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Department of Environmental, Population and Organismic Biology, University of Colorado, Boulder, Colorado 80302. Accepted for publication 13 September 1975.

GROWTH OF THE SWAINSON'S HAWK

JAMES W. PARKER

The growth of naturally-raised birds of prey is inadequately documented. When analyzing the growth patterns of 105 bird species, Ricklefs (1968) had to calculate growth statistics from single broods or individuals of many bird species, and for North American species of *Buteo* he could discuss only the Red-tailed Hawk (*B. jamaicensis*). Ricklefs' (1968, 1973) emphasis on the importance of growth rates in avian reproductive biology illustrates the need for continued fieldwork on bird growth and prompts me to report the growth of a brood of Swainson's Hawks (*B. swainsoni*). No published data describe the growth of wild-raised Swainson's Hawks, although Olendorff (1971) studied captive juveniles and tabulated all references of growth studies of raptors then available.

In 1970 I studied the nesting of a pair of Swainson's Hawks 6.4 km east of Arnett, Ellis County, Oklahoma. The nest was a mass of sticks typical for this species, about six dm in diameter and four m up in a 6-m osage orange tree (*Maclura pomifera*) on the south side of a shelterbelt woodlot. A colony (six nesting attempts) of Mississippi Kites (*Ictinia misisippiensis*) used the same group of trees. When found, the hawk nest held two nestlings and one egg that did not hatch and eventually disappeared. The ages of the two nestlings were estimated at three and five days on the basis of my experience and comparison with Olendorff's (1971: 234, 243) data for weight and tarsal length.

Weight and several body dimensions of the nestlings were measured at irregular intervals (table 1). Tarsal length was measured as the distance along the posterior surface of the tarsus from the base of the first digit to the posterior side of the distal head of the tibiotarsus at the heel; the tarsometatarsus was held perpendicular to the tibiotarsus. I measured the culmen as the chord from the anterior dorsal edge of the cere to the tip. The third-toe claw measurement was the chord from the tip of the claw to the proximal-most ventral surface of the claw at the toe pad. The greatest weights of the juveniles were estimates because the tares for a triple-beam balance were not available, and a spring scale graduated in English units was used to weigh the nestlings. Feather length was the distance from the point where the shaft exited the skin to the tip of the rachis minus natal down. The seventh primary remex and the longer of the two central rectrices were used.

The younger nestling was recently dead in the nest when it would have been 32 days old. Its condition did not indicate malnutrition; rather, it died of injuries suggesting either intentional or unintentional

TABLE 1. Growth data for two sibling Swainson's Hawks. The italicized days of age indicate the older nestling.

Days of age	Weight (gm)	Tarsal length (mm)	Culmen (mm)	Third toe-claw (mm)	Seventh primary (mm)	Longer central rectrix (mm)
3	49	17.9	8.7	2.6		
5	72	20.8	8.8	3.4		
10	226	35.5	12.4	6.1	1	
12	322	39.4	13.3	6.8	6	
15	328	47.2	15.3	8.5	20	
17	470	56.3	15.9	9.5	35	11
21	530	54.5	16.4	11.8	63	27
23	595	64.5	18.0	11.4	83	42
32	680	69.6	19.4	13.2	111	79
34	610	72.0	20.8	13.9	169	112
40	–	75.4	21.1	14.4	209	133

TABLE 2. Growth constants (K) of nestling Swainson's Hawks based on the logistic equation and calculated according to Ricklefs (1967). Asymptotes (a) are given for the wild-raised nestlings. Data for captives are from Olendorff (1971).

	Weight		Tarsal length		Culmen	
Nestlings	a (gm)	K	a (mm)	K	a (mm)	K
Wild-raised						
older	625	.202	76	.149	22	.089
younger	700	.202	75	.124	20	.126
Captive-raised						
mean		.172		.164		.111
range		.161–.189		.143–.186		.108–.114
N		4		4		2

fratricide or "Cainism." Thus, its weight and measurements at day 32 were included in the analysis.

Data for weight, culmen, and tarsal length were first examined graphically and then fitted to the logistic equation according to the methods of Ricklefs (1967). This technique converts a sigmoid curve of raw data into a more-easily-compared, linear function with a constant, K, indicating growth rate. Using this method, Olendorff (1971) found that the logistic function provided a best fit to data for captive Swainson's Hawks, and my choice of the logistic was made to facilitate comparisons.

Growth constants (K) were calculated using the asymptotes in table 2. The small number of data points near asymptotic age made the choice of asymptotes somewhat arbitrary, but they were similar to Olendorff's (1971) asymptotes for four male nestlings. The values of K were determined from a least-squares regression fit to the data as transformed into values from Ricklefs' (1967) appendix and not by eye fit.

Values of K (table 2) indicate that the wild nestlings increased in weight at identical rates, but 17 percent faster than the average for Olendorff's (1971: 311) captives, and 25 percent faster than his slowest-growing bird. Graphs of raw data showed that more rapid growth by the wild nestlings before 15 days of age was particularly responsible for the larger K values. Variation among K values for Olendorff's captive nestling Swainson's Hawks showed the two nestlings in 1970 growing at 93.2 percent of the rate of two raised in 1969, but overall variation among the Swainson's Hawks was comparable to variation among the K values of Olendorff's (1971: 309–310) other captive buteos. Thus variation in growth rate for the Swainson's Hawks might have been completely unrelated to their mode of upbringing. Difference in food intake might be expected to result in variation in growth rates between wild-reared young, but Ricklefs (1968: 432) showed that, unless severe, food deficiencies may have only a minor effect on growth rate.

Average values of K for both culmen and tarsal length are lower than Olendorff's averages and the former are contradictory in regard to which nestling grew faster. However, differences in measuring techniques could account for the first fact, and the second is probably due to the small number of data points for the wild nestlings. Ricklefs (1973) mentioned that error of 30–40 percent in estimates of growth rates can obtain if data sets for each bird are small, but that such error was acceptable in his analysis.

Based on extrapolations from plots of raw data, the juvenal remiges apparently emerged when the wild nestlings were 9–11 days old, and those of the rectrices appeared at about 14–15 days.

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Department of Biology, State University of New York at Fredonia, Fredonia, New York 14063. Accepted for publication 29 January 1976.

MORTALITY OF BANDED PEREGRINE FALCONS THAT HAVE BEEN HELD IN CAPTIVITY

WILLISTON SHOR

Snyder and Snyder reported (Condor 76:215–216, 1974) that four of 33 young Cooper's Hawks (*Accipiter cooperii*) that they had familiarized with human beings in the course of their studies at the nest had been recovered in less than a year after banding. They attributed all of these recoveries to "predation by man." Three of the birds had been shot and one had been killed in a building. Only one of 202 other Cooper's Hawks that they had banded in the nest and which had then been subjected to little exposure to human beings was recovered within a year after banding (one other was recovered two years and nine months after banding). The Snyders therefore concluded that the recovery of the four birds killed by "predation by man" was