

NEST MATERIAL SUPPLIES IN THE MARSH HARRIER *Circus aeruginosus*: SEXUAL ROLES, DAILY AND SEASONAL ACTIVITY PATTERNS AND RAINFALL INFLUENCE

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ABSTRACT Nest maintenance is an important part of parental care for the Marsh Harrier *Circus aeruginosus* throughout the entire breeding period. Nest material supply trips are mainly carried out by the female as the male only contributes during incubation and the early nestling period. The trips rate was greatest during the 1st half of the nestling phase, in the morning and on rainy days. It appears that material supply trips are related to nest maintenance needs during breeding and the time available to the parents.

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INTRODUCTION

For birds, nest building requires a considerable time and energy investment (Newton 1979, Collias & Collias 1984). This effort does not stop when the eggs are laid as the parents continue adding material to the nest during the incubation and nestling period. Despite the importance of this parental investment, studies of nest construction and maintenance are still scarce, especially among birds of prey (Newton 1979).

The purpose of this study was to trace some causes and the possible functions of the daily and seasonal variations in nest material supply by both sexes of the Marsh Harrier *Circus aeruginosus* the daily and seasonal variations in nest material supply by the sexes throughout the breeding period (incubation through the nestling phase). Nest material supply behaviour is an interesting phenomena for this bird of prey because it nests on unstable reedbeds and in wetlands that are subject to wide fluctuations in water level and therefore must continually rebuild the nest (Burger 1979).

STUDY AREA AND METHODS

The study is based on observations made of 10 pairs of Marsh Harriers nesting in the El Juncal and Dos Reinos reserves (Ebro valley, northern Spain). The

pairs studied were monogamous breeders (Fernández 1990). Observations were carried out by two people equipped with binoculars and spotting scopes situated at a fixed distance of 500 m. from the nests. A total of 828 hours were dedicated to the observation (303 h during incubation and 525 h in the nestling period). The nestling phase was considered from the hatching to the fledgling of the young and divided into 4 periods (N1, N2, N3 and N4) with a duration of 11 days each. The periods N1-N2 and N3-N4 were grouped together as 1st and 2nd phases of the nestling period. Five intervals of 3 h each (7-9, 10-12, 13-15, 16-18 and 19-21) were used to monitor the hourly activity patterns. To compare the nest supply trip rates between days with and without precipitation a χ^2 -test was used (Sokal & Rohlf 1969).

RESULTS

Seasonal activity

The rate with which materials (mainly reeds, but also bulrushes, grass and twigs) are supplied varied throughout the breeding period (Table 1). During incubation there was a high supply activity (0.16 trips h⁻¹). After hatching the visits to supply material increased, reaching a maximum of 0.38 trips h⁻¹ between day 12 and 22 of the nestling period. Afterwards, the number of material trips to the nest decreased considerably.

Table 1. Frequency (number/hour) of the material supply to the nest by the Marsh Harrier.

Period (days)	Observation hours	Nest material supplies			
		Total	Males		Females
Incubation	303	0.16	0.03	(20.8)*	0.13 (79.2)
Nestling					
N1 (1-11)	153	0.21	0.07	(31.3)	0.14 (68.8)
N2 (12-22)	124	0.38	0.01	(2.1)	0.37 (97.9)
N3 (23-33)	140	0.16	0.01	(4.4)	0.16 (95.7)
N4 (34-44)	108	0.04	-	-	0.04 (100)

* Percentage of male and female contribution in brackets.

Sexual roles

The females participated more than 85% of the material supply trips observed during the total breeding period. The males contributed by transporting 20.8% of the material items to the nest during incubation. This contribution increased during the first 11 days of the nestling phase when the female remained close to the nest, but decreased substantially afterwards, even though the rate of material supply trips was at its maximum then. In summary, a trend was observed where the participation of the male decreased as the nestling progresses and the foraging time increased (Table 1).

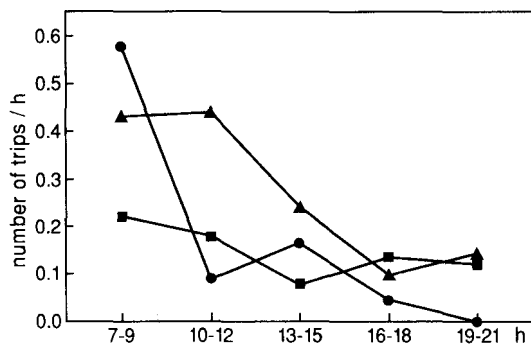


Fig. 1. Daily distribution of nest material supplies in the Marsh Harrier during incubation (squares), the 1st (1-22 days) and 2nd (23-44 days) nestling phases (triangles and circles).

Daily patterns

The distribution of material supply trips during the day was analysed for the three phases distinguished: incubation, and the first (1-22) and second (23-44) nestling phases (Fig. 1). During all three phases most material trips were carried out in the early hours of the day. However, this trend becomes more obvious as the breeding season progresses.

Influence of rain

During the first nestling phase the rate of nesting material supply trips increased markedly on rainy days, especially after storms (Table 2). During incubation and the second nestling phase the rain did not seem to affect the number of supply trips made.

DISCUSSION

Nest maintenance entails a considerable parental effort on behalf of the Marsh Harrier not only at the onset but also during the entire breeding period. Two factors seem to be responsible for the difference in sexual roles in the daily activity patterns and the supply rate for the different phases: (1) the rearing needs at the nest, and (2) the time available to each parent.

During incubation the material supplies seemed to be carried out to finish the nest construction. At that time the nest only serves to hold the eggs and

Table 2. Difference in the frequency of material supplies (absolute numbers in brackets) to the nest between dry and rainy days during the breeding periods studied: incubation, 1st (1-22 days) and 2nd (23-44 days) nestling phases.

Periods	Dry days		Rainy days		
Incubation	0.150	(36)	0.191	(12)	$\chi^2 = 0.44, p > 0.05$
1st Nestling phase (1-22)	0.122	(23)	0.636	(56)	$\chi^2 = 39, p < 0.001$
2nd Nestling phase (23-44)	0.111	(26)	0.071	(1)	$\chi^2 = 0.18, p > 0.05$

must be enlarged to house a large brood during the nestling period without risk of the chicks falling out (Johannesson 1975). During incubation the supply trips were related to the number of times the female leaves the nest to receive food brought by the male, therefore being distributed throughout the day. After hatching and throughout the nestling period the material added to the nest served two purposes: to maintain the nest structure which is constantly damaged by the young and the inclement weather (Burger 1978), and to maintain a clean and dry platform (Newton 1979, Elkins 1988), although other functions have also been suggested (Brown & Amadon 1968, Newton 1979). The maintenance requirements were at their peak around the third week of the nestling period when the chicks are large enough to damage the nest but are still without feathers, therefore requiring a platform in perfect sanitary condition. In this phase the effect of rain on the rate of supplies is best observed (Elkins 1988), as the number of material trips increased notably after storms (Burger 1978). When the nestling period ends well-feathered young move among the reeds to avoid predators (Altenburg *et al.* 1982) thus rendering the nest less important and as a result the number of material supplies decrease.

Material supplies are generally carried out in the morning (Johannesson 1975) when the females are more present in the nestling area (Burger 1976, Altenburg *et al.* 1982). In the morning it is also more necessary to dry the platform and to reform the structure after long periods of building inactivity in which the nighttime humidity of the wetlands

dampens the nest. It is also possible that the damp aids construction by compacting materials and making the nest more solid (Elkins 1988).

Finally the separation of tasks between the sexes depends also on the time available to the parents. Thiollay (1970) found that, although the two sexes participated in the nest construction before egg-laying, the male Marsh Harriers were more active than the females (cf. Cramp & Simmons 1980). However, our results indicate that after egg-laying material trips were mainly carried out by the female. The male contributed by bringing an important part of the material supplies during incubation and the first days of the nestling period, when the female spends practically all of her time on the nest (more than 90%, pers. obs.). Nevertheless, as the nestling period progresses and the females are less confined to the nest the males take a smaller role in the nest material supply. This is also probably due to an increase in the food requirements of the brood and the resultant increase in the time that the males spend foraging (Altenburg *et al.* 1982).

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REFERENCES

- Altenburg, W., S. Daan, J. Starkenburg & M. Zijlstra 1982. Polygamy in the Marsh Harrier, *Circus aeruginosus*: individual variation in hunting performance and number of mates. *Behaviour* 79: 272-312.
- Brown, L.H. & A. Amadon 1968. Eagles, hawks and falcons of the world. Country Life Books, Wisbwh. Cambs.
- Burger, J. 1976. Daily and seasonal activity patterns in breeding Laughing Gulls. *Auk* 93: 308-323.
- Burger, J. 1978. Determinants of nest repair in Laughing Gulls. *Anim. Behav.* 26: 856-861.
- Burger, J. 1979. Nest repair behaviour in birds nesting in salt marshes. *J. Comp. Psychol.* 93: 189-199.
- Collias, N.E. & E.C. Collias 1984. Nest building and bird behaviour. Princeton University Press. Princeton.
- Cramp, S. & K.E.L. Simmons 1980. The birds of the western Palearctic. Vol.II. Oxford University Press. Oxford.
- Elkins, N. 1988. Weather and bird behaviour. T. & A.D. Poyser, Calton.
- Fernández, C. 1990. Censo, fenología y éxito reproductor del Aguilucho lagunero *Circus aeruginosus* en Navarra. *Munibe* 41: 89-93.
- Johannesson, H. 1975. Activities of breeding Marsh Harriers (*Circus aeruginosus*). *Vår Fagelvård* 34: 197-206.
- Newton, I. 1979. Population ecology of raptors. T. & A.D. Poyser. Berkhamsted.
- Sokal, R.R. & F.J. Rohlf 1969. Biometry. Freeman & Co. S.Francisco.
- Thiollay, J.M. 1970. Observations sur l'écologie de Busards des roseaux, *Circus aeruginosus*, en Camargue. *Nos Oiseaux* 30: 214-229.

SAMENVATTING

Dit onderzoek aan Bruine Kiekendieven werd verricht in de El Juncal en Dos Reinos reservaten in het dal van de Ebro in noordelijk Spanje. Deze kiekendieven onderhouden hun nesten gedurende de gehele broedperiode door het aanvoeren van nieuw nestmateriaal. In dit artikel worden de belangrijkste factoren die van invloed zijn op dit gedrag geïnventariseerd.

Tijdens het broeden wordt gemiddeld éénmaal per zes uur nestmateriaal aangevoerd. Gedurende de eerste drie weken van de verzorging van de jongen verdubbelt deze frequentie, en in de daaropvolgende drie weken vermindert de aanvoer weer geleidelijk (Tabel 1). Aanvoer van nestmateriaal vindt vooral gedurende de vroege ochtenduren plaats (Fig. 1) en op regenachtige dagen (Tabel 2). Verreweg de grootste bijdrage aan de instandhouding van het nest levert het wijfje (Tabel 1), maar tijdens en kort na het broeden, wanneer het wijfje bijna voortdurend op het nest aanwezig is, levert het mannetje ook een aanzienlijke bijdrage. De resultaten wijzen erop dat onderhoud aan het nest bepaald wordt door de noodzaak op dat moment (kwaliteitsvermindering door jongen en regen) en door de tijd die ouders naast jagen en broeden voor nestonderhoud beschikbaar hebben.