

NOTES ON WHITE SPOTTING AND OTHER PLUMAGE  
VARIATIONS IN GEESE

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FROM 1940 to 1946, staff members of the Illinois Natural History Survey have conducted investigations of the flock of Canada geese wintering at the Horseshoe Lake Game Preserve in Alexander County, Illinois. Between 1943 and 1946 the writer was engaged in this research program.

Periodic censuses were made of this flock as it gradually increased in size during the autumn. These censuses as well as trapping activities afforded opportunity to scan the flock carefully for varieties of geese other than the greater Canada goose, *Branta canadensis interior* Todd, which made up the flock, and to note any unusual plumages. During the latter years of the study a surprising number of individuals showing unusual plumage variations, particularly white spotting, were observed and in some instances trapped.

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## SPECIES REPORTED

An extensive summary of atypical plumages in wild geese was previously made by Gladstone in 1926. He was able to learn of the existence of only 14 specimens of white and white marked geese. He cited Leverkuhn's earlier failure to find atypically colored geese in north European museums. Gladstone also summarized notes on a number of individuals observed but not collected. Seven of the nine species of waterfowl which he listed belong to the tribe Anserini (geese and swans). These species are: Canada goose, *Branta canadensis*; barnacle goose, *Branta leucopsis*; brant, *Branta bernicla*; bean and pink-footed geese, *Anser fabalis*; gray lag goose, *Anser anser*; white-fronted goose, *Anser albifrons*; and the blue goose, *Anser caerulescens*. This list accounts for seven of the 13 species as listed by Delacour and Mayr (1945: 37). Although Gladstone was apparently unaware of several American references, no new species can be added to this list.

## WHITE SPOTTING

The terms "albino" and "partial albino" are frequently found in the ornithological literature in reference to individuals that are white or partially white over areas of the body that are normally pigmented. The first term is often misused, while the second "partial albino" is

entirely incorrect from a strictly genetical standpoint, the term "white spotting" being the correct one to designate partly unpigmented individuals.

To rank as a true albino, the skin, the feathers and the eyes of an individual must be completely deficient of pigment. It is questionable whether any specimens of true albino geese are known. Although Gladstone (1926) has recorded a number of white geese (Table 1) he could not state whether or not the eyes (irides) were pigmented, since most of the records consisted of museum skins or inadequately studied birds in the wild. For the present it would seem best to regard previously reported white geese as extreme examples of white spotting.

Cream-colored individuals with a whitish wash over the entire body, but usually showing some degree of "ghosting" of the normal coloration pattern, are more common than pure white individuals, both as to the number of species represented and as to the frequency of occurrence within the species (Table 1).

Geese exhibiting the piebald pattern of white spotting may be grouped according to the distribution of white on the body. In most individuals the white is limited to one of the following areas: head; head and neck; entire body excluding head and neck; under parts of body alone; and wings. The distribution of white in many of these piebald geese may be related to the location of pigmentation centers in birds as described by Allen (1914: 550).

Canada geese having unusual amounts of white on the head and on the neck are not uncommon at Horseshoe Lake (Plate 1, B and Plate 2, A). In a flock that has varied from 26,000 to 50,000 in number, from 1943 to 1946, the writer has usually seen two or three prominently marked geese of this type each year.

On two occasions, November 3 and 4, 1943, Paul S. Smith and the writer observed a goose with the entire black neck stocking liberally flecked with white feathers. On October 24 and 30, 1944, another individual showing the reverse of the above condition was observed; that is, the head and neck appeared entirely white except for flecking by relatively small numbers of black feathers and a narrow vertical stripe of black behind the jaw. An intermediate stage of white spotting on the head and neck is shown in Plate 1, A. An unusual variation of white spotting on the neck is the checkerboard pattern, Plate 2, B.

A narrow band of white or whitish feathers across the forehead is not infrequent in the Horseshoe Lake population. Elder (1946: 101) found it in three per cent of the population he sampled at the Horseshoe Lake Game Refuge. A more extreme variation of this type of

TABLE 1.—SUMMARY OF GESE EXHIBITING WHITE SPOTTING

Species	Piebald Individuals		
	All white, whitish or creamy white individuals	Head and neck	Body, wings and tail
Canada goose <i>Branta canadensis</i>		3, Gladstone, 1926; occasional, Elder, 1946; this study	Taverner, 1908; Blakiston, 1863; Murray, Elder, 1946, and this study 1933 (also neck brown- ish gray); this study
Barnacle goose <i>Branta leucopsis</i>	Whitish: 1, Gladstone, 1926		Miscellaneous
Brant <i>Branta bernicla</i>	White: 1, Gladstone, 1926		White wings, Gladstone, 1926
Bean goose <i>Anser fabalis</i>	Pale buff: 1, Gladstone, 1926 Cream colored, pink feet: 1, Gladstone, 1926		
Pink-footed goose <i>Anser brachyrhynchus</i>	White: 1, Gladstone, 1926 Whitish: 1, Gladstone, 1926 Cream colored: 1, Gladstone, 1926		
Grey lag goose <i>Anser anser</i>	White: 3, Gladstone, 1926		Upper body, some pri- maries, tail: Gladstone, 1926
White-fronted goose <i>Anser albifrons</i>	Creamy white shading to buff: 1, Bryant, 1914	Gladstone, 1926	General interspersing of white feathers, Gladstone, 1926
Lesser snow goose <i>Chen h. hyperborea</i>	1, Soper, 1940		

spotting was observed in an individual in 1944, in which the forehead bar continued back of the eye and joined the white cheek patches.

The wings of geese may be entirely white and the rest of the body of normal coloration, or only certain primaries or parts of primaries may exhibit spotting. Two juveniles were trapped at Horseshoe Lake, one in 1944 and the other in 1945, which exhibited white on the basal half of the primaries, Plate 1, C.

Canada geese showing excessive amounts of white on the body are relatively common at Horseshoe Lake, one or more individuals having been observed each year between 1942 and 1946. A goose having a typically colored head and neck, but with a body only a few shades less than pure white was observed at the refuge three years in succession. The tail was white, but the distal third of the primaries of this individual was dusky, and it had a dusky streak down the lower back.

A juvenile female in the Natural History Survey collection, with underparts entirely white and extending as a broad white collar around the base of the black stocking of the neck which is also flecked with white feathers, was trapped at Horseshoe Lake in 1942. A second similar specimen, a juvenile male, was trapped in the autumn of 1943 and made into a study skin by the writer. In January, 1945, a third white-breasted bird, a juvenile female, was trapped and released at Horseshoe Lake, Plate 1, F. This individual was one of a family of five observed that year, all of which appeared to be identically marked. The hereditary nature of this mutation was again illustrated the following year. On October 14, 1944, Paul S. Smith observed a family of seven at the refuge, all marked with a broad white collar at the base of the neck and a white breast shield. This same family was subsequently observed on October 23, on this occasion by Smith and the writer. Less strikingly marked geese have been shot by hunters in the vicinity of Horseshoe Lake (Elder, 1946). In Plate 2, C, a white-bellied adult male is contrasted with a more typical juvenile male.

#### MELANISM

The most unusual instance of melanism is that of a male Canada goose shot near Plymouth, Massachusetts, which lacked the usual whitish cheeks and throat patch. "The bird's head was entirely black, with the exception of a few small lighter colored feathers on its throat, which showed only upon a very close examination," (Kennard, 1912: 391). This goose was one of a flock of seven, presumably a family, all of which were said to be darker than usual on the side of the head.

Extreme examples of variation of the cheek patch of Canada geese in the Horseshoe Lake flock is shown in Plate 1, E.

Melanism is evidently rare in the Horseshoe Lake flock. A slightly melanistic juvenile male was trapped in 1944, Plate 2, D. Elder (1946: 101) observed partly melanistic under-tail coverts in about 17 per cent of the population.

#### HEAD CREST

The most unique mutation recorded in wild geese is the crested condition reported by Phillips (1913: 578). Three crested Canada geese, all alike, were killed from the same flock near Pea Island, North Carolina.

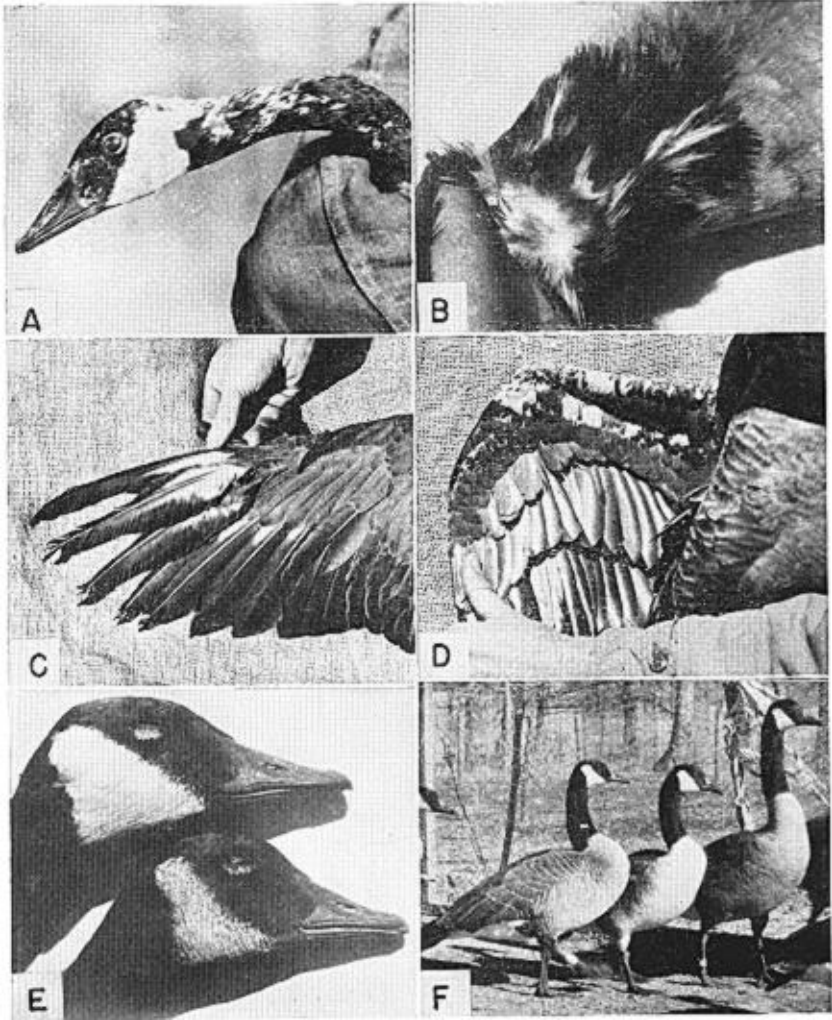
#### SOMATIC MUTATIONS

A chimeric Canada goose was found dead near Horseshoe Lake, Illinois, in the winter of 1944-45. According to Paul S. Smith, federal game agent who found the bird, the wing shown in Plate 2, E, was the only part of the body which was in any way unusual. The remainder of the body was of the expected coloration.

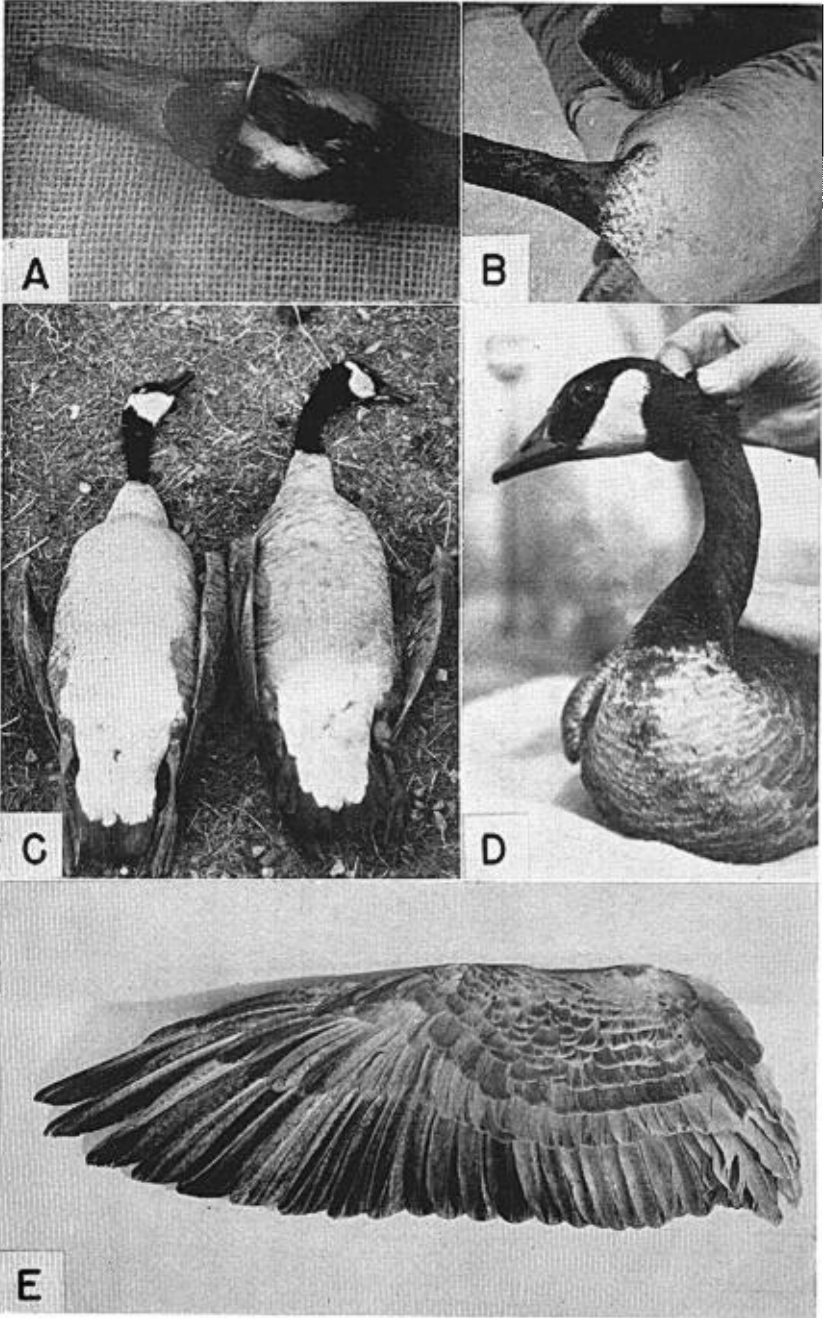
#### DISCUSSION

Despite the surprising number of white or piebald geese of which he was able to obtain records, Gladstone (1926) concluded that, "There can be no doubt that albino or albinistic . . . geese are of extreme rarity, and it is surely a very odd coincidence that white examples of three different species should have been obtained within the last fifteen years on the Solway and within a perimeter of only some twenty-five miles." Shiøler reported to Gladstone that he had never observed an unusual plumaged goose and M. Menzbier had seen only one case of white spotting in Russia in his 50 years of bird study. Soper (1940: 32) stated that he believed albinism to be extremely rare in both the blue and snow geese as he had observed hundreds of thousands of these geese without noting it prior to 1940.

It would now appear, however, from the number of additional records of white spotting in geese culled from the literature and from data gathered at Horseshoe Lake, that mutations to white in geese are not so rare as once believed. With the exception of Soper, probably few workers have had the opportunity to scrutinize carefully (or trap) the large numbers of geese annually as is ideally afforded at the Horseshoe Lake Game Preserve. This may account for the supposed rarity of odd-plumaged geese. More recently, however, Witherby *et al.* (1939:199) stated, "Occasional albinos or partial albinos



WHITE SPOTTING IN CANADA GEESE: *A*, ADULT; *B*, ADULT MALE; *C*, JUVENILE; *D*, ADULT FEMALE; *E*, *above*, ADULT MALE, *below*, ADULT FEMALE; *F*, *center*, JUVENILE FEMALE.



WHITE SPOTTING IN CANADA GEESE: *A*, ADULT MALE; *B*, ADULT; *C*, *left*, ADULT MALE, *right*, JUVENILE MALE; *D*, JUVENILE MALE; *E*, ADULT MALE (?).

of the species (pink-footed goose) occur with some regularity in large flocks and may be helpful in tracing movements."

Some types of white spotting are associated with increased age; others apparently occur only in the juvenal plumage. The most pronounced types probably appear in all successive plumages after the downy for which no data are available.

A white neck-collar and spotting on the under-wing coverts appear more frequently in older birds. Elder (1946: 101) found the white collar to be three times more frequent in older geese than in juveniles (16.6 and 4.2 per cent, respectively). The writer has found white spotting at the base of the black stocking almost entirely restricted to adults.

White spotting of the under-wing coverts occurs chiefly in Canada geese more than one year of age. Elder (1946: 101) found it in 32.2 and 37.5 per cent of the adult males and females but in only 1.5 and 1.4 per cent of the juveniles. The writer's recorded instances of spotting on the under-wing coverts (Plate 1, D) are confined almost exclusively to adults, the females demonstrating it twice as often as the males and usually to a greater degree.

On the other hand, the type of white-spotted primaries shown in Plate 1, C, may not appear in other than juvenile birds. The juvenile caught in 1945 was retrapped in November, 1946. On this occasion the wings of this individual were of normal coloration.

It is not likely that geese which have extensive white areas on their body undergo more than minor plumage changes from year to year, although records of some whitish- and cream-colored geese (Gladstone, 1926) indicate that gradual whitening may occur with increased age. The white of the white-bellied Canada geese trapped at Horseshoe Lake, however, was chalk white even in the juveniles. Maintenance of one type of piebald spotting in successive plumages was demonstrated by the white-bodied goose with a typical head and neck which returned to Horseshoe Lake in three successive years. This bird was not banded, but the writer and other observers feel certain that their observations pertained only to the same individual.

Since there has been no experimental breeding of unusual phenotypes of geese, the genetics of known examples must remain conjectural. Nevertheless, it might be well to cite a few examples of what may be parallel mutations in a few other species of animals.

Mutations to white in Canada geese, judging from known examples, do not appear to be sex-linked. In Barred Plymouth Rock chickens (Mueller and Hutt, 1941) "imperfect albinism" as demonstrated by ghost barring is sex-linked. The white, whitish and cream-colored



series in geese are reminiscent of the albinistic series of allelomorphs in the mouse (Grüneberg, 1943: 24). The genetics of the pied Canada goose described by Blakiston (1863), which had red or flesh-colored feet, a black and yellow bill and white primaries, may have been similar to the "runner" mutation reported in mallards by Jaap (1933).

In pigeons, the condition that arises when only a few feathers are affected by a somatic mutation is termed *flecking*, while birds which have extensive flecking and blotching are known as *chimeras* and are considerably rarer than individuals exhibiting flecking. Either type affects the body of the animal asymmetrically. Hollander and Cole's (1940: 39) summary of the genetic basis of chimeric pigeons may apply to the chimeric Canada goose reported here. They wrote, "Like the flecks, they mostly occur in heterozygotes, and in the majority of cases are recessive. These cases can be also explained as the result of recessive somatic mutations which have occurred relatively early in the ontogenetic development." Crew and Munro (1938) have also discussed lateral asymmetry of plumage in birds.

The relatively frequent occurrence of white spotting in geese as compared with many other kinds of birds may be related to a number of factors. Their semi-colonial nesting habits, coupled with a strong tendency to return to the same breeding grounds year after year, help to insure the isolation of breeding populations. Because of the tendency of individuals to remain paired to the same mate, there is a greater degree of reproductive isolation between various pairs of a goose population than between members of a duck population; the latter are generally believed to form new pairs each year.

Many mutant individuals that in a shorter lived species might die before reproducing their kind have in geese a better chance over the years of augmenting the number of individuals showing the mutation of the parent. The lifetime monogamy of the pair which was responsible for the white spotted phenotypes, and which presumably possess recessive genes for white spotting, increases the probability that additional white spotted offspring will be produced in future years.

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