

## Cases of kleptoparasitism and mutual roosting in Marsh Harrier (*Circus aeruginosus* L.) during the post-fledging period in Eastern Poland

Michał ZEMBRZYCKI and Jarosław WIĄCEK\*

Department of Zoology and Nature Protection, Institute of Biological Sciences, Maria Curie-Skłodowska University,  
Akademicka 19, 20-033 Lublin, Poland.

\*Corresponding author, J. Wiącek, E-mail: [wiacek@hektor.umcs.lublin.pl](mailto:wiacek@hektor.umcs.lublin.pl)

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**Abstract.** Several types of rare behaviour patterns occurring during the post-fledging period were observed in young Marsh Harriers (*Circus aeruginosus* L.; *Aves*, *Accipitridae*). The studies were carried out in natural and anthropogenic habitats in Eastern Poland. Out of 23 monitored nests, 17 individually wing-tagged fledglings from 6 broods were observed during the post-fledging period. We observed cases of kleptoparasitism between fledglings and adults, siblings, and unrelated young birds. Some of them were unsuccessful trials to steal prey. Moreover, mutual roosting of young from different nests was noticed. Intruding birds roosted together with local fledglings for up to 150 minutes. Kleptoparasitism and mutual roosting have been rarely observed in raptors before. We discussed the role of this behaviour in the context of increasing the independence of fledglings and the ability to recognize offsprings by adult birds.

**Key words:** Marsh Harrier, *Circus aeruginosus*, kleptoparasitism, post-fledging period, mutual roosting.

The post-fledging period in raptors, defined as the period between the first flight from the nest and the break-up of the family ties (Arroyo & Garcia. 2002), is very critical for young birds which are both still food-dependent on parents and gradually start hunting on their own (Kitowski 2008). Therefore, the number of intraspecific interactions including parental-offspring conflicts, competition between siblings, and unrelated young may be high in this timespan (Riedman 1982). This kind of behaviour was described in several raptor species, for example in Ospreys (Poole 1982), Black and Red Kites (Bustamante & Hiraldo 1993), Lesser Kestrel (Bustamante & Negro 1994), Montagu's Harrier (Pandolfi & Giacchini 1990), and different species of Harriers (Simmons 2000). The phenomenon of kleptoparasitism still arouses the interest of researchers in the evolutionary and ecological context (Garay et al. 2020). In this context, the behaviour in which young birds try to take food from other parents or young birds from other nests is observed relatively often in birds of prey (Cramp & Simmons 1980).

Marsh Harrier *Circus aeruginosus* is a species of raptor in which post-fledging behaviour can be easily analysed because it nests in open-areas and often perches on exposed sites. Adults can be distinguished due to individual differences in plumage. Using coloured wing-tags to individually recognize fledglings is easy to perform, effective, and safe to birds. This method was used in studies of many raptor species (Kochert et al. 1983) including harriers (Clarke 1995, 1996, Simmons 2000). Our study aimed to investigate the post-fledging behaviour of young Marsh Harriers like kleptoparasitism and mutual roosting in two breeding habitats.

Young harriers from different broods were observed sitting together waiting for food carried by their parents. Our observations of the unusual behaviour of young Marsh Harriers during the post-fledging period were carried out in two study periods. The first study was conducted from June to August 1988 near Chelm in eastern Poland (51°7'56" N, 23°28'40" E, Lublin Voivodeship). It is a natural habitat for the species, characterized by the occurrence of the sedge community *Cladietum marisci* (detailed description in Wiącek 2009). This natural habitat near Chelm is under the protection of three nature reserves and the NATURA 2000 network as Special Pro-



Figure 1. Individually marked fledglings of Marsh harrier in the nest.

tection Area PLB 060002 "Chelm Calcereous Marshes". During the study period, birds from 11 nests were regularly monitored (once a week). Young harriers (8 individuals) from three nests were individually marked. These fledglings were observed from a distance of about 100-200 m. Individually marked birds and their parents were observed 2-3 times a week. Each day, the observations lasted for 12 hours (from 8 am to 8 pm). The total time of observation was 324 h (27 days). Observations were carried out using a scope and a binocular.

The second study was conducted from July to August 2019 in the Rawa fishpond complex (51°33'01" N, 22°22'30" E) near Lublin in Eastern Poland, an anthropogenic habitat, and was part of a wider project concerning behavioural ecology of Marsh Harrier. A total of 12 harrier nests were monitored this season. In this part of the project, marked fledglings from three nests located in reeds were observed. Three studied nests (with 9 individually marked fledglings) were situated approximately 260 m apart. Nest sites were monitored 6-12 h a day from points located approximately 100 meters from nests by binoculars and scopes. The total time of observation was 174 h (22 days).

Young harriers from all observed nests in two study periods were marked both with coloured wing tags and conventional metal rings, provided by the Ornithological Station Museum and Institute of Zoology Polish Academy of Sciences (Fig. 1). The birds were marked about 7 days before the estimated time of fledging (based

Table 1. Age parameters during the first flights and duration of the post-fledging period in Marsh Harrier fledglings.

Year of study	Nest number	Number of fledglings	Date of first flights	Age of fledglings when started flying [days after hatching]	Average age of fledglings during first flight [days after hatching]	Average duration of post-fledging period [in days]
1988	I	3	27.06.1988	31	36	39
	II	3	7.07.1988	39		
	III	2	16.07.1988	36		
2019	I	4	1.07.2019	34	35	37
	II	3	12.07.2019	36		
	III	2	9.07.2019	33		

on the determined hatching time and observations). Each bird was equipped with an individual combination of coloured tags on the left and right wings. Adult birds were distinguished based on individual plumage differences.

During the 1988 study season, individually marked fledglings first took flight around 36 days (between 31 and 39 days after hatching). In the 2019 study period, fledglings started to fly around 35 days (between 33 and 36 days after hatching) (see Table 1). The observed values did not differ between the study seasons. Additionally, from 31.07.19 to 13.08.19 a fledgling from an unknown nest with distinctive dark plumage was observed permanently in the identified pairs' territories. All described harrier behaviours were observed in the second part of the post-fledging period when the observed birds flew smoothly (Fig. 2).

The following types of behaviour were noticed during both periods:

- The mutual roosting of young from separate nests (duration from 10 to 150 minutes) was rarely observed, 21 times during 27 days of observation in 1988 and 22 days of observation in 2019. Mutual roosting behaviour ran as follows: one fledgling from the adjacent nest flew into the observed pair's territory and started to roost on the same shrub or in the same part of pond shore as local fledglings. In all cases, except three, fledglings roosted together with intruders without any disturbance. In two cases, an intruder attacked a local fledgling and in one case, an adult local female attacked the intruder. Moreover, 7 cases of mutual roosting concerned an unknown fledgling.

- Kleptoparasitism (between non-siblings) – only two cases from a total of 94 observed feedings were noticed in 2019 (03.08. and 09.08.). Both consisted of unsuccessful attempts to steal prey by one fledgling from an unrelated bird which had received food from its parent.

- Successful kleptoparasitism between siblings was observed 10 times from a total of 296 feedings observed in both seasons. This kind of behaviour was observed only in the 1988 study period between 20.07 and 5.08. In the 2019 season, such successful attempts were not observed. Very often attempts were made to get food from siblings which had managed to receive food from a parent. Young birds made these attempts after virtually every transfer of prey from parent to young. Fledglings from the same brood were aggressive to each other at that time.

- Kleptoparasitism (between adults) – There was only one (1988; 14.07.) unsuccessful attempt to take food from an adult female by a female from an adjacent nest.

- Kleptoparasitism (between fledglings and adults) – a type of behaviour noticed five times, only during the 1988

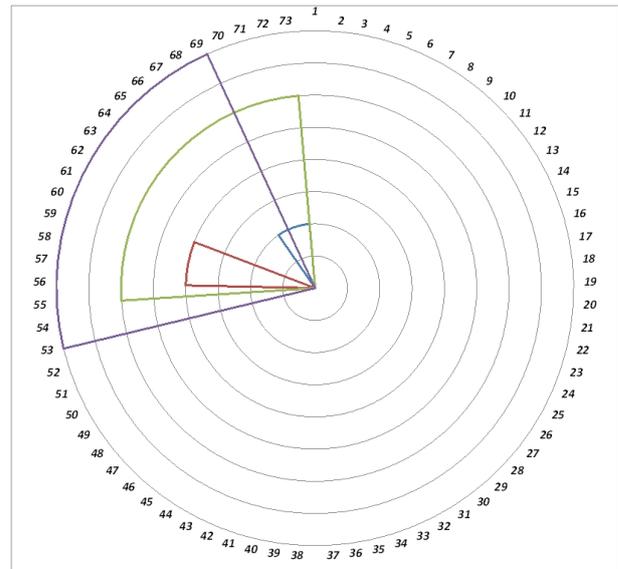


Figure 2. Days of the post-fledging period (points 35-73 after hatching) during which various types of kleptoparasitism and mutual roosting were observed. (violet colour-successful kleptoparasitism between siblings; green- mutual roosting; red- kleptoparasitism between fledglings and adults; blue- kleptoparasitism between non-siblings).

study (from 23.07. to 27.07.). It consisted of attempts to collect food from a non-parental male by young harriers. Only one of these attempts was successful. This behaviour was noticed both in the case of nests situated next to each other (200 m) and during the flight of a male with prey in the talons from a distant nest over the territory with young harriers (2 observations including the one that ended with the success of the young bird). This behaviour consisted of an aggressive attempt to receive food by one of the young. The attacked male loosened the talons with the prey, which fell out. A second young bird flying slightly behind caught the falling prey. This collaborative action of two fledglings ended successfully for one of them.

Various aspects of raptor behaviour linked to the post-fledging period in raptors have been described, such as kleptoparasitism, alloparental feeding (Frumkin 1994, Arroyo & Garcia 2002), or even the adoption of young (Poole 1982). In the Marsh Harrier, such types of behaviour in comparison with other species of harriers (Simmons 2000) and generally in birds of prey (Cramp and Simmons 1980) were noticed only occasionally (Kitowski 2001). The role of kleptoparasitism conducted by fledglings seems to be clear – it is driven by the increasing food requirements of the young. This problem and its various consequences have been described in the

literature (Fuijoka 1985, Forbes & Ydenberg 1992, Forbes 1993, Parmigiani & vom Saal 1994). All observed cases between fledglings took place in later stages of the post-fledging period (at least 14 days after first flights). It can result from both the increasing flying abilities of the young and the decreasing rates of parental investment (Arroyo et al. 2002). In turn, various forms of intraspecific interactions between adult Harriers during breeding periods occur frequently (Wiącek 2006) and probably also during winter, as was described for the Northern Harrier (*Circus hudsonius*) (Temeles & Wellicome 1992). Another type of behaviour, noticed during the post-fledging period in raptors, is alloparental feeding (Poole 1982). A similar phenomenon was detected during our study, but it's described as kleptoparasitism, not alloparental feeding because it was always connected with young birds' attacks on adults. Moreover, the defence of adults was present, suggesting that adult birds can recognize their offspring, as in Montagu's Harrier (*Circus pygargus*) (Mougeot et al. 2001). On the other hand, mutual roosting of fledglings from various nests was not very common during the study. The likely purpose of this behaviour was to take over food brought in by neighbouring adult birds as was sometimes observed. This phenomenon could also have a context of defensive behaviour, consisting of obtaining defence against predator attacks by two pairs of adult birds (a group defence). The concentration of young harriers also reduced the likelihood of an attack on each of them (Arroyo et al. 2001). Aggressive behaviour of local adults aimed at intruders (both with and without wing-tags) was almost absent. In some cases, the young were present in the adjacent territory for a relatively long time. The parents' ability to recognize their own young is unclear. Many species of birds use different methods to recognize their eggs or chicks or do not recognize them at all (Zumpe & Michael 2001). For example, many bird species do not recognize cuckoo eggs and chicks. There are some species that recognize the nest by its location or recognize chicks when they beg for food. Therefore, further studies including experimental methods using wing-tags are needed to discover the young's recognition mechanisms in Marsh Harrier. Apart from this, further studies are needed to analyse the connection between the decreasing rate of parental care and the increasing rate of fledglings' kleptoparasitism.

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