

Feb. 15, 1877.

My correspondents are Dr. P. L. Hatch, Minneapolis, Mr. H. B. Bailey, Newton, Mass., William Brewster, Cambridge, Mass., Dr. J. C. Merrill, Fort Brown, Texas, who welcomes me to his section, and last but not least Dr. Elliott Coues of the Smithsonian. Received a letter through Mr. Bailey from Mr. J. A. Allen of Cambridge. Sent Dr. Coues a fine Pelican and he was pleased with it and gave it to the Smithsonian, also sent him a juv. rabbit which he decides to be the young of northern Jack. He sent it to Prof. Allen who is making a study of Rabbits.

Feb. 19, 1877.

Received a letter from Spencer F. Baird of Smithsonian Inst. thanking Dr. Coues and me for the Pelican skin I sent the latter, and saying he had sent me a check list of birds.

Feb. 21, 1877.

Have been ready and waiting for two days for Mr. Webster, expect him every train. Was today studying Audubon about the Mammals and Birds of Texas and have hopes of getting great quantities of valuable skins. Every thing arranged at home, debts and accounts all settled up and every thing put away in good shape.

112 W. Adams St., Chicago, Ill.

SOME OBSERVATIONS ON THE STRUTHIOUS BIRDS.

BY W. HENRY SHEAK.

For seven months in 1918, from the first of April to the end of October, I had charge of the Ostrich house at the Philadelphia Zoölogical Garden. This paper is based almost exclusively on notes made at that time.

When I took charge there were in the house three specimens of the South African Ostrich (*Struthio australis*), two males and one female; two Somali Ostriches (*S. molybdophanes*), a male and a female; two Rheas (*Rhea americana*), both males; one male Australian Cassuary (*Casuarius australis*); two Papuan Cassuaries (*C. papuanus*), a male and a female; and two Emus (*Dromæus novæ-hollandiæ*), both males. During the seven months I was there I had no death and not a case of serious sickness among the ratite birds.

Toward the end of the summer, however, we received from an Ostrich farm in California three specimens of the Somali Ostrich,

a male and two females. These were young birds, but almost, if not altogether, fully grown. The birds were delayed in their long trip across the continent, shamefully neglected in the matter of food and water, and when they reached the Garden were in a dying condition. The male was so weak he could not hold up his head. Of all pitiable sights, an Ostrich with the strength all gone out of his neck, this long member as limp and resistless as a carpet rag, permitting the head to fall and lie helpless on the ground, is the most pitiable. The male was too far gone to take any nourishment and died within three hours after his arrival. The two females after being liberated from the shipping crate and stretching their cramped muscles for a quarter of an hour, began pecking at the mash of cracked corn and bran which I had prepared for them. Before night they were eating ravenously.

The Ostrich farm shipped us a second male which arrived about a month later. He reached us in a condition similar to the first. Superintendent Robert Carson, Assistant Superintendent C. Emerson Brown, Head-keeper Manly, and the writer spent a September morning trying to induce the new arrival to eat, and with little success. Not one of us had much hope of saving him. But after a few hours he did take a little food, in a day or two was eating readily, and by the end of October he and the two females received earlier were in good condition and well on the way to complete recovery.

These new birds were not placed in the Ostrich House, but in a new paddock prepared especially for them south of the new Bird House. The paddock was provided with a shelter house, but with no artificial heat. Here these birds remained all winter and thrived. One of the females died subsequently, but when I last visited the Garden, late in July of the present year, the other female and the male were still living and in the best of health. This species has been found most satisfactory on the Ostrich farms of America, and is kept almost to the total exclusion of *S. camelus* and *S. australis*.

The Ostrich house is provided with a boiler for steam heat, but it is only in extreme weather that it is used. The winter of 1917-18 in the region of Philadelphia was a record-breaker for frequent and heavy snows and low temperatures, but every day

the struthious birds were given the freedom of the outdoor paddocks, for at least the warmer part of the day, excepting on a few occasions when the ground was a glare of ice and there was danger of the birds falling and breaking their legs. This applied to Ostriches, Rheas, Emus, and Cassowaries alike.

One of my most striking and interesting observations on the ratite birds was that they all love rain. On the occasion of a shower, every bird, instead of seeking the shelter of the house, would dash out the door and dance about in the rain. The harder the downpour the more they seemed to enjoy it. After the first transport of pleasure, they would settle down to the regular business of picking edible tidbits or pebbles from the ground of the paddocks. I never knew them to go under a roof to get out of the wet. This would not have been surprising in the Cassowaries, as they affect deep woods where rains are frequent and heavy, but it was certainly unexpected in the African Ostriches which live on deserts and plains where rain is practically unknown.

Another surprising fact about these great birds is the small amount of food upon which they can not only subsist, but thrive. The principal caution Head-keeper Manly gave me when I went to the Ostrich House, was this: "If you see the need for it, *decrease* the feed, but *never* increase it." The bill of fare for the Ostriches the year around, was two quarts of alfalfa, one quart of cracked corn, and one quart of bran to each bird in the morning as soon as the cages were cleaned, and again in the evening just before closing time. In addition to this, I fed each bird in the evening one quart of chopped carrots, beets, and bread, equal parts. To the Emus, Cassowaries and Rheas I fed, morning and evening alike, to each bird, one slice of bread, three medium-sized bananas, one-half pint of boiled sweet potatoes, one apple, a little boiled rice rolled in corn meal, and a little lettuce.

When we consider the great size and bulk of body of these birds, this is certainly a small ration. But this is not all. Whenever my birds began to show any decided signs of being "off their feed," by leaving a part of their ration in the feed boxes, I would eliminate the evening meal altogether until they would clean up what I gave them in the morning.

As was to be expected, these great birds have their own individualities, their own idiosyncrasies, their own likes and dislikes, very much as human beings. For instance, I had one Emu that would not eat bananas (and I could not get him hungry enough to eat them), although my other Emu, the three Cassowaries, and the two Rheas were fond of them. Some of the birds were very dainty about their eating and rarely ate all I gave them, while I had one big South African Ostrich which not only ate all I gave him, but usually ate what the other Ostriches left in their feed boxes. Although red beets were on the bill of fare for the Ostriches, they cared little for them, and always ate everything else in preference to the beets.

In each cage was kept an earthen vessel filled with ground bone, crushed shell, and grit, and each struthious bird received a little fresh chopped bone and meat every Monday and Thursday. I was surprised to find the Cassowaries, especially the Papuans, picking up the pebbles when the cage floor was fresh sanded each morning, and swallowing them. This was hardly to be expected in a bird not a seed eater, but supposed to subsist exclusively on fruit, vegetables, grass, and the like. The Emus and Rheas also gathered pebbles.

One morning I was walking through the service passage back of the cages, when I saw a mouse that had been caught between a bar and the feed box in the cage of the female Papuan Cassowary. Thinking that possibly the mouse had gotten poison or died of some disease, I stopped to get him out of the cage. But the bird discovered him at the same time I did, and before I could reach the rodent, she seized him in her bill, shook him as a terrier shakes a mouse or rat, evidently to make sure he was dead, then gave him a toss and swallowed him.

A little later I tried the Cassowaries with dead mice which I had caught in a trap, and the Australian as well as the Papuan ate them readily. I then put a mouse into the west Emu cage, but it lay there for some time. Then I put it into the feed box of the Emu in the big center cage. When let in from the paddock, he picked the feed from under it, seeming not to care for the rodent. I did not feed the bird that night and do not know if he ate the mouse or not, but the next morning it was not in the feed box.

I told Mr. Hess, for more than thirty years keeper of the Reptile House, about my experience with the Cassowaries and the mice, and he said, "Oh yes, they are very fond of them." He told me, too, that before the Ostrich house was built, several Cassowaries were kept in the Antelope house and Elephant house. They were "off their feed" and got poor. George Harrison, one of the old keepers, cut up raw bone and the marrow and gave it to them. They ate of it ravenously. Their health picked up and they got fat. The females began laying and laid a large number of eggs. Harrison also chopped up oyster shells, thrown out from restaurants and hotels, containing a little meat, and fed to them. He would also burn charcoal for them. From these facts it would seem that the Cassowaries are not in their native state so exclusively vegetarian in diet as is commonly believed.

Under the old system of feeding, when Arthur Erwin Brown was Secretary of the Zoölogical Society, the African Ostriches received more green stuff, lettuce, cabbage, etc., than they do under the later regimen. Then the females would lay an egg every alternate day for long periods of time.

For a long time I could not find that the male Somali Ostrich ever drank any water. His drinking vessel was never more empty than might be due to evaporation; there was never any water splashed about it, as was almost always the case with the other Ostriches, and I never found him at the water. This was true even in the hottest weather. But, finally, one morning about the first of September, I caught him at the bucket apparently drinking. But he took a few sips only. This was a clear, sunny day, but not very warm. He never mussed his cage much. The three South Africans always had a litter of sand and other dirt kicked up on the footboard of their cages, and considerable out in the front service passage, while the Somalis had very little.

The Rhea has the best developed wing of any struthious bird, and frequently goes about with the wings lifted from the body, as do also the Ostriches. This is never done by the Emu or Cassowary. The skeleton of the Cassowary shows the wing bones feebly developed, but never having examined a bird in the flesh, I do not know if the wing is free from the skin of the body or not.

Both the male and female Ostrich make a hissing sound, but the

male only makes the sound called "booming." He possesses a gular air bag capable of considerable inflation. The sound is not produced by forcing the air *out* of this bag, as might be expected. On the contrary, the bag fills as he utters this boom, enlarging with the first coarse note, beginning at once to subside, but the subsidence is arrested by a second boom, when the gular bag is enlarged more. A second subsidence is arrested by a third boom, when the bag is enlarged still more. The booming may end with the third note, or there may be a fourth, after which the bag gradually subsides. Then the Ostrich begins all over again. He may go through this performance three or even four times in succession. The performance seems to cost him considerable exertion. It is probably both a love note to the hen and a challenge to rival males. At a short distance the call resembles the roar of the lion a mile or more away. I never heard them make the "cackling sound" mentioned by some writers.

The Rhea has a peculiar call or cry, but it is given only at rare intervals. It sounds much like the syllables "wah-hoo," with the first slightly prolonged, and the second considerably so. It is given in a deep bass tone. They make a hissing noise when angry, as do also the Cassowaries. The latter have, too, a sort of clucking note. I do not remember ever to have heard an Emu make any kind of vocal sound except a sort of low grunting, rumbling noise, made deep in the throat, and somewhat similar to the boom of the Ostrich.

I often observed the two male Rheas, in the paddocks together, stand facing each other at a short distance, spreading and fluttering the wings in a love-making scene. The Ostriches, both male and female, would frequently spread and flutter the wings, at the same time rocking the whole body from side to side, in an attempt at love-making. Sometimes they would do this standing, sometimes "kneeling," with the tarsi protruding straight out in front. The smaller of my male South Africans would frequently go through this performance when I came near him, always kneeling before me. He was a bird of good disposition.

Since no two of our struthious birds, with the exception of the Rheas, could be kept together, the eggs were not fertile. Only one of our birds laid with any regularity while I was in the Ostrich

House. This was the South African. Beginning about the first of May she averaged two eggs a week during the summer. For six or eight hours before laying, she would appear listless and would take no food. The presence of the egg was indicated by a great swelling near the vent. She usually dropped her eggs in the inside cage; only once did she drop one on the ground of the paddock. In an hour after laying she would be eating and in as lively spirits as usual. She was good natured and offered no objection to my taking her eggs. I usually went to the door of the cage and drew the egg out with a garden rake. One evening, however, forgetting my caution, I went into the cage to get the egg. This disturbed the bird and in stepping around, she kicked the egg with sufficient force to roll it over against the cement "footboard" and crack the shell. Superintendent Brown said I might take it home and cook it, which I did. When boiled I found the yolk smaller in proportion to the bulk of the "white" than in the common hen's egg, but the flavor was much the same. Since one Ostrich egg is equal to about two dozen hen's eggs, my wife and I breakfasted off Ostrich egg for a week.

The eggs of the two species differ considerably, that of the South African being a rich cream color, deeply pitted, and oval in shape, while that of the Somali Ostrich is white, almost smooth, and almost round, being very little greater in one diameter than in the other. The period of incubation is from forty-two to forty-five days. The hen sits on the eggs during the hours of daylight and the male at night, hence the gray of the female, harmonizing with the color of the prevailing sand of the native habitat, and the black and white of the male, inconspicuous in the darkness.

As both our Rheas were males, we had no eggs. Both our Emus were males, but we had an egg in the Ostrich House from a hen formerly kept in the Garden. It is a very dark green, verging on blue. The egg of the Cassowary is a very light tea green.

The African Ostrich does not reach full size until he is three or four years old, but his first feathers may be ready for plucking as early as the tender age of nine months. After that he yields a harvest of plumes about once in every eight months. The most valuable feathers come from the wing of the male. These are long, broad, snowy white, and twenty-four in number from each

wing. These are the primaries. The secondaries are much smaller, a dull black or even gray in color, and of course much less valuable. The tail feathers of the male are second in size and value. They are a beautiful jet or glossy black. They are almost as fine and beautiful as the primaries. The gray wing and tail plumes of the female, while smaller than those of the male, are still very beautiful. The black and white wing coverts of the male and the gray wing coverts of the female, are very soft and pretty, and are much in demand when made into boas, fans, and other ornamental articles.

The long quills of the Rhea are not without beauty and are used extensively in the manufacture of dusters. The feathers of the Emu and Cassowary are of interest to the naturalist from the great development of the aftershaft, this being equal in every way to the shaft, making the structure appear as two feathers on one quill. These double shafted feathers are also in considerable demand by milliners. While I was at the Garden a milliner told me that many of the apparent Lesser Bird of Paradise plumes are Emu feathers dyed.

Of all my struthious birds, the Rheas were the best natured. They were always ready to go out of the cage as soon as the doors were opened in the morning, eager to come in to eat, and easily driven in at night. I could go among them in the cage or paddock as among domestic fowls. Only once did they cause me any trouble. One Sunday evening they objected to going indoors at closing time. The weather was too fine and the hour too early to retire, in their estimation. They led me a merry chase all over the yard and did considerable hissing, and I had to get the rake to drive them into the house. The experience was rather humiliating. My wife was at the Garden and I had just been bragging to her what good birds my Rheas were.

The African Ostriches were generally fairly good-natured. The young Somali birds received from California would gather about me at feeding time like barnyard fowls. My wife went in the paddock one Sunday evening with me and they wanted to eat the flowers off her hat. My larger male South African, however, was mean and irritable. I could not enter the cage with him without first attracting his attention elsewhere. I would usually throw

him about three-fourths of a pound loaf of bread, stale and hard, too big for him to swallow whole, but of such a size that he thought he could swallow it, and while he was working with the bread I would enter the cage and clean it. But if I touched his toes with the rake or shovel, he would bristle up like a turkey cock. Frequently he would walk up and down the fence trying to get at the sightseers.

The Emus never offered any objection to my entering the cages with them. The Cassowary is essentially a bird of the thick forest rather than of the plains and can not bear the glaring light and heat of midsummer which is the delight of the Ostrich. He seeks the shade with mouth open and tongue protruding. The Australian Cassowary never attacked me in the cage, but one morning, as I was reaching between the bars to unfasten the door, he charged with a vicious hiss, kicking at me with great force. Fortunately for my hand and wrist his aim was poor and he only grazed the member. He is a much better-natured bird than the Papuan and this is shown in his more noble posture and carriage. He goes about with his head in the air, looking the world in the face, while his cousin from New Guinea sneaks around with his head low and his eyes on the ground, like the evil creature he is.

My male Papuan Cassowary was the most irreligious bird I ever knew. He had a diabolical disposition. He was always ready for a fight and would never permit me to enter the cage with him. When I opened the doors in the morning, all the other birds were eager to get out, but the male Papuan could not be persuaded to leave the inside cage as long as I was watching him. I would open his door, then go to the other side of the house and busy myself cleaning cages. In half an hour or so I would slip back on tiptoe to see if he had forgotten himself and gone out. I generally had to make several such stealthy reconnaissances before I caught him unawares. If he heard me coming, even if he were at the furthest corner of the paddock, he would start back at full speed, and just hump himself to get inside before I could close the door. He and I had many a kicking match. One morning the door stuck and he thought it was a good time to get that keeper. He came at me like a whirlwind, but he kicked just a little too soon and his foot merely touched my stomach.

This gave me an opportunity and I planted my shoe with full force in his gizzard. He responded with a grunt. Thinking discretion the better part of valor, he went on into the cage. I did not always fare so fortunately, however, for once he kicked me in the side till I was lame for a week.

The kick of all the Ostrich-like birds is forwards and downwards. They can not kick backwards, but can kick considerably to one side of straight-forward. I have seen the Emu kick at an angle of at least forty-five degrees from the straight-forward direction. I never knew one of these birds to jump on an antagonist when down. It seems they can strike a telling blow only at a height of two or three feet from the ground. I was always told to lie down if attacked.

The only act I ever observed in any of these birds that had the least resemblance to intelligence was shown by my big South African. He seemed, at least, to work a scheme to get a piece of bread. I have already spoken of his mean disposition and how I was in the habit of throwing him a big piece of bread with which to amuse himself while I cleaned his cage. He was always hungry and not only ate all I gave him, but usually cleaned up what the other Ostriches left in their boxes. Several times toward the end of my stay in the Garden, when I was ready to clean his cage and opened the doors, he lingered inside and refused to go out. So I would get a piece of bread, break it into small pieces, and throw them into the paddock. He would rush out eagerly to get the bread. After a time his staying in the cage became a settled habit. No matter how long I waited, he would not go out till I went for the bread. When he saw me come from the feed room, he would immediately run out of his cage, even before I had time to get out of the house and throw him the bread. However, there may not have been as much design in this as was apparent.

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