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EVALUATION OF SOME BREEDING PARAMETERS IN A POPULATION OF EAGLE OWLS Bubo bubo IN PROVENCE (South Eastern France)

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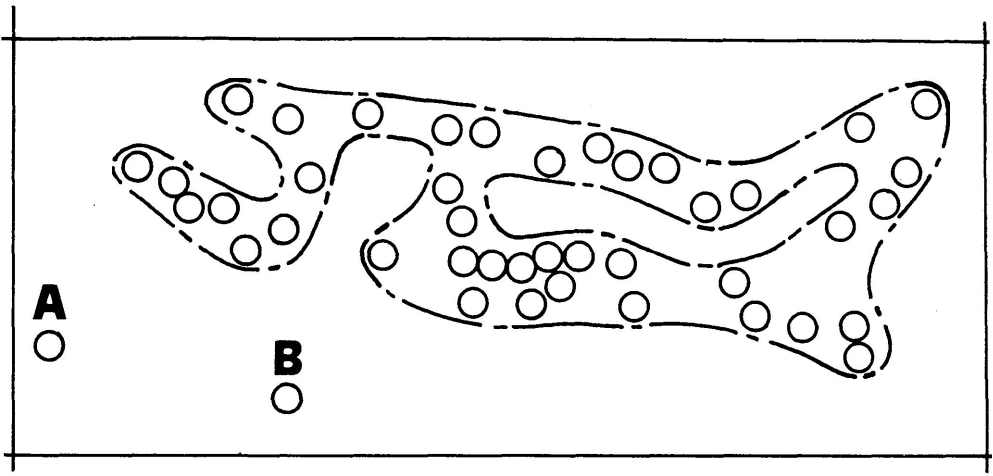
This note aims at presenting the values of some breeding parameters studied in a population of Eagle Owls *(Bubo bubo)* in Provence, between 1968 and 1990. It includes data previously published by Blondel and Badan (1976) and Bergier and Badan (1979), recorded in the same area.

NUMBER, SIZE AND LOCATION OF TERRITORIES

The study area covers about 200 km^2 of Mediterranean mountain. Forty-three territories (*) have been recorded there but, taking into account a remote part of the mountain difficult of access and hence less prospected, the total number of territories is estimated at 43-50. The theoretical size of one territory is thus 400-465 hectares (990-1050 acres) and the density 0.22-0.25 territory/sq. km (0.57-0.65 territory/sq. mile). The distribution of these territories assumes an aggregate shape (Fig. 1) which almost entirely covers the contact areas between the mountain and the cultivated areas. Only two other territories (A and B, Fig. 1) are several kilometres from the massif and are not connected with any other territory.

(*) The word "territory" is understood as "a share of space, delimited by more or less firm borders, where breeding has been recorded at least once".

Figure 1: Symbolic display of the position of Eagle Owl territories in the study area.



TERRITORY OCCUPATION RATE

A total of 418 territories were visited between 1968 and the end of the breeding season of 1990. 395 were occupied (a territory is considered as occupied if at least one adult has been seen or heard between January and May, or if signs such as droppings, pellets, feathers or occupied nests, hooting young etc., showing the presence of at least one bird, have been observed). The average territory occupation rate is thus 94%, but has ranged from 88% to 100% (n = 22 years, standard deviation = 4%).

RATE OF PAIRS LAYING EGGS

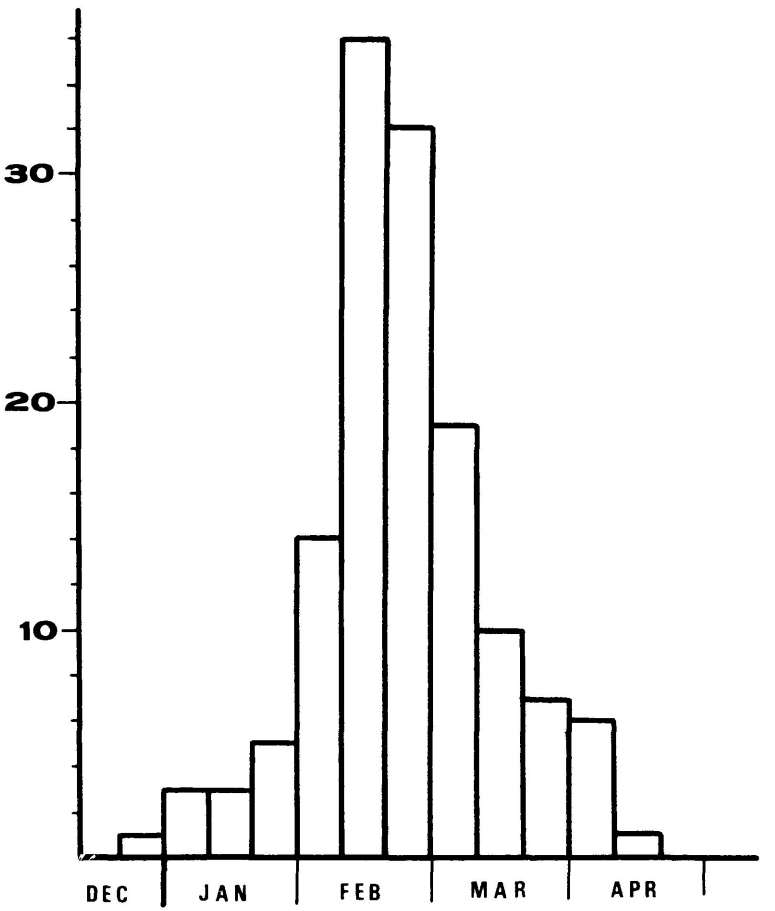
Because of such phenomena as the presence of only one adult, bird immature or in bad condition, loss of an adult before egg-laying, insufficient food availability, too frequent disturbance, etc., some of the occupied territories were not used for egg-laying. 274 territories out of the 395 occupied gave enough evidence to infer whether or not a breeding attempt took place; the 121 other territories have not been sufficiently studied. The rate of pairs that laid eggs varied from 65% to 100%, with an average of 89% (245 occupied territories with breeding attempt; s.d. 10%, n = 22 years).

EGG-LAYING PERIOD

There is an important spread in the egg-laying period; the records give 27 December and 11 April as extreme first-egg-laying dates (Fig. 2) Some of the latest clutches are probably replacement clutches, but it was not possible to

get enough information to dissociate first from replacement clutches, and thus to infer the latest egg-laying dates of the first clutches. The annual variation of this spread is generally not significant. Only the 1986 and 1989 egg-laying periods were significantly shorter than in other years.

Figure 2: First-egg-laying dates in 137 breedings between 1968 and 1990. X-axis: months divided into periods of 10 days; Y-axis : number of breedings.



Most of the eggs are laid during the last two thirds of February (Fig. 2). The first-egg-laying average date is the 24th February (s.d. = 16 days; n = 128); no annual variation could be detected (Table 1; no significant differences between average egg-laying dates).

Table 1: Annual first-egg-laying average dates.

Year	Average date	Standard deviation (days)	n
1977	23 February	15	12
1978	16 February	27	7
1979	21 February	22	10
1980	03 March	14	6
1981	26 February	18	16
1982	21 February	8	7
1983	04 March	24	15
1984	24 February	17	10
1985	21 February	19	16
1986	25 February	5	7
1987	24 February	20	10
1988	19 February	11	6
1989	25 February	6	6
Average or total:	24 February	16	128

CLUTCH SIZE, HATCHING RATE, REARING SUCCESS AND BREEDING SUCCESS

Eighty-Seven complete clutches were noted between 1968 and 1990, totalling 210 eggs (1xl, 51x2, 33x3, 2x4), giving a mean clutch size of 2.41. An evaluation of the hatching rate (1) is deduced from 70 clutches that were monitored immediately before and after hatching; it amounts to [(10x0) + (17x1) + (26x2) + (16x3) + (1x4)] young born/[(1x1) + (41x2) + (27x3) + (1x4)] eggs laid = 121/168 = 72%. This value is an under-estimation of the actual hatching rate, because of the influence of the monitoring that can only be unfavourable to this parameter. The minimal mean brood-size at hatch thus reaches 2.41 x 0.72 = 1.74.

The rearing success (2) is estimated from 60 nests where the numbers of fledged and born young are precisely known, i.e. [(3x0) + (22x1) + (23x2) + (11x3) + (1x4)] young fledged/[(17x1) + (25x2) + (17x3) + (1x4)] young born = 105/122 = 86%. This value is an under-estimation of the actual rearing success, for the same reasons as above.

The minimal breeding success (3) is thus 0.72 x 0.86 = 62%. The minima mean number of fledged young per clutch started is 0.62 x 2.41 = 1.50.

Another evaluation of this parameter is deduced from the ratio (number of young fledged/number of monitored breedings), i.e. 359 young fledged for 206 breedings monitored, or 1.74 young fledged per breeding. This leads to an estimation of the breeding success as 1.74/2.41 = 72%. This value is

(1): Hatching rate = ratio (number of young born/number of eggs laid).
(2): Rearing success = ratio (number of young fledged/number of young born).
(3): Breeding success = ratio (number of young fledged/number of eggs laid) = rearing success x hatching rate.

probably an over-estimation of the actual value of this parameter, in particular because of the clutches that did not hatch and could not be disclosed.

PRODUCTION OF THE POPULATION

The annual production of the population (number of young fledged per year) is the product [number of territories] x [territory occupation rate] x [rate of pairs that lay eggs] x [clutch size] x [breeding success]. Each year, on average, 54 to 73 young Eagle Owls thus fly away from the nests of the study area (54 = 43 x 0.94 x 0.89 x 2.41 x 0.62; 73 = 50 x 0.94 x 0.89 x 2.41 x 0.72).

This remarkable production has resulted in an increase of the population-size since the end of the 70s, when it was estimated at 35 pairs maximum (territories A and B excluded), see Bergier and Badan 1979. This can probably be attributed to a greater food-availability, due to an abundance of the Rabbit *Oryctolagus cuniculus* (the most frequent species in the diet, accounting for ca. 60% of the prey during the breeding period, (pers. obs.; Orsini 1985; Bayle *et al.* 1987), linked with an opening up of the environment which makes capture easier (setting-up of new tracks and cereal fields for feeding game birds; fires followed by preparation for reafforestation).

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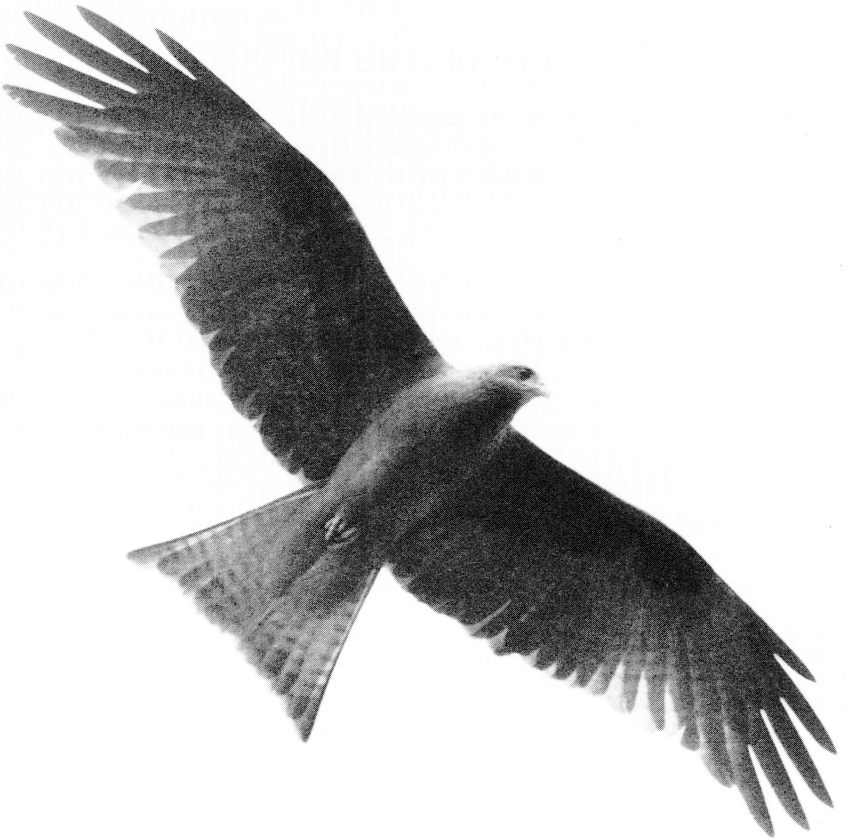

Black Kite *Milvus migrans*. Photo: B.-U. Meyburg