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AN INDIGENOUS PREDATOR, THE GOLDEN JACKAL (CANIS AUREUS L.1758) SPREADING LIKE AN INVASIVE SPECIES IN HUNGARY

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Abstract. Golden jackal (Canis aureus Linneaus 1758) was one of the indigenious predators in Hungary. It disappeared from the Hungarian fauna by the ’50s in the last century (1). The first specimen reappeared in the last years of the ’70s (1), then the observations became frequent in the beginning of the ’90. The first breeding pairs were detected near the southern border in the middle of the ’90s and huge populations established mainly in the southern counties. In the same time more and more articles were published about its appearing, and the increasing of its populations in Europe (Slovakia, Romania, Transsylvania, Slovenia, Ukraine, Austria, Italy) (2,3,4,5,6,7,8,). Simultaneously the provable settling down in Hungary, the monitoring of the population status and the spreading of the species has started. The project contains three independent methods: mail questionnaire survey among the Hungarian Game Management Units (GMU), hunting bag datas on the basis of National Game Management Database and fieldworks (collecting proof specimens, acoustic survey). We followed in attention the changing of the hunting bag datas in the last 10 years (1997: 11 specimen, 2005: 140 specimen), the GMUs observed jackal between 1997-2006 (1997:4, 2006:67). Numerous proof specimens (54 carcasses, 8 skins/skulls) were registered in a relatively short period (7 years). Results of the acoustic survey done (2004-2006) in a large research area (Bács-Kiskun county) verified the continuous presence of the jackal. We studied the population changing by acoustic method in two main distribution areas in Hungary. The population size is eminent in these areas. The highest density that we counted was 13,6 specimen/1000 ha. It is above the highest fox density ever counted in Hungary (13,0 specimen/1000ha). Golden jackal –as a well-monitorable species- has been spreading intensively in Hungary, showing the characteristics of invasive species. Our results show that the only limiting factor in the spreading of the jackal in Hungary is the quality of the habitat (hiding-place and minimal disturbing). The expansion of the jackal is uncontinuous- in contrast to Red fox. In the preferred habitats (core areas) the density of the jackal population can increase relatively high in a very short time.

INTRODUCTION

The *Golden jackal* is an indigenous predator in Hungary. For the sake of the habitat-changing, destruction (eg. drainage), and the persistent hunting against the predators, species became exinct from the Carpatian-basin by the middle of the last century [1]. The last known and officially reported specimen was shot in Derecske in 1942 [15].

After this the observations were rare, and few vagrant males were brought down only for fifty years [1]. The species was declared extinct by the Hungarian Red data Book in 1989 account for this and because its area-edge situation [12]. Considerable populations were remained in Europe only in Bulgaria and Greece by the middle of the 20th century. The expansion of the jackal started from here in the ’70s [2]. The valley of River Danube and other rivers, galleries were used for spreading. The first vagrant specimens reappeared in Hungary again in the early ’80s [1]. The first reproductive pairs were observed near the southern border in Transdanubia (Somogy and Baranya counties), then between the River Danube and River Tisza (Bács-Kiskun county) in the first part of the ’90s. Their presence is

permanent in the region since then. Huge populations established in the southern counties, there are more and more new observations in the country. The stable populations and the distribution [9] in the Balkan-Peninsula and Adriatic-maritime is indicated by the Atlas of the European Mammals' maps [11]. The spreading and the growing populations are verified by the Slovakian [4,5] and Ukrainian [13] datas. In the same time observations are getting frequent in Austria, North-Italy [2, 17] too, where young males are noticed frequently. Sudden increasing of the romanian jackal populations in Dobrudzsa in the second part of the last century is noticed by Szeley and Sepsi [14], jackals are observed in North-Moldova, Havasalföld, and also in Transylvania [8].

Our aim was to start a monitoring program for this resettled, medium sized generalist predator with high reproductive ability and good adaptability at the beginning of the re-colonization in Hungary.

MATERIAL AND METHOD

A three-level monitoring program was used for survey the distribution of the jackal and to estimate the population density in Hungary.

Mail questionnaire survey

The survey was based on voluntary response with the involvement of the GMUs as a well functioning data-supplying system extended the whole country. The aim was to collect every GMUs yearly, where one observation was noticed at least. The data received were processed by Paradox, Quattro Pro (Corel Corporation) and Excel (Microsoft) database programs, linking the official code of hunting area to every respondent. It was possible to show the results by UTM (Universal Transverse Mercator) maps. We separated the Transdanubian datas from the East part of Hungary. The results were analysed by linear regression and significance test.

Official hunting bag data

We also analyzed hunting bag data on the basis of National Game Management Database between1997-2005 [18]. The data were noticed in each county. We used the same statistical tests as in the case of mail questionnaire survey.

Field-works

1. Collecting proof specimen

Proof specimens (carcasses, photos, skins and skulls) have been collected from all over Hungary since 2000. After the identification by the help of typical external signs we entered the most important measurements of the body [body length(bl), total length(tl), weight(w)] on record. We registered the name of the respondent each time. In every case of proof specimens we noted the name of the nearest settlement and the UTM code of the place.

2. Acoustic method

We started to use the acoustic method for the population survey in 2004. This method had been used successfully in other studies on highly developed predators. This is the most precise method to estimate the density in the core areas particularly.

The first surveys were done in those areas where the jackal was accurate. These (core areas) places are in the center of the distribution area: Kétújfalu is in Transdanubia (on the border of Somogy and Baranya counties), Hajós-Szentgyörgy lies between the River Danube and the River Tisza in Bács-Kiskun county. We worked in two periods in a year (spring –mating- and autumn -first collective hunting of the family) after sunset.

Technical equipment: We connected a megaphone Monacor TM-45 with a discman, operated by cigar-lighter in our car. We used a 32 sec. long jackal howling record received from the Greek World Wildlife Fund, and we have our own recordings now. We used a professional, digital recorder (MicroTrack 24/96) and a rifle microphone (AudioTechnika AT815b) to this.

The coordinates of the calling-stations (waypoint) and the routes were recorded by a Garmin Quest GPS, which also helped us in the navigation. The data were processed by Arcview 3.1 (ESRI, USA). The following data were registered each survey: number of the calling-station, the beginning and the end of the survey, the weather, the name of the area, visual observation, and other important comments. Howling can be heard from one km by people, that is why we marked a 1 km buffer around each calling-station (area= 314 ha). The following calculations were done: total studied area (number of locations multiplied by 314 ha), total area of positive locations (number of positive locations multiplied by 314ha), minimal number of families (add all the counted families), minimal density of the families (minimal number of families divided into the total studied area).

RESULTS AND DISCUSSIONS

Mail questionnaire

According to the county data the number of those counties, where jackal was observed increased continuously (1997:4, 1998: 6, 2000: 9, 2001: 10, 2002: 14, 2003:12, 2004: 12, 2005:13, 2006: 12). Moreover the number of GMUs where the species occurred also increased fast: (1997:4, 1998:12, 2000:26, 2001:37, 2002:42, 2003:49, 2004:49, 2005:65, 2006:67). Compare the Transdanubian data and the results from the East part of Hungary there were no serious difference. On the other hand the disparity increased for the benefit of Transdanubia in the last two years. Occurrence of the *golden jackal* was noticed in every counties at least once between 1997-2006. Majority (95%) of the responses came from the southern part of the country, mainly the counties of Baranya, Somogy and Bács-Kiskun. The results of the mail questionnaire survey showed that the species population is increasing linear in Hungary. The difference between the years were significant in the whole country ($n=9$, $R^2=0,97$, $p< 0,001$), in Transdanubia ($n=9$, $R^2=0,89$, $p< 0,001$), and East from the River Danube ($n=9$, $R^2=0,86$, $p< 0,001$).

Official hunting bag data

The total number of official hunted jackals was 600 between 1997-2005. The number of shot specimen increased fast (1997:11, 1998:22, 1999:38, 2000:59, 2001:70, 2002:80, 2003:85, 2004:95, 2005:140), mostly in Transdanubia (1997: 9, 2005: 95) . Most of the shots were in the same three counties (Baranya, Somogy and Bács-Kiskun). From 1997 the growing rate is extremely rapid, linear and seems to be unrestricted. Growing rate of the hunting bags were significant in the whole country ($n=9$, $R^2=0,94$, $p< 0,001$), the West ($n=9$, $R^2=0,94$, $p< 0,001$) and the East side of the country ($n=9$, $R^2=0,86$,$p< 0,001$).

Proof specimen

During the last years we identified unambiguously 54 carcasses (average: w: 8.48kg, bl: 73.52 cms and tl: 94.94cms), 15 photos and 8 skins, skulls. Males, females, juvenile and adult specimens were found. Most of the proof specimens came from the same three counties.

Acoustic method

Bács-Kiskun county

The cumulative results of the last three years of the study are shown on Table 1:

Table 1

The most important results of the acoustic survey in Bács-Kiskun

	2004		2005		2006	
	Spring	Autumn	Spring	autumn	Spring	autumn
Number of locations (n)	49	92	37	54	67	125
Whole studied area (ha)	15386	28888	11618	16956	21038	39250

Positive locations (n)	21	12	11	17	14	20
Minimal family number (n)	19	13	13	24	15	11
Minimal number of individuals (n)	6	2	0	3	1	8
Minimal density of families (in 1000ha)	1,23	0,45	1,12	1,42	0,71	0,28

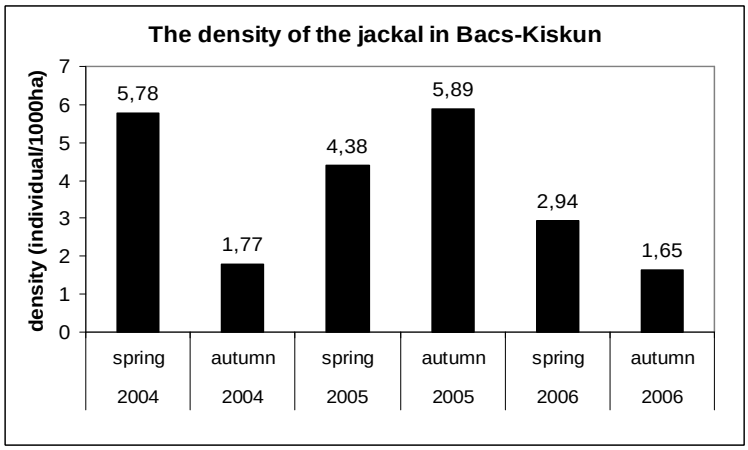

Figure 1.

More answers were heard in springs. Both the density of families and the density of individuals were higher on average in this season. We registered the density of families (springs:1.02 family/1000ha, autumns: 0.72 f/1000ha), the individual density (springs:4.36 sp/1000ha, autumns: 3.1 sp/1000ha) on average between 2004-2006. The data of the family density followed the changing of the individual density. The reason of this could be the few solitary individuals. The smallest density was counted (family: 0,28/1000ha, individual: 1,65/1000ha) in the autumn of 2006.

Statistical tests were done on the basis of the results of the same seasons. The density of the individuals showed similarity in springs (KW=1,48 DF=2 P=0,1), but the results of autumn in 2005 differed significantly (KW=9,87 DF=2) both the autumn in 2004 (P<0,01) and the autumn in 2006 (P<0,05). If we compared all the seasons we found significant difference (KW=23,1 P<0,001) between the two seasons in 2004 and in 2006. After comparing the data of the family densities we noticed significant difference (KW=21,34 DF=5 P<0,001) only between autumn of 2006-spring of 2005 and autumns in 2005-2006.

Core areas:

We counted 22 locations (7000 ha) in each core area on average. The population seemed to be balanced in Kétújfalu (except 2005), the data rather showed fluctuation in Hajós. Neither the answers of the solitaire individuals could attached to one season undoubtedly.

The density of individuals were (Kétújfalu: 6.46 sp/1000ha, Hajós: 7.9 sp/1000ha) in springs, (K:9,72, H:5,89) in autumns on average. The density of the families were (K:1,52, H:1,91) in springs, (K:2,28 H:1,38) in autumns on average.

Table 2

The most important results of the acoustic survey in the core areas

S: Spring, A: Autumn	**2004 S**		**2004 A**		**2005 S**		**2005 A**		**2006 S**		**2006 A**	
I: Hajos-Szentgyörgy, II: Kétújfalu	**I**	**II**	**I**	**II**	**I**	**II**	**I**	**II**	**I**	**II**	**I**	**II**
Number of locations (n)	22	28	21	30	18	20	18	18	20	20	25	19
Whole studied area (1000 ha)	6,9	8,8	6,6	9,4	5,6	6,3	5,6	6	6,3	6,3	7,8	5,9
Minimal family number (n)	15	18	5	15	12	3	18	19	9	13	2	11

Number of individual answers(n)	6	4	2	6	0	4	2	1	1	0	2	7
Minimal density of families (n/1000ha)	2,2	2	0,7	1,6	2,1	0,5	3,2	3	1,4	2,07	0,25	1,84
Number of visual observations (n)	4	0	0	2	0	0	0	0	0	0	1	0

On both research areas the density (13,1 and 13,6 sp/ 1000ha) was above the highest *fox (Vulpes vulpes)* density (2002: 13,0 sp/ 1000ha) ever estimated on Transdanubia, according to the results of autumn (2005).

Stress the importance of that the first breeding pairs were observed no sooner then ten years. The counted individual density of the core areas was nearly 7 sp/1000ha on average in three years. We estimated 1.54 family/1000ha in Hajós in 6489ha on average in three years. A little bit higher density was counted (1.91) in Kétújfalu in 7065 ha on average in the same period.

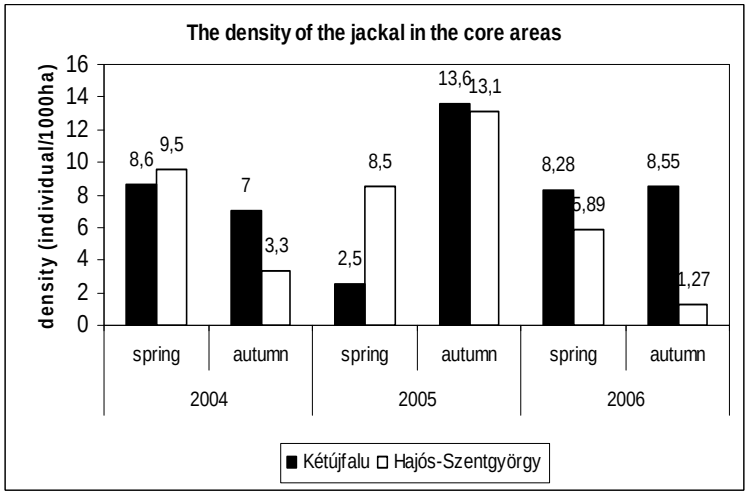

Figure 2

Kétújfalu: There wasn't significant difference neither between family data (KW=6,3 DF=5 P=0,28), nor the individual results (KW=4,92 DF=5 P=0,42).

Hajós: After we compared the same seasons we found significant difference in the family densities (KW=16,65 DF=2 P<0,001) between the autumn of 2005 and the other autumns. This difference was verified in the individual density too (KW=14,08 DF=2 P<0,001). After the total comparing a significant difference (KW=21,14 DF=5 P<0,001) was also found between the spring of 2004 and the autumn of 2006.

During the survey stable families were found in the core areas mostly. It indicated the continuous presence of the families and the specimen in the area.

CONCLUSIONS

A three-level monitoring program was used for studying the distribution of the golden jackal and to estimate the population density in Hungary in the last ten years.

The results of the mail questionnaire survey and the official hunting bag data showed linear increase year by year. *Golden jackal* has been intensively spreading in Hungary, showing the characteristics of invasive species. The application of the acoustic survey was successful. The estimated results were comparable to researches in other countries [2,3]. It is conceivable that the changing of the population density of the core areas can influence the further spreading of the species. The results of the core areas show that the density of the

population could be similar or higher then a general predator, *red fox (Vulpes vulpes)*, locally. The estimated density in Bács-Kiskun (3,75 sp/1000ha) seems to be stable and important. The only barrier for continuous spreading is the quality of the habitat (hiding-place). The expansion of the jackal is well-indicated by the observed young males. The reason of it that they must leave the family first and have to find their own new territories. According to our results the golden jackal seems to be a common predator in Hungary. The species is declared an invasive, strange predator northward from Hungary, its occurrence depends on the Hungarian population. Anyway these facts raise the question of the further years' problems and issues of wildlife management and nature conservation. So it is necessary to monitor jackal populations according to an action plan in Hungary.

BIBLIOGRAPHY

1. Demeter A, 1984, Recent records of rare or non-resident large carnivores in Hungary. Vertebrata Hungarica 22: 69-71.
2. Demeter, A und Spassov, N,1993,Canis aureus Linnaeus, 1758. 107-138 Pp. in : Niethammer, J. und Krapp, F. (Eds.) Handbuch der Säugetiere Europas. Wiesbaden, Aula-Verlag Giannatos G., Marinos, Y., Maragou, P. and Catsadorakis, G.2005, The status of the Golden Jackal (Canis aureus L.) in Greece. Belgian Journal of Zoology., 135 (2) : 145-149.
3. Hell, P und Rajsky, D ,2000, Immigrationen des Goldschakals in die Slowakei im 20. Jahrhundert. Beiträge zur Jagd- und Wildforschung, Bd. 25: 143-147.
4. Hell P. & Bleho Š. 1995, Novobodý Výskyt Šakala Obycajného (Canis aureus) Na Slovensku. Folia Venatoria 25: 183-187.
5. Heltai, M, Szemethy, L és Biró, Zs, 2000, Új fajok a hazai faunában: az aranysakál, a nyestkutya és a mosómedve Magyarországon. Vadbiológia, 7: 63-71.
6. Heltai M, 2002, Emlős ragadozók magyarországi helyzete és elterjedése. PhD thesys, Szent Istvan University, Department of Wild Biology and game management, Gödöllő, Hungary.
7. Kiss, J. B, 2000, Egy elterjedőben lévő kutya rokon: az aranysakál. Erdélyi Nimród. 2000/3: 9
8. Krystufek B., Muraiu D., Kurton C.,1997, Present distribution of the Golden Jackal *Canis aureus* in the Balkans and adjacent regions. –Mammal Review 27: 109-114
9. Lanszki L and Heltai M, 2002, Feeding habits of golden jackal and red fox in southwestern Hungary during winter and spring. Mammalian Biology-Zeitschrift für Säugetierkunde, 67 (3): 129-136.
10. Mitchell-Jones, A J, Amori, G., Bogdanowicz, W, Krystufek, B, Reijnders, P.J.H., Spitzenberger, F, Stubbe, M, Thissen, J B M, Vobralik, V & Zima, J,1999, The Atlas of European Mammals. Academic Press, London (12) Rakonczay, Z ,1989, Vörös Könyv. Akadémiai Kiadó, Budapest
11. Rozhenko N.V. & Volokh A.M., 2000, Appearance of the golden jackal (Canis aureus) in the south of Ukraine. Vestnik Zoologi 34 (1-2): 125-129
12. Szeley-Szabó László - Sepsi Árpád, 2003, Gondolatok az aranysakál és kutya párosodásának lehetőségéről Erdélyi nimród szeptember-október, 8-9
13. Szunyoghy J, 1957, Systematische revision der ungarlandischer schakals, gleichzeitig eine bemerkung über das rohrwolf-problem. Annales Historico-Naturales Musei Nationalis Hungarici, 78: 425-433.
14. Szűcs E and Heltai M, 2002, Az aranysakál bemutatása irodalmi adatok alapján.–Vadbiológiai. 9, pp. 83-88.
15. Zedka, H, 1990, Wolf" war ein Goldschakal. Wild und Hund 6: 44.
16. www.vvt.gau.hu/adattar/