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Short Communications

Determining Age and Sex of Nestling Gyrfalcons

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Accurate aging of nestling birds is useful in determining breeding chronology so that informed management decisions can be made. Nestling age is also needed to estimate reproductive success using the Mayfield method (Mayfield 1975), which is useful in calculating a daily nest survival rate from all breeding attempts checked more than once during a breeding season. No growth data have been published that enable field workers to determine sex or estimate age (±3 d) of nestling Gyrfalcons (*Falco rusticolus*). Although sexually dimorphic in weight as adults (males = 62–68% of female weights on average [Cramp and Simmons 1980:360]), determining sex using weight of nestlings <4 wk old is unreliable, because 1) the possibility exists for asynchronous hatching (Poole and Bromley 1988), and 2) opposite-sex siblings are not always present for size comparison.

Estimating age by comparing nestlings to photographs of known-age chicks (Moritsch 1983) is too subjective to ensure accuracy to within a few days (Petersen and Thompson 1977; Bechard et al. 1985). Growth of primary remex feathers in raptors appears to be linear until shortly before maximum length is attained (Petersen and Thompson 1977; Ellis 1979; Newton 1979; Bortolotti 1984; Simmons 1984; Bechard et al. 1985). Length of the fourth primary remex has been used to estimate age of nestling Red-tailed Hawks (*Buteo jamaicensis*) to within ±2 d (Bechard et al. 1985). Length of central rectrix feathers has been suggested as a means of estimating age of nestling Gyrfalcons (after feather emegence) in Iceland (Nielsen 1986), but growth data were not presented. In this paper I present weight and feather growth rates and suggest how these measurements can be used to determine sex and estimate age of wild, nestling Gyrfalcons.

Research was conducted on the Kilgavik study area in the Northwest Territories, Canada (68°10′N, 106°15′W). Details on vegetation and climate of the area are reported in Poole and Bromley (1988). Weights and feather measurements were obtained from 11 male and 9 female known-age nestling Gyrfalcons in 1985 (3 nests) and 1986 (4 nests). Most nestlings were found on their day of hatch, or were observed as pipping eggs and assumed to hatch the following day (Newton 1979). Hatch of 2 nestlings at one nest was determined from time-lapse film (Poole and Bromley 1988). Sex was ascertained subjectively late in the nestling period (mean age of last measurements of nestlings = 38 d; range 33–42 d) based on weight dimorphism (Nielsen 1986) and differences in wing chord and tarsus length measurements among siblings and broods. All 20 nestlings fledged successfully.

Data were collected at irregular intervals of 2–7 d. Weights were obtained using a Pesola 300-g spring scale for younger nestlings (to nearest 1 g) and a 2000-g scale for larger chicks (to nearest 5 g). No allowance was made for crop contents. Feather measurements were taken using a plastic mm rule both from the right seventh primary remex (numbered distally from carpel joint) and from the right middle rectrix, from the point of insertion in the body (at the base of the follicle) to the feather tip ventrally along the straightened rachis. Nestlings were differentiated using felt pen marks on the head until 14 d of age when each was banded with numbered U.S. Fish and Wildlife Service aluminum leg bands. Visits to nests ended when chicks were about 40 d old and the chance of premature fledging and risk of injury was increased. Gyrfalcons typically fledge at 45–50 d of age (Cramp and Simmons 1980; Poole and Bromley 1988). Because of the small number of nestlings examined, all measurements were used to calculate regressions, even though data were not independent (see Bechard et al. 1985).

Weight gain of nestling Gyrfalcons (Fig. 1) followed a sigmoidal growth pattern typical in other raptors (Olendorff 1974; Ellis 1979; Newton 1979). During the period of rapid growth (6–27 d), males gained weight at about 50 g/d and females at about 59 g/d ($F = 6.39$; df = 1,85; $P < 0.02$).

Regression coefficients of seventh primary remex length by age were slightly greater than those from middle rectrix length by age for both sexes (males: remex $r = 0.986$, rectrix $r = 0.979$; females: remex $r = 0.986$, rectrix $r = 0.968$). Rectrices were often tattered because of abrasion from nest substrate, therefore age estimation was calculated using primary remex length only. No significant difference in feather growth (dependent variable) with age occurred between sexes (ANOVA, $P > 0.75$), and data for males and females were combined. Seventh primary remiges emerged when chicks were about 11 d old (Fig. 2). Feather growth was linear over the period examined but probably decreased closer to fledging (likely beginning about 40–42 d of age). Using inverse prediction (Sokal and Rohlf 1981:497) from a linear relationship (Bechard et al. 1985), nestling age (NA) for young >11 d old can be determined from seventh primary remex length as

$$NA = 0.15PL + 11.7 \qquad (1)$$

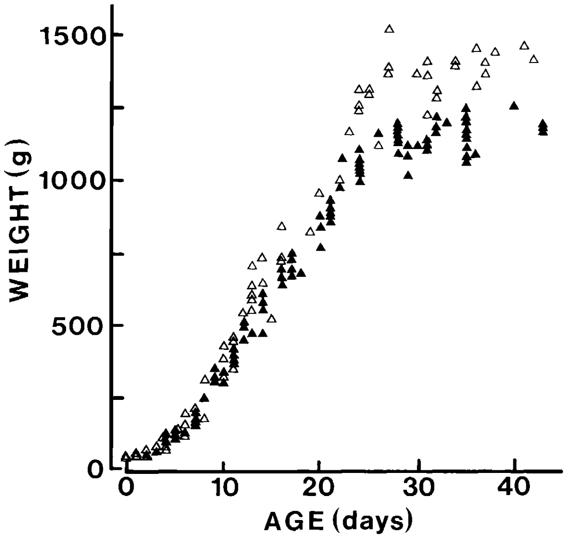

Figure 1. Relationship between age and weight of male (closed triangles) and female (open triangles) nestling Gyrfalcons. Data points include repeated observations on individuals (males N = 11, females N = 9).

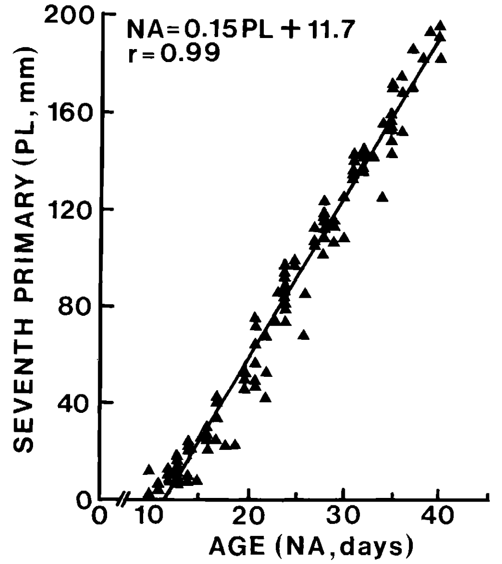

Figure 2. Relationship between nestling age (NA) and length of seventh primary remex (PL) of Gyrfalcons. Data points include repeated observations on individuals (N = 20).

($r = 0.99$, $P < 0.001$), where NA is nestling age (d) and PL is seventh primary remex length (mm). All data points (N = 108) from the 20 nestlings, except for 4 points from the same nestling, were within 3 d of predicted age, and most points (88%) were within 2 d (Fig. 2). The 95% confidence limits for age estimates using the above equation were ± 3 d (Snedecor and Cochran 1967:159–160).

In nestlings ≤ 11 d old, prior to emergence of primary remiges, age is best estimated by weight by the equation

$$NA = -0.000069(WT)^2 + 0.057(WT) - 1.2 \quad (2)$$

where NA is nestling age (d) and WT is nestling weight (g). All points used to determine this equation (age ≤ 11 d, N = 50) were within 2 d of predicted age.

A combination of weight and seventh primary remex length measurements can be used to determine sex of nestlings >11 d old. As a result of similar primary growth between sexes but more rapid weight gain in females, a plot of seventh primary remex length against weight produced a range of points generally separate by sex (Fig. 3). A plot of seventh primary length versus weight from a nestling of unknown sex should produce a point on one side or the other of the curved line in Fig. 3.

Estimation of age or sex can be biased by several factors. Weight curves are subject to daily or seasonal variation in food availability, such that starved females could be classed as large males (Fig. 3). However, starvation appears to have a minimal effect on growth of remex feathers (Petersen and Thompson 1977). Although growth of remiges in young Gyrfalcons appears linear until late in the nestling period, limited evidence suggests that growth rate of remiges may fluctuate to some extent (D. G. Roseneau, pers. comm.).

Larger sample sizes may increase the accuracy of predictions, and use of nonindependent data in my analyses may have underestimated variation. However, I believe techniques presented here are adequate to estimate age and determine sex of nestling Gyrfalcons up to about 40 d of age in the central Northwest Territories. Because size differences in Gyrfalcons are minor throughout their range (Cramp and Simmons 1980), these techniques may apply to other regions as well. Additional tests would determine the applicability of these equations to Gyrfalcons elsewhere.

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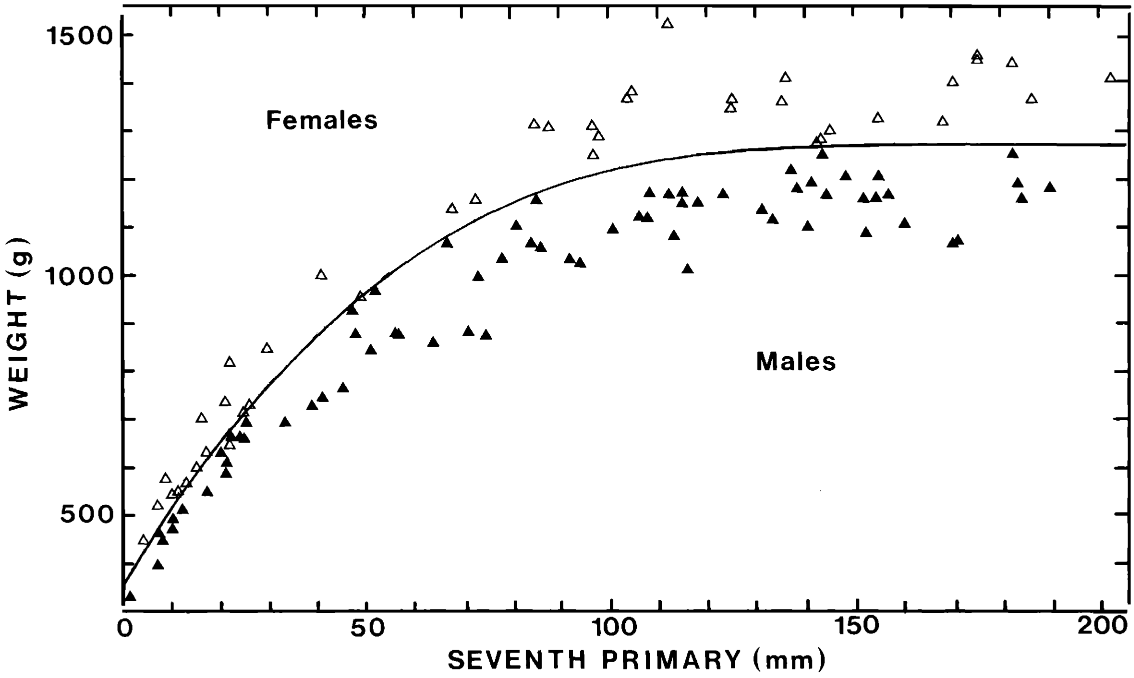

Figure 3. Relationship between length of seventh primary remex and weight of male (closed triangles) and female (open triangles) nestling Gyrfalcons. Data points include repeated observations on individuals (males N = 11, females N = 9). Dividing line placed by eye.

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