

Differences between social and non-social hunting of juvenile Montagu's Harriers *Circus pygargus* in the post-fledging dependence period

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Zusammenfassung

Unterschiede zwischen gemeinschaftlichem und solitärem Jagen bei juv. Wiesenweihen *Circus pygargus* in der Phase nach dem Flüggewerden

In SO-Polen wurde soziales und nichtsoziales Jagen flügger Wiesenweihen beobachtet. Das soziale Jagen war von imitativem Charakter, da keine Form der Kooperation beobachtet wurde. Soziales Jagen war erfolgreicher (8,3 %) als individuelles (5,3 %, ns.). Während beider Jagdformen wurden Grüne Heupferde *Tettigonia viridissima* gefangen und zum Teil in der Luft gefressen. Zum sozialen Jagen bevorzugten die juv. Wiesenweihen Felder mit Hafer und niedrig liegendem Weizen, während Einzelvögel nur über letzterem jagten.

Introduction

The knowledge of a post-fledging period ecology of most European raptors is rather scarce. This results partly from difficulties in observing the young once they have left the nest (NEWTON 1979, ALONSO et al. 1987). The dependency period is especially important for those stages in the life history when development of foraging skills of young raptors is essential for their survival (BUSTAMANTE 1990, 1994). High mortality

rates of recently independent juveniles in the first year of their life reflect the critical nature of this stage (SCHMUTZ & FYE 1987; PRESTON & BEANE 1993).

This paper aims to compare social and non-social hunting performed by juveniles of Montagu's Harrier in their post-fledging dependency period, with reference to its sequence and effectiveness. The research was performed in south-east Poland.

Study area and methods

The studies were carried out in calcareous marshes near Chełm (51°08'N, 23°37'E, south-east Poland) and their closest proximity. The area is known as a nesting place of about 15-20 pairs of Montagu's Harrier (KITOWSKI 2002a) at present, and in the past even numbers of up to 40-50 pairs (KROGULEC 1992) used to breed there. The stud-

ies were performed in the late post-fledging dependency period, with the breeding cycle heading towards its end. From 1999-2000 between 20th of July and 15th of August 10 watching sessions, each 12 hours long, from 8.00 a.m. until 8.00 p.m., contributed to a total of 120 hours of observation. The birds were watched with a tele-

scope 60× and a binocular 10×60. The idea of individually marking the offspring was rejected for the sake of the fledglings. Undisturbed broods are less likely to be abandoned by parents and fledglings have not been exposed to any disturbance as well. Such dangers were clearly imminent in studies performed previously on Harriers (SIMMONS 1988, KITOWSKI 2002b). In consequence, the presented paper lacks the data related to both age and sex, as well as family relations of focal juveniles. Sessions of cruising flights parallel to the surface (*sensu* JIMENEZ & JAKSIC 1989, 1991), when a juvenile with its head lowered kept searching for prey, were treated as a “hunting activity” of offspring. Such flights could be regarded as a “hunting activity” if at least one capture attempt was performed by a juvenile bird, regardless of its success. As social hunting we regarded a hunting activity, performed by the observed juveniles, which occurred at a distance shorter than 10 m from another juvenile of Montagu’s Harrier or a group of them. Hunting activities performed in a distance fur-

ther than 10 m from other juveniles were regarded as non-social hunting. Adult birds that were foraging or perching on the ground in the distance further than 100 m from the nearest offspring, were not treated as adults present at the offspring side.

During the study a few cases of allopreening and beaking were observed. Allopreening was defined as preening of conspecific individual plumage (VARLAND et al. 1991). Beaking was understood in terms following Sherrod’s definition (SHERROD 1983) when a juvenile of Montagu’s Harrier nibbled at the beak and lore area of another juvenile.

The median value of hunting sessions duration and the number of capture attempts was compared by means of Whitney-Mann U-tests. Frequencies were compared by the Chi-square test with Yates correction applied. Spearman rank correlations were used to analyse the trends in behaviour of hunting groups with increased number of involved individuals. All data are presented as mean values \pm SD (LOMNICKI 1995).

Results

Social hunting

A number of $N=44$ hunting sessions which involved 2 to 6 focal juveniles of Montagu’s Harrier was analysed. A social hunting session involved an average of $\bar{x}=3.27 \pm 1.24$ offspring. A hunting session of groups of juveniles lasted $\bar{x}=277.4 \pm 280.5$ seconds, within a range of 72–1327 seconds. A total of 167 capture attempts, 14 (8.3%) of which were successful, were registered during social foraging. During social hunting, juveniles of Montagu’s Harrier performed an average of $\bar{x}=3.8 \pm 3.0$ attempts per hunting session, which ranged from 1 to 12 attempts. All caught prey consisted of

Grasshoppers. In two plucking places of focal juveniles, the remnants of three Green Grasshoppers *Tettigonia viridissima* were found. During 9 (20.4%) observed sessions of social hunting at least one adult (seven times females, two times males) was observed (see Table 1). Social hunting sessions prolonged in time with an increased number of involved juveniles (Spearman $r=0.655$, $n=44$, $P<0.001$) and with the number of attempted captures (Spearman $r=0.853$, $n=44$, $P<0.001$). During social hunting in 4 cases of feeding in the air, caught grasshoppers were registered. In the context of social hunting, offspring also caught and ate in air 2 dragonflies (Odo-

nata). Among all the observed capture attempts performed in the context of social hunting, 101 (60.5 %) were executed into laid-down wheat and oat. All these pouncings were successful. As determined from places at which the capture attempts were performed, fledglings preferred foraging on fields covered with oat and laid wheat while stubble fields and areas cultivated with other crops such as beetroot, potato, and rape, etc. were rather avoided (see Table 2 for details). Social perching (N=71), registered in the context of hunting (both before and after), took place in 59 (83.1 %)

cases on hay stacks, bushes, or small trees. Cases of direct social contacts, namely 3 beaking and 2 allopreening cases, were registered while groups of juveniles rested after social hunting activities.

Non-social hunting

A number of N=73 hunting sessions of individual juveniles of Montagu's Harrier were registered. They lasted on average $\bar{x}=185.1 \pm 182.8$ seconds, with corresponding ranges from 31 to 1116 seconds. Individual hunting lasted considerably short-

Table 1: The number of social hunting sessions with offspring involved. – *Anzahl Fälle gemeinschaftlichen Jagens juveniler Wiesenweihen.*

Number of involved juveniles	Number of hunting sessions	Number of hunting sessions with adults present at their side
2	9	1 (11.1 %)
3	9	3 (33 %)
4	14	4 (28.6 %)
5	8	–
6	4	1 (25 %)
Total	44	100 %

Table 2: Frequency of observed capture attempts in relation to habitat type for social and non-social hunting sessions of Montagu's Harrier performed by juveniles, compared with the expected distribution. – *Häufigkeit beobachteter Fangversuche pro Habitattyp für soziales und solitäres Jagen, verglichen mit der erwarteten Verteilung.*

Habitat type	Habitat availability %	Social hunting			Non-social hunting		
		N	%N	χ^2 , df=1	N ₁	%N ₁	χ^2 , df=1
Meadows managed differently	18 %	23	13.8	1.99 ns	17	13,9	1.39 ns
Fields covered with laid wheat	14 %	54	32.3	48.5***	26	21,3	5.54*
Fields covered with oat	7 %	47	28.1	109.99***	11	9,0	0.48 ns
Other crops	32 %	17	10.2	35.82***	20	16,4	13.6***
Stubble fields	21 %	19	11.4	10.23**	14	11,5	8.04**
Other area	8 %	7	4.2	3.00 ns	34	27,9	62.74***
Total	100 %	167	100	–	122	100	–

* p<0.02, ** p<0.01, *** p<0.001

er than social hunting (Mann-Whitney U test: $Z = -7.72$, $n_1 = 44$, $n_2 = 73$, $P < 0.0001$), while individual offspring hunting performed a total of 132 capture attempts, on average $\bar{x} = 1.85 \pm 1.44$, (range 1-9 attempts), from which 7 (5.3 %) succeeded in catching the prey. However, no statistically significant difference in the number of successful hunting was found between social and non-social hunting activities ($\chi^2 = 0.65$, ns). In the course of non-social hunting sessions the fledglings performed less capture attempts as compared to social hunting sessions (Mann-Whitney U test: $Z = -3.13$, $n_1 = 44$, $n_2 = 73$, $P < 0.0018$).

Fledglings foraging individually, alike the ones hunting socially, caught only Grasshoppers *Tettigonoidea*. Adults were present at the side of individual juveniles that per-

formed a foraging activity in the context of 19 (26.0 %) hunting sessions. Offspring, resting after or before lonely hunting sessions, ($N = 114$), chose to perch in 61 (53.3 %) cases on hay stacks, bushes, small trees and other places of similar character. In the context of lone hunting juveniles ate one caught Grasshopper and one dragonfly (Odonata).

In the areas covered with laid wheat or oat offspring performed 37 (30.3 %) capture attempts, all of which were successful. Laid wheat only was preferred in lone hunting birds. Fledglings that hunted individually avoided stubble fields. A significant percentage of capture attempts in fields cultivated with crops such as beetroot, potato, rape, or even maize was observed (see Table 2).

Discussion

Both lone hunters and social hunters of fledged Montagu's Harriers fed on easy-to-catch Green Grasshoppers. It confirms the rule, applicable to many raptors, that in the post-fledging dependency period sessions of hunting, if performed by offspring, concern primarily easily caught and profusely accessible invertebrate prey (SHRUBB 1982, JOHNSON 1986, LAWRENCE & GAY 1991, VARLAND et al. 1991). The cases of social foraging, observed during the studies, were undoubtedly of imitative type, since the individuals had a possibility to observe other group members, to copy, initiate, learn and improve foraging behaviour, as reported by other authors (EDWARDS 1989, VARLAND et al. 1991). The presented study of Montagu's Harrier proved that their social hunting led to greater hunting success and optimal choice of habitat patches with respect to food resources. Research made by VARLAND et al. 1991 on American Kestrel *Falco sparverius* as well as SCHAADT

& RYMON (1982) and EDWARDS (1989) studies on Ospreys *Pandion haliaetus* have shown the significance of social hunting for accelerated development of innate foraging capacities in young raptors.

Researchers pointed also to yet another distinguishable type of social hunting – so called social cooperative hunting (MOONEY 1989, ELLIS et al. 1993). The presented study, however, registered no form of cooperation in hunting sessions performed by juveniles of Montagu's Harrier as reported for other birds of prey. The caught grasshoppers were occasionally eaten by juveniles in the air, as reported for adults and fledglings of other species of raptors (VARLAND et al. 1991, COOPER 1996). Such behaviour was also frequently observed in adults of Montagu's Harriers breeding at the study area (KITOWSKI unpubl.). Obviously, it can be interpreted as an adaptation that helps the fledglings to utilize small size prey very quickly, without wasting

their energy on unnecessary landing and take-offs. Frequently observed cases of air feeding in the context of social hunting may suggest, that apart from acquiring efficient abilities of effective hunting, the skill of in-flight eating prey might be transmitted then by imitation. Nevertheless, it seems worth to note that the skill is frequently applied while catching dragonflies by both juveniles and adults (KITOWSKI 1994, KITOWSKI in prep.).

Regardless of the type of hunting, social or non-social, the adults were rarely present at the post-fledging areas of emancipating fledglings. It can be attributed to a typical avoidance strategy applied by adults with reference to offspring in the terminal stage of the post-fledging dependency period, that was discovered in many species of

birds of prey (LETT & BIRD 1987, BUSTAMANTE 1990).

While watching resting groups of juveniles, forms of direct social contact such as beaking and allopreening were registered. The observed cases of such direct social contact are of great interest, since so far such behaviour was observed in Falcons (*Falco* sp.) only (SHERROD 1983, LETT & BIRD 1987, VARLAND et al. 1991, BUSTAMANTE 1994). It helps to maintain mutual bonds between individuals from the same social group, which may be manifested as well by cases of altruism registered in earlier studies (KITOWSKI 2001) among the individuals from the same brood. Interesting results provided by the presented study, give reason to continue such research in the future.

Summary

Social and non-social hunting of juveniles of Montagu's Harrier *Circus pygargus* during a post-fledging period was observed in south-east Poland. Social hunting sessions were of imitative character since no form of cooperation between juveniles was observed. Social hunting was found to be more effective (8.3 %) as compared to non-social (5.3 %) of lone individuals but the difference fell into the range of

statistical insignificance. During both social and non-social hunting the juveniles caught Green Grasshoppers *Tettigonia viridissima*, a certain number of which was eaten mid-air. For social hunting the fledglings preferred fields covered with oat and laid down wheat, while lone birds preferred areas covered with laid-down wheat only.

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