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ON SOME OF THE CAUSES AFFECTING THE DECREASE OF BIRDS.

BY H. W. HENSHAW.

IN an extended field experience in Massachusetts and at various points along the Eastern coast, I have often noticed marked changes in the relative abundance of the species of birds of a given locality from summer to summer. A locality that for several years has furnished a certain species or a summer resident in great numbers will be found after the usual spring migration to be inhabited by comparatively few of that species, although the associate kinds may continue in undiminished force. Or it may be that the reduction will be found to affect several species to a varying degree, involving perhaps birds of very different habits. As my experience in this particular is by no means unique but, on the contrary, as I find, has been shared by every ornithologist whom I have consulted, I have been led to an inquiry as to the probable cause of these seemingly mysterious fluctuations in the numbers of birds, amounting in some instances to almost the complete extermination of a certain species over a restricted area.

It is perhaps scarcely necessary to call attention to the fact that the great variation occasionally to be noticed in the number of migrants passing a given point can have comparatively little weight in an estimate of the actual increase or decrease of the several species, the facts concerning migration being too general

in their nature and the number of observers too small for exact inferences to be drawn. Evidences of a general stability in the course of migration are, however, numerous, and it is certainly true that given species may confidently be expected to occur and recur in abundance along a certain route, while the uniformity with which a species known to be rare will present itself each year in just about the same numbers is still more remarkable. Nevertheless, most observers will agree that no two seasons yield precisely similar notes on migrations, and not infrequently the differences are very great. It is evident that it needs but a slight deflection to one side or the other to carry the bulk of a certain species quite outside the range of observation of the limited number of observers, and this may readily happen from a number of causes. The effect of a severe storm is frequently to retard the migration, and in the long delay that sometimes follows, birds become more or less scattered and may resume their journey on somewhat different lines.

Possibly, also, and especially in fall, the scarcity of food along an accustomed line of flight, and its abundance elsewhere, may be to some extent instrumental in influencing the course taken. But the most potent agent in deflecting birds from their course is adverse winds, and to them doubtless are due most of the variations noted in the number of migrants which are not caused by actual mortality. In connection with the effect of winds in turning migrating birds aside from their usual paths, the interesting question arises whether large numbers are not forced to such remote distances that they are unable to regain the lost path leading to their old homes, and are thus compelled to settle in new quarters. That this does occasionally happen there can, I think, be no question, and doubtless these accidental dispersions form an important means for the spread of species.

Doubtless many of the "accidentals" that so frequently figure in our local lists are to be thus accounted for. But these wanderers are almost always reported singly, and I can recall no instance where a neighborhood has been invaded by a large number of breeders of a species hitherto rare. The home instinct in birds is so strong and enduring that it seems certain that nothing but the most adverse circumstances will cause them to relinquish their efforts to reach their old homes. Were it not indeed so our Avifaunæ would become sadly unstable.

Before advancing an hypothesis to account for the decimation in the ranks of species occasionally to be noticed, it may be well to glance at certain factors in the mortality of bird life, natural and other, with a view to ascertaining what part they play, if any, in the phenomenon.

As is well known, foxes, skunks, weasels, snakes, and the whole tribe of predatory birds, animals, and reptiles contribute towards the reduction of bird life, and unquestionably in wild sections, where nature reigns supreme, play an important and as usually thought, a beneficent part in preventing the overproduction of birds.

While it is true that the aggregate of birds destroyed by these agents is large, it nowhere, I think, even during the nesting season, the period of greatest danger, amounts to the proportions necessary to account for the decrease noticed. This belief is changed to certainty with respect to the civilized districts, where birds of prey, predatory animals, and even snakes are themselves subject to extermination at the hands of man.

If the above be true of the nesting season, still less can natural enemies be supposed to affect to any very appreciable extent the ratio of birds at other seasons or in other regions when away from our observation.

Little appears to be known of the number of diseases among wild birds and the extent to which they prevail. That diseases do actually exist among birds, and to a greater extent than is usually supposed, is, I believe, true, and in a few instances I have myself found dead birds under circumstances that precluded the idea of death from any form of violence.* The almost total lack of evidence upon the diseases of birds is, however, conclusive proof of their comparative rarity,† since if serious diseases were common, or anything like epidemics prevailed, we may be sure their presence and effects would make themselves visibly known.

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* Upon this point see Shufeldt in American Naturalist (Vol. XV, Apr. 1881, pp. 283-285). The subject is an interesting one and that its fuller investigation would result in developing some valuable facts cannot be doubted.

† As compared, for instance, with mammals, which are well known to be subject to epidemic diseases that actually depopulate wide districts. Buffalos among large animals, and rabbits among small ones, may be cited in illustration. The latter, particularly, fairly swarm in certain parts of the western Territories, and by their numbers and the consequent damage they inflict upon the farmer would be intolerable nuisances were it not for the occasional epidemics that sweep them off by thousands.

Old age among birds, as elsewhere throughout animated beings, is instrumental as a check on increase, and doubtless many birds survive the various dangers to which bird life is heir to and pay the last great debt from the decay of their vital powers. But the number of deaths from disease and old age doubtless varies within comparatively narrow limits, and hence either alone or combined with natural enemies cannot furnish the cause we seek. Of death-dealing causes none is so curious as that modern invention the telegraph wire. On the plains where high winds prevail and where there is insufficient shelter many birds have been noticed under the wires, dead or crippled from being blown against them. Under such circumstances it has proved a source of considerable mortality among small birds. But when the wires are first put up in a neighborhood it is by no means a rare accident for birds of various kinds to fly against them in calm weather, evidently not seeing, or at least not comprehending, the nature of the obstruction. As might be expected from the height at which it flies and the time of day when most active, the Woodcock is particularly prone to this sort of accident, and scores of this bird have been reported in the sporting papers as being found dead or disabled under newly laid wires. It bears witness to the intelligence of birds and their power to profit by the lessons of experience that in a very short time they learn to appreciate the danger and to avoid it by flying above or below the obstruction, so that they rarely suffer even in high winds.

Storms, especially when they are prolonged and accompanied by sudden and excessive change of temperature, are directly responsible for important changes in the relative numbers in the species of a district, and not a few instances could be cited where certain species have been entirely exterminated from a locality.

The less hardy of our small Insectivores are specially liable to disasters of this kind, particularly in the spring, during or just subsequent to their return from their tropical winter quarters. Indeed, taking our country at large, it is probable that scarcely a year passes without the loss in one or several districts of great numbers of birds from this cause. Sometimes the storm-visited area is small, and occurring early in the season the storm works injury to comparatively few of the earlier migrants. But occasionally it is wide-spread in its effects and, coming in the height of the migration, destroys great numbers of individuals and affects a considerable number of species.

The past season has been unusually fruitful in casualites of the sort referred to, and during early May storms in New England carried off great numbers of Swallows which, from their tender organization and inability to procure food in tempestuous weather, easily succumb to the effects of long, cold storms. Even as far south as Washington, and as late as June, a rain storm accompanied by hail killed large numbers of as hardy a bird as the English Sparrow, other species suffering in due proportion. Of the local effects of a storm, however, the best example I know of is the case of the extermination of the Purple Martins in Cambridge and near vicinity years ago during a cold storm which caught the birds a day or two after their arrival from the south.* This instance is of peculiar interest, insomuch as the Martins, although affected only within a small area and remaining abundant outside of it, have never reoccupied the lost ground; whether from a failure to increase sufficiently to colonize it, or from inability to make headway against the Swallows and Wrens, usurpers of their ancestral seats, is uncertain.

That the causes above named play an important part in the reduction of birds is certain, but with the exception of the last they act in so regular and systematic a manner, or are too unimportant in their effects, to be accepted as explaining the marked decrease which many species undergo in the interval between their departure from and their return to their northern homes. We have now to consider another class of facts in which storms appear as the destructive agents but in a totally different way from those hitherto noticed.

It has long been well known that in foggy and tempestuous weather, at all seasons of the year, but particularly during the migrations, birds are killed in great numbers by being dashed against the light-houses.†

* Facts of this sort, which may be indefinitely multiplied, are of themselves a sufficient refutation of the common superstition that birds are endowed with some mysterious faculty by means of which they are enabled to foretell the weather in advance, and time their movements accordingly. The ill-timed arrival of migrants may be studied to peculiar advantage on the shores of the Great Lakes, where the sudden northers of early spring often check the migrations and fill the shrubbery of the southern shores with great numbers of northern bound birds. The much quoted adage of the "early bird," with its appropriate lesson, fails of application most signally in the case of our migrants, whose forwardness not rarely bears bitter fruit in the death of thousands.

† For interesting data on this see Mr. J. A. Allen in Bulletin Nuttall Ornithological Club, Vol. V, pp. 131-138. July, 1880.

It is not necessary to enumerate the species that have been noted among the birds thus destroyed or to institute any comparisons as to their relative or aggregate numbers. It is enough to note here that the list when fully made out will be found to embrace all our smaller species whose routes of migration or whose habitats are not so far inland as to place them beyond the reach of the coast storms. That the larger species, too, are not wholly exempt from disasters of this sort can be readily shown, Hawks, Owls, Ducks, and even Pelicans having been forced by gales against light-houses. The testimony is sufficient to show that thousands of birds are annually destroyed in this way, and that an infinitely greater number pass by unharmed and are lost to sight in the obscurity of the gale. What then becomes of these latter?

It is perhaps not so well known that vessels coasting off shore from ten to one hundred miles or more are frequently visited by birds that have been swept off the land by the wind. I have frequently during a voyage in the calm summer months found in the early morning three, six, eight or a dozen or more land birds perching on the vessel or flying in excited circles around and over it. Some of these are doubtless forced away from land by the pursuit of Hawks,* or by moderate off-shore breezes, and without doubt soon find their way safely back. The same facts hold good, I believe, for the coast line all over the world, and I am told that in the Mediterranean it is extremely common for birds to alight on vessels, and that here their flight is rarely sufficiently protracted to in anywise injure them. But if caught at any considerable distance from land, it is noticeable that these wanderers will invariably die from exhaustion, no matter what care be taken of them, showing conclusively that they must have been on the wing a very long time. This fact is of interest, as it seems to imply the utter impossibility of at least the weaker-winged North American species — so many of which have been detected in England and the Continent — crossing the ocean without material assistance from vessels or other stable support upon which to alight and rest.

* In fact, I once saw a *Falco polyagrus* in attendance upon some Snowbirds and Sparrows at a distance of about seven miles off the California coast, and similar observations have been made by others.

But it is in spring and fall, and especially after high winds and foggy storms, that the full effects of this class of disasters are to be observed and to some slight extent measured, instances being known where in an interval to be measured by minutes hundreds of birds have been seen from a vessel to fall into the water and perish from sheer inability to sustain themselves longer on the wing.*

The same disastrous results which often accompany the migratory birds along the ocean coasts are also experienced as they pass over the great interior lakes. An account of an instance of such destructive results has just appeared in a late Chicago newspaper, which is of such interest in the present connection, I give it in the subjoined note.†

These two classes of facts point to the conclusion to which I wish to call attention, *viz.*, that the ocean each year proves the burial place for vast numbers of birds. If, as is the case, "hundreds" of birds are dashed against the slender shaft of a lighthouse in a single night, a thousand are hurried past on the wings of the gale for one that meets its doom through the treacherous lantern's rays, and if, as is equally true, not alone bundreds but multitudes are occasionally noticed from the decks of vessels after storms dropping into a watery grave or striving with faint and failing wing-beats against a stern and inevitable fate — if these

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[* See Mr. Frazar's note on destruction of birds by storms in the Gulf of Mexico, published in this number of the Bulletin in the department of "General Notes."—ED.]

† "Very few people have any idea of the really immense number of birds which are lost in the great lakes every year. They are driven off shore by heavy winds, or, crossing from shore to shore, are tired out and fall into the water.

"Very many are lost when they come up from the South in spring, and there are more or less losses all summer, though the fall is the time in which the greatest destruction occurs. Then the birds are gathered in families or flocks, living a nomadic life all through the time of molting, wandering everywhere in search of food. Their new plumage is not always perfeet, and their flight is therefore apt to be feeble, and September gales drive them where they will. It is not the small birds alone that fall victims, but the largest and strongest as well as the small and delicate.

"Two years ago there was a heavy storm, lasting some twenty-four hours. It occurred during the first week in September, and the eastern shore of Lake Michigan was strewn with dead birds. I took some pains to count these on a certain number of yards, and estimated that if the eastern shore was alike through all its length over half a million of birds were lying dead on that side of the lake alone. It is more than likely that nearly as many more were on the west. Not *all* the birds could be counted, because many were immediately buried in the sand that is being swept back and forth on the beach.

limited points of observation give such results what estimate will suffice to comprehend the number of the Ocean's victims in its vast expanse of storm-visited surface! That millions of birds are annually thus destroyed cannot be doubted, and it is in this way I would account for the numerical fluctuations noticed in the beginning of this article.

The migrations of birds have been well likened to the waves of the ocean, each billow of this living sea being made up of different species, the individuals of each species coming from more or less contiguous ones. This latter statement is proven from the fact that the main body of a given species arrives at a locality in the spring, as it leaves it in the fall, almost simultaneously, a single day usually sufficing to see a neighborhood stocked with its full quota, the onset of the numerous clans having been

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"It was a strange and pitiful sight. Some were so fresh and perfect, and their feathers so unruffled, that it seemed impossible that they had been drowned. There were multitudes of wrens, with narrow, gauzy wings spread out, so that the wind swept them up and down on the sand, like autumn leaves sere and brown. Tiny creepers, looking ghastly with only a head and wing unburied, and moving as if alive; kinglets with their bright crowns defaced huddled into a group, where I counted a robin with fair unruffled breast, a kingbird, a summer yellowbird, and one orange-crowned warbler. The greatest number of any one species was the yellow-winged sparrow, both young and old. The grass finch and the song sparrow were abundant, as was also the familiar little pair bird. Of the goniaphea I do not remember a single specimen. They leave before September, I think. There were cowbirds, and one or two blackbirds, and no orioles. Blue jays one or two, much worn and defaced, and the common phebe more numerous. Belted king-fishers I saw once or twice, and of the picidæ, the red-head and the golden-winged, a single specimen each, as well as two of the downy woodpeckers.

"There were none of the varieties of the hirundinidæ, and but one or two of the thrushes, except the robin, which was rather numerous. Evidently that bird comes earlier and stays later than any others of his family. A single catbird came under my notice.

"I have observed that all through the summer more or less birds are drowned and thrown up on the beach. How many it is impossible to say, as they are soon covered with sand or carried away by prowling wildcats, whose tracks I constantly saw there. It is unlikely that during the breeding season any bird ventures so far from home as to cross the lake, and as there are no bays, and a sandy beach skirts all the wooded shores, the birds are not lost in flying voluntarily over the water, but are blown out and exhausted by baffling winds, fall down, and perish. . . . .

"If one had time to follow the beach during the season a pretty fair knowledge of the birds that haunt the shores of Lake Michigan might be gained. My observation was necessarily limited to a small space, but a wider research would no doubt give many other varieties of birds that perish in the lake. This is a very large percentage of loss no doubt, and must be reckoned as only the part belonging to Lake Michigan, since the same thing happens on all the great lakes to some extent. . . . ." —*Chicago Tribune*, Sept. 3, 1881.

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.

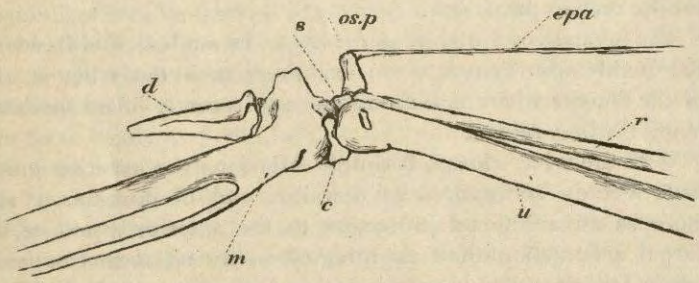
IT does not seem possible that a bone the size of one which I am now about to describe could have been entirely overlooked by ornithologists, yet after a careful perusal of such parts of the works of the most prominent writers, as refer to the skeletology of the upper extremity I fail to discover the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

OÖLOGICAL 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.