BLUE AND LESSER SNOW GEESE ON SOUTHAMPTON AND BAFFIN ISLANDS

BY T. H. MANNING

Plate 7

THE SOUTHAMPTON ISLAND COLONY

IN 1929, Sutton (1932: 44–57), while staying on Southampton Island, learned of a colony of Blue and Lesser Snow Geese (*Chen caerulescens* and *Chen hyperborea hyperborea*) at the Bay of God's Mercy. Owing to other work he was unable to visit it, but sent an Eskimo to make collections. In 1934, I camped near the center of this colony almost continuously from June 25 to August 7, and was, I believe, the first white man to visit it. The goose nests are situated almost entirely on grassy islands in the mouth of Boas River, where they are comparatively safe from foxes. At its mouth, the river is at least two miles wide, and in July is so shallow that it can be crossed in knee boots; but during the spring, it is greatly swollen. On both banks the river is bounded by about eight miles of flat marshland which terminates in disintegrated limestone ridges. In 1934, the concentrated breeding area covered about three square miles, with about fifteen birds to 10,000 square yards. For about another ten square miles outside this area, the average was about five birds to every 10,000 square yards. To every forty pairs of Snow Geese there were one pair of Blue Geese and two or three mixed pairs.

When I arrived at the colony on June 25, 1934, the ice and snow had all disappeared, and most of the geese had begun to incubate. Eskimos who had visited the colony on June 19 reported that most of the nests contained one, two, or three eggs, and that the river was very swollen, with ice still on the bottom. They also said that a little earlier, large flocks of Blue and Snow Geese had flown over their camp which was situated some twenty-five miles to the east, thus bearing out the suggestion made by Sutton (1932: 53) that they migrate over Coates Island, or at least toward the east coast of Hudson Bay. In this connection it may be remarked that when I was at Daly Bay and Cape Fullerton about mid-June 1936, no Snow or Blue Geese were seen.

In the many hundreds of nests seen, the average number of eggs for a Snow Goose was five or six, while seven was not uncommon. Three nests had eight, and two held nine eggs. It is possible that these large clutches were due to two birds having laid in the same nest;

but I have no evidence to that effect and normally a goose approaching a strange nest will be driven off. The Blue Goose and hybrid nests had rather fewer, at most, five eggs; but as comparatively few of these were observed, I could not assert this as a general rule.

During the incubation period, the female rarely if ever leaves the nest except when disturbed, and much of the time the male stands by her side. If the male has been killed, or possibly if he has deserted, the female will most frequently continue incubation. I have no evidence that the male ever incubates. All the birds that I collected after having seen them leave the nest were females, and I have never collected a male with the least indication of an incubating patch. These two remarks apply equally to Brant, Lesser Canada, and Hutchins's Geese. About a hundred and fifty yards from my tent at Boas River was a hybrid nest which was observed about fifteen times a day. The female, a Snow Goose, was invariably on the nest, while its Blue Goose mate, a particularly faithful bird, stood by. The same applies to a hybridizing pair on Baffin Island; each of the three times I visited their nest, the female was incubating.

Many Herring Gulls nest in the colony, chiefly on large glacial boulders. Whenever my passing disturbed a goose and caused it to leave its nest, a gull would soon swoop down to examine it, and, on seeing the eggs, alighted close by. That, however, was usually as far as it got before the parent goose, most frequently the female which always kept a close watch about a hundred yards away, returned, quite oblivious of my presence, and, alighting some yards from the nest, with flapping wings made a dash at the intruder. In its hurry it would often fall flat on its breast. If geese have time, they cover their nests with down before leaving them, and unless the gulls actually see the eggs, they rarely trouble to investigate further. That the gulls do account for large numbers of eggs was shown by the pecked ones scattered about the colony, but I am inclined to think that most had been previously abandoned by the parents.

It was not rare to see a Herring Gull's and a goose's nest within a few yards of each other. In this case there appeared to be a truce between the two parties; the gulls never attempted to take the goose eggs, and the geese did not try to drive away the gulls. There was an example of this near my tent: both nests were on a small island five yards long, past which I often walked to observe the birds' behavior on being disturbed. On every occasion each would return peaceably to its own nest.

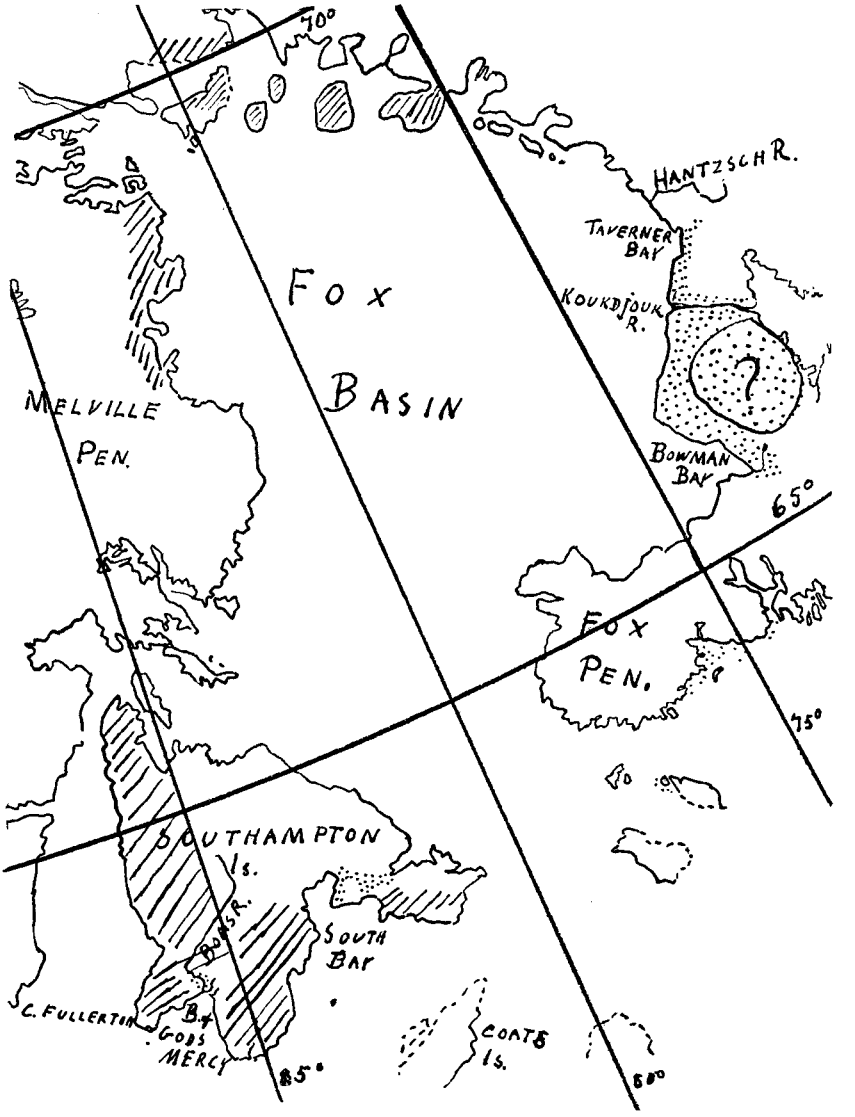
Until about four days before hatching time, geese of both sexes

were wary unless their eggs were threatened by a gull or jaeger, and it was not until after the young were hatched that the male became really tame. Then I was able to walk to within ten or fifteen yards of a nest without the parent leaving. When they were moving away from the nesting ground, although few if any of the parents had lost their primaries, it was almost impossible to flush them.

With very few exceptions, the eggs hatched between July 14 and 17. Immediately the young are sufficiently strong, that is, in about three to four hours after the last has hatched, the parent leaves the nest and calls to them to follow. They will follow either parent, but it is usually the female that calls them on, while if danger threatens, the male remains behind hissing defiance. As soon as they can walk, they can swim and dive. I saw numerous nests containing a single pipped egg, or even a live chick as yet too young to follow; these had been deserted by the parents who seem to be in the greatest haste to move off and collect into flocks. Of those families observed before they joined a flock, not one had more than five young. As I walked through the colony at hatching time, I saw many young that had lost their parents. Occasionally these managed to catch up with another family, and after an examination by the mother, were adopted. If I picked up one of these lost birds or stopped to examine it, it would thereafter follow me as readily as its parent. Probably the gulls soon dispose of strays as well as deserted eggs and young. Near the edge of the breeding ground there were several flocks apparently waiting until sufficient families had collected together. When a flock contained about forty old birds, it moved off. When they had formed into flocks, the family groups seemed to lose their identity.

By July 19, all the geese had left the nesting ground. The Eskimos say that they go to some big lakes about fifteen miles inland. When the Eskimos visited the nesting ground at the beginning of August 1933, they found no geese. In 1934, although the geese never returned to the nesting ground, small flocks were usually in sight from my camp. The first time I had an opportunity to go after one of these was on July 25. There were thirty adults in this particular flock and twice as many young. Five adults were shot; of these, only one retained some of its flight feathers. A few flew when I shot. By August 2, the young were sufficiently grown for ringing, and a flock of two hundred adults with an equal number of young was rounded up for this purpose. Only one could be induced to fly, and so far as I could tell, the remainder were without flight feathers.

Returns for 72 downy Lesser Snow Geese banded between August



TEXT. FIG. 1.—Dotted areas where Blue and Snow Geese nest at least occasionally. In the area marked (?), Blue and Snow Geese are said to be numerous, but whether they actually nest there is unknown.

Lined areas where there is considerable low-lying marsh land which would appear fairly suitable for nesting, but where, so far as the writer knows, no nests have been found.

2 and August 12, 1934, at the Blue and Snow Goose colony at the Boas River, Southampton Island, are as follows:—

Recovered at	*Date killed*
Near Assumption Parish (presumably), Napoleonville, Louisiana	November 2, 1934
Near Collegeport, Texas	November 3, 1934
Port Arthur, Texas	November 4, 1934
Five miles from Palacios, Texas	November 4, 1934
Near Port Arthur, Texas	November 7, 1934
Twenty-eight miles southwest of Bay City, Texas	November 9, 1934
Chambers County, Texas	November 10, 1934
Near Port Arthur, Texas	November 10, 1934
Matagorda Bay, Collegeport, Texas	November 18, 1934
Fourteen miles southwest of Corpus Christi, Texas	November 24, 1934
Sixteen miles west of Corpus Christi, Texas	November 25, 1934
Near Corpus Christi, Texas	November 25, 1934
Fifteen miles south of Corpus Christi, Texas	November 30, 1934
Ten miles southwest of Port Arthur, Texas	December 7, 1934
Fifteen miles east of Palacios, Texas	December 15, 1934
Trout River, south coast of Hudson Bay, 70 miles northwest of Cape Henrietta Maria, Ontario	May 27, 1935
Bala (presumably), Kansas	November 4, 1935
Johnson's Bayou, Louisiana	November 28, 1935
Moosonee, Ontario	May 1936
Between Kaskalamagan and Severn Post	October 15, 1937
Bay City, Texas	December 20, 1937
Delaraine, Manitoba	January 22, 1939

Of three Blue Geese banded at the same time, one was shot by an Indian near York Factory, Manitoba, some time previous to 1940.

Acknowledgments for the above returns are due to the United States Bureau of Biological Survey, and to the Lands, Parks, and Forests Branch of the Department of Mines and Resources of Canada; also to those who kindly returned the bands to the Biological Survey.

I identified no yearling geese at the colony. There were usually several flocks of presumably non-breeding birds feeding along the shore at the edge of the colony. They were difficult to approach closely, but I think they were mature birds, possibly some that had lost their eggs. The yearling birds are probably scattered on suitable feeding grounds throughout the island, and I have observed small flocks at several places. Nearly all the geese seen actually in the colony had nests. A greater relative proportion of those seen without were Blue Geese.

When the geese arrive at the breeding grounds, they are still quite fat, but once laying starts, their condition rapidly deteriorates. When driven from their nests, they always take the opportunity to feed,

but I think the female seldom or never leaves the nest for this specific purpose, although she pecks at any moss that is within reach. By the time the young hatch, there is no vestige of fat on either sex; their breast muscles are also much reduced, and their gizzards are small. During the flightless period, the breast muscles are further reduced, the gizzard rapidly becomes more than twice its former size, and the legs grow large and muscular.

In 1936, Bray (1936–37) spent the summer near the colony and I visited it on two occasions. On June 21, there were only a few places completely bare of snow, and Boas River was as yet indistinguishable from the remainder of the flat land, all of which was intersected with streams and pools of water under the snow. I found one nest with two eggs, and two nests with one egg each. The next time I was able to visit the colony was on July 1, and incubation had begun. There were considerably fewer birds nesting than in 1934. This was also borne out by Bray's estimate of the number. It seems likely that the decrease was due to the exceptionally late thaw which either prevented the birds from finding suitable nesting sites, or destroyed their nests by flooding, in which case they would probably not remain in the colony. I had observed a few nests destroyed by flooding in 1934.

Birds seen in the goose colony while the geese were nesting, were in the order of their abundance:—

Snow Goose—common and nesting.
Herring Gull—common and nesting.
Sabine's Gull—common and nesting.
Arctic Tern—common and nesting.
Blue Goose—common and nesting.
King Eider—some nests found.
White-rumped Sandpiper—two nests found.
Red-throated Loon—some nests found; possibly an occasional Black-throated Loon.
Red-backed Sandpiper—no nests found.
Red Phalarope—no nests found.
Ruddy Turnstone—no nests found.
Knot—no nests found.
Hutchins's Goose—two nests found. Often seen flying.
American Brant—two nests found. Often seen flying.
Parasitic Jaeger—occasionally seen flying and stealing eggs; common until June 28.
Semipalmated Sandpiper.
Lapland Longspur.

BAFFIN ISLAND BREEDING GROUND

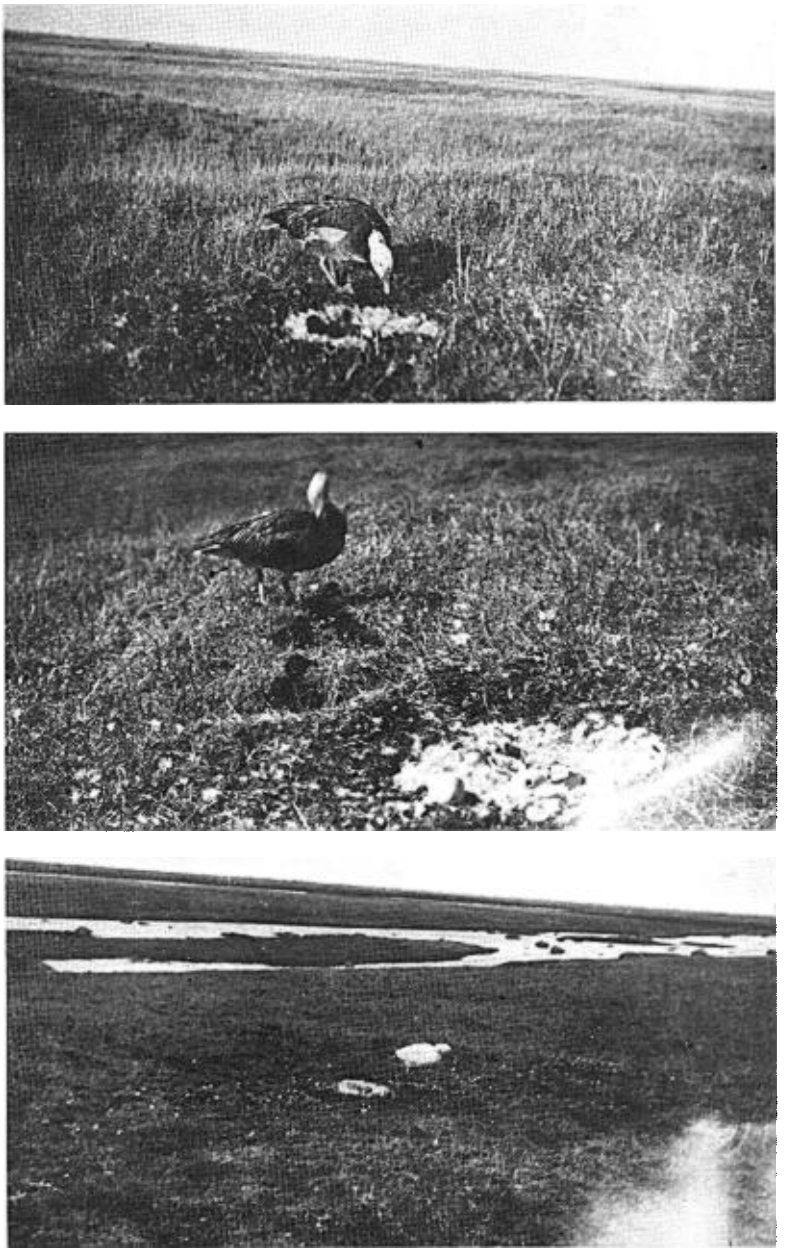
This is not a single colony, but several, separated by areas in which are scattered nests. The greatest concentration of Blue Geese is on

the east side of Bowman Bay. This colony was found and studied by Soper (1930) in 1929. Although he found a considerable number of nests, it appears that they were not nearly as close together as those of the Snow Geese at Boas River on Southampton Island. An Eskimo who travelled along the coast in November 1938, said he saw numerous old nests in two places between Bowman Bay and the Koukdjuak River. In 1910, Hantzsch (Hesse, 1915: 156–166) found many geese on the western side of Lake Nettilling, particularly near the Koukdjuak River. These were mostly Snow Geese; but on July 31 he (Hesse, 1915: 158) notes: "Only a few dark specimens yet." Since it was too early for these to be young, they were presumably Blue Geese. From August 30 to September 3, 1925, Soper (1928: 91–93) saw numerous flocks of Snow Geese near where the Koukdjuak River leaves Lake Nettilling. It was then too late to tell if they had nested there, but a corral on one of the islands in the river showed that flightless geese had once been numerous there (cf. Hesse, 1915: 157).

Between August 19 and 24, 1938, I went by boat up the west coast of Baffin Island. From the south side of Bowman Bay to the north shore of Taverner Bay, the land is absolutely flat. In whichever direction one looks, the long, waving grass of the marshes is bounded by the flat circle of the horizon. In places the tide goes out about ten miles, leaving mud and gravel flats. It is a country suitable only for the breeding grounds of geese, ducks and shorebirds. Every time we approached the coast sufficiently closely, we saw mixed flocks of Blue and Snow Geese, both flying and flightless; those flying were probably immature. If immature geese are ever completely flightless, it is probably at an earlier date than the mature birds.

I walked inland in only one place, about fifty miles south of the Koukdjuak River; that was on August 21. There were several flocks there, but I approached only one closely. It consisted of about three hundred Snow, and fifty Blue Geese, with a nearly equal number of young. About a third of the adults could fly well, half a little, and a few not at all. The development of the young varied from those having feathers just showing, to some that were completely feathered and had only a small amount of down left on the neck. Most were in the latter stage. This variability was rather surprising and contrary to my observation on Southampton Island in 1934.

The spring of 1939 was spent at the north end of Taverner Bay. Having seen several flocks of Blue and Snow Geese there the preceding fall, I was disappointed to find only one nest in the neighborhood. It was by a small lake on a rocky ridge, a very unusual place. On August 5, at the mouth of the Koukdjuak River, I observed closely



(TWO UPPER) FEMALE BLUE GOOSE AND YOUNG.
(LOWER) LESSER SNOW GOOSE AT NEST

a flock of about two hundred adults with one hundred and fifty young. All were flightless. There was an age variation in the young of at least a week. Several other flocks were seen both there and between the mouth of the river and Taverner Bay. All the flocks were mixed with at least ten per cent Blue Geese.

Back at Taverner Bay on August 25, flocks of Blue and Snow Geese which had been fairly numerous during the spring but almost absent during the breeding season, again became plentiful. Young birds first began to appear in these flocks during the first few days of September, and rapidly became more numerous. From these facts it might be thought that they were migrants from the north, but during the previous year at Hantzsch River, some twenty miles north, we had observed no geese flying over. I therefore concluded that these flocks were merely taking advantage of all the available feeding ground in the vicinity, although from my next year's (1940) observations it appears that they were at least fifty miles north of their breeding grounds at a time when they might be expected to be moving southward. Another indication that they were not from the north is that in August 1940, I went around the north coast of Foxe Basin, for the most part closely following the coast, without seeing a sign of geese. On the north Baffin coast, the geese of the genus *Chen* are usually supposed to be the Greater Snow Geese, and none of these was identified at Taverner Bay. Bray (1936–37), however, mentions two specimens from Strathcona Sound, Admiralty Inlet, which he thought were *C. h. hyperborea;* these may migrate up the west side of Foxe Basin. Bray (1936–37) says that according to the Iglulik Eskimos, there is a Snow Goose colony (subspecies unknown) on Baird Peninsula and Bray Island, although they judged from the old stone corrals, at one time used for capturing flightless geese, that they are less plentiful there than formerly. Since it is possible that the Eskimos had not visited either of these places in summer for many years previous to giving this information, these colonies may no longer exist. I did not, however, visit the south and west side of Bray Island or the north side of Baird Peninsula. There is a faint possibility that some Blue or Snow Geese nest on lakes about twenty miles up Hantzsch River, but the type of country is not that usually selected by these species. In 1939 the last geese were seen at Taverner Bay on September 10.

At the beginning of June 1940, we established our camp about ten miles south of Taverner Bay, and from there the coast between the Koukdjuak and our last year's (1939) camp was searched for a Snow and Blue Goose colony. However, I succeeded in finding only four

Snow Geese, two Blue, and one hybrid nest. I also made one big circle inland from the Koukdjuak to the eastern end of the flat land and back to Taverner Bay. It seems unlikely that I should have missed a sizeable colony on the coast, and inland I saw considerably fewer geese. Those I did see were all flocks of yearlings. The brooks soon 'peter out' inland, and the large lakes were still frozen at the end of June, so that geese could obtain little or no protection on islands in them. Soper (1930: 25), mentions a large number of geese migrating over the upper part of the Koukdjuak River in late August and early September 1925. As there were no Blue Geese among them, he concluded that this species did not breed north of the Koukdjuak River. It now seems probable that neither Blue nor Snow Geese breed in great numbers on the flat land north of the river, although many flocks feed there. Since all the larger flocks seen at Taverner Bay contained a considerable proportion of Blue Geese, the geese mentioned by Soper may have been migrants from much further north; possibly they were the Greater Snow Geese (*Chen hyperborea atlantica*).

In 1940, the first Snow Geese were seen at Taverner Bay on June 2, the first Blue Geese on June 8. In 1939, neither was seen until June 8. A record was kept of the approximate number of birds seen each day. The totals of these for June and the first nineteen days of July in 1940 are 820 Snow, and 381 Blue Geese. This large proportion of Blue Geese was not observed in the flightless flocks either at Koukdjuak in 1939 or fifty miles south of there in 1938. Except in the early part of June, most of the geese seen were yearling non-breeding birds, and it is probable that a large number of the Blue Geese originated from Bowman Bay, where Soper (1930: 55) states they outnumbered the Snow twenty-two to one. The proportion of Blue to Snow Geese that breed north of Bowman Bay is between ten and twenty-five per cent.

I have mentioned that the Eskimo visited the Southampton Island goose colony in 1934. It is probable that they visit this colony about once in two years for the purpose of collecting eggs. When they do, they take perhaps 1,500 eggs and shoot 100 birds. This is a small number compared to the number of birds in the colony, and no one familiar with the conditions among the Eskimos could possibly begrudge them these, particularly when one considers the number which my band-recoveries indicate are killed by sportsmen in the South. Stone corrals and caches filled with bones show that previously the Eskimos killed a very large number of geese while they were flightless. Now they rarely if ever visit the colony at that time.

The number of geese, and especially Blue Geese, on the west coast of Baffin Island far exceeds that on Southampton Island. The area covered by them is so large, and I saw so little of it in detail, that I have considerable hesitation in suggesting even the approximate number. Certainly there must be over 100,000 Snow, and nearly or quite as many Blue Geese. I know of no occasion in recent years when the Eskimos have visited this area during the nesting season. The extreme flatness of the land and the shallowness of the water make the district very uninviting to them. During the time I was there, the nearest Eskimos were over 150 miles by sea from the extreme south of the area, and nearly 300 miles from the north.

INCUBATING PERIODS AND HATCHING TIMES

1940

Blue Goose Nest containing Five Eggs

June 17: Found Blue Goose nest with two eggs.

July 12: At 11 hrs., one egg just pipped.

July 13: At 06 hrs., two hatched, two pipped. At 11 hrs., four hatched and could just get out of the nest while the other egg was well pipped. As they normally lay an egg a day and probably begin incubation very soon after the full clutch has been laid, this gives an incubation period of twenty-three days.

Snow Goose Nest containing Four Eggs

June 18: Found a Snow Goose nest with three eggs.

July 11: 00 hrs., three eggs well pipped; 08 hrs., two hatched and fluffy, one half-hatched, and one well pipped.

12 hrs., three hatched, two just able to leave nest, the last almost out of the shell. This gives an incubation period of twenty-two days. The difference in period can be explained as being partly due to my knowing only within twenty-four hours the time that the last egg was laid, and partly due to individual variation. With regard to the latter, whereas it was noted that the Snow Goose was a very close sitter, hard to flush, returning to its nest immediately after I left, the Blue Goose was emphatically the reverse. From the time I found the eggs till July 10 I did not visit either nest.

Hybrid Nest containing Four Eggs

The nest of the mixed pair was not found till incubation had begun. As it was too far away from the other to be closely observed, the eggs were removed and placed in a nearby Blue Goose

nest, after first removing the four eggs in that nest. All these latter were found to contain undoubted Blue Goose embryos.

July 10: At 17 hrs., eggs removed from the hybrid nest. At 21 hrs., while being carried in my shirt for warmth, the young in two eggs began to chirp. At 24 hrs., eggs were placed in Blue Goose's nest.

July 11: At 23 hrs., two eggs well pipped.

July 12: At 11 hrs., two hatched and one pipped.

July 12: At 16 hrs., two able to follow parents, one just hatched; the fourth egg, very rotten, contained little except dirty liquid, and was presumably a last-year's egg.

An incubation period averaging twenty-two days agrees with my approximate observations on Southampton Island. The hatching of only three sets of eggs was actually observed at Taverner Bay, but the approximate start of incubation of five others was noted, including one in 1939. The incubation of these began about June 19, and they might therefore be expected to have hatched on July 11. Although over two hundred miles farther south the average hatching date at the Southampton Island colony was July 15, in 1934, and according to Bray (1936–37), July 17 in 1936. At Bowman Bay, in 1929, Soper (1930: 58) collected a series of young that he considered not more than two or three days old on July 20 and 21.

Specific Status of the Blue and Snow Geese

It is generally considered that the Blue and Snow Geese are separate species. From his observations of the Blue Goose colony at Bowman Bay, Soper (1930: 14–15) was led to this conclusion; Sutton (1931: 362) also held the same opinion. My observations on Southampton and Baffin Islands, however, do not entirely agree with this.

Except for the color of the plumage, the Snow and the Blue Geese appear identical. In body form, stance, behavior and calls, I have been unable to detect any difference. Their nests and eggs are indistinguishable. The only contradiction of this is given by Hon. R. M. Barnes from observations on captive geese. Bent (1925: 181) quotes him as saying: "In addition to the difference in the young and eggs, the build of the two birds is very different, and their physical appearance is very distinct. The call notes are not very similar." Soper (1930: 53), who made extensive collections and measurements of eggs, was unable to find any difference between those of the two species. As I have already mentioned, there seems to be a difference in the size of the clutch laid at the Southampton Island colony. There, the average for the Snow Geese was five or six; for the Blue,

only four. The same was noted by the Eskimos reporting to Sutton (1932: 55). On Baffin Island, however, there is no evidence to support this. The nests I observed at Taverner Bay gave a slightly larger average for the Blue Goose than the Snow, but insufficient nests were seen for generalization. The average given by Soper (1930: 53) for eleven [full?] sets of Blue Goose eggs is three eggs to the set; he also notes that several nests of Lesser Snow Geese contained from one to five eggs. It might be thought that the large proportion of Blue Geese that on Southampton Island must be hybrids has reduced their fertility, but this can hardly be reconciled with the fact that both species appear to have larger clutches there than on Baffin Island. Further exact observations of a large number of geese known definitely to be incubating are therefore necessary. There is no reason to suspect that the light-breasted Blue Geese are less fertile than the others. Since evidence to the contrary is lacking, it may be assumed that the large percentage of Blue Geese that hybridize on Southampton Island indicates the fertility of the cross; otherwise the Blue Geese would be bred out unless constantly augmented by Baffin Island birds.

The main breeding ground of the Blue Geese is in the Bowman Bay region. There Soper (1930: 55) estimates that they outnumber the Snow Geese by about twenty-two to one; on Southampton Island and to the north of Bowman Bay, the Snow Geese are in the majority; and to the west on the Canadian mainland, there may be colonies of Lesser Snow where no Blue Geese occur at all. This, however, is not a satisfactory argument against dichromatism, as the same phenomenon also occurs among other dichromatic species: witness the variation in the relative abundance of the white and blue Arctic foxes (*Alopex lagopus*) from one per cent blue on the west coast of Hudson Bay to over fifty per cent in Greenland. Also Johnson (1938: 56–59) shows that there is an almost equal variation in the percentage of 'white-eyed' individuals occurring in the colonies of the Common Murre (*Uria aalge aalge*). Although on a wide geographic basis the two species of geese are partially segregated, at the Southampton colony the Blue Geese were scattered uniformly throughout, and did not show any tendency to form into separate flocks. At Taverner Bay in the spring of 1940, flocks of geese were quite often seen which contained considerably more Blue Geese than the average for that district, but these were mostly non-breeding yearling birds, and probably belonged to the Bowman Bay colony. Among the flightless flocks seen with young near the Koukdjuak River, there was no segregation. Soper (1930: 14) states that "during

migration, even though evidently never wholly absent from each other, the Blue and the Snow Geese appear to split at, or south of James Bay, into two main bodies to follow separate courses, as would distinct species with independent and hereditary migrational routes, the Snow Goose to follow the west coast of James Bay, and the Blue the east side." I suggest that rather than the Blue separating from the Snow, it may be the severance of the Bowman Bay group from the remainder, irrespective of whether they are Blue Geese or Snow. Lewis and Peters (1941: 112) were informed that although twenty years ago the proportion of Blue Geese on the west coast of James Bay was small, it has gradually increased until the Blue Geese are about as numerous as the Snow.

The young of the Blue Geese, although similarly marked, are much darker all over than those of the Snow. This dissimilarity Soper (1930: 15) considers an indication of their specific difference. It is true that in some groups of birds, for instance the plovers, the young of different species resemble each other much more closely than do the adults; but the adult Blue Goose is so much darker than the adult Snow that the melanistic character of the young is not surprising. The downy young of not only different breeds of Domestic Fowl, but also of different colors within the same breed (Warren, 1929) show a considerable variation in color, yet no one would suggest that they were different species. There are two color phases of downy Arctic Terns (*Sterna paradisaea*) although the adults are identical (Bent, 1921: 253). When the geese are between two and three weeks old, their dissimilarity is not nearly so well marked (this was noted particularly on Southampton Island). Not only the down, but also the feet and the bill of the Blue Geese become distinctly lighter. Possibly this is due to fading.

That Soper (1930: 15) found no geese hybridizing at Bowman Bay is surprising, but as he does not mention the total number of Blue and Snow Goose nests observed, it is difficult to say whether this may not have been accidental. That the same species of birds which hybridize on Southampton should not do so on Baffin Island under the same conditions is unlikely; and indeed, the finding of one mixed nest among the three Blue and four Snow Geese on the north of the Koukdjuak, shows that they do hybridize there at times. Whether they are less inclined to hybridize when the Blue Geese are in the majority, as at Bowman Bay, is an interesting point needing further investigation.

The hybrid pair collected on Baffin Island had two apparently Blue and one apparently Snow offspring. Only the female parent,

a Snow Goose, was collected, but the breast of the male was seen to be quite dark. As there were no other nests within at least five miles, confusion was impossible. One set of hybrids collected on Southampton Island consisted of one Blue Goose and three Snow Geese, the other of one Blue Goose and two Snow Geese. These were taken in the nest. None of the parents of the Southampton hybrids was collected but they were identified as being pairs with certainty. Obviously, from a distance of twenty-five yards there can be no question of confusion between a Blue and a Snow Goose. Bray (1936–37) says that of fourteen hybrid young (three broods) that he collected, six were indistinguishable from pure Snow Geese, five were indistinguishable from pure Blue Geese, and one differed from the latter only in the possession of a tiny yellow patch on the side of the throat. Besides those collected, there were probably many hybrids among the hundreds of young seen on Southampton and Baffin Islands, but in no case could they be distinguished from the birds of pure stock. Blaauw (1907: 623), who conducted breeding experiments with captive Blue and Snow Geese, found the same lack of hybrid character in the downy young; whence he concluded that they were two color phases of the same species. Details of his experiments are unfortunately not given.

In the adults as well as in the young, there are no birds that are obviously hybrid: that is to say, there are none whose color approximates to half-way between a Blue and a Snow Goose (cf. Sutton, 1931: 360). It is usually assumed, probably correctly though without evidence, that the light-breasted variety of Blue Goose is a hybrid between the Snow and the Blue Goose. To the best of my remembrance, the majority of the Blue Geese at the Southampton Island colony have considerably lighter breasts than those of the Baffin Island group; this seems to indicate that the assumption is correct. When it is possible to make a comparison of all the Blue Geese now collected from their breeding grounds, this point may be elucidated.

About five per cent of the geese breeding at the Southampton Island colony were Blue Geese; of these a little less than half (750), or about 650, were mated with Snow Geese. If they had picked their mates according to the law of chance, there would have been 1,420 mixed pairs, and only 40 Blue pairs. It is therefore evident that most Blue Geese prefer a Blue mate. This may be evidence of a more deeply seated difference than mere color variation, but I would not be surprised if captive Snow Geese showed a similar disinclination to mate with artificially colored birds, although naturally,

those artificially colored would not discriminate against uncolored birds. Johnson (1938) considered that the mating of 'White-eyed' Murres with normal individuals was purely random, but the color difference in that case is not comparable to that between the Snow and the Blue Geese.

Sutton (1931: 360), although considering it improbable, refers to the possibility of some of the hybridizing Snow Geese being albinistic. There is, however, no difference between the Snow Geese mated with Blue Geese and those mated with other Snow Geese. The color of the feet, bill and eyes in adult Snow Geese is the same as that in adult Blue Geese. Sutton (1931: 363) also suggests that cross-mating may be due to an excess of one sex over the other. Bray (1936–37) verified that in four out of the six hybrid pairs he recorded, the male was a Blue Goose. Unfortunately I made no notes on this question in 1934, and I cannot therefore say whether it is more than coincidence that in the only six hybrid pairs on which there is definite information, the male was a Blue Goose. It is probable that had this been an invariable rule, it would have attracted my attention in 1934. An excess of male over female Blue Geese on Southampton Island may be the effect rather than the cause of a greater tendency for that sex to hybridize.

It was unfortunate that neither Bray nor I was able to collect or observe any 'pure' Blue Goose families on Southampton Island before they became confused in flocks, as, owing to the presumed hybrid derivation of most of the Blue Geese at the colony, one would certainly expect a mixed brood of chicks unless the blue characteristic acted as a recessive. I saw one or two broods of Snow Geese that had at least one Blue young with them; but as they had left the nest, they may easily have become mixed.

Soper (1930: 15) states: "All birds observed were pure and characteristic of the invariably similar parents which they followed." This is to be expected if for some reason the Bowman Bay birds do not hybridize, and if Soper saw sufficient broods of both species, it may be taken as further evidence that they do not hybridize there, but it is doubtful from his paper whether he saw many young Snow Geese. It is not, as Soper says, an argument against the Blue being a color phase of the Snow Goose, since it assumes that in cases of dichromatism an animal of one phase will arise from a pair of animals of the other phase, even though these latter are homozygotes. This is a thing which, so far as I know, has not been proved to occur in any case of dichromatism, and all evidence supports the opposite conclusion. For instance, both blue and silver foxes breed true in

captivity although they are usually regarded as color phases of the white and the red respectively. In the case of the Blue and the Snow Geese, it is obvious that the two have a common ancestry. As the interbreeding of the two species does not produce an intermediate form, it seems likely that their common ancestor was either of pure Blue or of pure Snow Goose stock. For the sake of argument, I shall assume it to have been a pure Snow. This is the more probable as it is the more widely distributed species. The lack of intermediate forms (if we except the rather doubtful white-breasted Blue Goose) suggests the formation of the Blue species as a sudden mutation from the Snow. Whether a mutation forming a single individual would be sufficient, or whether several were formed at the same time or at different times, I do not know. But that these mutations must necessarily be continuing at the present time in order for it to be recognized as a case of dichromatism, would necessitate a definition of dichromatism that would prevent the term being applied to the majority, if not all the cases, for which it is now used. If the mutations occurred at only one place, and at a date comparatively recent, it may account for the continued concentration of Blue Geese on the breeding ground at Bowman Bay, and perhaps also their apparently recent spread.

CONCLUSIONS

Reasons for considering the Snow and Blue Geese as

Separate species	*Same species*
Marked color difference.	Apparently identical in body form.
They do not hybridize indiscriminately.	Behavior identical.
Apparent difference in the number of eggs to the clutch on Southampton.	Calls similar (or identical).
Other reasons mentioned above but not considered valid by present writer.	Flock, feed, breed, and nest together.
	Eggs and nests identical.
	Hybridize freely.
	Hybrids may be presumed fertile.
	Similar length of incubating period.

Although I have attempted to show that some of the reasons previously given against considering the Snow and the Blue Geese as two color forms of the same species are not justifiable, and while perhaps there is as good a reason for considering them a dichromatic species as there is in some other forms of birds and mammals which are now so-called, the fact that the Snow and Blue Geese nesting in the colony do not hybridize in the proportion that would be expected if the birds were identical, is perhaps sufficient reason for not considering them dichromatic phases. Other birds and mammals

which are classified as dichromatic forms may also show a disinclination to breed with the opposite phase, but obvious difficulties of making observations on non-colonial forms may have concealed it. Also, as I have pointed out, the Snow and Blue Geese have a better opportunity to select a desirable mate than solitary species, and are probably more careful than the polygamous species.

A large number of separate species and even genera will on occasion hybridize, and some will produce fertile offspring; but when they hybridize regularly as the Snow and Blue Geese do on Southampton Island, it seems extremely doubtful whether they should be considered as separate species, especially when the only proved difference in the two forms is one of color. I therefore believe that the relationship between the two forms can best be expressed by considering them subspecies. However, it seems hardly desirable to make any change in their present status until further work has been done both on their breeding grounds and in captivity. This should include not only the Blue and the Lesser Snow Geese, but also the Greater Snow Goose.

EXPLANATION OF PLATE 7

Top figure: Female Blue Goose with newly hatched young in nest. Taverner Bay, west coast of Baffin Island.

Middle figure: The same nest a few minutes later when the young attempted to follow their mother. Probably they would not have left the nest for a few hours had they not been disturbed. Note the pipped egg.

Bottom figure: Lesser Snow Goose at her nest. Taverner Bay.

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