# FEATHER STUDIES ON THE CALIFORNIA CONDOR

By Loye Miller

Since the California Condor (*Gymnogyps californianus*) has developed such a strong candidacy for the pluperfect status and seems likely to win in spite of all we can do to stem the tide, our interest has become most active, and any information regarding the species from any source whatever is considered worthy of record. I have recently had the questionable pleasure (with unquestionable profit) of tearing down an old and badly worn mount of the species, placed in my hands by Mr. W. Lee Chambers. Hunters had killed the bird in the Santa Monica Mountains, California, some thirty years ago and had brought it, none too promptly, to the Chambers' sporting goods store in Santa Monica where it was mounted in really creditable amateur fashion by Chambers and Harry Rising.

The bird was killed at a season when it was in the process of molting the remiges, so that a partial record of this process was obtainable. Unfortunately the long post-mortem deterioration of the plumage made it impossible to detect "unworn" feathers in those instances in which the calamus had been completely developed.

The youngest quill in the primary series was number five; a mere tuft of barbs was projecting from the enclosing sheath. Next older was number eight, with the calamus two-thirds complete. Then followed number seven with the calamus beginning to close at the base. Other primaries were complete and all probably had been fresh thirty years ago, except possibly number six which appeared more like an old quill than the others. Should this number six be the only remaining primary unmolted, we could say that at the time the bird was killed the molt was more than half completed for the primary series. Numbers one (innermost), two, three, four, nine, and ten, had been replaced and the remainder were following the order, seven, eight, five, and six.

There were twenty feathers in the secondary series, of which about one-third were developing feathers. The others appeared to have been recently replaced. The new feathers had sprouted in the following order: number one (outermost), fourteen, eighteen, three and nine, nineteen, and twelve. It would seem that the primary and the secondary series had both changed to about the same extent and that the molt had proceeded in both at the same time.

It was interesting to note that, in the spread wing, the vacancies in the primaries were temporarily closed up by the approximation of adjacent feathers, whereas the secondary spaces were not thus closed. This fact, due in part to the angle the feather subtends with the long axes of the wing bones and in part to the greater width of the secondaries, may be of importance. It would tend to keep the plane area more dependable in the region where greatest strain falls, that is, in the tip.

It is interesting also to note how the greater primary coverts are flexed at the junction of calamus with vane to support at least two of the primaries. To illustrate: the calamus of covert number one is bound very tightly to that of its primary on the dorso-distal side and the two are parallel out to the base of the vane. Here the shaft of the covert angles sharply outward, to cross primary number two and terminate in the space beyond it. This angle is less pronounced as the wing tip is approached and even becomes slightly reversed in covert number ten. Both the Andean and California Condors show this arrangement. Is it a provision for absorbing the great strain on the primaries and for distributing some of it to the coverts in these heavy bodied birds? The California Brown Pelican shows almost none of such arrangement, and in the Glacous-winged Gull, it is entirely lacking.

As the terminal portion of the wing was further dissected, the pollex or thumb proved most interesting because of the tremendous development of its claw. The majority of modern birds have but a single phalanx in the thumb and this bone is entirely covered by the skin in which the feather alveoli are developed. A few groups, widely separated as our present ideas of classification go, are, however, provided with a second joint to the pollex. This second joint is not covered with feather-bearing skin, but is terminated by a corneous claw which can be felt as a sharp thorn among the feathers. All the rails I have examined, even the great wood rails of Panama, have the claw, as do some hawks, some male domestic fowls, the South American palamadeids, and the cathartids. In *Gymnogyps* this claw is unusually long, measuring 30 mm. in the specimen dissected. Other condors examined show extreme development, though measurements were not possible without injury to the specimens. A young bird, with down on the head, had a claw of size proportionately greater than I have seen in other birds. The claw is strongly curved, but is not sharp pointed, and the taper is very gradual. There is no indication of its having been used against abrasive surfaces of a rocky substratum.

The claw appears to be made up almost wholly of corneous material, with but a small osseous element at its base. This ungual phalanx is articulated by a synovial joint to the basal phalanx, but the attachment is very weak and would not support the strain of any active use. I would look upon it rather as a rudimentary and functionless phalanx with an exaggerated sheath.

Dissection of the tail brought out the interesting fact that only six alveoli for the development of rectrices were to be found on the left side of the pygostyle, whereas there were seven on the right. Even then, a single rectrix of the left side was just bursting its sheath. With seven complete feathers on the right side and only five on the left, there must have been an appreciable muscular unbalance in the tail area during flight.

All the other twelve rectrices were complete, though it was not possible to determine whether they had been recently molted.

No date of capture was available for the specimen, hence the molting season is not directly indicated. Mr. Ernest I. Dyer very generously placed in my hands a freshly molted primary (number six) from a condor obtained on June 15. While working for photographic records of condors in Santa Barbara County he visited a certain "bathing pool," where the condors come habitually to bathe and preen in the sun, and here Mr. Dyer picked up the freshly molted feather. The date would suggest that condors begin the molt early; by comparison with the Santa Monica bird, they appear to be half way through the change of remiges by June 15.

This feather is really in excellent condition, not visibly the worse for wear. Molting of the flight feathers appears to take place before their efficiency is to an appreciable degree impaired. It was evidently produced by a relatively small individual, as it is nearly two inches shorter than a similar feather brought me thirty years ago by a student in a biology class.

This larger plume, primary number six, is really a magnificent structure, probably representing close to the maximum of feather development in strength and serviceability. The tail feathers of certain phasianids are longer in both shaft and barb, but they are fragile ornamentals without much power of resistance in the bird's monoplane. The condor plume measures 656 mm. (25.75 inches) across the cord of its pronounced arc. Under pressure it straightens out to 690 mm. During flight the primaries may straighten completely, or even yield into a reverse curvature.

Of this total length, the calamus from base to first downy barb (superior umbilicus) measures 144 mm., has a maximum transverse diameter of 10.3 mm., and a maximum sagittal diameter of 11.5 mm. The early gold miners of the western placers are reported to have used condor quills as containers for their gold dust. Because of lightness and unbreakable texture, they might have served very well. A quill of the dimension just recorded was filled with fine uniform grained sand which was then poured into a ten cubic centimeter graduate which it filled just to the top. Such a container, then, would seem to have a very appreciable capacity for so concentrated a form of wealth as gold dust.

*University of California at Los Angeles, April 16, 1937.*

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## WEIGHTS OF SPOTTED TOWHEES

By JEAN M. LINSDALE and E. L. SUMNER, Sr.

The weights of birds are useful for several purposes, among them the interpretation of geographic variation in body size and as indicator of seasonal change in physiological behavior. It is necessary, however, in using them to make proper allowance for the several kinds of influence which affect weights under various circumstances. In order to learn something about these influences for certain fringillid species we kept records, in 1932-33, of weights of Golden-crowned Sparrows (*Zonotrichia coronata*), Fox Sparrows (*Passerella iliaca* subsps.) and Spotted Towhees (*Pipilo maculatus falcifer*) trapped on the campus of the University of California at Berkeley.

Reports on the first two species have been printed (Univ. Calif. Publ. Zool., vol. 40, 1934, pp. 309-320; Condor, vol. 36, 1934, pp. 107-112). Although fewer records are available for Spotted Towhees, we consider them worthy of summarizing because this species is permanently resident while the other two are migratory; we were able to distinguish sexes in the towhee, but not in the other two; and the inconvenience involved in trapping and weighing this bird makes it unlikely that anyone else will provide this information.

Table 1. Weights of a male Spotted Towhee (no. A 283839) in the spring of 1933.

| Date | 9 a.m. | 1 p.m. | 5:30 p.m. | Date | 9 a.m. | 1 p.m. | 5:30 p.m. |
|---|---|---|---|---|---|---|---|
| Jan. 10 | ........ | 41.00 | ........ | Mar. 14 | ........ | 40.00 | 42.05 |
| Jan. 14 | ........ | ........ | 41.95 | Mar. 30 | 40.95 | ........ | ........ |
| Feb. 15 | ........ | 40.30 | ........ | Apr. 22 | ........ | ........ | 40.35 |
| Feb. 18 | ........ | 39.70 | 37.10 | Apr. 26 | 38.80 | ........ | 39.70 |
| Feb. 26 | 41.20 | ........ | ........ | Apr. 27 | 41.05 | ........ | ........ |
| Feb. 28 | ........ | ........ | 41.60 | Apr. 28 | 38.90 | ........ | ........ |
| Mar. 4 | 40.10 | ........ | ........ | May 3 | 40.65 | ........ | 40.90 |
| Mar. 6 | ........ | ........ | 41.55 | May 10 | 38.65 | ........ | ........ |

Table 2. Weights of a male Spotted Towhee (no. A 283838) in the spring of 1933.

| Date | 9 a.m. | 1 p.m. | 5:30 p.m. | Date | 9 a.m. | 1 p.m. | 5:30 p.m. |
|---|---|---|---|---|---|---|---|
| Jan. 10 | 39.70 | ........ | 38.60 | Feb. 22 | 36.95 | ........ | 39.50 |
| Jan. 14 | 38.70 | ........ | ........ | Feb. 24 | 39.85 | ........ | ........ |
| Jan. 17 | ........ | 40.25 | ........ | Feb. 26 | 37.85 | ........ | ........ |
| Feb. 3 | ........ | 40.20 | ........ | Mar. 1 | ........ | ........ | 36.85 |
| Feb. 6 | ........ | 41.75 | ........ | Mar. 6 | 36.10 | ........ | ........ |
| Feb. 7 | 38.75 | ........ | 41.00 | Mar. 14 | ........ | 39.40 | ........ |
| Feb. 8 | ........ | ........ | 38.25 | Mar. 20 | ........ | 37.05 | ........ |
| Feb. 9 | ........ | 37.90 | ........ | Mar. 21 | 36.50 | 37.35 | ........ |
| Feb. 10 | 34.70 | 37.65 | 42.05 | Mar. 22 | 37.75 | 40.60 | ........ |
| Feb. 14 | ........ | 38.85 | ........ | Mar. 23 | 38.10 | 38.35 | 39.85 |
| Feb. 15 | 36.65 | 38.85 | ........ | Mar. 24 | ........ | 39.40 | 38.05 |