REFERENCES

CHAMBERS, E. 1738. Cyclopedia or Universal Dictionary.

DWIGHT, JONATHAN, JR. 1900. *Annals of Academy of Sciences of New York.* 13: 73-360. 1900. Moult of North American Shore Birds. *Auk*, 27 (4): 372.

RYVES, B. H. *British Birds*, 37 (8): 151.

SKUTCH, ALEXANDER F. 1945. Incubation and Nesting Periods of Birds. *Auk* 62 (1): 11.

3016 North Second Street, Harrisburg, Pennsylvania.

A METHOD OF DETERMINING THE AGE OF LIVE PASSERINE BIRDS

By ALDEN H. MILLER

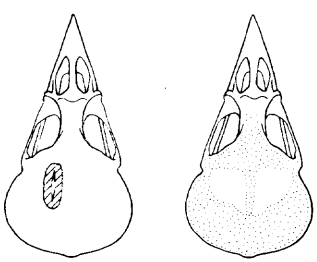
Frequently, in utilizing passerine birds for experimentation or in following their history in banding studies, it is important to know the age of individuals. In the majority of species differential plumage characteristics of first-year and adult birds are not distinct enough to afford dependable criteria. Even where appreciable differences do exist, adequate analysis of them may not have been made, or it may be infeasible for the worker accurately to evaluate them at his field station. Another method helpful in some species has recently been put into practice with fully satisfactory results. It utilizes in the live bird the condition of the skull, a criterion well known to experienced preparators of bird skins.

The skull of a passerine bird when it leaves the nest is made up of a single layer of bone in the area overlying the brain; at least, the covering appears single when viewed macroscopically. Later the brain case becomes double-layered, the outer layer being separated from the inner layer by an air space across which extend numerous small columns of bone. It is not necessary to section the bone to determine the condition. Externally the skull of the immature bird appears uniform and pinkish in live or freshly-killed specimens. The skull of the adult is whitish, due to the air space, and also it is finely speckled as a result of the dense white bony columns between the layers.

As is well known, the double condition is attained progressively and, in some species, more rapidly than in others. In some non-oscine families, as the Furnariidae, I think doubling may never be complete; and some specialized types, like the crossbills, have aberrant structure.

In a normal passerine, double areas appear first about the occipital and auditory regions and at the margins of the orbits. These areas enlarge and usually the last remnants of the single-layered state persist on the crown on a line connecting the auditory openings. Obviously only the positive evidence of a single-layered condition is significant. A double-layered skull may be that of a second-year bird or merely that of a precocial individual in its first year of life. However, in many passerine species in the north temperate region one may rely on evidences of immaturity persisting in the skull through September and October. Often they may be detected later. Experience must be gained separately with each species in order fully to evaluate the evidence.

With the live bird, a minor and essentially innocuous operation is performed to bare a small area of the skull. Lack of muscles and the extremely thin skin of the crown, with its slight blood supply, makes this feasible. Feathers are plucked from a space about 5 mm. long and 3 mm. wide extending backward from a line connecting the posterior margins of the orbits. This should be made to one side or the other of the mid-line. With the surrounding feathers pressed back, a longitudinal cut 3 mm. long is made in the skin with a razor blade or scalpel. Usually little or no bleeding results if the midline is avoided. A slight spreading of the incision with forceps enables one to view the skull and at once to evaluate its age. The skin of the head is loose enough so that the opening may be moved about and a considerable area of the skull thus inspected through the window if this is necessary to determine the condition. Occasional blood droplets that appear may be removed with absorbent cotton. After the inspection, edges of the cut are pressed together and a drop of 20 per cent celloidin is spread along the cut and allowed to dry for a few seconds, forming a seal. Healing is well advanced within two days and the skin is fully repaired in a matter of a couple of weeks. No post-operative care is necessary.



Left: outline of skull of Golden-crowned Sparrow (No. 7297, Mus. Vert. Zool.) showing location of plucked area (cross-hatched) and of cut made in skin to enable age determination.

Right: same skull showing single-layered areas surrounded by dotted, double-layered areas, a pattern typical of an immature bird taken in October.

This method has been employed with a group of twenty Golden-crowned Sparrows *(Zonotrichia coronata)* held in an aviary to determine the complicated sequence of changes in crown pattern correlated with age. Individuals taken in October display strong age contrasts in skull condition. The crown feathering was so little disturbed by the procedure that upon immediate release in the aviary the alteration of the smooth contour of head feathering was scarcely noticeable. No scratching of the celloidin seal ensued. The birds showed little excitement during the inspection. Apparently the most disturbing action is the plucking of the crown feathers. After that the birds are quiet. The actual operation would seem to be less severe than blood-bank procedures, with which many persons are now intimately familiar. The skull operation, after a little practice, takes less than two minutes. It is not nearly as disfiguring, even temporarily, as the frontal injuries which many birds receive in the course of ordinary banding activity, and there are not the associated dangers of concussion and tumor growth.

Museum of Vertebrate Zoology, Berkeley, California.

GENERAL NOTES

Two Starlings banded as nestlings returned to their birthplace.—One young Starling *(Sturnus v. vulgaris)* No. 40-221124, banded in the nest on May 23, 1942, at the Quebec Zoological Garden, Charlesbourg, Quebec, Canada, was found dead on June 9, 1944, shortly after it had been killed by foxes in an enclosure at the Zoo, some 200 feet from its birthplace. The bird was eating meat scraps inside the enclosure when killed.

Another nestling, No. 40-221132, banded on May 23, 1942, from a nest in a 56-room bird house at the Quebec Zoo was caught in a room of the same bird house on May 21, 1945, when he was feeding a brood of four young. This Starling had been color banded, and through previous observations had been found to be a male.

Twenty-eight young Starlings were banded in 1941 and 41 in 1942 in that bird house, but the young from the broods of 1943 and 1944 were not banded. Breeding adults were not trapped in the house previous to the summer of 1945 when 57 adult Starlings were banded. From that number, only one "return" was recorded and it was No. 40-221132.

No attempt has been made to trap and band the Starlings breeding in the vicinity of that colony. Raymond Cayouette, La Société Zoologique de Québec, Charlesbourg, Québec, Canada.

Catbird Age and Return Records.—In the past decade, *Bird-Banding* has published reports on the banding of Catbirds *(Dumetella carolinensis)* in North Carolina, New Jersey, New York, and Pennsylvania (1935, M. A. Boggs, 6: 134; 1939, W. R. Batezel, 10(3): 124; 1940, G. Gill, 11(1): 21-22; 1944, H. Groskin, 15(4): 160 and 1945, 16(3): 106).

At Nashville, Tennessee, Catbirds appear about mid-April and remain into