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The Roost and Roosting Behaviour of Eurasian Marsh Harriers *Circus aeruginosus* During Autumnal Migration in Eastern Poland

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Abstract: The study deals with characteristics of behaviour, individual roost sites selections used by Eurasian Marsh Harrier (*Circus aeruginosus*) during autumnal migrations on the first known communal roost in Poland over the years 2003-2005. Eurasian Marsh Harriers communal roosts contained from 1 to 23 individuals which were spend nights in: Reed beds (*Phragmites australis*), Purple moor grasses *Molinia cearulea*, Small reeds (*Calamagrostis* sp.), Sedges (*Carex* sp.) thistles (*Cirsium* sp.). Adult birds were found to prefer centrally located individual roost sites, while juveniles rather the ones distributed regularly over the area of the roost. It was observed that Eurasian Marsh harriers competes for the centrally located individual roost sites. During pre-roost activities unsuccessful day foragers tend to hunt in the vicinity of the roost area. Some individual roost sites of Eurasian marsh harrier were also adopted by other vertebrates. The collected data indicate the informative and defence function of the roost.

Key words: Communal roost, Eurasian Marsh Harrier, individual roost site selections, pre-roost behaviour

INTRODUCTION

Many raptor species may roost communally (Newton, 1979; Hiraldo *et al*., 1993; Parker *et al*., 1995). Still, apart from vultures, the Harriers (*Circus* sp.) seem to be the species whose roosting habits we are most knowledge about, as far as raptors are considered (Gurr, 1968; Cramp and Simmons, 1980; Clarke, 1996). Among Harriers the significant body of accessible data are related to roost habits of Hen Harriers *Circus cyaneus,* whose communal roost were studied in many parts of range of this species (Watson, 1977; Christiansen and Reinert, 1990; Clarke and Watson, 1990; Walk 1998; Kitowski *et al*., 2003). Studies on roosting habits for other species of harriers are very rather scarce including the data on communal roosting habits of Eurasian Marsh Harrier *Circus aeruginosus* (Clarke *et al*., 1998; Verma, 2002; Oliver, 2005) the species whose population in western Palearctic (Hagemeijer and Blair, 1997; Heath *et al*., 2000) has been increasingly growing over the past decade. The purpose of this study was to document the roosting habits and behaviour within the area of the only known communal roost of Eurasian Marsh Harriers in Poland and probably in the central-east Europe.

MATERIALS AND METHODS

The study was conducted at vast meadows located between the villages: Sitno and Kornelowka and Czolki near Zamosc (50° 45'N, 23°23'E, SE Poland) in summers 2003, 2004 and 2005. In late Septembers of 2003-2005 when communal roost were left by Eurasian Marsh Harriers, the area of the communal roost was extensively searched over to locate individual roost sites. Such places are called bed forms (Watson, 1977; Kitowski, 2005). Their sizes were measured and their content was examined, as well as the height of the vegetation among which they were located. Since the individual roost sites were controlled at the time when the flowering period was over, in many cases it was very difficult to identify the species of plants who formed the floor and core of a particular bed form. However, the overall area was mapped as covered with plant categories in which harriers located their bed form. In 2004-2005 on overall number of n = 42 evening observation sessions of birds in the pre-roost context was perform. While observing pre-roost activities of Harriers the harriers arrival time and the direction they flew from, events of foraging on the roost, aggressive interactions (aggressive diving, talons presentations, etc.) and the size of pre-roost group were noted. The degree of filling of crops of roosting birds was estimated. Since it was quite often that thickening darkness and the distance at which the observation were performed (100-150 m) did not allow to accurately determine the spatial distributions of the individual roost sites selected by harriers, 3 categories, namely central, mediate and peripheral, were applied to classify individual Harriers roost sites. Such criteria were supported by differences in physiognomy roost area and

lavishly taken pictures. The droppings, pellets and feathers of Harriers were carefully distinguished from the droppings, pellets and feathers of owls *Strigiformes*, which was carried following (Clarke, 1972; Holt *et al*., 1987; Cieslak and Dul, 1999). The pellets analyses are published elsewhere in a separate paper (Kitowski, 2005).

Statistical analysis: Frequencies related the behaviour of birds were compared with χ^2 test with Yates' correction. Trends were ascertained using Spearman rank correlation. Differences between the parameters describes individual roost sites in particular years of study were compared with Kruskal-Wallis ANOVA. Mann-Whitney U-test was used to compare the time of drop into vegetation by birds. The results are presented as mean±SD (Fowler and Cohen, 1992).

RESULTS

General description of roosts area: Over the period of the performed study, the communal roosts of harriers were located at the same open meadows, though the vegetation patches platy tend to change. Still, each year of the study the roost of Eurasian Marsh harrier was located in a vegetation patch of an area of about 1.5 ha. The distance between different indicated patches was not longer than 1.0 km. Similarly, each year the roost was located in the central part of the particular vegetation patch. The roost area (a polygon convex area) determined by the most outward bed forms found within the roost area tend to be very much alike each year and amounted on average to: 902.0±107.6 m^2 (Table 1). The birds also tend to select for roosting a narrow spectrum of vegetation such: Reed beds (*Phragmites australis*), Purple moor grasses *Molinia cearulea*, Small reeds (*Calamagrostis* sp.), Sedges (*Carex* sp.) Thistles (*Cirsium* sp.) (Table 2), Though the roost areas were covered with 5 types of vegetation patches the birds in particular years clearly avoided only one vegetation patch, namely the areas covered with Thistles (Table 2), which most likely resulted from their low height and even smaller compactness that did not provide proper shelter conditions. Harriers and other vertebrates on the roost area.

During the study an average number of 6.8±5.2 roosting Harries (range: 1-23 individuals, n = 42 evenings), among which Eurasian Marsh Harriers juveniles were the most numerous: 5.9±4.2 individuals, range: 1-19 individuals, n = 42 evenings. In Eurasian Marsh Harriers the most heavily represented group was the group of first year juveniles: 3.7±2.6 individuals, n = 38, range: 1-12 individuals. Apart from Eurasian Marsh Harriers a smaller number of Montagu's Harriers Circus *pygarus* individuals were also noted on the roost: average 2.0±1.6 range: 1-6 individuals, though they were seen only during, n = 18 (42.9%, n = 42) evenings. Moreover, at 2 sessions individual juveniles of Pallid Harriers *Circus macrourus* were observed 27 August 2005, 2 September, 2005). During 2 session in early September 2004, single females of Hen Harriers were also observed. In autumn 2005 migrating 1-2 females Hen Harriers exploited the roost area in late September, when migrating Eurasian Marsh Harriers were no longer noted. On the 11th of September 2004 during the observation session of Eurasian Marsh Harriers pre-roost activities, 1 individual of Short-eared Owl *Asio flammeus* was recorded.

It was surprising to observe a juvenile individual of Merlin who roosted on the ground among Marsh Harriers communal roosts during 3 evening sessions (7, 9, 19 September, 2005). A significant factor that may contributed to the presence of the falcon on the roost could be present passerines such as: Starlings *Strunus vulgaris*, Goldfinches *Carduelis carduelis*, Linnets *Carduelis cannabina*, which in big numbers roosted socially in the vicinity of the Harriers' roost. During 11 (26.1% n = 42) observational sessions foxes were noticed that were penetrating the vegetation patch the roost was located within. In 2005 in the communal roost area ground holes of Badger *Meles meles* were detected.

Individual roost sites and their consistency: While examining the communal roost area n = 108 bed forms Marsh Harriers were found. The average bed forms were

Table 1: Comparison of individual the roosts and individaul roost sites used during study

Parameters describes individual roost sites	2003 sites (n = 33)	2004 sites (n = 31)	2005 sites (n = 44)	Kruskal-Wallis ANOVA (df = 2, n = 108)
Vegetation height	90.08±24.8 cm	101.3±22.6 m	88.7±14.6 m	H = 13.8
	range: 64-177 cm	range: 63-197 cm	range: 60-120 m	p = 0.001
Nearest bed	5.0±3.5 m	10.9±9.8 m	5.7±5.2 m	H = 6.2
form distance	range: 1-15 m	range: 2-33 m	range: 1-20 m	p = 0.043
Distance	29.8±14.9 m	16.3±10.8 m	30.5±11.2 m	H = 12.8
to the edge	range: 6-60 m	range: 5-33 m	range: 15-60 m	p = 0.016
Bed forms length	77.9±16.8 cm	77.1±8.5 cm	77.0±16.7 cm	H = 0.757
	range: 55-147 cm	range: 60-91cm	range: 44-147 cm	p = 0.687
Bed forms width	47.5±12.3 cm	48±9.4 cm	47.0±14.0 cm	H = 0.693
	range: 29-84 cm	range: 36-66 cm	range: 29-86 cm	p = 0.618
Total area of roost	790.1 m^2	1004.8 m^2	910.8 m^2	-

Table 2: Plant categories selected for roosting by migrating Marsh Harriers

	2003 site				2004 site				2005 site			
Plant categories	Avail. (%)	N	N (%)	χ^2 df = 1	Avail. (%)	N	N (%)	χ^2 df = 1	Avail. (%)	N	N (%)	χ^2 df = 1
Sedges	20	13	39.4	5.12*	5	11	35.5	11.4*	5	5	11.4	4.7*
Purple moor grasses	5	2	6.1	ns	30	1	3.2	-	25	7	15.9	ns
Thistles	5	1	3.0	-	30	2	6.5	7.7*	20	3	6.8	5.02*
Reed beds	70	14	42.4	6.3**	20	13	41.9	10.1**	40	20	45.5	ns
Small reeds	10	3	9.1	ns	15	4	12.9	ns	10	9	20.4	6.9**
Total	100	33	100.0	-	100	31	100.0	-	100	44	100.0	

*p<0.05, **p<0.01, Plant categories- plants species orgenus where bed forms were located; N- number of bed forms, %N- percentage of all bed forms, Avail (%)- availability; as percentage of all the vegetation patch area

Table 3: Comparison of individual the roosts and individual roost sites used during study depend on number found pellets

Parameters describes individual roost sites	No. pellets sites (n = 46)	1 pellet sites (n = 37)	2 pellets sites (n = 14)	3-5 pellets sites (n = 11)	Kruskal-Wallis ANOVA (df = 2, n =108)
Vegetation height (cm)	92.8±22.9	86.9±13.3	97.2±13.8	110±31.1	H = 12.3
	range: 64-177	range: 63-106	range: 70-116	range: 75-197	p = 0.0006
Nearest bed form distance (m)	4.8±4.1	7.7±8.5	9.1±8.8	6.7±3.6	H = 5.02
	range: 1-20	range: 1-33	range: 2-33	range: 2-10	p = 0.17
Distance to the edge (m)	29.8±13.8	24.6±13.2	22.4±14.4	21.6±11.8	H = 6.1
	range: 6- 60	range: 6-60	range: 6-45	range: 6-36	p = 0.11
Bed forms length ©	77.2±15.6	77.0±16.1	77.3±12.4	80.1±11.8	H = 2.1
	range: 60-147	range: 55-147	range: 57- 95	range: 57- 96	p = 0.49
Bed forms width (cm)	45.5±11.1	48.5±13.3	50.0±10.3	51.0±11.6	H = 4.26
	range: 29-86	range: 29-80	range: 34- 80	range: 37-80	p = 0.23

sized 77.4±14.7×47.7±12.1 cm. Statistically significant differences were found in neither length nor width of the bed forms between the years of the study (Table 1). Eurasian Marsh Harriers tend to locate their bed forms in vegetation of average height of 93.0±21.0 cm, n = 108. Statistically significant differences were found in height of vegetation where Marsh Harriers roosted in particular years of the study (Table 1). Harriers tend to locate their roosting bed forms an average distance of 26.2±13.7 m from the roost edge. There were also inter-year statistical differences in roost edge-bed forms distance (Table 1). Roosting Marsh Harriers spent the night at a short distance from each other. For the studied bed forms the nearest bed forms distance were 6.6±6.7 m. This distance over the studied years and the differences were statistically significant (Table 1). While closely examining their bed forms feces,, feathers, pellets and scats were found. In 99 (91.7%, n =108) bed forms piles of droppings of Harriers were found. In 62 (57.4%, n = 108) individual roosting sites a number of 1-5 pellets of Eurasian Marsh Harriers were found. Five pellets were found only in one bed form, whereas 4, 3, 2 or 1 pellet were found in 8, 2, 14 and 37 individual roost sites, respectively. Overall a number of 1.7±1.1 pellets/bed form with pellets. Droppings and pellets were piled on the opposite sides within a individual roost site indicating that the Marsh Harriers over several nights took the same position on the ground. Significant differences were found in the vegetation height for the 4 classes of bed forms distinguished according to the number of found pellets (Table 3). The highest vegetation corresponded to individual roosting sites were 3-5 pellets were found (Table 3) which indicates that individual roost sites located in higher vegetation were distinctively preferred. These individual roost sites were located centrally. It also may indicate that better foragers can choose better quality individual roost sites. While examining individual roosting sites in n = 6 (5.6%, n = 108) sites scats of fox *Vulpes vulpes* were found. In further 4 (3.7%, n = 108) roosting forms of Marsh Harriers feathers and droppings of Pheasants *P. colchicus*, were found. Feathers of Partiges *Perdix perdix* were found only in 1 (0.92%, n = 108) bed form of harriers. In n = 2 (1.8%, n = 108) bed forms feces hares *Lepus capensis* were found, whereas in n = 4 (3.7%, n =108) roosting forms feces of owls *Strigiformes*, probably Short eared Owl *Asio flammeus* were found and in another 2 individual roosting sites feathers of Short eared Owl were also detected. An overall number of 21 (19.4%, n = 108) out of the examined bed forms was certainly used by other vertebrates.

Behaviour of roosting Harriers: The first Eurasian Marsh Harriers tend to drop into the roost vegetation 2926±2972 sec. before sunset (range: 239-5520, n = 42), while the last Marsh Harriers dropped into vegetation both before sunset (1622±290 sec, 1323-2106 sec, n = 5) and after sunset (891±913 sec., range 120-2882 sec, n = 35). In two evenings Marsh Harriers dropping was disturbed by agricultural machinery and thus, they were excluded from the current calculations. Eurasian Marsh Harrier juveniles more frequently have been landing as first in the vegetation of the roost area (31 vs 11: $\chi^2 = 9.52$, df = 1,

p = 0.0020), whereas it was definitely more frequent for the adult birds to land as the last (6 vs 34: $\chi^2 = 25.6$, df = 1, p = 0.0001). Among the adults, males were observed to drop as the last birds more frequently (8 vs 26: $\chi^2 = 9.52$, df = 1, p = 0.002). In 2 cases males drop into vegetation took place in absolute darkness.

A number of n = 5 social defences against foxes of 3.6±0.90 individual (range: 3-5) adults Marsh Harriers lasted 259.6±112.4 sec, range: 148-416 sec. During such defences a basic activity of adults was circling above the carnivore; only 0.2±0.44 dives (range: 0-1) was performed on the fox. Among 247 cases of Marsh Harriers landing on the roost 176 (71.3%, n = 247) birds had full crops before landings in vegetation, while the remaining ones in the number of 71 (28.7%, n = 247) were observed with empty crops. Juveniles with empty crops: 44 (62.0%) vs 27 (38%), ($\chi^2 = 4.07$, df =1, p = 0.044) formed the biggest fraction among all hungry roosted Marsh Harriers. Their drops on the roost vegetations were preceded with foraging sessions in the roost area; they hunted small mammals and passerines. Among empty crops juveniles 31 (70.4%, n = 44) ($\chi^2 = 7.36$, df = 1, p = 0.007) tried to forage in the close vicinity of the roost area by 568±226 sec range 234-822 sec, but only 2 (6.4%, n = 31) sessions ended with a successful catching of passerines.

Further in to the season (given in a Julian calendar) the time between the sunset and landing in the roost vegetation by the last Harrier (Sperman r = 0.648, n = 42, p = 0.004), have increased. It indicates that migrating raptors are forced to forage for long due to progressive depletion of food resources they met and what pushed them to left roost area grounds.

Montagu's Harriers present on the communal roost dropped into vegetation later (1195±361 sec. after sun set, range: 540-1620 sec., n = 21) than Eurasian Marsh Harriers (Mann- Whitney U-test: Z = 3.21, $n_1 = 35$, $n_2 = 22$, p = 0.0013). It was contributed to 2 main reasons: a) aggression of Marsh Harriers juveniles who harassed Montagu's Harriers in the roost area (Table 4), b) and hunting sessions for passerines. A number of n = 9 hunting session was observed; they lasted: 702±185.1, range: 474-916 sec and were initiated by forming groups of birds sitting on the grounds, who watched the roost and initiated landing into vegetation, not sooner than the great majority of Marsh Harriers had dropped already into the roost.

Table 4: Aggressive interaction during pre-roost activities

Victims/ Aggressors	Ca. juv.	Ca. M	Ca. F	C.p M.	B.b ad	P.p
Circus aeruginosus juv.	16, 6*		10*	1		
Circus aeruginosus M.	2*					1
Circus aeruginosus F.	2*					
Circus pygargus juv.	36		1			
Circus pygargus. M.		1			1	
Circus pygargus. F.	6					
Circus cyaneus	1					
Circus macrourus juv.	2					
Buteo buteo ad.		1				1
Pica pica	1					

juv.- juvenile, ad.-adult, F- female, M.-male. *-corresponds to the chasing from bed-forms, other aggressive interactions are given without asterisk. Columns-victims, rows-harassers

Spatiotemporal individual roost sites selections: The research showed that droppings on the roost area was not the final act for some birds. In the overall number of n = 248 drops of Eurasian Marsh Harriers into vegetation, 200 events (80.6%, n = 248) were of the final character. For the remaining cases (n = 48) the birds tend to change their roost. In 31 cases it resulted from the attacks of other Marsh Harriers, but 17 events seem to be spontaneous. Differences in frequency were significant ($\chi^2 = 4.08$, df = 1, p = 0.043). In 26 cases juveniles had to leave the bed forms, whereas it happened only to 5 adults of Marsh Harrier ($\chi^2 = 14.2$, df = 1, p = 0.0002). Juveniles happened to be most frequently chased away form their bed forms by other juveniles of Marsh Harrier (16 vs 10 events), though no significant differences ($\chi^2 = 1.38$, df = 1, p = 0.39), were noted (Table 4). The rate of juveniles, which had to change their bed forms due to aggressive behaviour of other birds was statistically bigger than the rate for adults leaving the individual roost sites for the same reason (26 individuals out of 140 individuals vs 5 individuals out of 108; 2×2 tables: $\chi^2 = 9.6$, df = 1, p = 0.002). Majority of adult Harriers spent the night in centrally distributed bed forms, with less frequent cases of spending nights in mediate, or peripheral bed forms: 52 vs 31 vs 25: $\chi^2 = 11.17$, df = 2, p = 0.002). Juveniles were more evenly distributed all over the roost area: respectively 42 vs 47 vs 51: $\chi^2 = 0.871$, df = 2, p = 0.647. Statistically significant differences were found in rates between juveniles and adults landing in the central part of the roost (adults: 42 individuals vs 98 individuals and youngs: 52 individuals vs 56 individuals, 2×2 tables: $\chi^2 = 7.78$, df = 1, p = 0.0053). Moreover, it was noted that birds dropping first in roost vegetation preferred central parts of the roosts, though differences in frequencies were not statistically significant (27 individuals vs 15: $\chi^2 = 3.42$, df = 1, p = 0.64). However, a statistically significant, clear trend for juveniles which did not have to leave their bed forms was observed-birds were mainly from individual roost sites located centrally (19 individuals vs. 7 individuals; $\chi^2 = 5.54$, df = 1, p = 0.018). Unsuccessful empty crop juveniles, which hunted on the roost (n = 29), were never dropped in its central part.

DISCUSSION

Observed conservatism in locating the roost site of migrating Marsh Harriers corresponds to the roosting conservatism of this species (Oliver, 2005; Verma, 2005) of other species of Harriers, individuals of which are known for exploiting the same areas for social spending of the night over many years (Clarke, 1996; Clarke *et al*., 1998; Kitowski, 2004a; Walk, 1998). The results confirmed an observed tendency to form common communal roosts by Eurasian Marsh Harriers with Montagu's Harrier or Pallid Harriers in out their breeding period (Cramp and Simmons, 1980; Clarke *et al*., 1998; Verma, 2005). In the Netherlands the case of very close localization of communal roosts of Marsh Harriers and Hen harriers were reported (Clarke *et al*., 1993). Eurasian Marsh Harriers from the studied roost used to spent night in vegetation of average height of 93 cm. It is smaller that the height of vegetation (1-2 m) given from winter roosts (Oliver, 2005; Verma, 2005), but it should be noted that migrating individuals of Marsh Harriers spent smaller amount of time compared to wintering ones.

Hen Harriers exploited the roost area in late September, when migrating Marsh Harriers were no longer noted. Such a phenomenon is also in line with other cases observed in central Europe of Hen Harriers using the roost area of Montagu's Harrier, or even their former individual roost sites and former nests of Marsh and Montagu's Harriers as roost places (Kitowski and Wojtak, 1998; Kitowski *et al*., 2003; Kitowski, 2004a,b).

During one observational sessions 1 individual of Short-eared Owl *Asio flammeus* was recorded. Some communal roosts of Hen Harriers are shared with Short-eared owls in different part of range this species (Serrentino, 1989; Walk, 1998; Kitowski *et al*., 2003). In east Poland during the day Hen Harriers' individual roost sites can be used by Barn owls (*Tyto alba*) and Long-eared owls (*Asio otus*), as evidenced by the feathers found there and flushed individuals during the day examinations of individual roost sites of Hen Harrier (Kitowski and Wojtak, 1998; Kitowski *et al*., 2003). Communal roosts of Hen harriers have been known, in the proximity of which roosting communally merlins were noted. When the these species is present, the Merlins are sitting conspicuous on low perches or bushes and little animosity is generally shown by either species (Clarke, 1987). Still, the observed Merlin could have originated from a population nesting in the area not impacted by carnivore mammals On the area utilized as communal roost ground holes of Badger *Meles meles* were detected. It seems that Badger present at the roost may have permitted the foxes from deeper nocturnal penetration of the roost, though due to their diet they were not perceived as threat for Eurasian Marsh Harriers (Jedrzejewska and Jedrzejewski, 2001). There were inter-year differences in roost edge-individual roost site distances and the nearest bed forms distance. Most likely, the fluctuations in the edge-roost distance and the nearest bed forms distance reflected a varied pressure from terrestrial mammals, similarly as it was observed in Montagu's Harrier male's roost during their post-fledging period (Kitowski, 2004a, b).

Feces and pellets were piled on the opposite sides within a roost site, indicating that the Marsh Harriers over several nights took the same position in the similar phenomenon was also noted for Hen Harriers (Watson, 1977). The observed passivity of adult Marsh Harriers during fox operating seems to be a significant characteristic typical for them, which differs their communal roost behaviour from Montagu's Harrier, whose adult males fiercely chased the foxes from away from the roost area (Kitowski, 2004a, b). The late landing in the roost area by adults seem to be a defence adaptation and allows experienced birds to detect terrestrial predators operating close or on the roost area. Performing pre-roost sitting by individuals or by groups of individuals seems very common behaviour for Harries' communal roost (Watson, 1976; Kitowski, 2004a,b; Verma, 2005). Under strong penetration of the vicinity of the roost by terrestrial predators, it would be very dangerous for the sitting birds, but it also allows to detect predators operating close or on the roost area.

The considered communal roost was penetrated by foxes, but no direct evidence for predation on Harriers were found. But the other studies gave clear examples such predation on roosted Eurasian Marsh harriers (Verma, 2005). Individuals of harriers killed by predators were also found on the communal roost of Hen Harriers (Clarke and Watson, 1990; Kitowski *et al*., 2003).

Unsuccessful juveniles with empty crops were never dropped in its central part of the roost and they were frequently expels from their individual roost sites. Such observations confirm hypothesis that birds on the edge of roost provide a buffer from predation to more centrally roosting birds (Weather head, 1983; Beauchamp, 1999). It suggest a competition for the best located individual roost sites, but may also explain the second adaptive value of communal roost formation which suggests that unsuccessful birds follow companions to food patches (Ward and Zahavi, 1973; Beauchamp, 1999) The study indicates that roost may have a role of an information center where less experienced foragers (mainly juveniles)

can improve their foraging abilities by observing the birds arriving with full crops where the optimal foraging habitats are located. Such a role seems to be basic one for migrating young Eurasian Marsh Harriers, whose foraging abilities are not fully developed yet, since their hunting skills are not experienced during the post-fledging dependency period (Bavoux *et al*., 1998; Witkowski, 1989) and need to be perfected quickly at the critical time of migration. It corresponds very nicely with observed foraging adults with groups of juveniles during daytime in the area of surrounding meadows.

The obtained results for Eurasian Marsh Harriers roosting habits appeared promising enough to continue the research. It is recommendable to include the considered roost sites in to the areas protected by law. It has also generated the need to search for this type roosts in this part of Europe, to enhance the data on roost habits during migration (Kitowski and Pienkosz, 2004).

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