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SOME OBSERVATIONS ON THE WATER OUZEL.¹

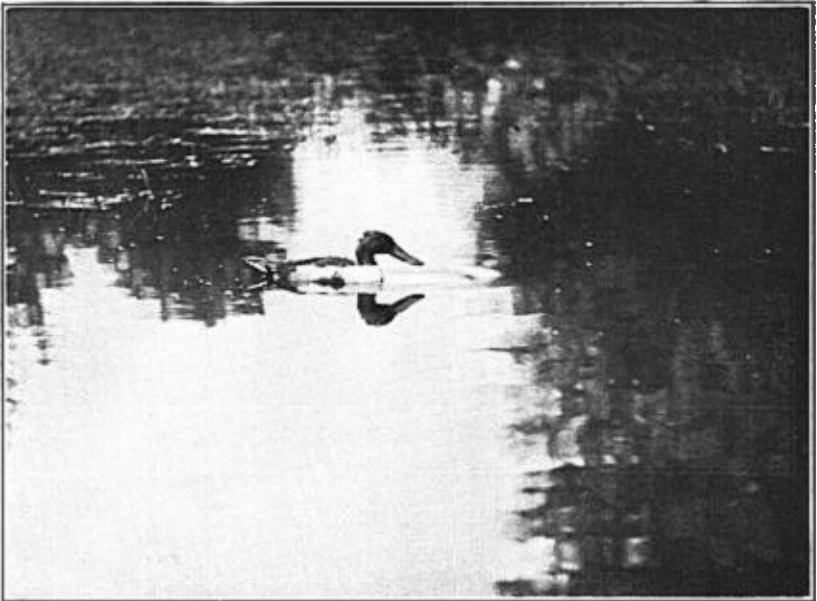
BY A. H. CORDIER, M.D.

Plates VI-VII

IN the limited literature on ornithology at my command I find very little written about the Dipper, or Water Ouzel (*Cinclus mexicanus unicolor*), and much of this at variance with my observations on the bird. Before entering into details regarding questions of the bird's anatomical makeup and aquatic habits I wish to report my experience with a pair of nesting Ouzels in Colorado during the month of June, 1926.

I have made many visits to the beautiful Seven Falls located in the Cheyenne Cañon of Colorado. The altitude here is about seven thousand feet. This cañon is one of the wonder spots of American landscape, walled by perpendicular granite masses many hundreds of feet in height. The cañon is about one mile in length and from thirty feet to one hundred feet wide. It ends in a beautiful circular glacial-like cirque, down whose sides a stream from dizzy heights plunges in seven leaps. At the base of this beautiful waterfall, where the sun at mid-day plays on the tossing spray, myriads of miniature rainbows form in the mist. In the midst of this colorful display on a narrow rocky ledge the Ouzels each year build their nest of water soaked green moss, a few dead twigs and grasses. Mr. Standahl, the official photographer for the Seven Falls Company, told me that the Ouzels for the last five years had

¹ Read at the meeting of the American Ornithologists' Union, at Ottawa, Canada, October 13, 1926.



DUCK PORTRAITS. BY H. H. PITTMAN.
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1. BLUE-WINGED TEAL.

2. SHOVELLER.

built their nest and reared their young on a small ledge near the foot of the last fall. In 1925 they reared two broods there. He wrote me June 18, "The young Ouzels are hatched," and I set out for the Falls, seven hundred miles from my home city.

At the foot of the Falls is a shallow granite-floored and granite-walled pool about thirty by thirty feet in area and one foot deep. In this icy cold and crystalline water I built a platform within six feet of the nest and from this continuously sprayed perch, clothed in waterproof garments, with camera protected by a rubber cloth, I stood for many hours making "stills" and "close-up" moving pictures and observing the birds.

Within twenty minutes after I mounted the platform the birds were feeding their young. The female did most of the feeding. On her alighting near the nest with food for the young, there was no hesitation, they fed at once. After feeding and making a hurried inspection of the immediate surroundings, before her departure, she often took a step or two away from the nest, turned about as though assuring herself that all was well and that she had not forgotten anything. On leaving the nest, she would often fly so close to my head and camera that I had to dodge to safety. At no time did either bird show the least resentment at my presence. On one occasion when my head was within eighteen inches of the nest, the female lit on the face of a slick rock three feet from the nest, but only for a second. She had in her beak a small rainbow trout, which she delivered to one of the young birds. Although there were four young birds, at no feeding did I see more than two gaping mouths protruding from the nest's entrance. The young Ouzel has an appetite not excelled by a young Robin and is a persistent beggar. The parent birds did not within my hearing utter any sounds other than the feeding call as they approached the nest with food. I have heard them in other localities sing melodiously and freely, the sweet notes rising above the crashes of rapids and the roar of waterfalls.

The nest measured ten inches in its horizontal, and eight inches in its vertical dimension. The nest entrance was on the side, a little below the center. This opening was about four inches in its diameter. The nest cavity was about five by five inches. I had ample time and opportunity to make these measurements without

disturbing the parents or doing the nestlings any harm. The nest was finished and contained eggs May 28. The young were several days old on June 20, my first visit. On July 4 they left the nest.

The male was slightly larger than the female. His feeding visits were about one to ten as compared with those of the female. The female fed about eight times per hour. The male fed oftenest between ten and two o'clock, at which time the combined feeding visits averaged twelve per hour. I noticed that the male made most of his visits to the nest while the female was brooding. She entered the nest by crawling over the young birds, turned about within the nest cavity and remained far back in the nest. At such times when the male made his visits, she remained in the nest, the young birds protruding their heads from beneath her breast to receive the food from the male. He rarely hesitated after feeding but took his departure at once. The female usually continued her brooding until she decided to depart, disregarding his visits. On coming out of the nest she climbed over the young and usually turned two or three times in front of the nest and inspected the margin of the door jam and the little shelf of rock in front of the nest.

The birds are extremely cleanly in their habits. As the interior of the nest was often inspected, any excrement found adhering to a straw or piece of moss was carefully picked up and carried away. The young birds when defecating turned the tail toward the nest entrance and with a well marked expulsive effort shot the foecal mass four to six inches from the nest. These masses were always enclosed in a membrane. Many of them rolled unbroken down the rocky incline into the water and were carried down stream. Those remaining were picked up by the female and removed. Some of them sank and could be seen as pearly white globules on the bottom of the pool. The mother often entered the nest and cleansed every small particle of filth from its floor, roof and sides, tossing it from her bill into the water or carrying it down stream. The male bird did not at any of his visits remove any of the fecal debris or other filth from the nest or its vicinity.

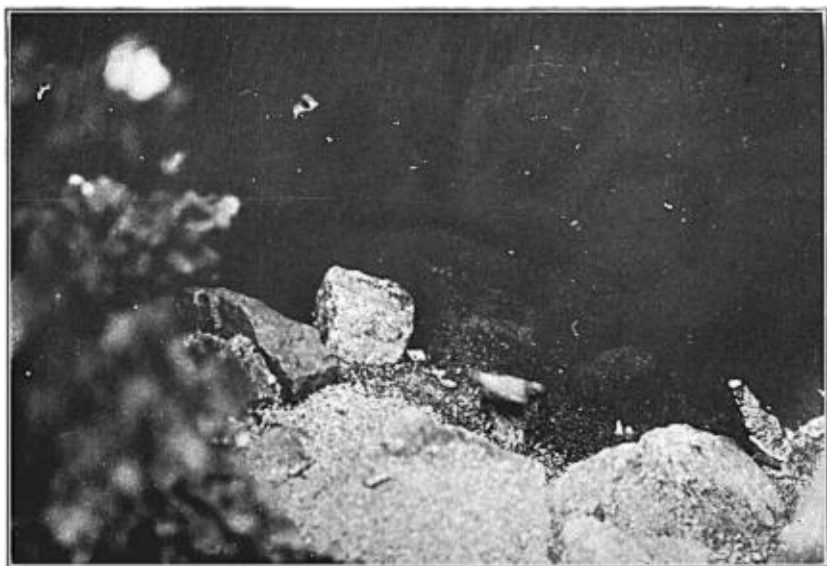
One bird only was fed at a feeding visit. On one occasion the male fed twice in five minutes. The female was in the nest during this time.

Some of the food is collected from the surface of the water as the bird swims, some from damp stones on the shores of the brook, some from still, pebbly spots near the shore and beneath the water, and some from the depths of the rapids and even in foaming whirlpools.

These webless footed birds are as artful and daring swimmers and divers as the Grebes and Mergansers. They are courageous birds in the water. The sexually maddened salmon in its element, as it rushes up rapids and over waterfalls, displays no more courage than this little bird as it fearlessly dives into whirlpools and rushing rapids.

At no time did I see either bird in a position of repose or rest. While the female was collecting food from among the pebbles in shallow water at the edge of the stream, if I approached a little too near (five feet), she would hesitate, teeter a few times, give me a few winks, and then resume her food hunting, or in a disgusted manner, as if to say "don't bother me," fly a few feet up or down stream. What little traveling these birds did was up and down their own thoroughfare. In seeking food in the still pools, the female with her head up stream alighted on some object protruding from the water. From this perch, after bobbing a few times, she waded leisurely into the still water to the bottom and walked deliberately about hunting under the edges of rocks for her prey. One-half minute was the longest time I saw her remain immersed. If she succeeded in catching anything, she came to the surface like a cork, secured a good hold on her prey, and flew toward the nest. When gathering food in swift water, she seemed to go down head first with her feet holding on to the rock beneath the surface and fed up stream. The toe nails are long and the flexors are strong, thus the feet are constructed like ice creepers, giving the bird much foot power. This was beautifully illustrated by the bird's ability to scale the water-splashed, glazed surface of the almost vertical face of the cliff down which the Seven Falls rush. Repeatedly the bird flew from the nest and alighted on the slick face of the cliff within a few inches of the massed waters of the fall, and climbed up its perpendicular surface, all the while gathering some form of food for the young.

These birds at no time displayed any of the nervous restlessness



1. SEVEN FALLS, HOME OF THE WATER OUZEL.
2. WATER OUZEL PHOTOGRAPHED BELOW THE SURFACE OF THE WATER.

of the House Wren. The ceaseless food seeking was marked by no undue haste. It was an act carefully planned and skillfully executed. I saw the Ouzels gathering food a half mile down stream. In returning to the nest they always flew close to the water and followed the bends of the stream. Away from the nest, they permitted me to approach within five to fifteen feet. After the first day at the nest, the female would feed the young with my head only fifteen or twenty inches away.

I saw the female catch a trout nearly two inches long; she flew to a partly submerged flat rock to secure a firm hold on the fish, then pounded it to a pulp before delivering it to the young.

A few yards below the nest site, the stream is converted by a dam, into a small lake one hundred yards long, thirty feet wide, and from two feet to ten feet deep. In this pool are many large rainbow trout. The water in this little lake is as clear as crystal, and I could see the Ouzel wade on the bottom of the pool, where the water was two feet deep. I saw the bird fly fifteen or twenty feet while two or three feet under the water, come to the surface and swim as gracefully as a Duck.

On one occasion a young White-throated Swift (*Aeronautes melanoleucus*) had fallen from its nest and lodged on the wall of the cañon. The Ouzel discovered it, flew to it, looked it over, and returned to her aquatic pursuits.

In 1925 I found two nests of the Ouzels within a mile on the same stream. This is unusual, as a pair of nesting Ouzels usually pre-empt a given territory on a stream by proceeding to drive away any "claim jumping" Ouzels who invade that territory. Choice nesting sites for Ouzels are scarce. I have often wondered where each new brood finds an unclaimed nesting site. The bird banders could quickly solve this problem, as Ouzels are not long distance travelers. They are permanent residents of their nesting locality and seem to thrive and enjoy their winters about the few water holes remaining open, amidst zero or below zero temperatures. In Alaska and Wyoming they live in a temperature of fifty below zero. Their heavy water-proof covering, like a thermos bottle, keeps the cold out and the heat in.

In the literature at my command there appears to be a diversity of opinion on some points in this bird's anatomical make up and aquatic habits.

Wishing to obtain an expression in regard to the nictitating membrane and its action, I wrote to a number of ornithologists and submitted the following questions, and a courteous reply was received from each. The diversity of opinion as expressed in these replies, convinces me that the Water Ouzel presents some problems in its anatomy and physiology not generally understood, and that some of its aquatic habits are still in dispute.

1. Has the Water Ouzel a nictitating membrane?
2. Does it use this membrane?
3. Is its upper eyelid covered with small white feathers?
4. Does the membrane move from the inner canthus horizontally, as in the Eagles, vertically, or obliquely across the cornea?
5. Why does it use the membrane so frequently?
6. Does the membrane come from above and go downward across the cornea?
7. Is it clear or translucent in the living bird?
8. Does the lower eyelid move upwards?
9. Does this bird ever use the membrane while beneath the surface of the water?

Dr. W. H. Bergtold of Denver, Colorado, whose home city is surrounded by Water Ouzels' territory, says: "I never paid any attention to the nictitating membrane, but I do not recall ever seeing the bird under water with the membrane covering its eyes. The eyes have always been open."

Mr. Charles E. Aiken of Colorado Springs, who has lived for many years along the mountain streams where the Ouzels nest, says: "I can give you no assistance from personal observations of the Water Ouzels. I got the impression that the membrane came up from the bottom."

Mrs. Shufeldt, Washington, D. C.: "I only wish I could help you in regard to the literature on the Water Ouzel. Looking over my husband's set of bound books, his work from 1880 to 1926, I find but one short paper devoted to the Water Ouzel."

Charles W. Richmond, Associate Curator, Division of Birds, U. S. Nat. Museum: "On the nictitating membrane of the Dipper I find very little, though I have searched for sometime this morning in the books in our library. I had hoped to add a reference to Macgillivray's 'History of the British Birds,' but while he

gave a very excellent account of the British species of the Dipper, he seems to have omitted any mention of its nictitating membrane or anything connected with the eye apparatus.

"Macgillivray was one of the few British ornithologists who investigated the anatomy of birds of that region and he seems to have overlooked this item. I am sorry I have not been able to help you very much in this matter, but the fact is there has not been much to add to Dr. C. W. Townsend's observations."

Mr. A. C. Bent, Taunton, Mass.: "In reply to your letter of the 4th inst. I am sorry to say that I know nothing about the anatomy of the Water Ouzel except what I have read in recent periodicals about it. I have seen the bird a few times and collected a few specimens in Alaska."

W. DeW. Miller, for Dr. F. M. Chapman of the American Museum of Natural History: "The Dipper has a nictitating membrane and it is separate from the upper and lower lids. The upper eyelid is covered with small white feathers. The nictitating membrane moves horizontally or nearly so. I believe the membrane is translucent or nearly clear in the live bird. Your other questions I cannot answer with any degree of certainty."

Dr. Charles W. Townsend, who is one of the most accurate field ornithologists I know, in 'The Condor' (Vol. XXVII, pp. 143, July, 1925) says: "Quoting from Grinnell and Storer, 'Animal Life in the Yosemite,' p. 544, 'The Nictitating membrane or third eyelid is whitish in the Dipper and when drawn backward across the eye as it is frequently when the bird is above water, can be seen at a considerable distance. This membrane probably is drawn over the eyeball when the bird is working beneath the surface of the water.'"

"Dawson's Birds of California, II, p. 733, says of this bird: 'Ever and again he delivers a slow wink upside down with the white nictitating membrane.'"

Dr. Townsend continues, "I hesitate to disagree with such authorities, but my observations, made under very favorable circumstances and mainly with this point in view, lead me to think that the winking is done with the upper eyelid. My studies of other birds to be detailed later, confirm me in the belief that it is not the nictitating membrane of the Dipper which makes such conspicuous

and easily seen winks. As the movement in every case seemed to me to be from above downward, it was apparent that it was the upper eyelid that winked and not the nictitating membrane, for movement of the latter is from the inner angle of the eye outward. I noticed several times that a narrow upper white lid at these times was not at once returned to its place. The fact that the part moved is white in an otherwise dark bird, has doubtless led to the belief that this is the nictitating membrane which in most birds is of a milky white color; but the direction of the winking is a vertical and not a horizontal or slightly oblique plane and proves this belief to be erroneous."

An anatomical structure that is common to most birds will be developed largely in proportion to the demands created by a bird's surroundings and habits. This is a noticeable fact in the case of the Water Ouzel. The nictitating membrane in this bird is an outstanding feature of its physical make up and habits. The surroundings in which the bird lives and its habits have been the means of developing this membrane into an appendage essential to the bird's comfortable existence. The membrane is called into action to clear the cornea of the watery mist while the bird is near the spray and splashes of falls and rapids. This was beautifully illustrated while the female was in the nest brooding. The flashes of the membrane could plainly be seen. The spray from the nearby falls, with the changing air currents could be seen to enter the nest and with each gust of moistened air, the membrane was called into action with increased vigor to brush aside the watery vapors from the cornea. This was performed independently of the white margined upper eyelid. The slow eyelid action is in part controlled by volition; the quick action of the membrane is brought about by an unconscious reflex demand.

Like Dr. Townsend, "I hesitate to disagree with such an authority." However, with some of his deductions I must take issue. My observations leading to these conclusions were made at a range of four feet to eighteen inches from the bird, extending over several hours each day for several days. The winking in this bird was performed by the action of the nictitating membrane and not by the upper eyelid. The upper eyelid has a well defined white margin. From beneath this, the membrane was flashed in a down-



1. WATER OUZEL WITH SMALL TROUT IN ITS BILL.
2. WATER OUZEL AT NEST.

ward direction in rather an oval shape, extending to the lower border of the cornea. The moving pictures show this membrane very distinctly. The movement is seen to come from above downward, *nearly the horizontal width of the upper eyelid*. When the bird was in the shadow of the nest cavity, with my eyes within eighteen inches of it, I could see the membrane very plainly as it frequently flashed across the eye ball. At other times I could see the iris and pupil, and again I could see the bird's head distinctly when neither the iris nor membrane could be seen, as the cornea was covered by a dark eyelid. Whether this was the lower, the upper, or both upper and lower eyelids, external to the membrane, I was unable to determine. As a rule most birds use their lower eyelids to cover the cornea when sleeping. The upper eyelid is not as free in its movements owing to the absence of constrictor muscles. In the Ouzels the upper eyelid moves freely. The external layer of the upper lid is like any other part of the bird's naked skin surface. The glistening, pearly-white, translucent, moist fold of the conjunctiva, making the nictitating membrane, does not present the appearance of the outer layer of the upper eyelid. The true lids in most birds move up and down, the winker moving horizontally. The Water Ouzel is an exception in so far as the movement of the winker is *nearly vertical*. In no bird can the upper eyelid be made to close and open with the speed of the nictitating membrane. According to the record made by the moving picture camera, there are five frames, or individual pictures, impressed on the film at each flash of the membrane. This represents about one-third of a second to each wink. Some of the winks are so quick that they may be compared to the rapid action of a focal-plane shutter of a graflex camera. On one occasion Mr. Sandahl pressed the button of the camera exactly at the time the bird winked. This picture shows the extent of the membrane's action from above downward. It also shows the membrane as an oval covering of the eye and not a straight line shield as would be the case if made by the upper eyelid.

This membrane in the Golden and Bald Eagles moves horizontally from the inner canthus past the cornea. The Alligator is almond-eyed, the pupil being a vertical slit. In this creature the nictitating membrane moves upward and outward from beneath the lower eyelid.

I find that certain authors are in error as to some of the bird's habits.

Jacob H. Studer, in 'The Birds of North America,' 1876, page 139, says: "When the Water Ouzels dive below the surface of the water, there is a film of air surrounding them which looks like silver and may assist in supporting respiration. They do not, however, swim on the surface, but always dive and sometimes fly across streams beneath the surface."

These birds have an under cape of oily down; while in the water, this often may be seen protruding through or between the heavier coat of feathers producing a shimmering halo about some parts of the bird's body. This oily down, like the powder-down tracts on the breast of the Black-Crowned Night Heron, may have led Studer to write the above. What effect darkness might have on this shimmering I am unable to state. Some writers have claimed that a phosphorescent-like glow may be seen on the breast of Herons. Forbush in 'Birds of Massachusetts' 1926, I think, by good witnesses disproves this claim. The Ouzel is a graceful swimmer on the surface of the water. It floats like a cork and uses its big webless toes as propellers.

Dall (Trans. Chicago Acad. I, 1869, p. 277) says, "When these birds are disturbed, they dive into the water." Of the many I have observed, I have never seen one go under the water from fright. The Water Ouzel's ability to immerse its body at will and to walk about on the bottom of the stream while feeding, then to return to the surface like a submarine and float as lightly as a piece of cork is hard to comprehend.

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