

Feeding Habits of Montagu's Harrier *Circus pygargus* in Central Italy

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INTRODUCTION

The reproductive biology of Montagu's Harrier has been relatively well studied for northern Europe (Robinson 1950; Glutz *et al.* 1971; Schipper 1979), and more recently also in the Mediterranean countries, in particular Italy (Martelli 1984; Martelli & Sandri 1989; Pandolfi & Pino d'Astore 1990a; Pandolfi & Giacchini 1991).

Analyses of the species' diet in its nesting areas have been made in France (Thiollay 1968), the Netherlands and the South of France (Schipper 1973), and Spain (Garzon 1974; Hiraldo *et al.* 1975). However, in Italy there is an almost total lack of any such data, except for reports of some time ago on migrating individuals (Moltoni 1937).

The purpose of the present study is to analyse some aspects of Montagu's Harrier's feeding habits in its central Italian nesting areas. The hunting effort over the course of the day, and the male's behaviour with respect to the various biological phases of the reproductive cycle, are two of these aspects. In addition, the first data are given on the diet, referring only to the role of reptiles, even though in the study area the diet includes other categories such as insects, small birds and micromammals; also factors of selection and seasonal variations in a hilly area of subcolonial utilisation are considered.

MATERIALS AND METHODS

The research was conducted in the province of Pesaro and Urbino (Marches region) during the 1986-1988 breeding seasons in a 60ha hilly area *ca.* 15km from the coast. Observations were made throughout the daylight hours, and in those preceding dawn, using Zeiss 10x40 binoculars, at a distance of not less than 100m from the nest, and for a total of 397h.

The amount of prey could be quantified by direct observation in the field, identifying the reptiles mainly by recognition of the colouring and morphology of the prey carried in his talons by the male for the female, or by both adults for their young. Cases in which the male reached the nesting area with the prey but ate it himself are also included.

ROLE OF THE MALE AT THE NEST

The active role of the male in nest-building or in feeding the chicks was analysed on the basis

of the number of flights to the nest, the material brought and the phase of the reproductive cycle in which they occurred. The results are presented in Table 1 and show how the male spends much more time at the nest after the brood has hatched than during incubation or nest-building. Of his visits, 79.4% were in presence of the chicks for whom he was bringing food. This behavioural pattern can be considered a common one in the study area, despite some authors (Perez Chiscano & Fernandez Cruz 1971; Martelli 1984) holding it to be rather anomalous and infrequent.

Out of 62 cases of material being brought by the pair for building or repairing the nest, the male contributed in 3.2%.

Table 1. Visits of the male to the nest during the reproductive cycle.

	without material	with straw	with prey
NEST CONSTRUCTION	1	-	-
INCUBATION	5	1	-
FLEDGING	4	1	22

Table 2. Intervals (in minutes) between two captures of prey during the various parts of the day.

Time of day	Length of interval
5/6	120
6/7	106
7/8	58
8/9	62
9/10	54
10/1	147
11/12	53
12/13	37
13/14	49
14/15	74
15/16	63
16/17	54
17/18	60
18/19	67

During incubation, rapid descents on the nest were noted in which the male assumed the role of caretaker in the brief lapse of time between the food-pass and the return of the female. This behavioural trait is not at all common, since only in exceptional circumstances is the male able to take over incubation (Vincent 1929).

Visits to the nest with food for the young were usually rapid: on six occasions the male remained on the nest for a period of 15-30 seconds and on two occasions for 60-90 seconds. These longer stays might suggest that the male was breaking up the food, as reported by Studinka (1942), but in contrast with the findings of Colling & Brown (1946).

FOOD-PASS

The prey is given to the females or young with the Food-pass, typical for the genus *Circus*. This display, already investigated in detail in previous studies (Pandolfi & Pino d'Astore 1990b), is carried out both in flight (Aerial Food-pass) and on the ground (Ground Food-pass), and fairly

Figure 1. Time frequency of capture of prey.

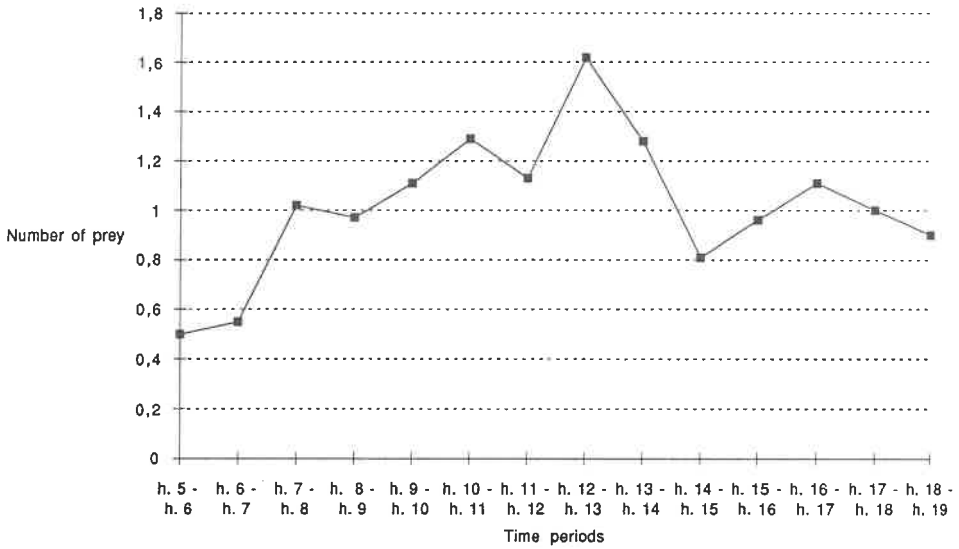
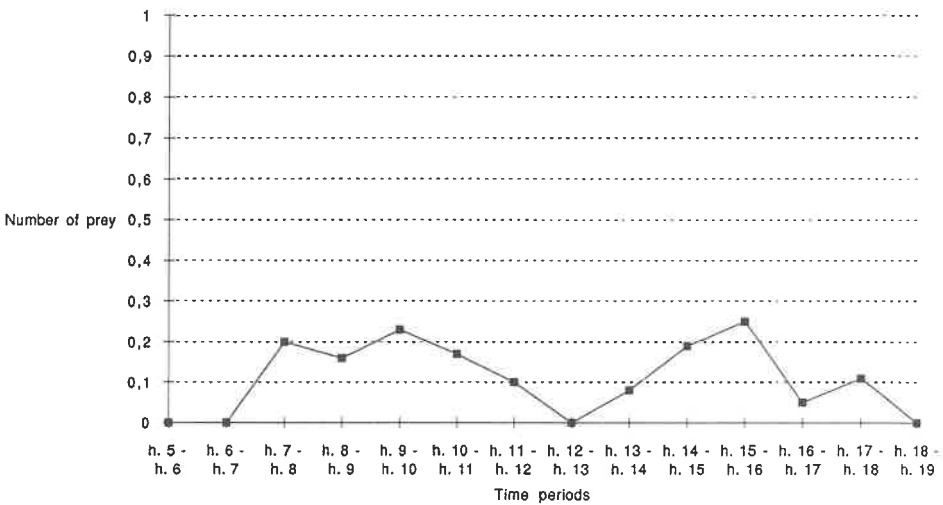


Figure 2. Time frequency of capture of reptiles.



accurate observation can be made, at least as far as certain taxonomic categories are concerned, of the type of prey given. Between male and female, the handing over of prey takes place mainly by an Aerial Food-pass. When the young are fledged, they are almost exclusively fed by the male. The Aerial Food-pass between male and young can be schematically subdivided into three models:

1) the male with prey is approached by one fledgling only, while the others remain still; immediately after the Food-pass, the male returns to hunt while the young bird settles down to feed;

2) the male with prey is approached by several young, but only the first to arrive receives the prey; after the Food-pass the young remain in flight, trying without success to take possession of the food (Pandolfi & Giacchini 1990);

3) the male passes the prey to one of the young, who is at once surrounded by the others, on whom the male performs a series of diving attacks; this behavioural pattern occurred in 18.3% of the cases (N = 71).

In view of what has been reported in previous studies (Pandolfi & Pino d' Astore 1990a), this form of display may be interpreted both as Food-pass training and as a form of protection by the male of the young which received the food, thereby preventing the others from disturbing it and avoiding any loss of food. In fact, this pattern is a modification of the one in which the male assumes the role of protecting the young with the prey from conflict with the other young, and is not just designed to divide the food equally among the fledglings, something which has still to be proved.

TIME OF HUNTING

Fluctuations in hunting intensity during the course of the day and over the whole reproductive cycle are reported in Figure 1 and Table 2, and show the species to be active from dawn to dusk. If, on the one hand, its morphological characteristics allow it to hunt even without upward air-streams, on the other hand with the growing young the amount of food required, therefore of hunting activity, increases. The briefest intervals between successive prey captures, and thus the greatest hunting activity, occurs between 10 a.m. and 2 p.m., with a maximum between 12 a.m. and 1 p.m. These observations are in contrast with those of Thiollay (1968) for France, where the hunting activity may reduce to less than 40% between 11 a.m. and 2.30 p.m. on account of the high temperature. In our study area, a considerable drop in activity was noted after 2 p.m., at which time Thiollay observed a full-scale resumption. No long pauses were revealed during the course of the day, unlike those reported for *Circus aeruginosus* during the mid-day hours (Thiollay 1967).

Table 3. Percentage composition of Montagu's Harrier diet, with particular reference to class of reptiles.

	1987	1988	Σ
Reptiles	24.3	11.2	18.8
<i>Podarcis muralis</i> / <i>Podarcis sicula</i>	2.9	1.6	
<i>Lacerta viridis</i>	21.4	7.2	
Not identified	-	2.4	
Insects, Birds and Mammals	75.7	88.8	81.2

Table 4. Number of reptiles caught in various weather conditions.

<i>Wind</i>	strong	medium	slight	absent	total	%
<i>Weather</i>						
clear	-	2	2	10	14	48.3
variable	-	-	1	1	2	6.9
cloudy	1	3	2	1	7	24.1
overcast	-	-	2	3	5	17.2
showery	-	1	-	-	1	3.5
total	1	6	7	15	29	
%	3.5	20.7	24.1	51.7		

Despite the fact that hunting may begin early, the frequency of food supply remains low until the atmosphere warms up, and this could depend on the activity of certain prey rather than on the

hunting ability of the harrier.

In July and August, the males, which roosted in the same nesting area without forming communal dormitories, left to go hunting after dawn, between 5 a.m. and 5.20 a.m., but never returned with food before 5.41 a.m.

With regard to the evening hours, no food-passes were ever observed shortly before or after sunset, and in any event never after 6.24 p.m., unlike observations in France (Thiollay 1968) and in the Italian Apennines near Bologna (Martelli 1984).

DIET

The present study revealed how throughout the breeding cycle only 3.9% of the food is brought to the nest by the female, whose trophic role in chick-rearing is almost nil, a situation considerably different from that in central European countries (Schipper 1973). On the basis of observations made at the nest site, no prey of any size was noted, e.g. leverets or young pheasants, which are relatively abundant in the study area.

The investigation was mainly directed to the use made of the reptile food resource. Altogether, reptiles amounted to 18.8% (N = 298) (Table 3) of the total prey; the seasonal variation revealed a constant decrease from April (36.4%) to July (13.2%), as was also observed for the Spanish population in similar environmental conditions by Hiraldo *et al.* (1975).

This trend may be explained to some extent by the greater vulnerability of saurians in April, due to their courting activity, and the less dense vegetation cover. In the following months, together with the reduced availability of these reptiles, the fledging of numerous young passerines occurs, which thus constitute a valuable alternative source of food.

Also the hunting of reptiles was analysed over the various parts of the day and in various weather conditions. The most favourable hours proved to be 8 a.m. to 12 a.m., with another peak period from 3 p.m. to 5 p.m. (Fig. 2). In this way, the hottest time of day, when other classes of prey come under pressure, and the beginning and end of day, when the reptiles have still not left, or not yet returned to shelter, are avoided.

With regard to weather, ca. 50% of reptiles were caught in conditions of clear sky and absence of wind (Table 4). These findings are in contrast with observations by Schipper (1973) in the Netherlands, where overcast skies and rain seem to be the best conditions for catching reptiles, which appear to be then less mobile.

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