

often be impossible to go further, but in many winter or summer falcon ranges, accurate identification of pellet material, at least to family or genus may be made, and not rarely to species or even subspecies. The bulk of the feathers in a pellet are usually from head, neck and breast. These feathers may be slightly altered in color, but apparently not in pattern, if any exists. Frequently the beak or claws or both are present and are useful in identification. A knowledge of local distribution and habitat will help narrow the field, as in mammals, and it should be remembered that cover-haunting birds are not ordinarily available to any falcon. Finally, at a given site there may be a dozen or so pellets of exactly the same color, size, and consistency. Two or three of these may be positively identifiable through beak, claws, primaries, etc. Since falcons so habitually pursue one species of prey at a time, there is an extremely strong likelihood that the beakless and clawless pellets of the lot represent the same species as the others, especially if from state of dryness and weathering they seem to form a compact age series.

Similar deductions may often be made from the scales of reptiles, especially since the skin of one or more feet of a lizard may often be floated out of a pellet almost entire. Insects may be counted, and at least partly identified, by the very resistant mandibles, even if the rest of the head is broken beyond use. Other parts of insects in recognizable condition are of irregular occurrence in falcon pellets.

Oakland, California, December 3, 1935.

STATUS OF THE CORMORANTS OF GREAT SALT LAKE

WITH TWO ILLUSTRATIONS

By WILLIAM H. BEHLE

In a recent article dealing with the history of the bird colonies of Great Salt Lake (Behle, 1935, p. 32) attention was called to the fact that the fourth edition of the A. O. U. Check-list (1931, p. 23) indicates that the cormorants of Great Salt Lake belong to the race *Phalacrocorax auritus albociliatus*, while elsewhere they are found designated as *P. a. auritus* (see Lewis, 1929, pp. 7, 9, 10, and Peters, 1931, p. 86). In order to test out this matter of subspecific status, I have sought some breeding cormorants with nuptial plumes. At my request, Mr. Milton T. Rees of Salt Lake City obtained several specimens from Egg Island, Great Salt Lake. Three of these, taken on April 19, 1935, were sent to the Museum of Vertebrate Zoology, at Berkeley, and three reached the Department of Zoology at the University of Utah. These six breeding examples have now been examined by me.

The Pacific coast race, *albociliatus*, as the name indicates is characterized by having white nuptial plumes, these in groups or "crests" on the sides of the head above and behind the eyes—at least plumes in which white predominates. In the eastern race, *auritus*, these plumes are predominantly black. I find that the black plumes predominate in the birds from Great Salt Lake. A great amount of variation, however, is observed in these specimens as to color and number of plumes.

These diagnostically important nuptial plumes are of course "ornaments" of the breeding season and are acquired anew each year in the spring, starting to appear in March. They are worn by both sexes but are larger on the males than on females. According to Lewis (*op. cit.*, p. 58) they do not appear until a bird is nearly three years old, and there is usually not a marked development of crests until the fourth

year. This perhaps explains the absence of crests on many individuals even at the height of the breeding season.

In detail, the nature of the crests of the six specimens in question is as follows. No. 67008, Mus. Vert. Zool., ♀, has no trace of plumes. One or two worn light gray feathers on the sides of the breast give an indication that the bird is not an old adult, and this probably explains the absence of the plumes. No. 67009, ♂ adult, has but three plumes on the right side, all of which are white, while on the left side there is only one plume and it is black. No. 67010, ♂ adult, has one plume only on either side, each being black. The University of Utah specimens proved to be more enlightening. No. 2485, ♂ adult, has four plumes on the left side of the head; all are black except one which is white at the base with the tip black. On the right side are twelve or more plumes, all black except one which again is white at the base and black at the tip. No. 2484, no sex mark on tag, has no plumes on the left side and only one black one on the right side. No. 2486, no sex mark on tag, apparently is not an adult, as indicated by many juvenal feathers on the neck and upper breast. Even so, this individual has great tufts of plumes, about thirty individual feathers on each side, and all are black.

Since so much emphasis must necessarily be placed on the color of the plumes in establishing the subspecific identity, and since the situation is often complicated by the absence of crests or by mixed plumes when crests are present, one or two specimens, even though they have plumes, may not be sufficient material for determining the race to which they belong. It is requisite that a series of skins with plumes be available. The mixed black and white plumed condition was noted years ago by Baird, Brewer and Ridgway (1884, pp. 151, 152). They remark that there is "a gradual change from uniform glossy black nuptial crests, in eastern birds, to crests entirely pure white, or with merely a slight admixture of black in Pacific coast examples; specimens from the interior of the continent having the tufts mixed black and white."

The mixture in the Great Salt Lake series has now been discussed. A somewhat comparable situation exists in a series of birds from Salton Sea, Imperial County, California, which series as a whole is referable to *P. a. albociliatus* on the basis of predominance of white plumes. Certain individuals of this series possess all black plumes, while still others have a combination of black and white. Even single specimens from the Pacific Coast may be misleading as to this feature, as shown by no. 4410, Mus. Vert. Zool., ♂, from the Farallon Islands, which has as many black as white plumes. In spite of all this general variability of the plume color, the predominance of black in the Great Salt Lake cormorants justifies, I think, on this score alone, calling them *P. a. auritus*.

In addition to the systematic aspects here discussed, there are other considerations worth reporting in connection with the Great Salt Lake cormorants. It seems strange that there should be an outlying colony of the eastern race of these birds in northern Utah. Whither they migrate is still unknown. Birds were banded on Egg Island in 1933 by J. W. Sugden and also in 1934 by me, but no returns have been reported.

The nesting of the cormorants at Egg Island shows adaptation to local conditions where a low rocky terrain exists (see fig. 15). The nests have been built on or among the large rocks which are often used as supporting bases. Each nesting site has been used year after year, and apparently new material is added each season. At the present time the majority of the nests are a foot or more high; the lowest found was six inches high, the tallest measured twenty-two inches from its base. Each nest is fairly uniform in outer diameter and is 1½ to 2 feet across (fig. 16). The sticks



Fig. 15. Nests of Double-crested Cormorants on Egg Island, Great Salt Lake, Utah; May 18, 1932.



Fig. 16. Young Cormorant in nest at Egg Island, Great Salt Lake, Utah; May 18, 1932.

are interwoven and are white-washed with excrement. The sticks must have been carried from the mainland, or from the larger Antelope Island near-by, since Egg Island is devoid of such material.

In spite of the low level of the lake, the island itself is still (April, 1935) surrounded by water affording some isolation and protection. Food in the form of the preferred non-game types of fish is abundant in the region of the lake. Yet the cormorants are declining steadily in numbers. This is shown by the abandonment of Dolphin Island as a nesting site and the reduction in numbers on Egg Island from 500 in 1915 to possibly 114 in 1935. Also only a few birds still breed at the Bear Lake colony, whereas hundreds were there a few years ago. One reason for the decrease is disturbance of the nesting colonies by boating parties.

During the breeding season of 1935 at Egg Island the cormorants were nesting with Treganza Great Blue Herons and California Gulls. On April 10, Mr. Rees counted 57 cormorant nests with eggs. There were most commonly 4 eggs in a nest. During the few minutes he was on the island about two dozen cormorant eggs were destroyed by gulls. At this time there were also noted 11 heron nests with eggs. Hundreds of gulls were flying about, but apparently not yet nesting. On April 19, there were only 48 cormorant nests with eggs, and but 6 heron nests occupied. On this last date Mr. Rees and his companion arrived by boat at the same time that a party of students waded to Egg Island from the nearby Antelope Island, which is now connected with the mainland. The crowd remained about two hours on the tiny island. The gulls were given an excellent opportunity to levy on the eggs, an opportunity which they made the most of. Also many young cormorants and herons succumbed from exposure to the heat of the sun. Just such occurrences as this, repeated year after year, are contributing to the decrease of the cormorants and herons on this island.

By way of summary, then, the evidence indicates that the Great Salt Lake cormorants are to be identified as of the race *auritus*. The most important differentiating character between *auritus* and *albociliatus* is the color of the nuptial plumes, and those of the Great Salt Lake specimens are predominantly black. The numbers of breeding cormorants in the region are steadily decreasing and extinction is threatened.

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