AGING YOUNG HERRING GULLS FROM MEASUREMENTS OF BODY PARTS

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A simple and reliable method for aging young chicks is often desired by people working on behavioral, developmental, and other studies involving certain bird species. The Herring Gull (*Larus argentatus*) is often used in such studies because it nests in large and often accessible colonies where observations can be made on a large number of chicks in a rather small area. In this paper, we describe a simple and accurate method for aging young Herring Gull chicks. Because of variability, Hailman (1961) concluded that the length of the tarsus alone was not an accurate method for aging Laughing Gull (*Larus atricilla*) chicks, and Smith and Diem (1972) found that California Gull (*Larus californicus*) chicks could not be aged more precisely than to the correct week by using tarsal measurements and plumage characteristics. However, by taking measurements of several different body parts and comparing them to age through a multiple regression analysis, Holcomb and Twiest (1971) were able to age Red-winged Blackbird (*Agelaius phoeniceus*) nestlings to within ±1 day. We attempt, also, to use combinations of measurements as criteria for aging. Aging based on more than one characteristic seems to be much more accurate than a method based entirely on a single measurement.

METHODS

Birds used in this study were from a nesting colony on Kent Island (about 2.8 km long) located about 8 km south of Grand Manan Island, New Brunswick, Canada. An estimated 15,000 pairs of Herring Gulls nest on the island during the spring and summer (Paynter, 1949). We sampled chicks from two different areas on the island during June and July of 1976. A large group of 39 nests was located near the south end of the island in the main part of the colony. A smaller group of 14 nests was located near the north end of the island where nests were sparser. Both areas were covered with high, thick grass.

Each nest was identified by a numbered stake driven into the ground beside it. We numbered the eggs in each nest in the order of laying with a black waterproof felt pen and checked the progress of each egg daily. When a chick hatched, it was banded immediately with a U.S. Fish & Wildlife Service aluminum leg band crimped down slightly, as described by Paynter (1949), so that it would not slip over the foot. At the time of banding, the chick was designated one day old. We knew the time of hatching to within approximately one-half day. The first day measurements were taken at the time of banding, and thereafter, measurements were taken daily at as near to the same time as possible. We took measurements from the time the chick hatched until it either died or fledged. If a chick was missing for more than six consecutive days, we assumed that it was dead.

Three measurements were made on each chick every day: tarsus, culmen, and wing length. Weights were taken every other day, but they proved to be too variable for use in this study. Tarsus measurements were made from the tarsal joint to the metatarsal joint as described by Hailman (1961). We took the culmen as the length from the tip of the bill to the base of the feathers on the upper side as measured with calipers (Baldwin et al., 1931). Wing length was measured from the carpal joint to the tip, not including any down (or, later, primary feathers). All measurements were made to the nearest 0.5 mm.

The data obtained appeared to be extensive enough to allow some calculation of age, so we calculated the correlation coefficients for each measurement compared to age in days on a computer. This provided some insight as to how closely each component was related to age and thus how important each might be in calculating age. The data were then run through a multiple regression routine to determine the regression coefficients necessary for calculating age.

One of the main problems in collecting data was finding the chicks every day. Chicks three or more days old were active and ran at the sight of humans. Their habit of hiding from predators in the high grass made finding them impossible at times, especially the older chicks. This, plus the high mortality rate among Herring Gull chicks, caused a sharp decrease in the original sample size during the sampling period. Parsons (1971) reported a 57% mortality rate in Herring Gull chicks, and Paynter (1949) reported a 51% mortality rate in chicks from the Herring Gull colony on Kent Island. Although we did not calculate the mortality rate for our sample population, it seems fairly consistent with the above percentages.

TABLE 1.
Tarsal growth in Herring Gull chicks.

Age (days)	n	Mean tarsal length (mm)	Standard deviation	95% Confidence interval
1	66	33.1	1.28	32.8–33.4
2	53	34.5	1.88	34.0–35.0
3	49	36.0	1.54	35.5–36.3
4	45	37.4	1.84	36.9–37.9
5	26	38.5	1.57	37.9–39.1
6	30	39.6	6.92	37.1–42.1
7	20	40.8	2.81	39.6–42.0
8	13	42.7	3.19	41.0–44.4
9	11	43.5	3.01	41.7–45.3
10	9	47.9	3.36	45.7–50.1
11	9	48.9	4.58	45.9–51.9
12	3	48.5	4.49	43.3–53.7
13	4	52.0	1.87	50.1–53.9
14	4	56.6	2.92	53.8–59.4
15	4	55.9	2.79	53.2–58.6

Consequently, although we started with a large sample, the data became too scattered to make any significant calculations for birds older than 15 days.

RESULTS AND DISCUSSION

Tables 1, 2, and 3 show tarsal growth, wing growth, and culmen growth respectively. Figures 1, 2, and 3 show, respectively, tarsus length,

TABLE 2.
Wing growth in Herring Gull chicks.

Age (days)	n	Mean wing length (mm)	Standard deviation	95% Confidence interval
1	65	23.2	1.78	22.8–23.6
2	47	24.8	1.06	24.5–25.1
3	50	25.9	1.28	25.6–26.3
4	42	27.1	1.20	26.7–27.5
5	26	28.0	1.49	27.4–28.6
6	27	29.5	1.75	28.8–30.2
7	20	29.2	2.39	28.2–30.2
8	13	31.2	2.93	29.6–32.8
9	11	32.4	3.18	30.5–34.3
10	9	36.1	3.39	33.9–38.3
11	9	38.6	4.80	35.5–41.7
12	3	36.7	5.98	29.9–43.5
13	4	45.0	3.02	42.1–47.9
14	4	49.8	4.87	45.0–54.6
15	4	50.1	6.35	43.8–56.2

TABLE 3.
Culmen growth in Herring Gull chicks.

Age (days)	n	Mean culmen length (mm)	Standard deviation	95% Confidence interval
1	65	19.3	0.27	19.2–19.4
2	48	19.9	0.69	19.8–20.2
3	48	20.2	0.78	20.0–20.4
4	42	20.8	0.53	20.6–20.9
5	26	21.7	0.21	21.6–21.8
6	29	22.7	0.79	22.5–23.1
7	20	23.1	0.89	22.7–23.5
8	13	24.4	1.30	23.7–25.1
9	11	24.9	1.02	24.3–25.5
10	9	25.8	0.48	25.5–26.1
11	8	27.3	1.93	26.0–28.6
12	3	26.0	2.24	23.5–28.5
13	4	29.8	0.56	29.3–30.3
14	4	32.8	1.35	31.5–34.1
15	4	30.5	0.35	30.2–30.8

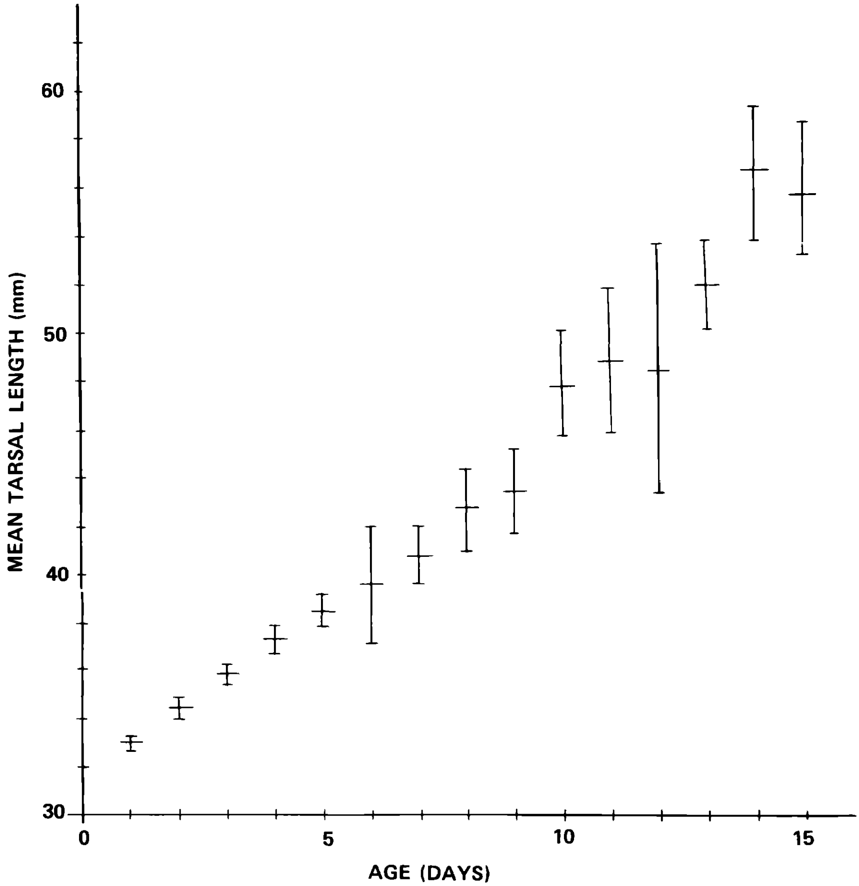

FIGURE 1. Tarsal growth in Herring Gull chicks. Outside lines enclose 95% confidence intervals. Correlation coefficient = .987.

wing length, and culmen length, each as a function of age. All three curves are approximately linear.

We calculated the correlation coefficients for each measurement versus age and they are: tarsus—.987; wing—.948; culmen—.966. These coefficients show that tarsus length is the best correlated with age, followed by culmen and wing length. However, by looking at the 95% confidence intervals shown in Figure 1, it is evident that tarsus length alone is not enough to age the chicks accurately. For example, according to Figure 1, a chick having a tarsal length of 49 mm could be anywhere between 10 and 13 days old. Wide variability is also present in the wing and culmen measurements. Because of this, we chose a method that took all three measurements into consideration when calculating age.

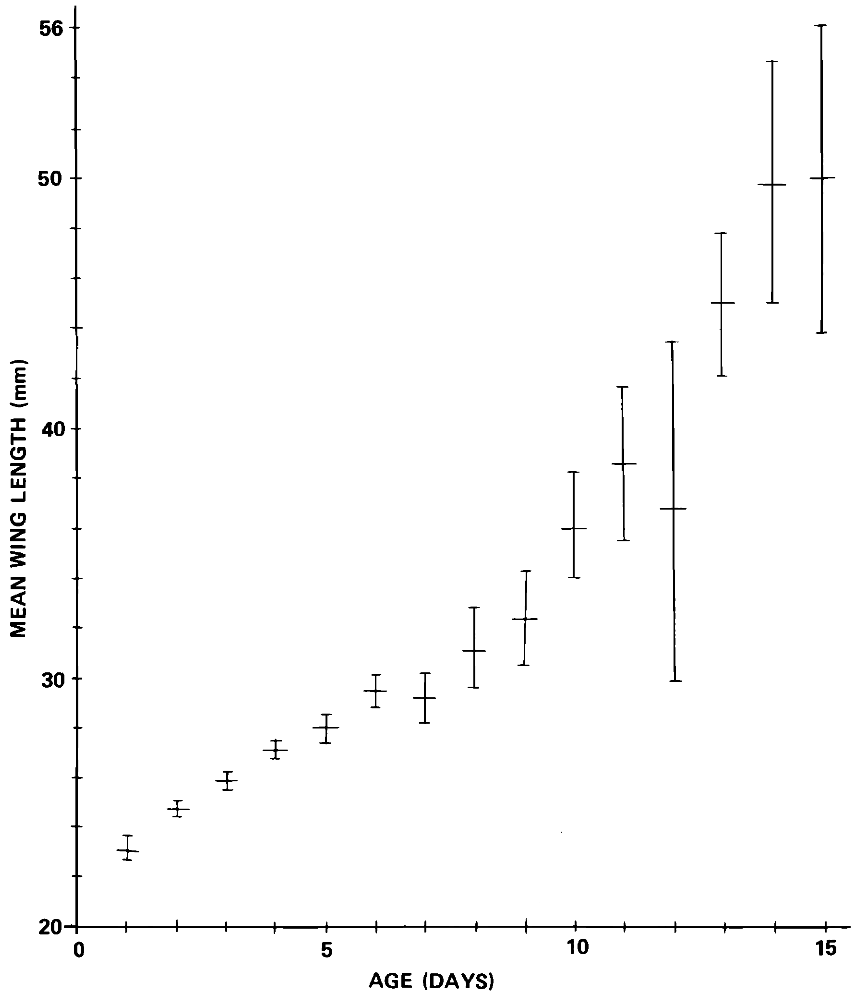

FIGURE 2. Wing growth in Herring Gull chicks. Outside lines enclose 95% confidence intervals. Correlation coefficient = .948.

We ran the data through a linear multiple regression routine that calculates regression coefficients for each independent variable (tarsus, wing, culmen) against the dependent variable (age). The resulting equation was:

$$A = .906(T) - .216(W) - .143(C) - 20.9$$

where A = age in days, T = tarsus length (mm), W = wing length (mm), and C = culmen length (mm).

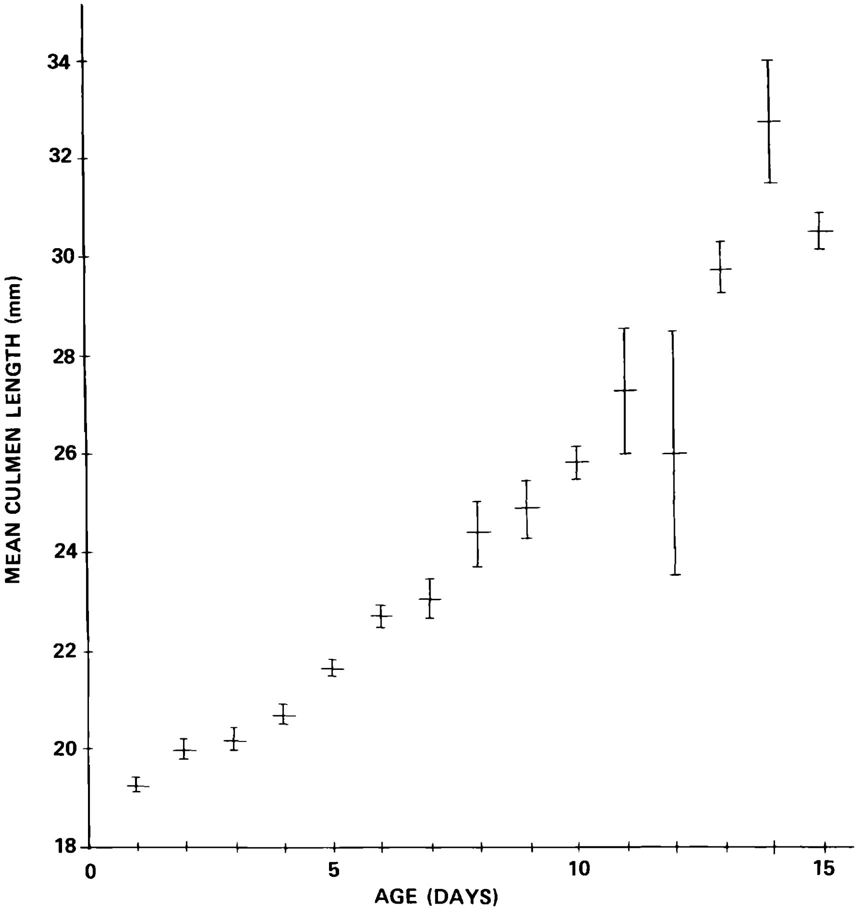

FIGURE 3. Culmen growth in Herring Gull chicks. Outside lines enclose 95% confidence intervals. Correlation coefficient = .966.

This equation predicts the age of chicks up to approximately 20 days with an error of ±14%. For example, if a chick has a tarsus = 37 mm, wing = 27 mm, and culmen = 21 mm, its age would be 3.8 days, plus or minus 0.5 days.

The relative error increases with age, so that while a four-day-old chick can be aged to within ±0.5 days, a 16-day-old chick, for example, can be aged only to within ±2.2 days. The larger relative error in older chicks is caused by the varying individual growth rates of chicks subject to factors such as hatching order. Parsons (1970) reported that the youngest chick in a clutch is often smaller and weaker than the others. This becomes more apparent as the chicks get older.

Hand rearing chicks probably could have supplied more data in the post-16-day-old period, but Smith and Diem (1972) found that chicks raised by hand weighed 12 to 15% less and had 5% shorter tarsi than wild chicks of the same age. Since we wanted our results to be applicable to wild chicks, we attempted to keep conditions as natural as possible and disturb the chicks only when necessary. Another season is needed to collect more data from older chicks to make aging after 20 days feasible.

SUMMARY

From a colony on Kent Island, chicks from 53 nests of Herring Gulls were studied from hatching until fledging. Individual eggs were marked and checked daily such that the hatching times for the chicks were known to within 0.5 day. Then, measurements of the tarsus, wing, and culmen were taken daily until the chick either died or fledged. The data obtained were then run through a computer that compared the graphs of tarsus length versus age, wing length versus age, and culmen length versus age in a multiple regression routine. The resulting equation was:

$$\text{Age} = .906\,(\text{Tarsus}) - .216(\text{Wing}) - .143(\text{Culmen}) - 20.9$$

This equation predicts the age, up to approximately 20 days, of Herring Gull chicks with an error of $\pm 14\%$.

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