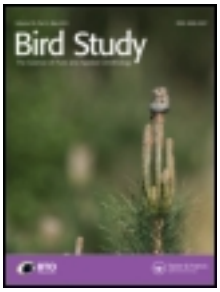

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Breeding success of Azure-winged Magpies *Cyanopica cyana* in Central Spain

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The breeding success of Azure-winged Magpies was studied in Central Spain during 1986. Nesting density was 1.01 nests/ha, but nests were clumped. Breeding season was short and synchronized. Clutches were initiated between 10 April and 25 May. Clutches were started in 69% and completed in 60% of 136 nests built. Mean clutch size was 6.2 eggs. Only 32% of nesting attempts were successful, with an average 5.1 young fledged. Success declined as the season advanced.

The Azure-winged Magpie *Cyanopica cyana* has two disjunct populations.[1] Although the breeding biology of Azure-winged Magpies has been studied with some detail in the Asian population[2–7] only partial and disjointed data based on small samples from marginal areas of its distribution range have been published on the Iberian population.[8–10] In this note we describe the breeding success of Azure-winged Magpies in one of the areas of highest breeding density in Iberia.

STUDY AREA AND METHODS

Data were collected in the Tiétar valley, 15 km SW of Candeleda (40°06'N, 05°17'W, about 300 m asl), in central Spain. The area prospected include 160 ha of flat to very gently sloping open Holm Oak wood *Quercus rotundifolia* with some interspersed Cork Oaks *Q. suber* and a woodlot of Pyrennean Oak *Q. pyrenaica*. Ash trees *Fraxinus excelsior* grow along two streams that cross the area. Understorey species include Hawthorn *Crataegus sp.*, Cistus *Cistus ladaniferus* and saplings of the dominant tree species. Some parts are cultivated, mainly with Oats *Avena sativa* and Rye *Secale cereale*, the rest of the ground vegetation being pasture land devoted to sheep grazing. The climate is meso-mediterranean with hot dry summers and mild humid winters.

The area was surveyed every 5 days during April–July 1986. The state and content of each nest were recorded during each visit. To determine the laying date of the first egg, we considered only the sample of nests found during the laying period, assuming that females laid 1 egg per day (pers. obs.). We only considered as complete clutches those with at least 4 eggs, as this was the lowest clutch size producing fledged young. Eggs that did not hatch because they were infertile or the embryo died were grouped in the same class. The number of nests found was 163, including those built but never containing eggs and those with incomplete clutches. The success of 27 inaccessible nests could not be recorded. On several occasions, the interval between visits was too long to assess the success of a nest. These cases were excluded from the samples (see Table 1). Nests that fledged at least 1 young were considered successful. Predation was assumed when all eggs or nestlings disappeared from a nest. Statistical analyses include Student's *t*-test, one-way ANOVAs, χ^2-test and Spearman's rank correlation.

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Table 1. Breeding success relative to clutch size. Figures are means with standard errors, and sample sizes in parentheses

Clutch size		*Brood size (Only successful clutches)*		*Fledged young*			
				All nests		*Only successful nests*	
4	(6)	3.5±0.50	(2)	1.4±0.87	(5)	3.5±0.50	(2)
5	(10)	4.5±0.50	(4)	2.6±0.89	(7)	3.6±0.87	(5)
6	(29)	5.2±0.37	(13)	3.1±0.60	(22)	5.2±0.37	(13)
7	(32)	6.1±0.48	(10)	2.5±0.65	(23)	5.7±0.59	(10)
8	(4)	7.5±0.50	(2)	5.0±2.51	(3)	7.5±0.50	(2)
6.2±0.11	(81)	5.4±0.27	(31)	2.7±0.37	(60)	5.1±0.28	(32)

RESULTS AND DISCUSSION

Nesting density was 1.01 nests/ha. However, large areas of apparently suitable breeding habitat were not used for nesting, most nests being concentrated in groups. Group nesting has already been described in this species.[1] The mean distance to the nearest nest within these groups was 48.7 m (se = 4.4, n = 107), shorter than that cited for the Eastern population ($P < 0.05$).[7] We never found more than 1 nest in the same tree.

The first clutch was initiated on 10 April and the last on 25 May. The frequency distribution of the clutch initiation dates is positively skewed, with most birds starting to lay in mid-April (Fig. 1). Azure-winged Magpies bred earlier in our study area than in most other areas of its distribution range.[5,6,8,9]

The species is single-brooded in our study area and no replacement clutches were recorded. The incubation period, defined as the interval from laying the last egg to hatching of the last young, was 16 days in each of 2 nests. Young fledged at 14–16 days of age (7 nests). These values are consistent with the findings of other authors.[2,9,10]

A total of 42 (31%) nests were built but abandoned before laying. Clutches were lost before completion in 13 (9%) nests, with a loss of at least 21 eggs. Complete clutches were laid in 81 (60%) nests. Mean clutch size was 6.22 (se = 0.11, range = 4–8, mode = 7), not statistically different from the values given by Pacheco *et al.*[10] and Hosono[5] but greater than that cited by Araújo (t = 3.26, $P < 0.01$).[9] There was no significant change in the clutch size with season (P = 0.20, ANOVA-test, clutches grouped in 10-day periods) although this is usual in other bird species.[11] In nests hatching at least one egg, losses during incubation averaged 0.77 eggs, with no differences with clutch size (ANOVA test).

The mean number of young fledged per successful nest was 5.1 (2.7 per nest including all nests), greater than those given by other authors[9,10] (t-test, $P < 0.05$ and $P < 0.01$, respectively). The number of young fledged per successful nest increased with clutch size, peaking in clutches of 6 in the sample of all nests ($P < 0.05$, Table 1), and decreased with season (Fig. 2). Since food resources (insects) increase

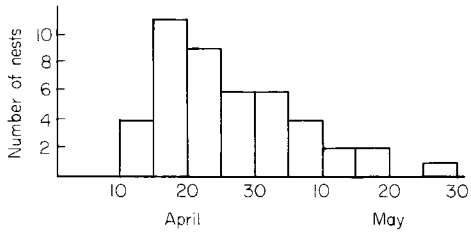

Figure 1. Frequency distribution of clutch initiation dates. The total number of clutches was 45.

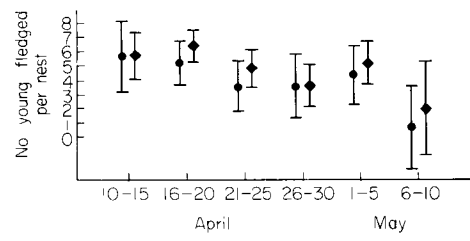

Figure 2. Number of young fledged per nest in relation to clutch initiation date for the sample of total nests (black dots, n = 37, r_s = −0.414, P = 0.013) and successful nests only (black diamonds, n = 30, r_s = −0.380, P = 0.041). Vertical bars represent 95% confidence intervals.

Table 2. Percentage nest success in Azure-winged Magpies. For each clutch size the percentages of success at each breeding stage are given. Sample sizes in parentheses

Clutch size	*4–5*	*6*	*7–8*	*%‡*
Total nests (n = 136)				100
Lost before laying				31
Lost before completing clutch				9
Complete clutch				60
Complete clutches (n = 60)*				
Unsuccessful	42	41	54	28
Successful	58	59	46	32
Successful clutches (n = 32)†				
All young fledged	67	69	42	18
Not all young fledged	33	31	58	14

*The remaining 21 clutches were of unknown success.
†The remaining 28 broods were of unknown success.
‡These percentages refer to total nests.

towards the summer, this may be because predation is heavier later in the season.

The nesting success of the population is given in Table 2. Only 32% of all nests fledged at least one young. Most unsuccessful nests were found empty but undisturbed after containing eggs or nestlings. Direct evidence of nest predation, such as eggshells or adult feathers were occasionally found. Therefore, we assumed that predation was the main cause of loss of complete clutch or brood (see e.g. Ricklefs[12]). Our figures for nesting success were significantly lower than the only other comparable figure given in the literature ($P < 0.05$).[10] Both the absolute success, expressed as the total number of young fledged in the population, and the net success, expressed as the percentage of eggs producing young per clutch, were highest in clutches of 6 eggs (Table 1), rather than in those of the modal size (7).

Azure-winged Magpies have a highly synchronized, short and early breeding season compared with similar corvids in the same habitat and latitude (pers. obs.). This fits in with the decrease in nesting success as the season progresses, which suggests that the duration of the breeding season may be limited by certain selective pressures. Other features of this population were the high percentage of nests abandoned before and during laying and the low average nesting success, which contrasts with a relatively high productivity in successful nests. We suggest that these characteristics reflect the high predation pressure in our study area and, as has been described for other cooperative breeders,[13] are probably related to the highly clumped and cooperative breeding system of this species.[5,7]

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