

heralded, perhaps one or two, possibly six or eight days, previously.* So that a gale would have precisely the effect noticed; that is, it would strike the long migrating line at a certain point where the victims taken would consist largely of the individuals belonging to the same neighborhood, perhaps of but one species or of more, as the case might be. The earlier and later migrants of that neighborhood would alone escape, except the fortunate few that succeeded by favoring circumstances in releasing themselves from the grasp of the storm. Thus it happens that a species usually abundant in a locality may suddenly become rare and yet the species hold its own over its general range.

That the ocean is responsible for the lives of many birds has long been known, but the idea that its victims annually reach such figures as to affect the numerical relation of species over extensive areas has not, I think, been hitherto advanced. That such is the fact seems to me certain and it is with the idea of directing the attention of observers to this class of facts, as well as with the hope of eliciting information already gathered but not yet made known, that these pages have been written.

ON THE OSSICLE OF THE ANTIBRACHIUM AS FOUND IN SOME OF THE NORTH AMERICAN FALCONIDÆ.

BY R. W. SHUFELDT, M.D., CAPT. MED. DEPT. U. S. ARMY.

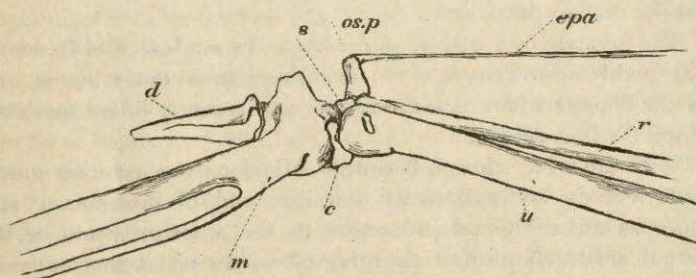
IT does not seem possible that a bone the size of one which I am now about to describe could have been entirely overlooked by ornithologists, yet after a careful perusal of such parts of the works of the most prominent writers, as refer to the skeletology of the upper extremity I fail to discover the barest mention as to the existence of any such an one.

* The departure of birds in the fall is less regular than their return in spring. At least this is true of many species, as for instance the whole Sparrow tribe and many of the Warblers that saunter along as fine weather and an abundant food supply may tempt. The Swallows are the best examples of the other class. Their deliberative gatherings in the fall and prompt departure as though at a preconcerted signal are familiar to all.

My attention was called to the fact several months ago, while engaged in preparing the skeleton of a fine specimen of *Circus hudsonius* which I had secured for that purpose. The bird in question had been allowed to macerate for a long time, as a disarticulated skeleton alone was desired, so that disintegration of the soft parts was very complete and the bones sank to the bottom of the vessel containing my Hawk. Upon collecting these together and assorting them I found a pair of ossicles that I could not exactly account for, nor conceive as to which part of the bird's skeleton they rightfully belonged; of course the vertebral column, sternum, ribs, and pelvis could, one and all, be immediately discarded; first in order, naturally came the carpus and tarsus both of which were carefully examined, an examination that at the time I am free to confess threw no further light upon the subject, for the extremities of the long bones seemed to possess nothing that approached the appearance of additional facets for articulation, and the two free ossicles of the carpus seemed to exhibit all their usual characteristics as irregularly formed bonelets, not differing materially from their homologues in other birds of powerful flight. From the bony remains of my disjointed Marsh Harrier, I turned to the authors and authorities but only after thorough search through the works of those then at my command did I find that my labors were to terminate as already cited. Nothing was revealed or described that assisted me in the elucidation of such an unsuspected problem. My fowling piece and another specimen was the only and best resort left, but, as we all know, when a certain species of the class *Aves* becomes particularly desirable and *must* be had at once, no matter how common it may be, that bird suddenly develops a remarkable shyness, to say nothing of rarity, and such was the case here, for fully a month elapsed before a duplicate was taken; but it came at last in the shape of a fine adult female of the species already considered, and she was eagerly carried to my study.

My first suspicions were the first to be satisfied, and to this end I made an incision, carried only through the skin, around the shoulder, then carefully removed the integuments, allowing the quills of the primaries to remain, from the entire wing. This being successfully accomplished, the following condition of affairs at the wrist joint at once were disclosed to me, and carefully noted.

The usual long bones and carpal segments interested in the formation of the wrist joint of this Hawk held their positions and relations to each other as we find them described by ornithomists generally; but superadded to these I found the ossicle which proved to be the counterpart of one of the pair I already had in my possession, found in the first specimen; in form it resembles an irregular parallelopiped or rather, and more correctly speaking, the frustum of a four-sided pyramid, its distal face being concave and its summit more or less tuberos. Its altitude measures 6 centimetres, while its base has a diameter of 3 centimeters, and is smooth, being covered with a thin layer of cartilage for articulation with a diminutive facet found on *scapholunar* and an extension of the usual horizontally compressed, distal end of radius that was produced anconad for that special purpose. The articu-



Right Carpus, *Circus Hudsonius*, Ulnar aspect.

u, ulna. *r*, radius. *c*, cuneiform. *s*, scapho-lunar. *os.p*, os prominens.
m, metacarpus. *d*, index digit. *epa*, tendon of extensor plicæ alaris.

lation is a true arthrodia, the little bone being perfectly free to glide over the surface in question, being restricted in its movements mainly by the ligaments that are attached to it and by the tendon of the *extensor plicæ alaris* that is found to be inserted at its summit. The principal ligaments are found to be those that are attached about its base to hold it in the position it occupies, and are blended with the carpal ligaments, generally; and an additional broad ligamentous expansion that is thrown out from the radial angle and aspect, from its summit to its base, to be inserted into the head of the metacarpus.

My sketch of the carpus in *Circus*, accompanying this paper, represents the bones of a life size from a large female of the species, entirely divested of all the engaged tendons and liga-

ments, with the one exception already referred to, the limb being in a position of extreme extension. When the member is brought to the side in a position of rest, the ossicle no longer being held in its erect position by the stretched tendon of the *extensor plicæ alaris*, falls forwards and inwards to cover the ulnar aspect of the carpal articulation and forms in so doing an unusually rotund joint, particularly noticeable in the bird before the removal of the elastic integuments that tend further to hold it in this position in the closed wing.

As this little bone can in no way be considered as belonging to the bones of the carpus proper, I have named it the *os prominens*, and regard it in the same light and place it in the same category with the *os humero-scapulare* of the shoulder joint of others of the class, they being simple segments super-added to the series of vertebræ, modified or otherwise, of the avian skeleton, to fulfil a certain purpose.

The function of the *os prominens* can be studied, and its action thoroughly appreciated, by an examination of the wing in any of the Hawks where it is found; a very recently killed specimen being the best subject.

With the wing closed, it simply falls into the position that I have already endeavored to describe, and in doing so, it acts more as an additional protection to the anterior aspect of the carpal articulation than anything else—by no means an unimportant object among the *Falconidæ*; in the extended limb, where it becomes erect, and the elastic tendon of the *extensor plicæ alaris* is put on the stretch, we will at once observe that the surface of the integumental membrane, that is found in the triangular space between shoulder and carpus, is very much greater than if that tendon were simply inserted at the wrist-joint; this circumstance giving to these Raptorial birds a more extensive alar superficies, a very important auxilliary during their sustained flight aloft when, sailing in circles, they scan the earth below for their food.

The various bones in the cut are lettered to correspond with the same bones of my former published monographs, and the *os prominens* is here lettered *os. p.*, and will be invariably so designated in future plates and papers when it becomes necessary to refer to it. I have thus far failed to discover this osteological character in any of the class except the *Falconidæ*, and doubt

its existence in any of the American Owls. The opportunity of examining the skeleton of *Surnia funerea* has never been afforded me.

In the skeleton of *Buteo borealis*, from the collection of the Smithsonian Institution, we find this bone present, although of relatively smaller size as compared with *Circus*; it also seems to articulate almost, if not quite, exclusively with *scapho-lunar*, barely coming in contact with radius at all.

In the same collection we observe, in the skeleton of *Haliaeetus leucocephalus*, the *os prominens* again present, and here of a more quadrate outline and figure, though evidently designed to carry out a like purpose as in the other diurnal Raptores.

The skeletons of *Accipiter cooperi* that I have examined, an indifferent one in my own possession, and another, not entirely reliable, in the collection of the Army Medical Museum, Washington, seem to be without these bones, and I am of the opinion that if this Hawk possesses them at all, they will be found to be very small as compared with others of the family. They are present in *Archibuteo lagopus sancti-johannis*, where they again resemble these bones as found in *Circus*, differing principally in the position they occupy, being placed apparently still further towards the inner aspect of the joint. We find them also in *Astur atricapillus*, in *Accipiter fuscus*, where they are quite prominent and elongated, and again in *Pandion*, but further than this I have not looked into the subject and would prefer, in any event, describing their exact size, position, and relation to surrounding parts from the recently killed specimens rather than from museum skeletons, as valuable as these subjects are to osteological students in so many other respects.

We may be certain that the *os prominens* will never be regarded by any one in the light of one of the bones of the carpus, but articulating as it does with one of those bones and the distal end of radius, it will be the proper place in descriptive works or special monographs upon ornithotomical subjects to notice and describe it; just as Professor Owen treats the *os humero-scapulare* of birds, directing attention to it under the section treating of the Scapular Arch and Appendage, where he says: "In *Raptores*, *Scansores*, and *Cantores*, an ossicle (*os humero-scapulare*) lies between the scapula and humerus at the upper and back part of the glenoid cavity." (Comp. Anat. & Phys. of Vert., Vol.

II, p. 67.) In the same volume, page 73, in his general description of the bird-wrist, he simply describes it in the following terms: "The ulnar trochlea articulates with the two free carpal bones, one — the 'scapho-lunar' — being wedged into the radial, the other — 'cuneiforme' — into the ulnar part, leaving a small intermediate tract for the 'magnum' which is confluent with the base of the mid-metacarpal" — not mentioning any such bone, nor do we find, further on under special references to certain departures in some of the genera from the general rule, any allusion to such an ossicle as the *os prominens*. Moreover, in the same work, in treating of the Muscular System of Aves, page 98, and apparently describing the muscles of a Hawk, too, — *Buteo vulgaris*, I think, — the opportunity, one would suppose, was afforded to have called our attention to the presence or absence of such a feature; but nothing of the kind has been noted, the muscle being simply described (for all birds) as follows:—

"A remarkable muscle, partly analogous in its origin to the clavicular portion of the deltoid, but differently inserted, is the *extensor plicæ alaris*, ib. 30, a. b. [the Hawk] and forms one of the most powerful flexors of the cubit. It is divided into two portions, of which the anterior and shorter arises from the internal tuberosity of the humerus; the posterior and longer from the clavicular extremity of the coracoid bone. In the Ostrich and Rhea, however, both portions arise from the coracoid. The posterior muscle, *b*, sends down a long and thin tendon which runs parallel with the humerus, and is inserted, generally by a bifurcate extremity, into both radius and ulna. The anterior muscle, *a*, terminates in a small tendon [the one shown in the cut, for *Circus*, accompanying this paper] which runs along the edge of the aponeurotic expansion of the wing. In this situation it becomes elastic; it then resumes its ordinary tendinous structure, passes over the end of the radius, and is inserted into the short confluent metacarpal, *u*. It combines with the preceding muscle in bending the forearm; and further, in consequence of the elasticity of its tendon, puckers up the soft part of the wing."

Professor Edward S. Morse, in his discussion upon the carpus of birds (*On the Tarsus and Carpus of Birds*; Ann. Lyc. Nat. Hist. New York, Vol. X, 1872), makes no mention of the

presence of any such bone, as being one likely to be confounded with the carpal bones, in our study of the carpi of *Falconidæ*. He sums up the results of his valuable and advanced studies by stating, "Thus we must recognize in birds the presence of four tarsal bones, and at least four carpal bones" (op. cit. p. 152).

Prof. Huxley in his "Manual" (Manual of the Anatomy of Vertebrated Animals, New York, 1872, pp. 248-9) has nothing to say to us in regard to any such segment; he concludes with the wrist-joint by briefly remarking that "There are only two carpal bones, one radial and one ulnar," although this same profound anatomist, to whom we owe so much, calls our attention, in another paragraph, to the much smaller ossicle, in these terms: "A small bone, the *scapula accessoria*, is developed on the outer side of the shoulder-joint in most *Coracomorphæ* and *Celeomorphæ*."

One would hardly look for it in Dr. Coues's elaborate description of the bird-wing in his "Key" (Key to North American Birds, 1872, p. 30), as that section was evidently written with a very different purpose in view, and certainly not to decide the peculiar osteological characters that might be or were already known, to occur in the various wings of the many representatives of the class. These remarks apply with equal force to all that Professor Carl Vogt has to say to us in his paper upon the *Archæopteryx macrura* (Ibis, Oct. 1880), where he devotes a paragraph to a revision of the osteological points as they occur in the upper extremity of the Ring-Dove.

OÖOLOGICAL NOTES FROM MONTANA.

BY DR. J. C. MERRILL, U.S.A.

THE following notes on the nests and eggs of six species of birds may be of interest, as all are rare and two, those of the Snowbird and Woodpecker, are, I think, undescribed. These nests were found during the past season in the northern part of the Big Horn Mountains, so near the Montana-Wyoming boundary line that in some cases it is impossible to say in which of these Territories they were located.