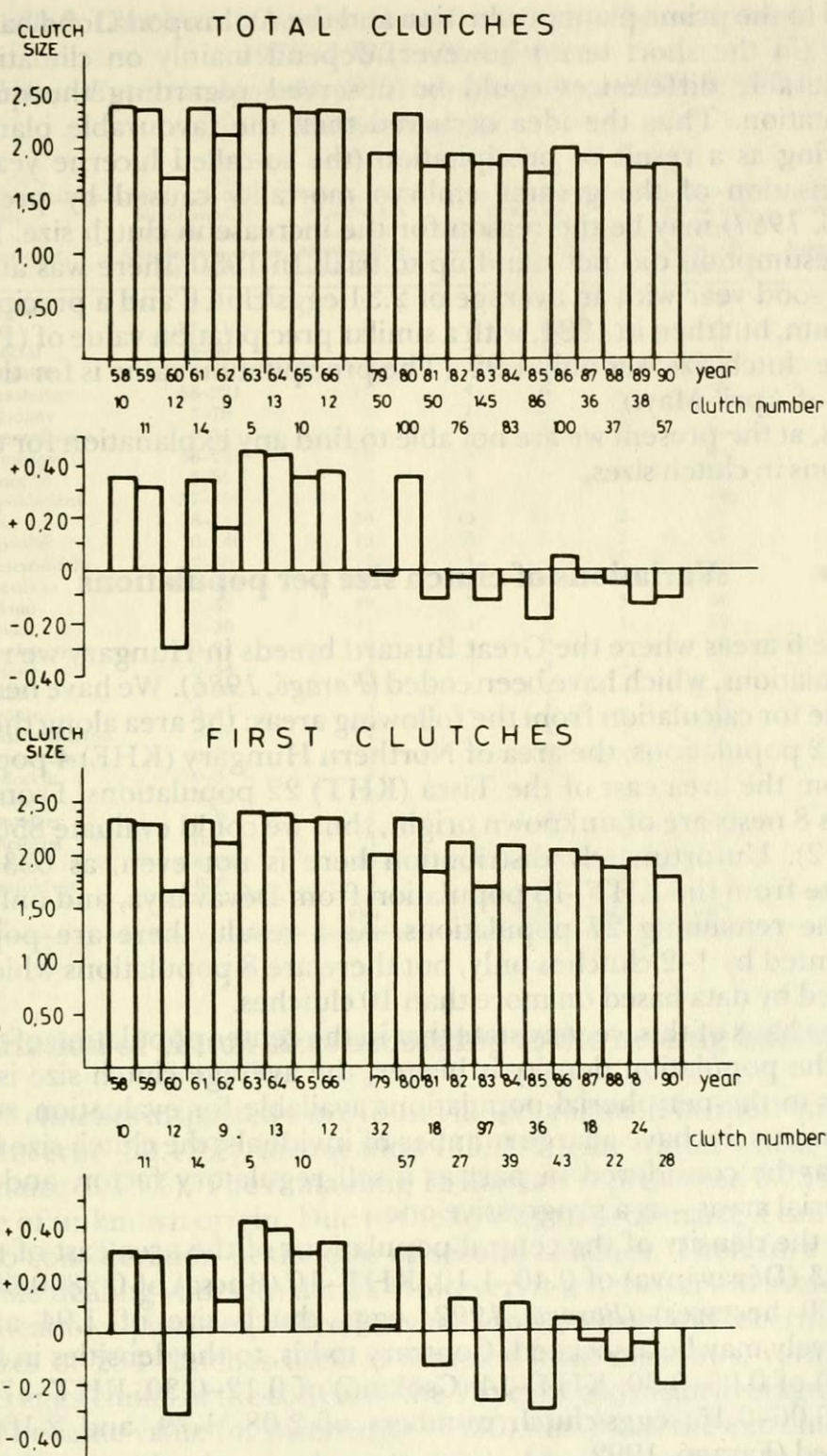


Fig. 1. Yearly variations in the average clutch size and their deviation from the average from 1958–66 and 1979–90. resp.

1. ábra. Az átlagos fészekaljnagyságok alakulása és eltérésük az átlagtól 1958–66., illetve 1979–1990 között

related to the prime plant production and the Arthropoda food basis. These factors (in the short term) however, depend mainly on climatic factors. Considerable differences could be observed regarding the quantity of precipitation. Thus the idea occurred that, the favourable plant growth appearing as a result of precipitation (the so-called lucerne year) or the compensation of the greater embryo mortality caused by precipitation (Faragó, 1984) may be the reason for the increase in clutch size. However, this presumption did not stand up to trial. In 1980, there was an outstandingly good year with an average of 2.31 eggs/clutch and a precipitation of 120.5 mm, but then in 1984, with a similar precipitation value of (110.7 mm) average clutch size was only 1.92. (The precipitation value is for the nesting period of April-May.)

Thus, at the present we are not able to find any explanation for the yearly variations in clutch sizes.

Variations of clutch size per populations

In the 6 areas where the Great Bustard breeds in Hungary we registered 46 populations, which have been coded (Faragó, 1986). We have nesting data available for calculation from the following areas: the area along the Danube (KHD) 2 populations, the area of Northern Hungary (KHE) 4 populations, and from the area east of the Tisza (KHT) 22 populations. From the 858 clutches 8 nests are of unknown origin, thus we could evaluate 850 clutches (Table 2). Unfortunately distribution here is not even, as 633 clutches originate from the KHT-13 population from Dévaványa, and only 217 are from the remaining 27 populations. As a result, there are populations represented by 1-2 clutches only, but there are 8 populations which can be described by data based on more than 10 clutches.

On the basis of this we may state that in the center population of the areas, where the population density is bigger, the average clutch size is smaller, whereas in the peripheral populations available for evaluation, which are still vivacious, ie. have a large number of individuals, the clutch size is bigger. This may be considered in part as a self-regulatory factor, and – at the peripheral areas – as a progressive one.

As to the density of the central populations of the area east of the Tisza KHT-13 (Dévaványa) of 0.40-1.10, KHT-10 (Bucsa) of 0.28-0.58 (individuals/100 hectares) (Faragó, 1992) eggs clutch size of 1.94 and 1.71, respectively may be associated. Contrary to his, to the densities in KHT-07 (Karcag) of 0.05-0.30, KHT-14 (Csökmő) of 0.12-0.30, KHT-37 (Túrkeve) of 0.06-0.15, eggs/clutch numbers of 2.08, 1.79, and 2.16 may be connected (Faragó, 1992).

We may also mention that in the old days the density numbers were much higher. We have no data concerning the differentiations during those times, but it is doubtless that habitat was also different. Today presumably all this – restricted by the environment – happens on a lower level.

Table 2. Clutch size of various Great Bustard populations between 1979–1990 in Hungary

2. táblázat. Egyes túzokpopulációk fészekalj nagyságai 1979–1990 között Magyarországon

Population Populáció	Locality Megnevezése	Size of population min-max 1981–90 Allomány min. és max. 1981–90-ben	N° of clutches inspected Megvizsgált fészek- aljak száma	Clutch sizes Fészekalj nagyság			Total number of eggs Összes tojás- szám	Average clutch size Átlagos fészekalj- nagyság
				1	2	3		
KHD-04	Csengőd	3–9	2	–	1	1	5	2,50
KHD-05	Harta	32–110	2	–	2	–	4	2,00
KHE-01	Mezőcsát	14–60	1	–	1	–	2	2,00
KHE-02	Szentistván	0–28	1	–	–	1	3	3,00
KHE-03	Füzesabony	58–221	11	4	6	1	19	1,73
KHE-10	Jászládány	3–70	3	1	2	–	5	1,67
KHT-01	Újszentmargita	5–21	9	–	7	2	20	2,22
KHT-03	Hortobágy	58–145	20	6	14	–	34	1,70
KHT-07	Karcag	5–85	12	1	9	2	25	2,08
KHT-08	Püspökladány	57–150	6	–	5	1	13	2,17
KHT-10	Bucsa	58–143	38	13	23	2	65	1,71
KHT-11	Nagyrábéc	20–140	13	5	6	2	23	1,77
KHT-12	Berettyóújfalu	12–30	2	1	–	1	4	2,00
KHT-13	Dévaványa	393–851	633	125	420	88	1229	1,94
KHT-14	Csökmő	20–55	19	7	9	3	34	1,79
KHT-15	Komádi	22–30	11	1	9	1	22	2,00
KHT-16	Biharkeresztes	0–24	2	–	2	–	4	2,00
KHT-17	Zsadány	0–34	4	1	2	–	8	2,00
KHT-19	Sarkad	2–28	3	1	2	–	5	1,67
KHT-20	Mezőtúr	0–41	1	–	1	–	2	2,00
KHT-22	Kunszentmárton	0–38	7	2	4	1	13	1,86
KHT-25	Cserebökény	0–75	5	2	3	–	8	1,60
KHT-27	Kardoskút	0–3	1	–	1	–	2	2,00
KHT-32	Pitvaros	7–32	3	1	1	1	6	2,00
KHT-33	Tiszasziget	0–2	1	–	1	–	2	2,00
KHT-35	Kuncsorba	0–8	1	1	–	–	1	1,00
KHT-37	Túrkeve	4–22	38	3	26	9	82	2,16
KHT-38	Tiszaaföldvár	0–6	1	–	–	1	3	3,00
Total – Összesen			850	175	557	118	1643	1,93

Variation of clutch sizes according to the nesting habitat

The 858 clutches inspected were found in 16 habitats. The most important were the lucerne (50.12%), the meadow (33.10%), the winter wheat (5.48%) and the maize (3.15%). The remaining 12 habitats represented 6.75%, while 1.40 were of unknown origin. Due to the sowing date of maize it can only be taken into consideration in the case of second clutches. Therefore it is not worth-while dealing with it in detail. However, it is necessary to evaluate the cases of meadows-pastures, collectively meadows, wheat and lucerne.

The sizes of 284 clutches used as samples from meadows, varied from 1.64–2.29 eggs/clutch in the course of the 12 years, the mean average coming to 1.90. The same value for lucerne (n = 430) was – with the extreme values of 1.31–2.34 eggs/clutch – 1.94 eggs) clutch. In winter wheat (n = 47) the clutch size ranged from 1.00 to 2.25 with an average of 1.94 eggs/clutch. The existing differences have no significance in a mathematical statistical sense.

The yearly dynamics, yearly and average relations of the three main habitats discussed, as well as the order of clutch sizes of all nesting habitats is

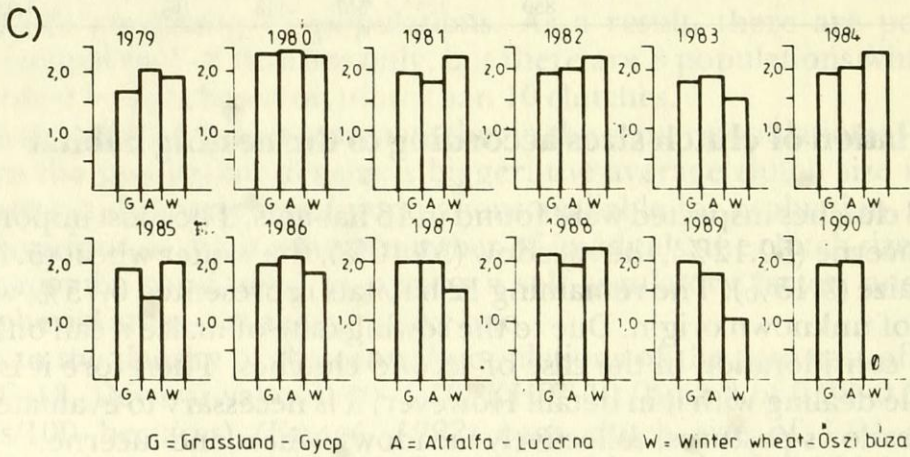
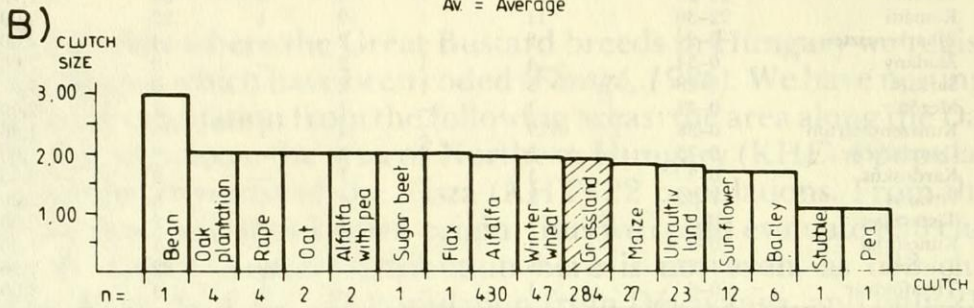
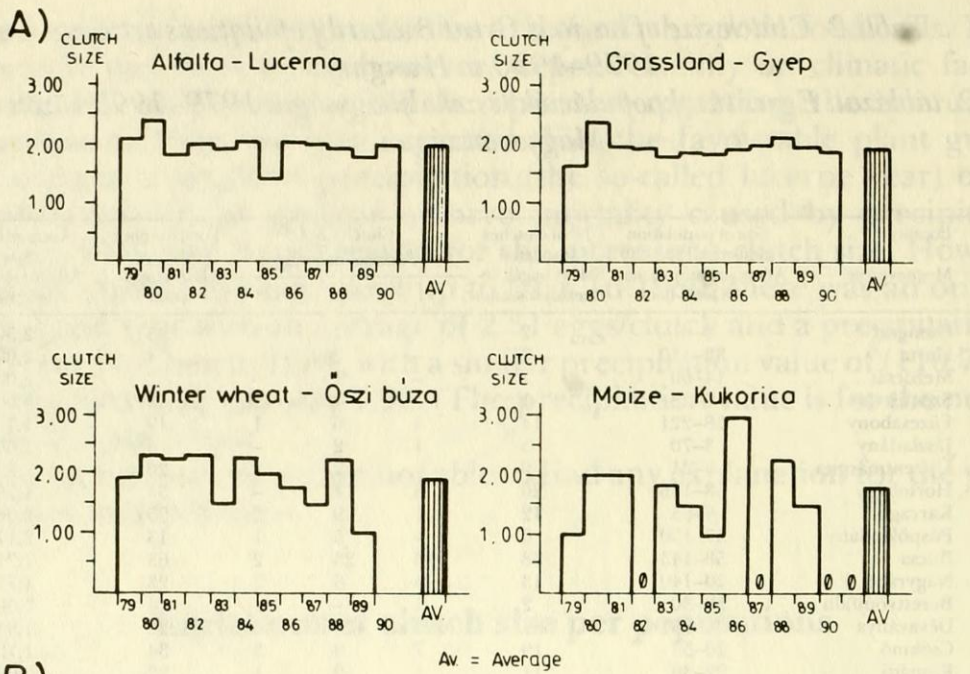


Fig. 2. Development of clutch sizes in various habitats

a) Clutch sizes in the most important nesting habitats in the period 1979–1990.

b) Order of average clutch sizes

c) Comparison of clutch sizes observed in grassland, alfalfa and wheat

2. ábra. A tuzok fészekaljok habitatonkénti alakulása

a) A négy legfontosabb fészkelőhabitat fészekalj nagysága 1979–1990. között

b) Az átlagos fészekalj nagyságok sorrendje

c) A rét a lucerna és a búza kultúrákban talált fészekalj nagyságok összehasonlítása

shown in Table 3 and Fig. 2. Thus, the above data supports my earlier statement (Faragó, 1983a) that the clutch sizes in culture habitats are bigger than those in natural ones. This may be explained by among other things the bigger Arthropoda food-basis found in them, which is actually one reason for the nesting habitat change of the Great Bustards, their moving into culture habitats (Faragó, 1983b).

Table 3. Great Bustard clutch sizes according to habitat (1979–1990)

3. táblázat. Túzok fészekaljnagyságok habitatonként (1979–1990)

Habitat	n	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Average Átlag	
Alfalfa	– Lucerna	430	2,09	2,34	1,75	1,97	1,83	2,03	1,31	2,07	2,00	1,87	1,75	1,91	1,98
Grassland	– Rét-gyep	284	1,64	2,29	1,93	1,92	1,76	1,84	1,83	1,93	2,00	2,13	1,95	1,82	1,90
Winter wheat	– Búza	47	1,88	2,25	2,20	2,25	1,50	2,25	2,00	1,70	1,50	2,20	1,00	–	1,94
Uncultivated land	– Parlag	23	–	–	–	2,00	–	–	–	2,00	1,00	1,00	2,00	1,67	1,78
Maize	– Kukorica	27	1,00	2,00	2,00	–	1,83	1,50	1,00	3,00	–	2,25	1,50	–	1,81
Oak plantation	– Tölgytelepítés	4	–	2,00	–	–	2,00	–	–	–	–	–	–	–	2,00
Sunflower	– Napraforgó	12	–	1,00	1,00	–	2,00	3,00	1,00	–	2,00	2,00	–	1,50	1,67
Barley	– Árpa	6	–	–	2,00	–	–	1,00	1,00	2,00	–	–	–	–	1,67
Oat	– Zab	2	–	–	–	2,00	–	–	–	2,00	–	–	–	–	2,00
Stubble	– Tarló	1	–	–	1,00	–	–	–	–	–	–	–	–	–	1,00
Rape	– Repce	4	–	–	–	–	2,00	–	–	2,00	–	–	–	2,00	2,00
Alfalfa with pea	– Borsós lucerna	2	–	–	–	–	2,00	–	–	–	–	–	–	–	2,00
Horse-bean	– Lóbab	1	–	–	–	–	–	3,00	–	–	–	–	–	–	3,00
Sugar beet	– Cukorrépa	1	–	–	–	–	–	–	2,00	–	–	–	–	–	2,00
Flax	– Len	1	–	–	–	–	–	–	–	–	–	2,00	–	–	2,00
Pea	– Borsó	1	–	–	–	–	–	–	–	–	–	1,00	–	–	1,00

Variations of clutch size within the nesting period

The average clutch size per pentades during the 12 years under evaluation is shown in Table 4 and Fig. 3.

Fodor (1974) suggested that the clutch size of following clutches is smaller than in the case of first clutches, and established it at 1.60 egg/clutch (on the basis of 17 clutches). According to our tests (Faragó, 1983a) the June clutches must be considered as *after*-clutches, which is in accordance with earlier results (Fodor, 1974).

Thus, we compared the following-clutch sizes with the number of eggs laid into the first clutches, yearly and in total (Table 5.).

From among the clutches inspected (858 pcs) 443 pcs (51.52%) were the results of first clutches, 416 pcs (47.48%) of following-clutches. The ratio was about the same each year, the number of following-clutches was bigger in 1981 (64.0%), 1982 (64.5%), 1984 (53.0%), 1985 (58.1%).

On six occasions during the 12 years (in 1980, 1981, 1983, 1985, 1988, 1990) the average size of following-clutches was bigger than that of the first clutches: the difference was 0.01–0.30 eggs/clutch. In two years (1979 and 1987) the sizes of first clutches were approximately the same as those of following-clutches (2.00 and 1.94, respectively). In the next four years the number of eggs in the first clutches was always higher, the difference varied from 0.04 to 0.31 egg/clutch.

Altogether, a value of 1.93 eggs/clutch for the first clutches, and 1.94 eggs/clutch for the second may be stated. The findings mentioned afore mean that if averages are computed on the basis of data recorded in the course of several years, there is no difference between the sizes of first clutches and following-clutches. This is contrary to *Fodor's (1974)* earlier statement but our conclusion was reached as a result of about a 24 times greater sample number, thus its exactness is more acceptable.

In the case of *Fodor (1974)* the number of second clutches had little influence when the averages were established, while in our case it varies between 50–75%.

Table 4. The variation of Great Bustard clutch sizes within the nesting period (1979–1990)

4. táblázat. A túzok fészekaljnagyságok alakulása fészkelési időszakon belül (1979–1990)

Month Hónap	Pentad	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
April Április	4	–	–	–	–	–	–	–	–	–	–	–	2,00
	5	–	–	–	–	–	–	–	2,00	–	–	–	–
	6	–	–	1,67	3,00	2,00	–	2,00	2,33	1,00	1,00	1,50	1,40
		–	–	1,67	3,00	2,00	–	2,00	2,25	1,00	1,00	1,50	1,50
May Május	1	–	–	–	1,50	2,29	2,40	–	2,33	–	–	2,00	2,00
	2	1,67	–	–	1,00	1,67	–	2,00	1,92	1,00	1,00	3,00	1,63
	3	1,40	2,25	1,75	2,00	2,10	–	3,00	1,71	2,00	2,00	2,00	2,00
	4	2,13	2,13	1,75	2,22	1,89	2,00	1,71	2,08	2,33	2,33	2,00	1,83
	5	2,50	2,24	2,00	2,27	1,64	2,50	1,67	2,00	1,67	–	2,00	1,86
	6	2,50	2,42	2,00	1,91	1,82	2,20	1,56	1,88	2,33	2,00	2,00	1,67
		2,00	2,29	1,89	2,03	1,88	2,20	1,71	1,98	2,00	1,92	2,06	1,80
June Június	1	1,83	2,33	1,75	1,20	2,00	2,00	1,80	2,50	2,00	2,00	1,50	2,17
	2	1,00	2,17	2,00	2,00	1,63	1,83	1,56	2,00	2,00	1,86	2,00	1,50
	3	3,00	2,57	1,50	2,00	1,80	1,80	1,93	2,00	2,00	2,00	1,00	2,00
	4	2,00	2,00	1,75	1,60	1,25	1,75	1,75	2,00	2,25	2,00	1,66	2,00
	5	2,00	2,25	2,00	1,50	2,40	1,88	1,56	2,14	2,00	2,00	2,50	–
	6	2,00	2,75	–	2,00	1,29	1,75	1,80	2,00	–	2,00	1,00	–
		1,82	2,33	1,78	1,82	1,73	1,86	1,74	2,07	2,08	1,93	1,69	2,00
July Július	1	1,00	2,00	1,83	2,50	1,75	1,71	2,00	1,33	2,00	2,00	1,50	–
	2	2,33	2,67	2,00	–	1,75	1,33	1,88	–	1,67	2,00	1,50	–
	3	2,33	2,00	2,00	–	2,00	2,00	2,00	2,00	–	2,25	1,50	–
	4	2,00	–	–	2,00	2,00	1,00	2,00	2,00	–	2,00	–	–
	5	1,00	–	–	–	1,00	3,00	–	–	1,00	2,00	–	–
	6	–	–	–	–	–	–	–	–	–	1,00	–	–
		2,00	2,29	1,90	2,25	1,82	1,71	1,93	1,75	1,71	2,00	1,50	–
August Augusztus	1	–	–	–	–	–	–	–	–	–	–	–	–
	2	–	–	–	–	–	–	–	–	–	–	–	–
	3	–	–	–	–	–	–	–	–	–	–	–	–
	4	–	–	–	–	–	–	–	–	–	–	–	–
	5	–	–	–	2,00	–	–	–	–	–	–	–	–
	6	–	–	–	–	–	–	–	–	–	–	–	–
		–	–	–	2,00	–	–	–	–	–	–	–	–
Total – Összes		1,94	2,31	1,84	1,94	1,82	1,92	1,77	2,00	1,94	1,92	1,82	1,84

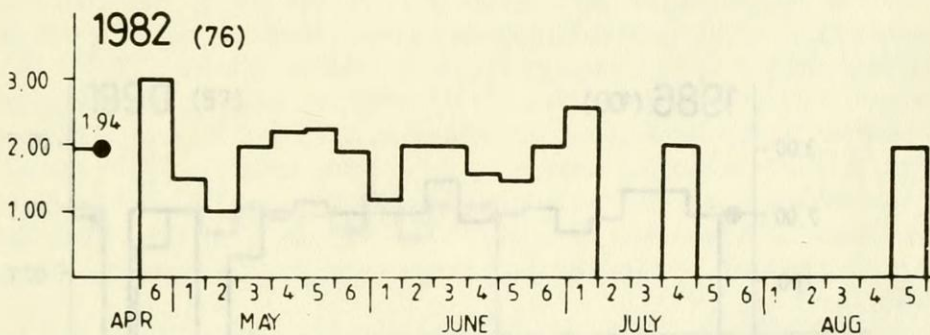
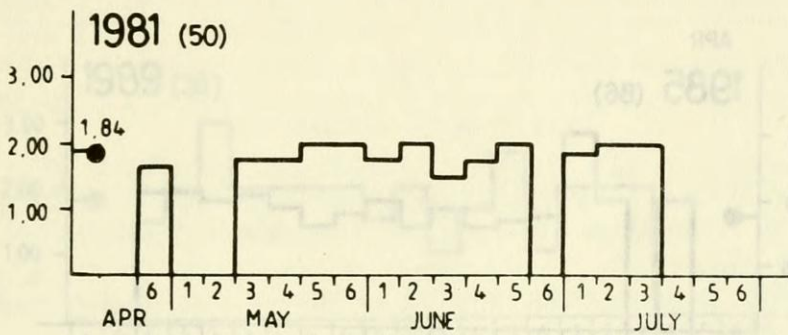
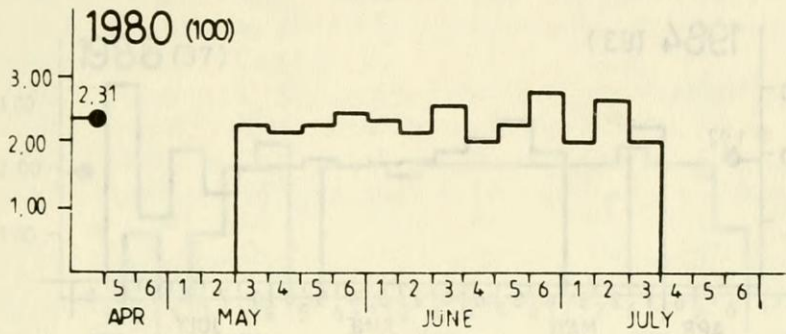
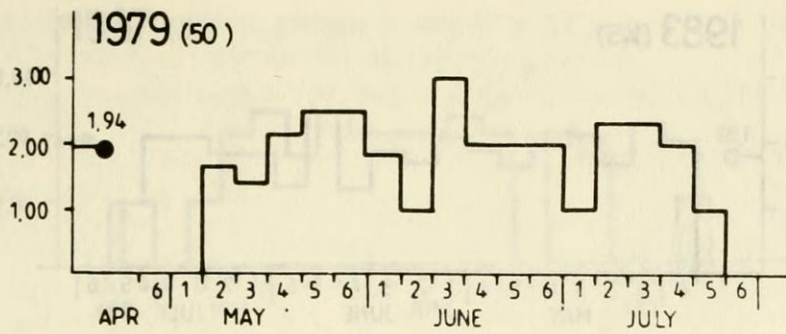


Fig. 3. Changes in average clutch size computed per pentades in the course of 12 nesting periods comprised by our investigations

3. ábra. A pentádonkénti fészekaljnagyságok változása a vizsgált 12 fészkelési időszak során

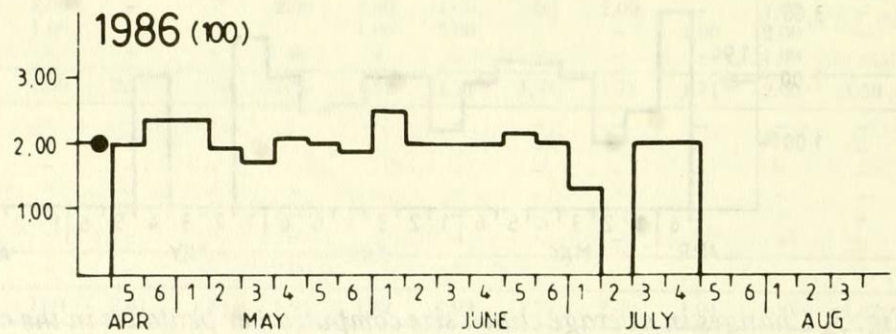
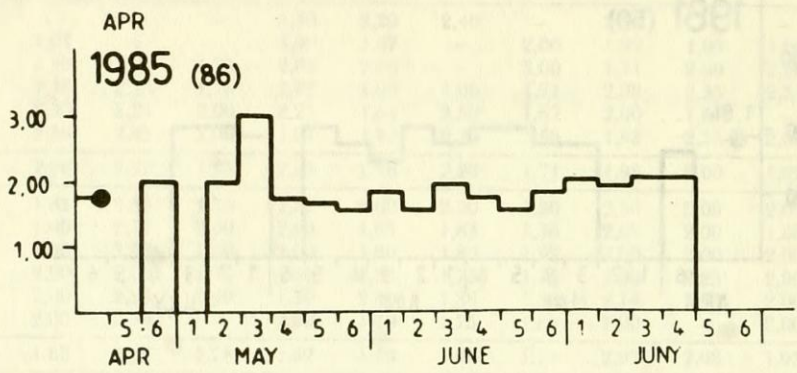
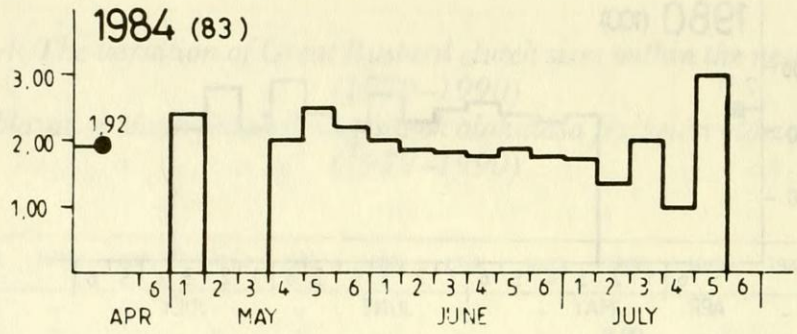
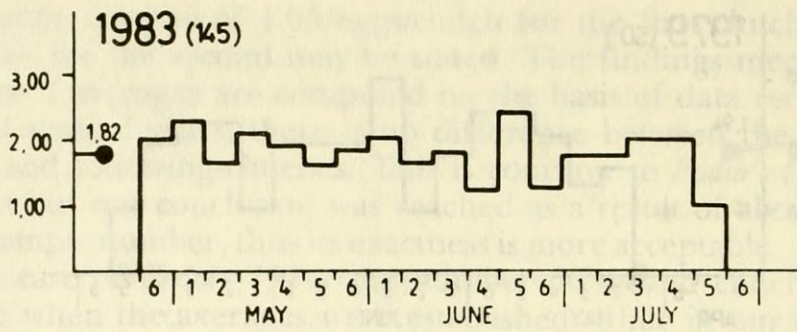


Fig. 3.
3. ábra.

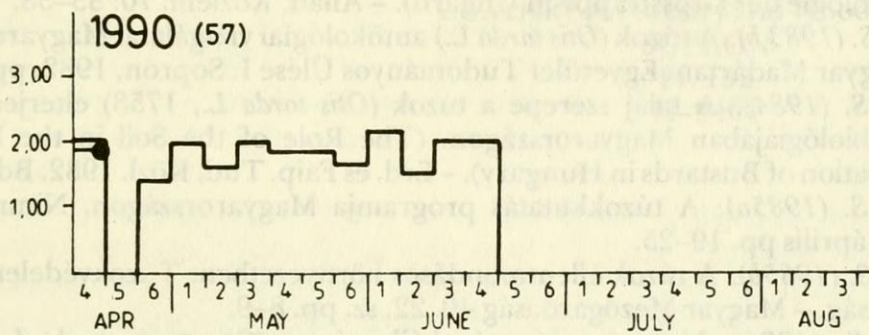
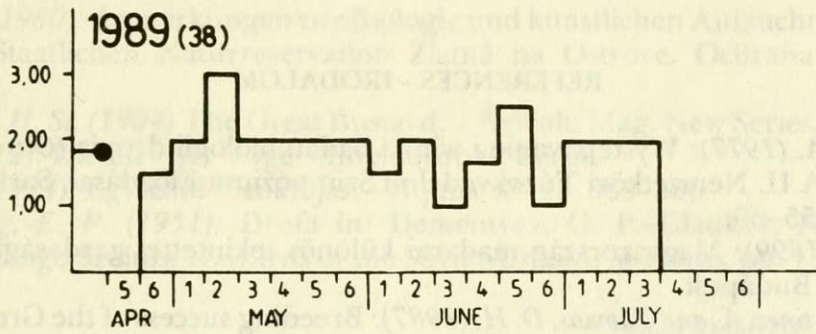
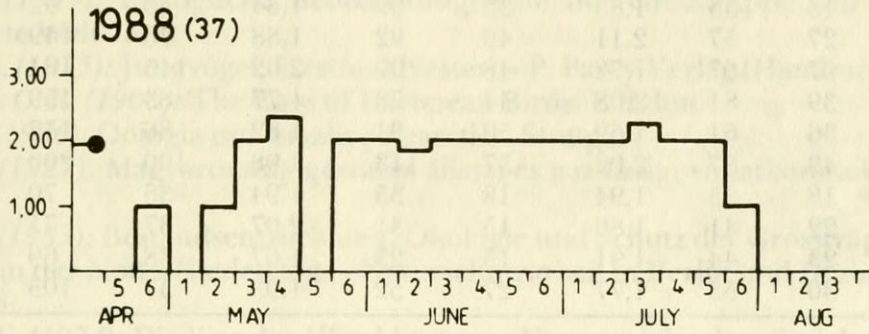
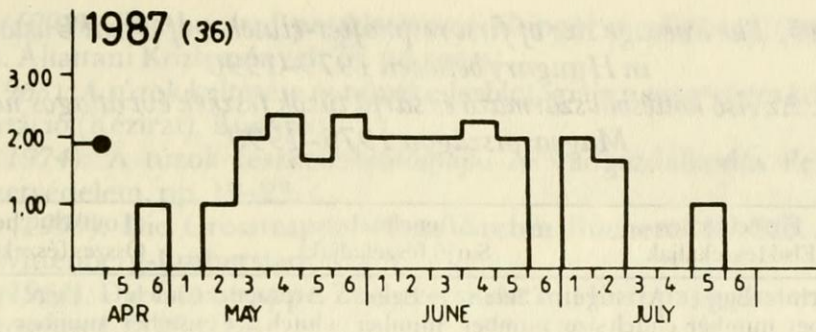


Fig. 3.
3. ábra.

Table 5. The average size of first resp. after-clutches of Great Bustard in Hungary between 1979–1990

5. táblázat. Az első költésből származó és sarjú tűzok fészkek évi átlagos nagysága Magyarországon 1979–1990

Year Év	First clutches Első fészkek			After clutches Sarjú fészkek			Total clutches Összes fészkek		
	Clutch number	Egg number	Average clutch size	Clutch number	Egg number	Average clutch size	Clutch number	Egg number	Average clutch size
1979	32	61	2,00	18	36	2,00	50	97	1,94
1980	57	131	2,30	43	100	2,33	100	231	2,31
1981	18	33	1,83	32	59	1,84	50	92	1,84
1982	27	57	2,11	49	92	1,88	76	149	1,94
1983	97	167	1,72	48	97	2,02	145	164	1,82
1984	39	81	2,08	44	78	1,77	83	159	1,92
1985	36	61	1,69	50	91	1,82	86	152	1,77
1986	43	87	2,02	57	113	1,98	100	200	2,00
1987	18	35	1,94	18	35	1,94	36	70	1,94
1988	22	41	1,86	15	31	2,07	37	71	1,92
1989	23	44	1,91	15	25	1,67	38	69	1,82
1990	30	53	1,77	27	52	1,93	57	105	1,84
Total Összes	442	851	1,93	416	808	1,94	858	1659	1,93

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A túzok (*Otis tarda*) fészekalj nagysága Magyarországon

Dr. Faragó Sándor

A Magyarországon 1979–1990 között meglegt és Dévaványára szállított 858 fészekalj elemzését a következőkben foglalhatjuk össze.

Nem sikerült meghatározó környezeti okot találni arra vonatkozóan, hogy mi befolyásolja az átlagos fészekalj nagyságok évenkénti változását.

A rendelkezésre álló adatok alapján kijelenthetjük, hogy a magasabb denzitású populációkban valamivel kisebb a fészekalj nagyság, mint az elterjedések peremén élő, életerős populációkban. A produktivitás tehát valószínűleg populációökológiai oldalról is determinált.

Egyértelműen kijelenthető, hogy a kultúr fészkelőhabitatok fészekalj nagysága nagyobb, mint az ősi fészkelőhabitatoké, ami a táplálékbőveltség (Arthropoda), s ezen keresztül a habitatváltással hozható összefüggésbe.

A fészkelési perióduson belül nincs különbség az első szándékú, ill. sarjűfészkek fészekalj nagyságai között.

Összességében 858 fészekalj alapján a túzok átlagos fészekalj nagysága 1979–1990 között Magyarországon 1,93 tojás/fészekalj volt.