 0030-0950/79/0001-0037$1.00/0

BRIEF NOTE

GROWTH ANALYSIS FOR AGING: FEMALE GREAT HORNED OWL[1]

MARK A. SPRINGER,[2] Department of Zoology, Miami University, Oxford, OH 45056

OHIO J. SCI. 79(1): 37, 1979

Complete growth data obtained from one Great Horned Owl (GHO) *Bubo virginianus*, seems insufficient to document growth, but upon inspection of the literature, this information is found to be of value. In Ricklefs' (1928) literature search of growth patterns of 105 species, only one study was reported for the GHO. Hoffmeister and Setzer (1947) reported the daily body weight changes of three nestlings, but they reported only sporadic quantitative information on culmen and primaries, no identification of which primaries they measured, and no information on the growth of the tarsus. Reed (1925) reported weekly body weight changes for two tethered young owls but, reported no information on culmen, primaries, and tarsus. My report is concerned with the daily growth measurements of body weight, tarsus, culmen, and second and seventh primaries of one female GHO, in central Ohio.

During the winter of 1975–76, I located 59 GHO nesting pairs, 6 non-nesting pairs, and 9 individuals in a 510 sq. km. area of Delaware County, Ohio. To dedetermine laying, hatching, and fledging dates, growth analysis was undertaken with two nestlings, only one of which survived. This information, together with the natural growth rates reported by Hoffmeister and Setzer (1947), enabled reliable determinations of nestling age for the first 3 weeks of growth. Growth parameters where defined after Olendorff (1971).

The nest (containing two eggs) was located in a squirrel nest approximately 40 feet above ground in a beech tree. One egg was piped on March 16; the second egg showed no signs of hatching. (After a week had passed, the second egg was presumed addled and was removed from the nest for subsequent chemical anslysis). For the next 31 days,

[1]Brief note received 8 December 1977 and in revised form 21 June 1978 (#77-92).

[2]Current Address: Department of Anatomy, Wright State University, Dayton, OH 45435.

daily measurements of body weight, tarsus, culmen were taken. Measurements of the second and seventh primaries were taken upon their appearance. Due to inclement weather measurements were not taken on days 15, and 30. On day 29, severe attacks by both adults prevented measurements of the tarsus and seventh primary being taken.

The nestling fledged on day 31. Length of GHO nestling period is reported to average 43 to 49 days (Hoffmeister and Setzer 1947). Premature fledging is reported to occur among flightless GHO nestlings (Austin and Holt 1966· Baumgartner 1938). Craighead and Craighead (1956) reported frequent visits to the nest may cause premature fledging. Frequent visits may have accounted for premature fledging at 31 days, however, the daily reduction of the nest size most likely would have caused similar results. By the third week, the nest was just large enough for the nestling to sit in. To increase the stability of the nest, I added sticks to the nest daily. After 10 days, however, premature fledging did occur.

The general form of the growth curves based on body weight was sigmoid. Three distinct stages could be defined: lag phase, logarithmic (log) phase, and decay phase (Olendorff 1971). Similar to Hoffmeister and Setzer (1947), the lag phase ranged between days 1 and 3, the log phase ranged between 4 and 24 days, and the decay phase ranged between day 24 and fledging (table 1). In both studies, nestlings fledged at ¾ their adult weight. Sexual dimorphism, as determined by weight, was not apparent until day 10 (Hoffmeister and Setzer 1947). Fitting the growth data to a logistic growth equation:

$$W(t) = A/(1+\exp(-K(t_1-t_2)))$$

where W(t) is weight at age t, A is the asymptote, K is the growth rate constant

Table 1

Growth Data For One Female Great Horned Owl, in Central Ohio.

Age days	Weight (gm)	Tarsus (mm)	Culmen (mm)	2nd Primary (mm)	7th Primary (mm)
1	63	20.6	10.0	—	—
2	76	20.6	10.0	—	—
3	79	20.6	11.9	—	—
4	114	21.0	11.9	—	—
5	125	21.5	12.2	—	—
6	158	22.5	12.6	—	—
7	197	24.7	13.0	—	—
8	230	26.4	13.8	—	—
9	270	28.4	14.0	—	—
10	275	28.2	14.2	1.3	1.1
11	350	31.4	14.4	4.1	3.2
12	380	34.0	15.0	8.3	5.6
13	420	35.5	16.2	9.0	10.0
14	445	40.0	16.8	9.7	15.4
15	—	—	—	—	—
16	575	43.5	17.0	10.9	16.0
17	630	43.5	17.5	15.0	18.0
18	735	43.9	17.5	19.5	21.9
19	750	44.5	17.9	24.0	26.0
20	800	46.4	18.3	28.7	32.0
21	810	51.3	19.1	35.0	38.9
22	861	51.5	19.6	38.0	45.1
23	920	51.7	20.3	42.0	51.0
24	1020	53.1	20.5	60.0	59.4
25	1000	56.0	20.7	64.5	63.7
26	1000	58.1	21.4	78.0	82.0
27	995	59.2	21.5	86.0	86.0
28	995	60.1	21.9	88.6	86.2
29	1035	—	22.4	92.0	—
30	—	—	—	—	—
31	1021	60.5	23.5	98.4	99.0

and t is the age at inflection (50% of A). I calculated K = 0.1900 (using 1200 as A) and t = 16.2 days. The growth constant for Hoffmeister and Setzer's (1947) two birds is equivalent to K = 0.138. Provided all the birds were healthy and well-nourished, the wide variation in K, may indicate some geographical variation within the population (Ricklefs, 1928).

Growth in the culmen was rapid and essentially a linear relationship with age from day 3 to fledging. Culmen measurements from the two studies were nearly identical.

Changes in the length of the tarsus followed a signoidal pattern of growth. Within 5 days of hatching, the tarsus began to grow so rapidly that within 28 days it had reached asymptotic value. Growth in the second and seventh primaries was rapid and essentially a linear relationship with age from day 10 to fledging. Growth of the two primaries was similar to those values reported by Hoffmeister and Setzer (1947). Development of the feather tracts, vision and defense behavior proceeded as reported by Austin and Holt (1966), Hoffmeister and Setzer (1947), and Reed (1925).

Body weight measurements are an effective method to determine the relative age of healthy birds. To obtain an accurate measure of age, however, one must measure weight, tarsus length, 2nd and/or 7th primary length and culmen length. Body weight is only useful in the early stages of growth, but once decay phase (approx. day 24) is reached, the reliability of weight measurements in predicting age decreases substantially. Primary feather measurements, however, offer a complementary measurement for aging. Whereas body weight and culmen length vary with food intake, Schreiber (1976) reports no change in the growth rate of wing length. Schreiber (1976) further indicates that once the feather begins to grow, the amount of resource allocation necessary for continued growth of a feather is considerably lower than that necessary to form the bone and other materials involved in culmen growth. Hence, feather development is a good measurement for obtaining specific age of individual birds. Similarly, weight measurement up to the decay phase is useful in determining relative age, but past this point it serves better as an indicator of the health of the individual birds.

LITERATURE CITED

Austin, G. R. and J. B. Holt 1966 The World of the Great Horned Owl. J. B. Lippincott, Philadelphia. 158 pp.

Baumgartner, F. M. 1938 Courtship and Nesting of the Great Horned Owls. Wilson Bull. 50: 274–285.

Craighead, J. J. and F. C. Craighead, Jr. 1956 Hawks, Owls, and Wildlife. Stackpole Co., Harrisburg. 433 pp.

Hoffmeister, D. D. and H. W. Setzer 1947 The postnatal development of two broods of Great Horned Owls. Univ. Kansas Publ., Museum of Natural History 1: 157–173.

Oldendorff, R. R. 1971 Morphological aspects of growth in three species of hawks. Unpubl. Ph.D. Dissertation. Colorado State Univ., Fort Collins. 460 pp.

Reed, B. P. 1925 Growth, development, and reactions of young Great Horned Owls. Auk 42: 14–31.

Ricklefs, R. E. 1928 Patterns of growth in birds. Ibis. 110: 419–451.

Schreiber, R. W. 1976 Growth and development of Nestling Brown Pelicans. Bird-Banding 47: 19–39.