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SHORT REPORT

Parental care, nestling growth and diet in a Spotted Eagle *Aquila clanga* nest

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Capsule The breeding biology of the Spotted Eagle was studied and we analysed results from direct observations at a nest in Estonia.

The Spotted Eagle *Aquila clanga* is a little-studied globally threatened species (BirdLife International 2000). Most reports about its natural history are regional descriptions of nest sites, reproductive success and diet.

We explored three gaps of knowledge in the breeding biology of the Spotted Eagle at a nest in Estonia: (1) parental care; (2) nestling growth of an eaglet of known sex; (3) diet based on a comparison of direct observations and the analysis of pellets.

On 10 June 2000, a 2-day-old nestling (estimated after Kutchin 1961, Meyburg 1970 and personal experience) and an egg were recorded in a Spotted Eagle nest near Tartu, east-central Estonia. The nest was monitored from a hide 30 m from the nest on 29 June and every second day between 3 July and 10 August (a total of 21 days), while the nestling was 21–63 days old. To reduce disturbance, observers entered and left the hide at night, except when measurements were taken. A telescope (30 ×) was used to identify prey items and nest material. Individual recognition of adults was based on plumage differences; the one brooding the nestling in the beginning of the study was considered to be female. Weather conditions (rain, wind and sunlight) were recorded at the nest-site every two hours. Day lengths, temperature, rainfall, wind and cloud cover data were obtained from Tartu Observatory.

DNA analysis of a blood sample (after Griffiths *et al.* 1998) identified the eaglet as male. Weight, lengths of flattened wing and opened vanes of the primaries 6 and 7, as well as tail (measured with a thin ruler from the tips of central rectrices up to the flesh) and opened vanes of central rectrices, were measured every fourth day between 29 June and 8 August. We collected pellets and prey remains during the nest visits between 10 July to 11 August, and analysed them using standard methods (Marti 1987) and reference collections. The average weights of prey items include our own data on small rodents and frogs and several published sources (Kumari 1954, Korpimäki & Sulkava 1987, Siivonen & Sulkava 1996).

Typically for the species (Glutz von Blotzheim *et al.* 1989), the young Spotted Eagle left the nest at the age of 63 days, flying poorly some 30 m. During the next week, the nestling was not observed in the vicinity of the nest again. Two days before fledging the young weighed 1900 g and had a wing length of 430 mm.

Measurements and weights of Spotted Eagle nestlings of known age (including published data) are presented in Fig. 1. The vanes of flight feathers were just opened (5–7 mm) when the eaglet was 21 days old, and these continued to grow almost linearly up to fledging. In contrast, weight gain slowed after about 30 days. Weight, but not the wing-length, tail and feathers, are known to reach an asymptote of logistic growth also in other large raptors (Ellis 1979, Bortolotti 1984, Schaadt & Bird 1993). Hence, the lengths of wing and primaries are probably the best criteria for ageing Spotted Eagle nestlings after the age of three weeks.

The roles of parents at the nest were similar to that of the closely related Lesser Spotted Eagle *Aquila pomarina* (Meyburg 1970) and Golden Eagle *A. chrysaetos* (Collopy 1984). As the nestling matured, the duration of nest attendance by the parents decreased almost linearly (Fig. 2), but the female regularly spent the night on the nest until the nestling was 43 days old and occasionally later. Feedings by the female also decreased and stopped after the nestling was 55 days old. Although the nestling swallowed small prey by

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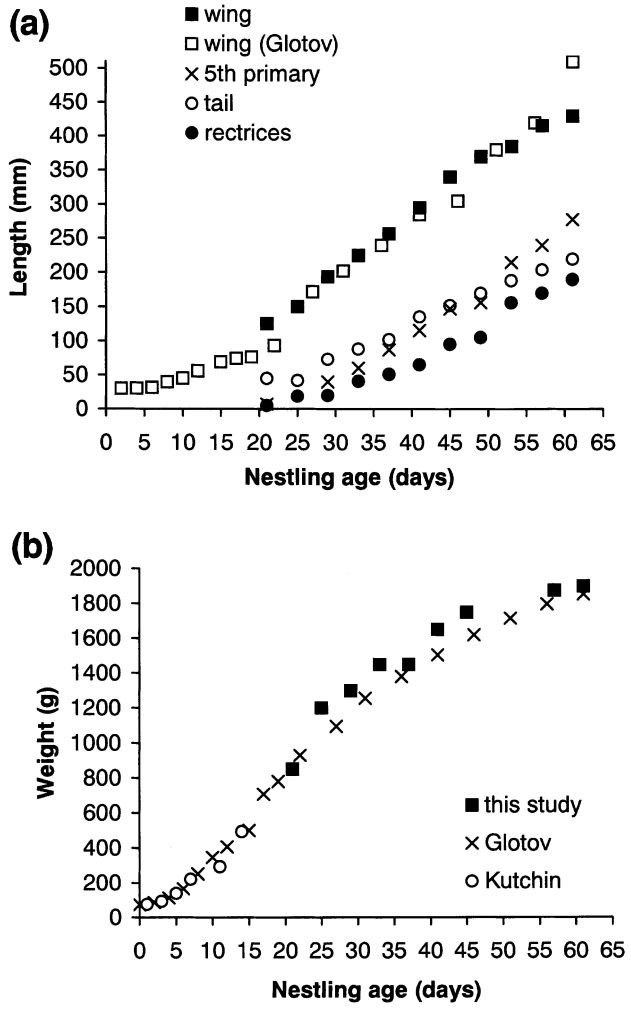

Figure 1. Growth data for Spotted Eagle nestlings: (a) body parts and feathers (data for wing-length from Glotov 1959); (b) body weight according to this study, Glotov (1959) and Kutchin (1961). Glotov's data on feather growth have been excluded because of insufficient details about his methods.

itself at the age of 25 days, it remained highly dependent on the female's care up to the age of about 50 days (Fig. 2). The male never fed the young, even though 90% of its visits were prey deliveries. Adding also the visits of adults of unknown sex, most (80%) of the probable visits of the male (n = 127) took less than a minute, and it attended the nest for no more than 8 (± 8 sd) min per day.

Most of the daily activity of the adults was during late morning and midday (e. g. 64% of prey was brought between 07:00 and 13:00 hours), and formed a smaller peak in the evening (Fig. 3). The active periods for bringing prey and nest material coincided significantly (for the data on Fig. 3: r_s = 0.58, n = 19, P < 0.01). However, we were not able to detect any impacts of

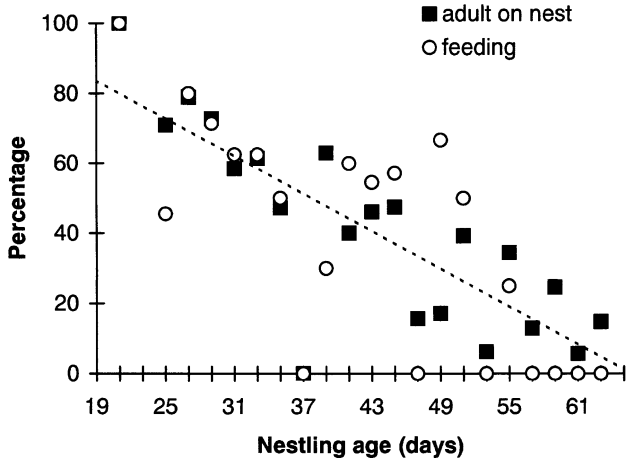

Figure 2. Percentage of day an adult attended the nest and the proportion of prey items fed to the nestling by female in relation to nestling age in the Spotted Eagle. Both correlations are highly significant (r_s = –0.92, n = 20, P < 0.001, and r_s = –0.71, n = 21, P < 0.001, respectively). Residuals of the linear regression (dashed line) between nestling age and the time of nest attendance were used to explore the impact of weather on parental care (see text).

weather on activity. Between 05:00 and 19:00 hours – daylight hours during the whole study period – adults tended to bring more prey or nest material in the hours with less rain (statistically not significant: r_s = –0.38, n = 15, P = 0.16). Similarly, residuals of the regression between nestling age and nest attendance by an adult (Fig. 2) were not related to the daytime without rain (r_s = –0.25, n = 20, P = 0.30) nor to the daily mean temperature (r_s = –0.07, n = 20, P = 0.78). The lack of relationships between the level of parental care and weather may have been due to the rainy summer (total rainfall in July 2000 was 117.8 mm, 57% greater than the normal level; A. Kallis pers. comm.), which may have forced the birds to hunt in bad weather.

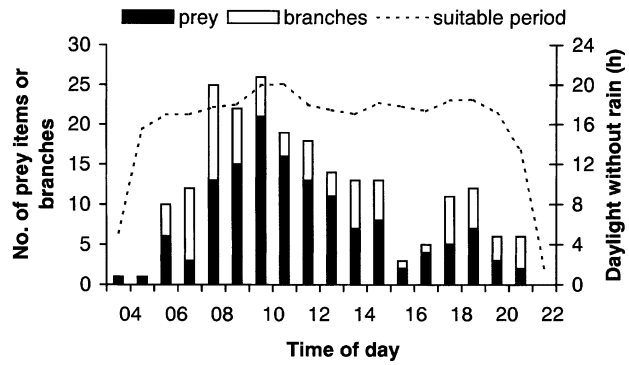

Figure 3. Number of prey items and branches brought to the Spotted Eagle nest during the day. The dashed line indicates the total observation time suitable for the activity of eagles (daylight, no rain).

According to visual observations, on average 6.9 (± 3.2 sd) prey items weighing a total of 399 (± 244 sd) g were delivered daily (n = 20). The female brought at least 15% of the items, in several cases taking prey (frogs and young birds) from the immediate vicinity of the nest. We did not detect significant general trends in the number and biomass of prey in relation to age of the chick (r_s = –0.29, n = 20, P = 0.21, and r_s = 0.12, n = 20, P = 0.62, respectively) nor a decline in prey-delivery rate before fledging (as is known for Golden Eagles; Collopy 1984).

Out of 105 visually identified prey items, *Microtus* sp. and unidentified rodents (probably *Microtus*) made up 63% by number but only 28% by biomass. Birds formed only 19% of prey number but 56% of biomass, as 45% of bird prey were medium-sized species (Hazel Grouse *Bonasa bonasia*, Grey Partridge *Perdix perdix*, Lapwing *Vanellus vanellus*, Hooded Crow *Corvus corone*).

Although four frogs were visually observed in the diet after 10 July, none of these appeared in pellets or prey remains. The proportion of mammals and birds by number did not differ significantly in the visual sample (82% mammals, 14% birds, n = 81) and pellets (85% mammals, 15% birds, n = 20; χ^2_{adj} = 0.08, P = 0.78). In some other raptor species the most accurate method for assessing diet is to combine analyses of pellets and prey remains (Collopy 1983, Simmons *et al.* 1991). We had too few prey remains to do this, but Priklonsky (1960) has shown that the relative frequency of birds in prey remains of the Spotted Eagle is several times higher than in pellets. Therefore, including prey remains is likely to overestimate the proportion of birds, and analysis of pellets seems to be the most effective method for studying Spotted Eagles' diet.

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