

Montagu's Harrier *Circus pygargus* Post-Fledging Activities in Eastern Poland - Preliminary Results.

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INTRODUCTION

In contrast with the breeding biology, of which detailed studies have been made (Krogulec 1992), the post-fledging ecology Montagu's Harrier in natural habitats is almost completely unstudied.

STUDY AREA AND METHODS

The study was carried out in south-east Poland on calcareous marshes near Chelm (south-east Poland) covered by Saw Sedge (*Cladium mariscus*). The population of Montagu's Harrier consisted of 30-40 pairs. The nests were located exclusively in Saw Sedge. The post-fledging period of 25 juveniles belonging to seven breeding pairs was studied during the summers of 1989-1991. All were wing-tagged with colour plastic strips of Saflag (Kochert *et al.* 1983). Observation started at the end of June shortly before the first flights of the young. The sex of these juveniles was assessed following methods described by Krogulec (1992). Observation covered almost complete days (8-20 h). In 1989 two families were observed daily; in 1990 and 1991 observations were carried out every 1-3 days. All data were recorded on tapes to register data quickly and accurately. Observations were made from stationary points (trees, bushes) at approximately 200 m from the juveniles, using 20 x 60 telescope and 10 x 50 binoculars.

RESULTS AND DISCUSSION

The post-fledging period lasted for 17-28 days ($\bar{x}$ = 23.7, $sd.$ = 2.9, n = 22). There were no differences between male and female juveniles at age of first flight (t = 0.63, $t_{23, 0.05}$ = 2.07).

During the first week after fledging, juveniles were clumsy in flight and landing technique, like the young of other harriers (Wiacek 1989). First flights were short, circling and flapping, starting and ending on nest platforms. As the young grew older they used more elaborate flying techniques such as gliding and soaring. For all juveniles studied, all variables in flight skills were significantly correlated with age for the greatest number of individuals, except for the number of flights (NF).

This may be the result of a similar strategy of flight development shown in the post-fledging period of the Black Kite *Milvus migrans* (Bustamante & Hiraldo 1989).

During fieldwork sibling and adult-juvenile aggression was observed. Sibling aggression, measured by the number of dives at other juveniles, was positively correlated with age for all

Table 1. Duration of post-fledging period in relation to sex in juvenile Montagu's Harriers. All parameters in days. F-female, M-male.

Juveniles	First flight	Leaving breeding area	Duration of PFP
ZC15/89 (F)	35	63	28
ZZ15/89 (F)	35	61	26
ZN15/89 (F)	34	60	26
CZ09/89 (F)	35	61	26
CB09/89 (M)	34	56	22
CN09/89 (F)	35	57	22
CN06/90 (M)	32	56	24
ZN06/90 (M)	32	54	22
BN06/90 (F)	31	57	26
PP08/90 (F)	33	56	23
ZB08/90 (M)	32	55	23
BC08/90 (M)	31	56	25
XP08/90 (F)	32	57	25
BN08/90 (F)	32	53	21
BB06/91 (F)	34	62	28
ZZ06/91 (F)	32	60	28
PP0M/91 (F)	35	60	25
BB0M/91(F)	33	57	24
PP11/91 (M)	34	52	18
ZZ11/91 (M)	34	55	21
OP11/91 (F)	35	52	17
BB11/91 (M)	32	52	20

The above results confirmed previous data, that the post-fledging period in Montagu's Harrier lasts 3-4 weeks (Brown 1976; Newton 1976).

22 surviving individuals (see below) ($r=0.317$, $p<0.001$, $N=181$). Sibling aggression was nearly restricted to the time of presence of food (82%, $N=181$). As in other raptors (Ceballos & Donazar 1990), maximum aggression occurred during feeds.

Parental aggression, measured by the number of dives at young, increased slightly in a few families with the age of the juvenile, but the sample size was insufficient to estimate any correlations. Adult aggression mostly took the form of attacks on begging offspring which were flying or perching (60%, $N=139$). Other forms of aggression were attacks on flying young (20%) and chasing of juveniles from their perch (30%). Parental aggression was not restricted to the time of food presence, but 40% also took place at the time of food transfer or other circumstances connected with the presence of food.

Shortly after the young left the nest, the adults spent much time near the nest. As fledglings grew older, the parents spent less time in their vicinity and this trend was statistically significant in six out of seven families, as in other raptors (Bustamante & Hiraldo 1990; Hiraldo *et al.* 1989). At the end of the post-fledging period, the parents' stay in the vicinity of their young was reduced to the time needed for food transfers. The number of parental flights towards young (NPF) was negatively correlated with age of the youngest juveniles in five out of seven broods.

Juveniles followed parents on hunting forays. There were 24 occasions of adults hunting in the presence of juveniles. On 79% of these the young were able to see the capture of prey. Young unsuccessfully chased mainly passerines - (60%) $N=27$ (Acrocephalidae, Emberizidae). Some of the young (six out of the 22) pounced on inanimate objects ($N=11$) such as the tops of branches,

Table 2. Correlation coefficients on juvenile age of the variables MX (maximum flight duration, in seconds), MD (mean flight duration, in seconds), TD (total flight duration, in seconds), NF (number of flights), PS (percentage of time spent circling or soaring out of total time of flights). Sample size in brackets to left of the coefficients.

Juveniles		MX	MD	TD	NF	PS
ZC15/89	(n=21)	0.81**	0.88***	0.80***	0.60**	0.69***
ZZ15/89	(n=19)	0.84***	0.89**	0.85***	0.65**	0.76***
ZN15/89	(n=19)	0.86***	0.87***	0.72***	0.68**	0.65**
CZ09/89	(n=22)	0.56**	0.68***	0.62**	0.44*	0.55**
CB09/89	(n=22)	0.48*	0.70***	0.77***	0.75***	0.52*
CN09/89	(n=22)	0.74***	0.84**	0.75***	0.76***	0.32
CN06/90	(n=8)	0.76*	0.84**	0.81*	0.75*	0.77*
ZN06/90	(n=8)	0.75*	0.89**	0.71*	0.67	0.76*
BN06/90	(n=8)	0.29	0.86**	0.68	0.44	0.72*
PP08/90	(n=8)	0.86**	0.84**	0.84**	0.75*	0.55
ZB08/90	(n=8)	0.75*	0.79*	0.86**	0.78*	0.69
BC08/90	(n=8)	0.66	0.69	0.66	0.54	0.86*
XP08/90	(n=8)	0.80*	0.82	0.68	0.53	0.69
BN08/90	(n=8)	0.68	0.77*	0.89**	0.86**	0.86**
BB06/91	(n=10)	0.83**	0.82**	0.85**	0.59	0.87**
ZZ06/91	(n=9)	0.70*	0.69*	0.66	0.64	0.76*
PPOM	(n=8)	0.72*	0.81*	0.80*	0.61	0.58
BBOM	(n=8)	0.73*	0.88**	0.87**	0.76*	0.57
PP11/91	(n=5)	0.88*	0.82	0.98**	0.76	0.78
ZZ11/91	(n=7)	0.67*	0.95***	0.84*	0.58	0.71
OP11	(n=6)	0.93**	0.91*	0.91*	0.60	0.85*
BB11/91	(n=6)	0.94**	0.95**	0.79	0.42	0.85*
Pooled	(n=248)	0.62***	0.72***	0.70***	0.59***	0.63***

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

tops of small trees or elevated sticks. Juveniles were also observed playing with inanimate objects (N = 9).

Three of the 25 colour marked juveniles were killed shortly after the first flights. Two were predated, probably by Red Fox (*Vulpes vulpes*) 35 and 37 days after hatching respectively; the other was certainly killed by its siblings (typical for Cainism: extensive wounds on back of head and internal surface of elbow). This showed that, whilst common in the nesting stage (Krogulec 1992), the phenomenon of Cainism may still exist after the first flights.

Table 3. Relationship between age of youngest juveniles in brood and the variables quantifying some aspects of parental investment. TS - time spent by parents (one or both) in the post-fledging area. NPF - number of flights towards juveniles.

Broods	n	TS	NPF
B15/89	21	-0.820***	-0.919***
B09/89 -	22	-0.537*	-0.884***
B06/90	8	-0.714*	-0.0733*
B08/90	11	-0.554	-0.824**
B06/91	8	-0.706*	-0.530
B0M/9	19	-0.732*	-0.679
B11/9	18	-0.871*	-0.989***
Pooled	87	-0.644***	-0.706***

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

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