

## Analysis of breeding behaviour in Montagu's Harrier *Circus pygargus* in a site of Central Italy

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**Abstract** - The breeding behaviour of Montagu's Harrier was studied in a pre-Apennine area (Marche, Central Italy). A group of 6 and 5 pairs was analysed in two successive breeding seasons. The most frequent pattern of courtship was Flight-play (67.9%; n=187). Communal soaring, not previously described in this species, was observed in all breeding stages. Our observations confirmed that the females were more aggressive than males over the whole breeding cycle (60.8%; n=115), and that the aggressivity of Montagu's Harrier towards other species, including birds of prey (40.3%; n=124) was scarce. Play behaviour among the young and an aerial "Food-pass exercises" by adult on young were observed. The frequency of Food-pass was analysed in all breeding stages; it differed significantly in male on female interaction ( $P < 0.01$ ).

**Key words:** breeding behaviour, *Circus pygargus*, eco-ethology, Italy

The breeding biology of Montagu's Harrier has been studied by Studinka (1942), Robinson (1950), Glutz et al. (1971), Brown (1976) and, in Italy, by Martelli (1984, 1987); specific analyses have been conducted by Dent (1939), Thiollay (1986) and Schipper (1973, 1977).

The present study aimed at describing specific behavioural patterns of Montagu's Harrier and quantifying its breeding seasons in Italy.

Groups of 6 and 5 nests were observed in 1987 and 1988 respectively. Montagu's Harrier can nest in small groups (3 nests in 0.6 ha; Robinson 1950) or in large groups (20 nests in 2-3 ha; Thiollay 1968). The minimum distance recorded between nests is 10 m (Glutz et al. 1971). Pairs already established in a territory may attract others (Martelli 1985). The relative density seems to be more due to the tendency to nest in groups, as is known in this species, than to the lack of suitable nesting sites (Weis in Cramp and Simmons 1980).

During the post-fledging period, some forms of play activity are known. Simulation of play activity has been recorded in "aerial mock-battles" in the Peregrine *Falco peregrinus* (Parker 1975) and in the Buzzard *Buteo buteo* (Weir and Picozzi 1975), which exhibit forms of social play among young, consisting in simulated hunting actions and communal flights over territory. In the genus *Circus* a case of play-chasing was reported, but only in the Hen Harrier *Circus cyaneus* (Summer in Fagen 1981).

The food-pass behavioural pattern was analysed in the study area. This is a characteristic sequence of *Circus* genera and shows slight variations in the species (Marsh Harrier, *Circus aeruginosus* and Hen Harrier *Circus cyaneus*, Brown, 1976; Cramp and Simmons eds. 1980).

## MATERIALS AND METHODS

The breeding area is a 60 ha badland, situated in the Monte della Mattered (479 m), in the province of Pesaro-Urbino (Marche region).

Daily observations were made using a Zeiss 10x40 binocular, for a total of 417 hours. The day-time period was covered as a whole. The breeding cycle of Montagu's Harrier in the area of study was: occupation of territory and pair-formation from 4 April to 6 May (46 h of observations); incubation and development of chicks, from 7 May to 4 July (151 h of observations); post-fledging, 5 July (120 h of observations); abandonment of the nest site, from 24 July to 15 August (26 h of observations).

By "activity" we mean individual or communal intra- and interspecific actions as a whole, including communal soaring over the breeding area. The activity periods were divided evenly over the day, with 20 minute peaks for each hour between 8-9 a.m. and 5-6 p.m., with an average of 16 minutes hour. Hunting was not included, since this normally takes place away from the nesting site, in agreement with Studinka (1942), Thiollay (1968) and Schipper (1973, 1977).

## RESULTS AND DISCUSSION

**Occupation of territory and pair-formation.** Territory occupation occurred early on the 4th April in 1987; the males, followed by females, arrived in the nesting sites no later than April.

The period of pair-formation was characterized by an intense aerial courtship activity which included (Tab.I):

*Flight-play* - a sequence of repeated diving by one partner on the other was observed, which corresponds to a complete or partial flight-roll, followed by a typical talon-presentation.

*Sky-dance* - aerial displays by the male such as "Pot hooks" and "Loop the loops". This sequence was observed exclusively during the period of courtship.

*Mutual gliding* - typical gliding flight of the pair with wings slightly flexed.

*Mutual high-circling* - soaring of pair, during which the male and female may leave the nesting area.

One display we have identified in all stages of the breeding cycle, which has not yet been described even for the other species of the genus *Circus*: was *Communal soaring* (n=23); it consisted of communal high-circling, where more than one individual flew about at high altitude following the upward currents of air. Individuals involved varied between 3 and 8, taking to flight mainly at the same time, in some cases with individuals of pairs approaching and or moving away from the group in flight. The young also took part in this display, in the post-fledging period (n=11). At the end of the communal flight only 4 cases were

TABLE I. Displays performed during the period of pair-formation.

DISPLAYS	NUMBER OF OBSERVATIONS
FLIGHT-PLAY	male on female=123 female on male=13 mutual sequence=7
SKY-DANCE	20
MUTUAL GLIDING	20
MUTUAL HIGH-CIRCLING	11
COMMUNAL SOARING	9

reported of several individuals moving away from the badland, whilst the return to low altitude over the breeding area prevailed in the others (n=15). The significance of Communal soaring may be:

- 1 - to signal the presence and occupation of territory by a group of nestlers;
- 2 - stabilizing of sociability of nestlers, since during display no intraspecific aggressivity was noticed;
- 3 - flight performed by each member of the group, with the aim of comparing flight abilities in order to determine an eventual hierarchical order within the group.

During pair-formation, the Sky-dance and the Mutual gliding were accompanied by offers of food by the male to the female; the offer mostly took place on the ground (58.3%, n=12), whereas, when the pair was definitely formed (incubation stage), the prey was mainly offered in flight (76.4%; n=68).

**Incubation and development of chicks.** The nesting of 6 and 5 pairs, in 1987 and 1988, respectively, was distributed over a badland of 60 ha, with abundant and similar ecological characteristics of habitat. The minimum distance recorded between the nests in 1987 and 1988 was 100 m and 175 m, whilst the maximum distance was 425 m and 675 m.

Montagu's Harrier displayed an active defence of the territory only in areas of modest size, within the immediate vicinity of individual nests. The area of the nesting territories varied between 1.5 ha to 6.0 ha, with an average of 4.0 ha.

Nesting in groups by Montagu's Harrier may be attributed to the scarce intraspecific aggressivity already shown in the species and may be related to the existence of particular environmental conditions (in agreement with Eibl-Eibesfeldt 1967; Martelli 1985).

Average clutch size was 3.6 (min.3 - max 4), while average brood size was 3.16 (min.2 - max 4). One of the 6 1987 nests was preyed upon, with loss of 4 chicks, while two of the 5 1988 nests were preyed upon, with the loss of 8 chicks.

**Post-fledging period.** In the two breeding seasons, 12 (1987) and 6 (1988) young fledged, respectively. In our observations the play activity of the young occurred in two ways:

- 1 - two young chased each other for a brief distance, then turned around together still in line, until the leader made a flight-roll with talon-presentation (n=53).

- 2 - two young flew about, meeting each other several times without interacting and then glided for a brief distance in the same direction, with their underparts facing each other but without talon-presentation (n=15). Both games were accompanied by wailing-calls;

The males were observed training the young in a symbolic Food-pass in the form similar to the first game (n=28). Sometimes (n=8), after feeding a female or a young, the males seemed to entertain the young, which had not yet received the prey, with Food-pass training. Only in few cases did the females train their young. Play behaviour of the young and forms of "exercise" in general show that there is a stage of teaching by males and learning by young in the behavioural sequence of Food-pass, with rare participation by female. The play activity of the young can therefore also be interpreted as a moment of perfecting the behavioural pattern, through autonomous exercising.

TABLE II. Frequency of Food-pass and its relation to the breeding stages. Stages: A (light: 14 h), B (light: 15 h), C (light: 15 h), D (light: 14 h). NO.= number of cases observed; D.F.= daily frequency (1 day= average hours of lights in each stage). M=male, F=female, juv.=juveniles.

	A		B		C		D		$\chi^2$	P
	NO.	D.F.	NO.	D.F.	NO	D.F.	NO	D.F.		
M-F	26	8.26	184	15.1	49	6.62	4	0.7	13.6	<0.01
M-juv.					39	5.25	7	1.2	4.6	n.s
F-juv.					9	1.2	2	0.3	1.2	n.s

**Abandonment of the nest site.** The females were the first to abandon of the nest site (end of July), followed by the males and young (first half of August), the pairs that lost their chicks leave the breeding area earlier (end of June).

**Intraspecific and interspecific aggressivity.** The females were more aggressive than the males at the nesting site, and turned their aggressivity mainly on other females (75.7%; n=70). In the period following pair-formation, aggressive interactions were recorded for territory defence (area around the nest, in agreement with Studinka 1942, and Robinson 1950) and for prey possession; in 58.6% (n=87) the aggressive action was conducted by female (Pandolfi and Pino d'Astore 1988).

Interspecific aggressions in the breeding area were relatively infrequent, both because of a scarce aggressivity of Montagu's Harrier (in agreement with Studinka 1942; Ryves in Cramp and Simmons 1980) and because of a reduced frequency of meetings with other species as a result of a certain lack of fauna in the study area. Only 40,3% of the 124 interspecific interactions were recorded as aggressive behaviour and took the form of individual diving attacks or simple accelerations; in both cases wailing-type calls were emitted.

The Passerines present in the breeding area were never recorded mobbing or performing individual attacks against Montagu's Harrier (Pandolfi and Pino d'Astore, 1988).

**Behavioural pattern of "Food-pass".** The most complete Food-pass sequence occurred during the incubation stage, where the male, returning from hunting with prey, performed a brief pot-hook over the territory, emitting chattering-type calls; the female immediately took to flight from the nest to meet the male, answering with wailing-type calls. The Food-pass occurred in flight or by talon contact, at times preceded by mutual gliding (Pandolfi and Pino d'Astore 1990).

The frequency of male on female interaction differed in all stages (Tab.II). The offering of food by the male to the female through the strongly stereotyped pattern of Food-pass may have, besides obvious trophic significance, a motivation of reinforcing the bond of the pair and probably belongs to the category of appeasement behaviour towards the more aggressive partner, by a real or symbolic offering of food (Tinbergen 1959, Eibl-Eibesfeldt 1967). The significant increase in frequency in stage B is bound to the need for the male to provide for the feeding of the female, which, occupied in the activity of incubation and parental care, does

not hunt. The frequency of Food-pass in the interaction of males with young was not significantly different in stages C and D, while the low frequency observed in the female to young interactions is not statistically testable with Chi-Square test. The general decrease in frequency of Food-pass recorded in stage D is connected to renewal of hunting by females which, no longer occupied in parental care, abandon the breeding area early, and to wandering behavioural by young around the nesting site.

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#### SOMMARIO

##### **Analisi del comportamento riproduttivo dell'Albanella minore *Circus pygargus*, in un sito dell'Italia centrale**

- E' stato studiato il comportamento riproduttivo dell'Albanella minore (*Circus pygargus*) in un'area preappenninica dell'Italia centrale.

- L'indagine ha interessato un'aggregazione di 6 e 5 coppie, nidificanti rispettivamente nelle stagioni riproduttive 1987 e 1988.

- Il Flight-play (67.9%; n=187) è risultato il modulo comportamentale più diffuso durante il corteggiamento.

- Il Communal soaring è risultato presente in tutte le fasi riproduttive e non risulta descritto da altri autori.

- Le femmine hanno mostrato maggiore aggressività rispetto ai maschi per tutto il periodo riproduttivo (60.8%; n=115), mentre è stata confermata la scarsa aggressività dell'Albanella minore verso altre specie (40.3%; n=124).

- Sono stati osservati sia un comportamento ludico fra i giovani che simboliche "esercitazioni" aree al Food-pass da parte degli adulti sui giovani.

- La frequenza del Food-pass è stata analizzata in tutte le fasi riproduttive; essa differisce in maniera significativa nell'interazione maschio su femmina ( $P < 0.01$ ).

TAB.I. Display effettuati durante il periodo di formazione della coppia.

TAB.II. Frequenza del Food-pass, considerato in relazione alle fasi riproduttive. Fasi: A (luce diurna: 14h). NO.= numero dei casi osservati; D.F.= frequenza giornaliera (1 giorno= media delle ore di luce in ogni fase riproduttiva).

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