

NOTES ON THE MOLTS AND SEQUENCE
OF PLUMAGES IN THE OLD-SQUAW.¹

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A PERUSAL of the literature pertaining to the Old-squaw, *Clangula hyemalis* (Linnaeus), in connection with my study of a representative series of skins collected during 1929 and 1930 at Southampton Island, Hudson Bay, leads me to conclude that there are some misconceptions regarding the molts and plumages of this interesting duck.

Principal among these misconceptions is one which apparently was engendered by Millais (*British Diving Ducks*, Vol. I, 1913, p. 114) and which has more recently been voiced by Forbush (*Birds of Massachusetts and Other New England States*, Vol. I, 1928, p. 255) that the Old-squaw is "unique in having different nuptial and winter plumages."

It is not surprising that this misconception has become current. We are so accustomed to thinking of the plumage which is characteristic of the breeding-ground, and of the period just before egg-laying as the nuptial plumage, that it seems perfectly normal to regard the dark plumage of the Old-squaw as its nuptial plumage in view of the fact that mature females practically always, and adult males frequently, arrive at their Arctic nesting-grounds fully attired in this plumage. Furthermore, the mere fact that this so-called 'nuptial' plumage is so infrequently seen in our latitude in its completed state has somehow invested it with a beauty and striking quality which actually, when in direct comparison with the winter plumage, it may not possess.

The male Old-squaw in its summer plumage is, to be sure, a

¹ This paper is based upon a study of forty-six specimens taken throughout the year, as follows: 2 males and 3 females, January; 1 female, April; 2 males and 1 female, May; 4 males and 2 females, June; 1 male and 1 female, July; 3 males and 1 female, August; 5 males and 4 females, September; 3 males and 3 females, October; 1 male and 2 females, November; and 5 males and 2 females, December.

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beautiful bird. But this summer plumage, I am now convinced, is not the nuptial, but rather the 'eclipse' plumage. My reasons for believing that the plumage which Forbush and others call the winter plumage is in reality the nuptial plumage are these: first, the boldly marked, strikingly handsome plumage of the adult male in winter has decidedly more the general appearance of a courting plumage than does the dark, summer plumage; and furthermore the extremely elongated scapulars and high crest of the winter male are altogether ornamental features which are more obviously consistent with a nuptial plumage than is any feature of the plumage which Forbush calls the "nuptial." The bold black and white color-pattern of the male in winter is probably partly protective since the birds frequent the ice-fields where there is considerable white in their habitat, and also since the female is whiter in winter than in summer; but the long scapulars and high crest of the male contribute nothing to any such protective scheme.¹

My second reason for believing the white plumage worn during the winter to be the nuptial, is that this winter plumage comes the nearest to being a really new plumage that the bird has during the course of the year. The plumage which Forbush calls the 'nuptial' is not a new plumage, for the wings are not renewed as is the body plumage, but are frayed and faded. In this respect the Old-squaw is similar to the rest of the ducks, all of which molt their primaries at the conclusion of the 'eclipse' or *post-nuptial* plumage.

My third reason for believing the white plumage to be the nuptial is that a great deal of courtship and mating takes place while the birds are in this plumage. Mating continues while the spring plumage change is going on, to be sure, and also even after the dark plumage has been assumed; but this does not, to my way of thinking, prove that the white plumage is actually not the nuptial plumage. The frequent retention until spring and summer

¹ Smalley (*British Birds*, Vol. IX, No. 6, November, 1915, p. 140) says that the "central pair [of rectrices] are quite two inches longer during the period from the molt in April to being cast in July than they are after being grown again in the autumn-molt from October to April." Were these central tail-feathers actually longer during this summer period than in winter I should question the advisability of calling the white plumage the *nuptial*, since these long tail feathers are certainly to a large extent ornamental; in the specimens at hand, however, there is no constant difference in the length of these tail feathers in summer and winter specimens, the longest feathers in the series being in a January specimen.

of part or even all of the winter plumage of the male, a phenomenon which has been referred to by many authors (e. g. Nelson, Report on Natural History Collections made in Alaska between 1877 and 1881, 1887, p. 73), is a point decidedly in favor of this concept. Millais himself (1913, p. 124), though regarding the dark summer plumage as the nuptial, says regarding the courtship behavior of the species: "Even males in full winter plumage will come and be almost, if not quite, as active as the rest [in pursuit of the female]."

My fourth reason for believing the winter plumage to be the nuptial and the summer the "eclipse" is that the male in summer resembles the female much more closely than it does in winter. The most striking characteristic of the eclipse plumage of male ducks in general is that it tends to resemble the summer plumage of the female very closely. While the male Old-squaw in summer differs markedly from the female in possessing the long central rectrices, its color-pattern in general is much more similar to that of the female than it is in winter, the most noticeable difference being the black breast area which is represented in the female only by mottlings and spottings of gray.

From my observations of the species on Southampton Island, I should say that as long as any of the white, winter, nuptial feathers remain in the plumage of the male, courting and mating are likely to continue, and that courting ceases by the time the males are in full summer attire. Practically all the courting and breeding males which I saw or collected still had white feathers on the crown, even as do many of the birds in Millais' spirited drawing (1913, facing p. 128). By the time the females are laying, the males are practically through with their courting, for mating is by this time a matter of brute pursuit, and they are now usually in nearly full summer or eclipse plumage. When the full sets of eggs have been deposited, the males leave the females altogether, desert the nesting-grounds for the most part, and congregate in some favorite feeding-ground where they enter upon the final stage of the post-nuptial molt, the dropping of the wing and tail feathers. Their flightless period, therefore, is spent at sea, as a rule. Occasionally a male bird in the molt is to be seen on one of the inland lakes, but not often.

The new wing feathers may, of course, be regarded as the last stage of the eclipse plumage to appear, but they are more properly the first of the new nuptial plumage, and once these have been donned the molt of the head and body into the striking black and white of winter progresses rapidly. The late appearance of the new wing feathers means that the eclipse plumage is never a completely new plumage, since by the time these wing feathers are fully grown, the dark plumage of the head and back is faded and worn, if not already molted.¹

The summer or eclipse plumage of the Old-squaw usually begins to appear, then, actually before the nesting season, even before the nesting-ground has been reached, though it is rarely, perhaps never, complete in the male before the female has begun to lay her eggs. This procedure, which is decidedly unusual, if not unique, among the ducks, may be explained in the following manner: first, since the primary purpose of the eclipse plumage is, as I see it, to give the bird a protective coloration during the nesting period, it seems only logical that when the birds shift their activities from the ice-filled bays and inlets to the rock-rimmed inland ponds, they should be equipped with a plumage which harmonizes with the nesting-ground surroundings. Ornithologists who have witnessed summer in the North Country will appreciate the force of this statement. The coming inland of the birds is sudden and widespread and it involves a decided change of habitat. On one day in early summer the tundra may be frozen shut, silent, and apparently lifeless. A week later, this same tundra may be entirely snowless, the lakes all open, and the flowers blooming. Such is the rush of the spring in the Arctic. If the Old-squaw waits until the lakes have thawed to begin its molt, it goes to its nesting-ground in anything but a protective coat; if it molts early, however, it is ready to fly into the grass-lined pools on a day's notice, and the female, rid of her white, winter plumage, can make her nest in the open unafraid of being seen by her enemies.

¹ It is evident from a most interesting specimen taken by Dr. R. M. Anderson at Elson Bay, Point Barrow, Alaska, on August 23, 1913 (Canadian National Museum Collection, No. 7307) that at least in some instances all the plumage of the wings (primaries, secondaries, and apparently all the coverts) and of the back is molted simultaneously. Judging from the condition of four late summer specimens examined, the wings and back feathers are thus molted and renewed before the tail drops out. And by the time the rectrices have dropped out and begun to grow in anew, the 'drab' feathers of the flanks have entirely disappeared.

Second, by the time the birds arrive at their actual nesting-ground the purpose of the nuptial plumage has already largely been served. By the time the females, eager to make their nests, have arrived at their nesting-ponds, they probably have been mated for weeks or even months, the selection of mates (if there be such a definite selection) taking place out among the ice-fields in the salt water. For all I know, the birds may actually mate in the fall.¹ By the time the nesting-ground is reached the taking on of any attractive plumage is unnecessary, for the attracting has already been consummated. Mating may continue to go on, to be sure, and copulation certainly continues, but I question a little whether this species ever mates very definitely, for I saw many males chasing a single female upon several occasions, and was given the impression again and again that the birds were both polygamous and polyandrous. The program of the Old-squaw is, it may be seen, rather different from that of most ducks. It moves northward very early in the spring; in fact, many of the birds probably actually winter in the open waters of Hudson Bay. The days become warm, long and bright, and the procreative urge undoubtedly leads to a great deal of early mating. At this time, long before the actual nesting begins, the winter plumage of the male, which has served as a protective garb among the winter seas, now serves an additional purpose, that of attracting, or of arousing the mating instincts of, the female. But though the handsome courting plumage is desirable at this time, there is an even deeper, more urgent need for a coloration which will be suitable in the nesting environment into which he suddenly must fly; and to meet this need the courting bird, while still courting, molts into the eclipse, in early anticipation of the decided change in environment.

The early summer mating activities of the male Old-squaw as I saw them, were not so much a matter of attracting the female, as of chasing her down. Night and day the pursuit went on, the

¹ The author will not be surprised if we someday learn that mating frequently takes place in this species as soon as the white, nuptial plumage is complete in the fall. The behavior of the winter flocks certainly is that of courting, mating birds. The towering flight, violent pursuit, and other strange antics which are to be seen throughout the winter, especially on fine days, are similar to, if not identical with, the mating performances which are to be observed on the actual nesting-grounds.

males giving their breathy, amorous call-notes ceaselessly, the females quacking loudly as if actually terrified by their consorts. The panting females led the males a wild chase, sometimes sweeping high into the sky, turning almost complete somersaults, then sliding sidewise or shooting downward to plunge without a second's hesitation straight into the water, often without stopping the beating of their wings.

The statement has been made by Ekblaw (cf. Bent, *Life Histories of North American Wild Fowl*, 1925, p. 34) and others, that the males are more numerous than the females and that therefore the "rivalry for the females is very keen, and the fighting continuous." Of conditions at Southampton I should say, not that the males were actually more numerous than the females, but that, due to the polygamous and polyandrous tendencies of the species, more than one male was practically always in pursuit of every female, and this often gave the impression that the males were more numerous. Millais (1913, p. 123) has called attention to this *apparent* overabundance of males among the flocks in early spring. He says: "I have noticed a bunch of eight or ten females swimming apart and not a male going near them, whilst ten or fifteen males will crowd round some particular female and lavish upon her all their arts of charm."

By the time the female birds with nests are incubating their eggs, most of the adult males leave the inland pools and congregate in the bays and inlets, frequently many miles from land. Some unmated females and full-plumaged males remain inland to be sure, but most of the males are gone to sea by the middle of July. Here they lose their faded primaries and secondaries and take on new flight feathers as the first of the new, nuptial plumage which will be worn until the following spring. At about the same time the females, inland with their broods, also undergo the molting of the wing feathers, and with their rapidly developing young await the time when they can fly out to the salt water and join the tremendous flocks of adult and young males, sterile or unmated females, and females whose nests were broken up or whose broods were destroyed before the molting of the wing feathers took place. It is at this time that the birds should take on what Millais has called the special "semi-eclipse" plumage. Millais says (1913,

p. 115): "My examinations of specimens [taken] during this period [from mid-July to September] have led me to conclude that this duck passes into semi-eclipse dress before gaining the winter plumage." This "semi-eclipse" plumage is described by Forbush (1928, p. 255) as "similar to the summer plumage but upper back darker; scapulars brownish or sooty brown, some (particularly the longer) shaded and broadly edged buffy-brown; sides and flanks drab; otherwise as in summer plumage." Mrs. Meinertzhagen (cf. H. F. Witherby, *A Practical Handbook of British Birds*, 1924, p. 340) bases her description of the "eclipse" plumage of the adult male upon a specimen in the E. L. Schiöler collection which may have been either "fully adult or in its second year." The description is as follows: "This plumage is acquired by a partial molt of the head, neck, upper mantle, scapulars, sides of body and flanks, followed by wings and tail in July and August. Some new black-brown feathers are acquired on crown and nape, also on upper mantle, which with abrasion of russet edges of summer feathers causes upper mantle to appear darker than in summer; new scapulars brownish or sooty brown, some uniform, others, especially the longer ones, more or less shaded and broadly edged buff-brown; sides of body and flanks with new drab feathers, drab-grey towards base; rest of plumage that of worn summer."

I have never seen the specimen upon which this description is based; nor have I seen the specimens which Millais describes and unfortunately does not figure; but I have examined enough specimens in this plumage to warrant venturing an opinion that they are actually only individuals wherein the final stages of what I am calling the post-nuptial molt have been delayed. It is well known of course, that this molt of the Old-squaw is very irregular and that it is prolonged through the entire summer. Dark, breeding birds noted or collected at Southampton Island in June and July nearly always had, as has been stated before, traces of the white nuptial plumage on the head and upperparts. Such white plumage was to be seen most frequently on the crown, neck and scapulars. All these white feathers must drop out sometime during the course of the summer or fall, and they must be replaced in due season. These old nuptial feathers are not replaced immediately by new nuptial feathers. Instead, though the season be late, and though

the post-eclipse (prenuptial) molt may be on, these feathers are replaced by new *dark* feathers. Why should there not be, therefore, "new black-brown feathers" on the crown and nape, new scapulars which are obviously different in appearance from the old, worn, faded ones, and so on?

The 'drab' flank feathers, which are certainly noticeable in late summer specimens and which may, according to my observations, be either dark ashy gray, or dark russet brown, are really not part of any "special eclipse" plumage, but merely part of the summer plumage or regular eclipse plumage which appears rather late in the season just prior to the dropping out of the wing and tail feathers. Though these feathers thus come in very late, they apparently drop out promptly. They are rarely to be seen in September specimens, for by this time the flanks are either in the normal winter plumage, or are more or less devoid of the longer flank feathers which are just coming in.

My belief that there is no special "semi-eclipse" plumage at the end of summer began with the conviction that, protectively colored as the bird is, and equipped with a perfectly warm coat of feathers, it really does not need a special plumage, either complete or incomplete, at this time any more than does any other species of duck. The plumage worn during the summer, or the eclipse, as we now understand it, is perfectly suited to the needs of the birds at this time, even though some of the feathers are faded and worn.

The plumage which Millais has called the semi-eclipse is, in reality, then, the full eclipse or the completed *post-nuptial* plumage which corresponds to the winter plumage of other birds even though it is worn during the summer. This plumage is not fully acquired until late in the season because of the long duration of the post-nuptial molt which extends, as has been stated before, from March or April until mid-summer. Judging from the several specimens at hand, and from my mid-summer experience at Southampton Island, I should say that the full eclipse plumage is practically never seen before August, and the drab-colored flanks do not appear until the very eve of the dropping out of the wings and tail.

The plumage which Forbush and others have described as the

“nuptial” is really, therefore, only that part of the eclipse plumage which is usually assumed early in the season. The complete eclipse plumage (or, rather, the eclipse in the most nearly complete state in which it is known to occur) is characterized in general by its sombreness. By the time the last of the eclipse feathers have come in, the earlier ones have become faded and worn, this giving the back and scapulars a very dark appearance; by this time the old, white feathers of the head and neck are all gone, for they have been replaced by the belated summer feathers; the winter feathers of the flanks which are held until mid-summer now drop out and are replaced by new ‘drab’ feathers which are obviously not very strong, and which will be replaced promptly. Even the light-colored area of the face becomes dingy and dark, or even spotty in appearance, largely due to the fading and exposing by wear of the dark bases of the summer feathers.

The feathers of the Old-squaw’s eclipse plumage are apparently much weaker than those of the nuptial plumage, and many of them, notably those of the crest and scapulars, are actually shorter. These eclipse feathers are worn only a comparatively short time, so they do not need to be so strong as those of winter which must be worn from late September or early October to April and May or later.

The fact that the post-nuptial molt of the male Old-squaw is prolonged throughout the spring and summer is most interesting. This prolongation of the molt may be due to the bird’s need for a constant and practically complete feather covering such as it might not have were the molt more abrupt and definite; or it may be due to the fact that since most of the bird’s vitality is expended upon mating activities in the spring, it is simply not possible for it to undertake the growing of a complete, new set of feathers at the same time. There is obviously some reason for the prolongation of this post-nuptial molt, since the pre-nuptial molt in the fall is amazingly rapid and definite, whole tracts of feathers frequently dropping out in such a way as to give the birds an exceedingly dowdy appearance.

Summary.

1. The plumage worn by the Old-squaw during the winter is really the nuptial plumage, and the plumage worn during the

summer is really the eclipse plumage. The Old-squaw is not, therefore, "unique in having different nuptial and winter plumages."

2. The molting of the nuptial plumage prior to the actual nesting season is an adaptation to a sudden and decided change in environment.

3. There is no "semi-eclipse" or special mid-summer plumage of any sort which follows the eclipse and precedes the nuptial plumage; but the acquisition of the full eclipse plumage requires so much time, because of the long duration of the post-nuptial molt, that this final stage of the eclipse sometimes has the appearance of an entirely distinct and separate plumage.

4. The great prolongation (throughout the entire spring and summer) of the post-nuptial molt may be due to the bird's need for a constant feather covering such as might not be possible were the molt more abrupt; or it may be due to the inability of the bird to carry on its spring mating activities and to grow a new and complete set of feathers at the same time.

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