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Dependence and Emancipation in Juvenile Marsh Harriers *Circus a. aeruginosus*

Christian Bavoux, Guy Burneleau, Pierre Nicolau-Guillaumet, Michel Picard & Christophe Sahuc

INTRODUCTION

The process of emancipation in juvenile European diurnal raptor species has been the subject of recent studies which, in most cases, owe much to wing-tag marking (Kochert *et al.*, 1983) and radio-tracking (Kenward, 1980) techniques, which are often applied together. Of the species studied, we may cite in particular: the Black Kite *Milvus migrans* (Bustamente & Hiraldo, 1989 and 1990), Montagu's Harrier *Circus pygargus* (Kitowski, 1994), Sparrowhawk *Accipiter nisus* (Frumkin, 1994 ; Wyllie, 1985), Goshawk *Accipiter gentilis* (Kenward, in press), Common Buzzard *Buteo buteo* (Nore *et al.*, 1992 ; Picozzi & Weir, 1976), Imperial Eagle *Aquila heliaca* (Alonso *et al.*, 1987). Very little if anything, however, has been published on the Marsh-Harrier *Circus aeruginosus*, although the species is well represented in Europe and also in Asia (del Hoyo *et al.*, 1994), and has been the subject of many breeding biology studies (Bavoux *et al.*, 1989 ; Hofmann, 1991 ; Witkowski, 1989, among the most recent ones).

The present study, which investigates juvenile behaviour in Marsh Harriers throughout the periods of dependence and emancipation, is the last in a series of articles published within the framework of a research programme on this species initiated in 1982 in the mid-western part of France.

MATERIAL AND METHODS

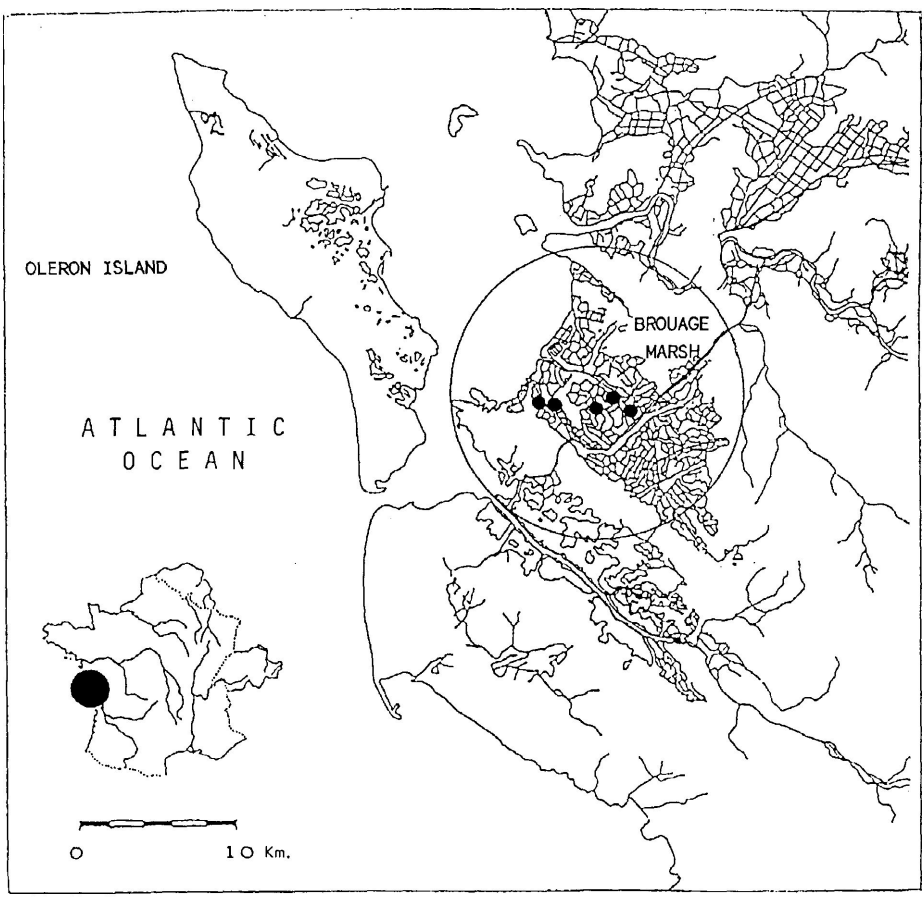
During the summer of 1993, we collected data on the nestlings from 5 harrier nests located in the Brouage marsh (Charente-Maritime). This marsh covers some 115 km^2 of former salt marshes, mostly used for extensive grazing but in parts reclaimed for cultivation, notably in its northern section (Fig. 1). As soon as incubation started, these 5 nests were monitored at regular intervals, which allowed us to know all hatching dates with an accuracy of plus or minus 2 days. Fifteen

young, which had been ringed and wing-tagged, subsequently fledged.

In order to establish, in particular, the length of the post-fledging period during which the parents continue to feed their progeny, the 5 broods were monitored during 19 observation periods of at least 2 hours, distributed over one month, at times and moments of the day (morning and evening) when, *a priori*, the birds are hunting.

Thirteen of the 15 young used in the study were fitted with BIOTRACK TW2 radio-transmitters attached with a backpack harness as described by Kenward (*loc. cit*), just before they were able to fly. These birds were monitored from fledging for up to 4 months of their existence, i.e. given the intervals between the hatching dates of the different nestlings, over a period stretching from end June to end September. We recorded seventy-three surveys in the marsh, at a rate of at least one survey every other day, from a vehicle confined to the existing network of

Figure 1. Map showing the distribution of the Marsh Harrier nests studied in the Brouage Marsh.



roads and lanes. The receiving equipment consisted of a YAESU receiver and a directional 4-element YAGI *Tonna* antenna.

Radio-tracking took place at different times of the day (N=44) during the daylight hours, but also at night (N=29) to discover the birds' night roosts. During each observation period, the observer tried to find all the birds and to locate their positions. This was not always possible, since some of them would be staying out of the investigator's sight, either because it was outside the study area (although all were monitored within a radius of at least 10 km around the nest), or because it was sitting in a depression on the ground in ditch reed (*Phragmites spp*) cover, which significantly shortened the range of radio signals. We recorded all locations (N=643), notably those of travelling birds that were encountered several times.

Of the 13 juveniles fitted with radio-transmitters, 3 were monitored from dawn to dusk for a total of 7 days. The envelope of their daily home ranges was not defined by extrapolation of probings, but by recording point to point the harrier movements that had actually been observed, a method that had been used in the past to study winter juvenile and adult daily home ranges in the same species (Bavoux *et al.*, 1992 and 1994).

RESULTS

Period of dependence on parental feeding

A study of more than 500 successful nidification attempts in the Charente-Maritime region (Bavoux *et al.*, 1989 and unpubl. data) showed that in very precocious birds disturbed at their nest site, the first attempts to fly may be observed as early as 35 days after hatching. Normally, when they are 40-45 days old, the chicks will spontaneously make their first flights from the nest or its immediate vicinity. At that age, their aerial movements are rather short and still quite clumsy. Although little by little these flights are becoming more skilled, most of the time the young are staying near the place where they hatched. The two parents, or only one of them, are sometimes feeding them at the nest or close to it. After 50 days the young are showing a great autonomy and seem to be easily able to make long sustained flights and to fly up in large gliding circles to altitudes of some hundred meters.

Monitoring of 12 young enabled us to determine that as of 50 days of age, parental feedings are progressively spaced out to stop completely after 60-65 days, that is some 3 weeks after fledging. During this period, juveniles apparently are not acquiring any hunting skills through apprenticeship with their parents since they usually do not follow the latter on hunting forays.

Yet, as soon as they have left the nest, they seem to react very well when trying to catch small passerine birds in flight or to capture mammals on the ground (young rabbits, small rodents). They are also practising prey-catching skills when

Table 1. Origin of monitored juveniles

Nest no.	Number of young (radio-tagged)	Juvenile identification no.
11	2 (2)	752
		753
12	2 (2)	740
		741
21	3 (3)	748
		749
		750
38	5 (5)	736
		737
		738
		739
		742
76	3 (1)	751

running through the vegetation to take such small prey as insects (Orthoptera) and lizards. Trying to recover food items carried by the parents but dropped in flight, is a occasion to exercise their agility. In the beginning they most often are unable to catch such prey, which gets lost in the vegetation. But even if the parent is leaving the prey on the ground, it is not sure that the young can feed on it, because of the Black Kite and its so frequently observed klepto-parasitic behaviour. We also saw several cases of necrophagy on Coypu *Myocastor coypus* carrion by harrier young. For these birds, the important numbers of coypu that are killed on the roads is probably the surest way to get fed after emancipation from parental feeding.

Summer dispersal

Only 7 of the 13 juveniles fitted with radio-transmitters could be monitored from fledging until they were 4 months old : 3 died soon after fledging and thus were not taken into account (birds 741, 750 and 753). We completely lost contact with the 3 others after 100 days (individuals 736, 738 and 752), at least for one of them because of transmitter failure.

The number of locations, established by 20-day observation periods, are indicated in Table 2. In fact, for each observation period we recorded only one location per bird, i.e. the one farthest away from the bird's hatching site, which amounts to a total number of 494 locations over an 80-day period.

Between 40 and 59 days, i.e. during the period of their first flight attempts, all of the juveniles remained near their nests, in fact within a distance of 0.5 km.

Table 2. Number of juvenile radio locations recorded from fledging to 4 months of age, as a function of distance moved from the nest.

Number of birds	Age in days	Distance in km: Less than 1	1-2	2-3	More than 3	Total number of locations
10	40 to 59	118	-	-	-	118
10	60 to 79	102	30	5	3	140
10	80 to 99	60	36	18	18	142
7	100 to 199	30	22	19	23	94

Between 60 to 79 days, they only rarely moved greater distances than 2 km from the nest, 79.9 % of the locations being recorded at rather closer distances (within 1 km). Between 100 and 119 days, this percentage decreased to not more than 31.9 %. At that age, the juveniles are making prospective flights moving farther and farther away, some of them being located at 9 km from their hatching site.

The young from nest 21 stayed together during the day, but not longer than 60 days after hatching, then they dispersed. Both, however, continued to roost together in the reedbed where their nest was located until they were 90 days old. By 70 days after hatching, the siblings from nest 38 had separated and were staying alone during the day and at night. They would visit independently this or that sector, although always staying not far from each other. Only occasionally would they roost all five together at their nesting site.

Activity range

Table 3 gives the approximate surface areas of the ranges frequented by the harriers monitored from fledging to the age of 4 months. To calculate their respective ranges, we used the so-called convex polygone method whereby the farthest locations are joined one to another, using all recorded locations.

The surface areas of the activity ranges varied between 21.3 and 42.8

Table 3. Areas of juvenile activity range from fledging to 4 months of age.

Nest no.	Juvenile	Surface area	Number of locations
12	740	42.8	76
21	748	22.8	45
	749	22.3	72
38	737	21.3	77
	739	33.0	33
	742	33.5	57
76	751	28.8	70

km² (average range : 29.2 km², SD=7.3). With regard to area as well as geographical location (Fig. 2), the activity ranges of the young from nest 21 were very similar. Since this was also the case for the young from nest 38, which had all been fitted with problemless transmitters (Fig. 3), one might well assume that siblings from the same nest are frequenting the same habitats.

Uninterrupted monitoring from morning to evening of three about 3-

Figure 2. Activity ranges of 2 juveniles from nest 21, from fledging to 4 months of age.

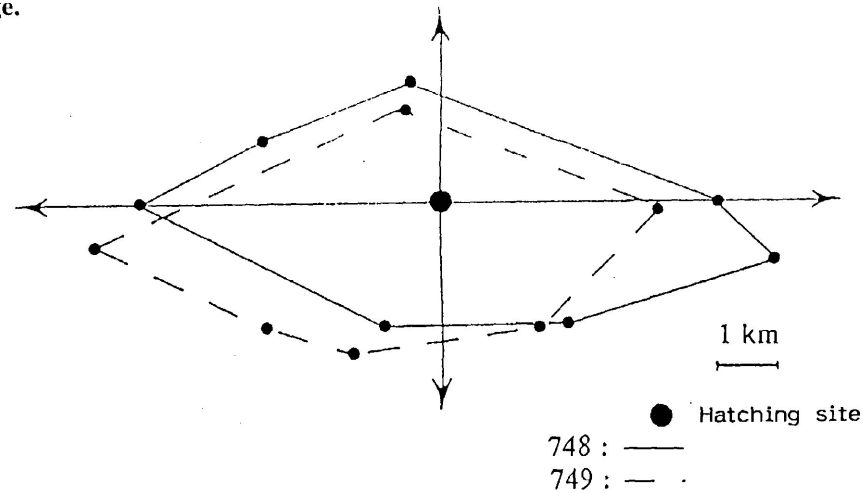


Figure 3. Activity ranges of 3 juveniles from nest 38, from fledging to 4 months of age.

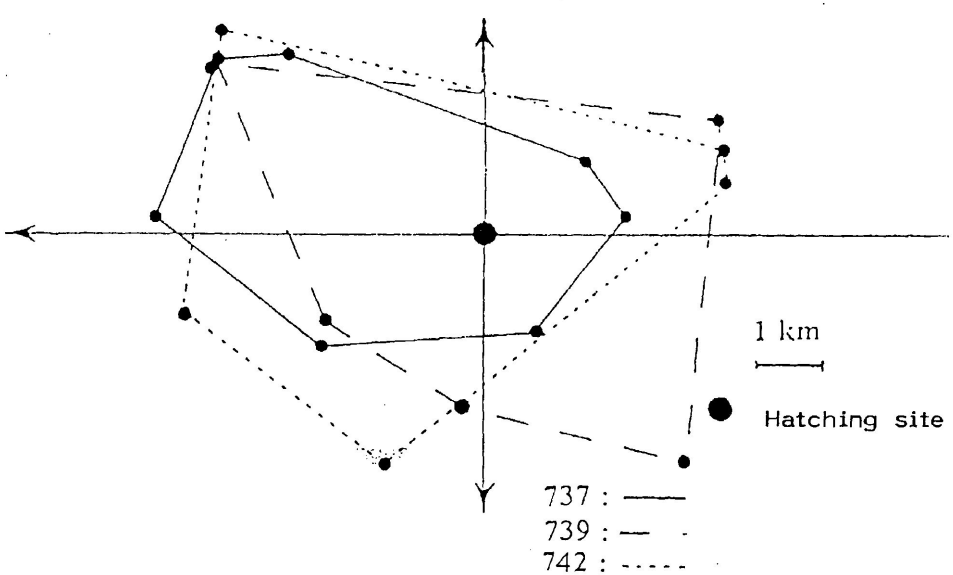


Table 4. Areas of juvenile daily home range.

Nest no.	Juvenile	Date	Area of home range
21	748	17.08.93	1.7
	749	29.08.93	1.2
		31.08.93	2.8
		02.09.93	3.1
38	737	20.08.93	2.5
		23.08.93	2.5
		26.08.93	1.6

Figure 4.- Daily home ranges of 2 juveniles from nest 21.

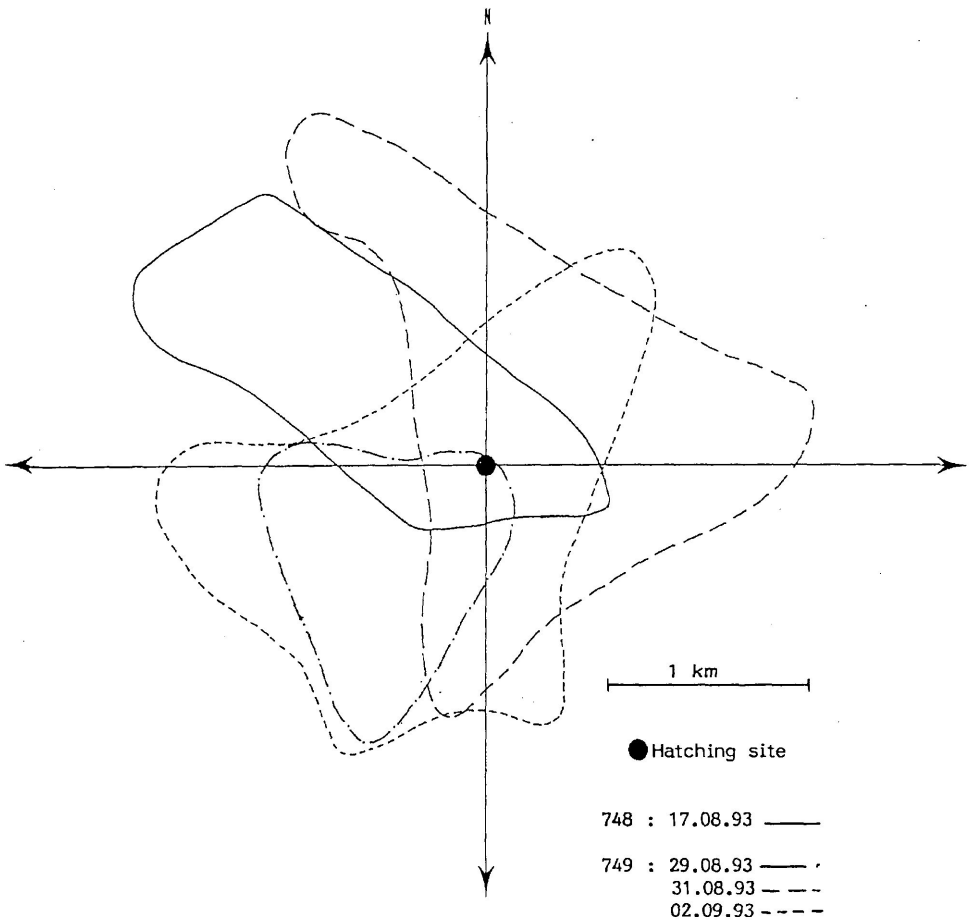
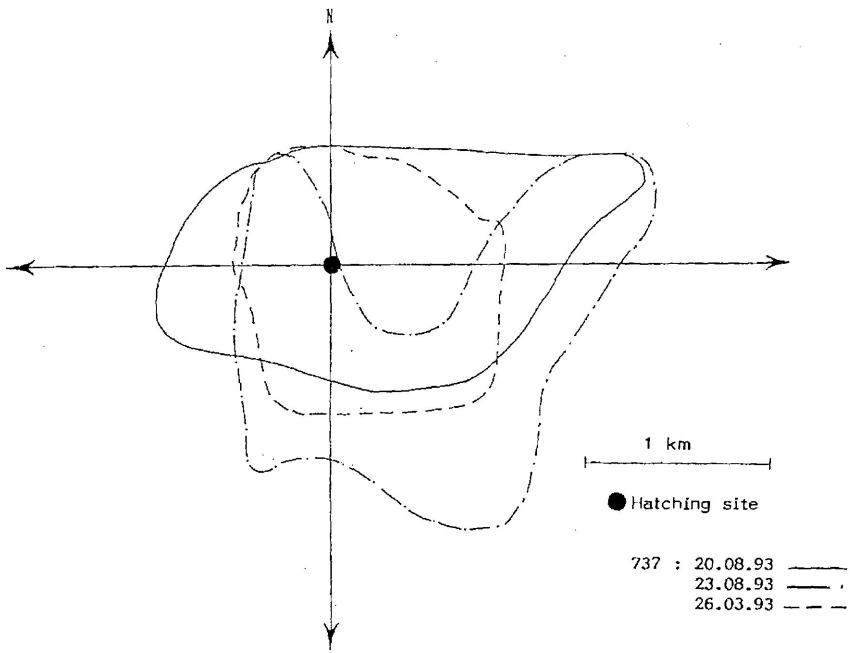


Figure 5.- Daily home ranges of 1 juvenile from nest 38



month-old birds from the two previously mentioned nests, enabled a good estimation of the areas (Table 4) and limits of their daily home ranges (Figs. 4 and 5). Our data show that these continuously monitored birds were always confining their movements to small areas of only 1.2. to 3.1 km^2 (average area of daily home range : 2.2. km^2, SD=0,7).

DISCUSSION

Little is known about the length of the post-fledging dependence period in raptors of the genus *Circus* during which the young continue to be fed by their parents : between 20 and 50 days for the Northern Harrier *Circus cyaneus*, in the United States (Beske, 1982), at least 4 weeks for the Australasian Harrier *Circus approximans*, akin to the Marsh Harrier, in New Zealand (Baker-Gabb, 1981). Please note that the raptors in these studies are migratory species. In our study area where the Marsh Harrier shows sedentary behaviour, it seems that three weeks after fledging the young are no longer dependent on parental feeding.

Up to the age of 4 months, the juvenile activity range encompasses their nest site where they tend to stay, making only a few exploratory flights

in the surroundings to discover and memorize their environment. The following winter, they show a particularly homebound behaviour (Bavoux *et al.*, 1992), a behaviour which appears to confirm itself once they have reached adulthood (Bavoux *et al.*, 1992), since they frequently nest not far from their hatching site, and even at the site itself (Bavoux *et al.*, unpubl.).

This paper presents preliminary data, which should be further investigated. The relationships between siblings from the same nest, those between a given nest and neighbouring nests, as well as parent-offspring relationships are still to be defined for a much larger number of birds. With the help of a well-defined investigational plan it would, in particular, be possible to apply Kenward's (1994) sociality test to the collected data, which would provide considerable information and avoid overlong and tedious observation.

Finally, for a purpose of comparison, it would be very useful if similar studies be undertaken on migratory populations of the same species in Northern and Eastern Europe.

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Christian Bavoux, Guy Burneleau, Pierre Nicolau-Guillaumet,
Michel Picard & Christophe Sahuc
Laboratoire de Zoologie (Mammif ères et Oiseaux), Centre de Recherches sur la Biologie des Populations d'Oiseaux, Muséum National d'Histoire Naturelle,
55, rue Buffon 75005 - Paris, France