

WINTERING OF THE GREATER SNOW GEESE

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DEARTH of literature on the life history and ecology of the Greater Snow Goose (*Chen hyperborea atlantica*) prompts recording the following observations made on visits to the coast of North Carolina and Virginia in December 1937, January 1938, and January 1939, and of information supplied by the men in charge of the United States Biological Survey waterfowl refuges at Pea Island, North Carolina, and Back Bay, Virginia.

The A. O. U. 'Check-list' (1931) gives the winter range of the Greater Snow Goose as "Atlantic Coast of Maryland, Virginia, and North Carolina, from Chesapeake Bay (sometimes Delaware Bay) to Core Sound." In recent years a substantial percentage of the entire population of Greater Snow Geese has wintered along the sandy shoreline of Virginia and the peninsula and the string of North Carolina islands and sand spits known as the Outer Banks. This coast is chiefly wind-swept dune lands which start at Cape Henry, Virginia, and extend three hundred miles or more south and west, almost joining the North Carolina mainland near Cape Fear. They are narrow, ranging in width from a few hundred yards to about three miles at Cape Hatteras, but averaging less than three-quarters of a mile. On the east is the Atlantic Ocean and on the west a series of broad shallow sounds; the northern ones, Back Bay and Currituck, are fresh or slightly brackish and the southern, Albemarle, Croatan, and Pamlico, are about as salty as the sea.

The barrier islands have been formed by action of the waves, and much of their surface is but a few feet above sea level although there are many high shifting dunes. The low elevation, abundance of winter rainfall, extremely high tides, and occasional partial inundation when strong winds continue from the west, produce many temporary ponds and wet meadows that are favorable feeding areas for the wintering Greater Snow Geese, Canada Geese (*Branta canadensis canadensis*), and several species of ducks. The former inaccessibility of the islands and the difficulties and expense incident to the building and maintenance of surfaced roads in a soil of nearly pure sand have tended to discourage extensive human development and to preserve a great deal of the wild and primitive character of the region. An important consequence has been that the habitat for migratory waterfowl here has not diminished to the extent of other Atlantic coastal wintering grounds.

ARRIVAL AND DEPARTURE

Temperature appears to be an important factor in the time and rate of arrival of Snow Geese on the Banks, according to Samuel A. Walker of the Pea Island Migratory Waterfowl Refuge. If cold weather prevails during the fall, the geese generally arrive in large groups within the space of a few days; warm weather seems to cause them to linger along the way, so that they arrive in small flocks over a considerable length of time. McIlhenny (1932) makes no mention of temperature as a factor affecting the arrival of Blue Geese (*Chen caerulescens*) on their wintering grounds in Louisiana, but states that he has seen small flocks on the Gulf Coast as early as August, and that heavy migration occurs in late October and early November.

The dates of arrival and departure of Blue Geese in Louisiana and of Greater Snow Geese in North Carolina are about the same, despite the marked difference in latitude of these two places. During the rather mild fall of 1937, ten Snow Geese and two Blue Geese were noted at Pea Island on November 4, and fifteen days later only 200 Snow Geese and seven Blue Geese were present. By December 14 the number of Snow Geese had increased to about 5,000, and another flock of about 2,000 had been discovered near the small settlement of Corolla, some sixty miles to the north. This smaller group seemed to be in no hurry to reach Pea Island, as it was seen flying north of Currituck Beach Lighthouse on December 16, finally joining the Pea Island flock later in the month. If the temperature is low late in winter, the birds stay on the coast, but when a few warm days come early in February they are away in a hurry; not as the Canada Geese go, in small groups over a period of several weeks, but in two or three large flocks. In the winter of 1937-38, the maximum number of Snow Geese at Pea Island approximated 8,000. All were gone by February 15. Harry A. Bailey of the Back Bay Migratory Waterfowl Refuge stated that in 1939 about 2,500 Greater Snow Geese remained at that refuge until March 5. Statements by other observers indicate that the large flocks disintegrate into groups of a hundred birds or less while in migration (Eynon, 1937; Shelley, 1937), but that they apparently come together again in large flocks at selected resting places (White and Lewis, 1937).

NUMBERS

Apparently Snow Geese have never attained great numbers on the Atlantic coast. Bent (1925) states that H. H. Bailey told him they were formerly not numerous in Virginia. Forbush (1925) records

this species as an "abundant migrant coastwise during settlement of the country; now very rare straggler." According to White and Lewis (1937), 2,000 to 3,000 Snow Geese stopped at St. Joachim, Quebec, about 35 years ago, while approximately 10,000 are now seen there each fall; this number, they think, includes practically all the Greater Snow Geese in existence. Local observers on the North Carolina Banks believe that the geese have probably been increasing in numbers within the last few years. This apparent increase might be attributed to a shifting of the wintering range from farther north along the coast, as it is known that the geese do not select the same location every year. Observers familiar with conditions along the entire coast, however, do believe there is a definite upward trend in the number of Snow Geese wintering in States bordering the Atlantic Ocean.

SHIFTING OF FEEDING GROUNDS

A characteristic of Greater Snow Geese on their winter range is their habit of staying in large, compact flocks which move from place to place to change their feeding sites. Although this pattern of behavior seems very firmly fixed, deviations from it do occur. Two Snow Geese were seen at Lake Mattamuskeet, on the west side of Pamlico Sound, during the first week in January 1939, and according to Dr. Maynard S. Johnson, Refuge Manager at Mattamuskeet, they stayed all winter. Judging by their preference for grassy meadows and marsh habitats along the Atlantic coast, one would not expect to find Snow Geese in the Lake Mattamuskeet locality, which is situated in farm land carved out of poorly drained forest.

Careful examination of a large flock reveals that it consists of small units that probably are families, as noted by McIlhenny in flocks of Blue Geese. Greater Snow Geese at rest crowd close together in a large oval or elliptical mass and maintain this formation while feeding, although they spread out to a greater degree.

In recent years there have been two main flocks in the region under discussion. One winters south of Oregon Inlet on Pea Island or north of the Inlet on Bodie 'Island,' which is no longer an island but a peninsula. This flock is usually referred to in the literature as the one that winters "in the vicinity of Cape Hatteras," some forty miles south of Pea Island. Another flock winters near the head of Back Bay in Virginia. Back Bay is not always used as a wintering range, according to Charles O. Handley, who reports that during some winters there are no Snow Geese on the lands bordering this freshwater sound.

Large flocks maintain neither size nor range during an entire winter,

as there is likely to be trading back and forth, and they may change feeding grounds one or more times during the season. The Pea Island birds spent part of the winter of 1936-37 at the lower end of Bodie Island, on the tidal meadows and the artificial freshwater pond near the lighthouse. They moved to Pea Island, but returned to Bodie Island about the middle of December. Gunning was unusually heavy at Pea Island, and this disturbance might have caused them to seek a quieter location. There also was considerable hunting there the next year, but despite this the geese chose Pea Island as their wintering ground, and did not occupy the tip of Bodie Island. Having been declared a Federal migratory-waterfowl refuge in the spring of 1938, Pea Island was closed to hunting the succeeding winter, 1938-39. That year the maximum number of Greater Snow Geese there was about 2,000, while a total of about 2,500 birds was reached in January on Bodie Island, less than fifteen miles to the north.

In January 1938, a coast guardsman at the Pea Island Station stated that he had not known of Snow Geese being at Pea Island until about five years previously. He believed that their numbers in that vicinity had been increasing and that they were then more numerous than ever before. Cottam, Nelson and Williams (1937), in writing of the Pea Island and Bodie Island birds said ". . . during the last five years, their numbers have increased from approximately a thousand to fully four times that number." For the birds at Pea Island in January, Walker estimates 3,000 in 1936, 4,000 in 1937, 8,000 in 1938, and 2,000 in 1939. The number at Pea Island does not necessarily give a true index to the total number wintering on the Atlantic coast, but merely indicates a shifting of winter range from year to year.

FEEDING HABITS

The feeding habits of Greater Snow Geese are probably largely responsible for their shifting from one feeding location to another up and down the coast. On land they feed in the marshes, rarely in the sounds, but when they do go to open water, it is usually to rest or to escape molestation. When feeding, they head directly into the wind, and there is a continual 'leap-frog' movement as small groups fly forward from the rear to the front of the flock. McIlhenny's description of the feeding of Blue Geese also applies to the behavior of the Greater Snow Geese. Feeding is done usually early in the morning or late in the afternoon, but the refuge managers at Pea Island and Back Bay said that it was not uncommon for the birds to feed also on bright moonlight nights.

The diet of the Greater Snow Geese seems limited to fewer items than that of the Blue Geese in Louisiana. Cottam (1935) states, "In the areas along the [Atlantic] coast where feeding observations were made, marsh grass (*Spartina patens* and *S. alterniflora*), with lesser quantities of salt grass (*Distichlis spicata*) and rushes (*Scirpus robustus* and *S. species*) were being consumed. Some segments of the alkali weed (*Salicornia* sp.) also were being taken." The geese select a locality where, to quote the natives, the cord grass is "belly deep on a cow." Preferred spots seem to be where the grass is standing in a few inches of brackish or salt water. If heavy rains or strong winds or tides cause the water to deepen, the birds leave until more favorable conditions prevail. Snow Geese do not graze, but drive their bills into the sand at the base of the grass or sedge and pull it out by the roots. After a few weeks of feeding in this manner what was once a grassy meadow becomes a shallow foul pool, completely devoid of vegetation. As the meadow changes to open shallow water, a new habitat is created that is frequented by ducks and shorebirds.

During the winter of 1937-38, Snow Geese denuded an area of approximately 300 acres on Pea Island. How many years must elapse before these bare flats will again be clothed with sufficient vegetation to be used as feeding grounds depends upon a number of factors—the soil, wind erosion, and water action. Plant succession is slow, as cord grass does not stolonize readily and good seed years seem to be far apart. During the vegetative succession the geese are forced to change their feeding grounds, so that a constant rotation of pastures takes place. On Bodie Island there are wide, bare, windswept patches of sand where the geese have fed in past years. Some of these barrens are known to be four or five years old and yet show little or no sign of revegetation.

Although a flock of Greater Snow Geese uses only a relatively small part of its range for feeding each year, it seems apparent that many thousands of acres are necessary to maintain the birds. Not only are feeding and resting grounds necessary, but a certain amount of buffer area is essential to protect them from the disturbance of vehicular traffic and other annoyances.

Bent (1925) quotes Dr. Elliot as stating that sometime prior to 1898 flocks of considerable size occasionally frequented the inner beach of Currituck Sound where the water was brackish, but that they did not stay long in such places. Walker told the writer that between 1915 and 1920 the birds wintered regularly in that location. He said they stayed in the marshes and along the beaches and did not feed

in the sounds. A large number of hogs were kept by the 'Bankers' about that time, and the Snow Geese picked up considerable food by eating roots of grasses and sedges turned up by the swine. Another source of food was grain left by hunters as bait for other kinds of waterfowl. Baiting is now illegal, and grain has therefore ceased to be an item in the diet of Greater Snow Geese. In the West, Lesser Snow Geese (*Chen h. hyperborea*) feed in grain and stubble fields, but as small grains are grown to a very limited extent near the east coast, Greater Snow Geese have little or no access to this type of food. Bent believes this may be why their winter range is restricted to the coastal marshes and beaches.

From Back Bay to Pea Island is a stretch of open water that ranges from fresh or slightly brackish to salt. At various times in the past the Snow Geese have been reported as wintering adjacent to these waters. At Pea Island the birds feed in water that is more or less constantly changing in degree of salinity owing to inundation of the feeding grounds by high tides and heavy rains. The irregular flights of the flock from Pea Island north to the freshwater pond on Bodie Island may be caused by a desire or need for a change in water. A freshwater pond has been recently created on Pea Island by the Biological Survey in its refuge-development program, and its use by the Snow Geese will be interesting to study.

ADULT-IMMATURE RATIO

The proportion of immature to adult birds apparently varies widely from year to year. Cottam, Nelson and Williams state that, when they visited Pea Island and Bodie Island in January 1937, from 15 to 20 per cent of the birds were in immature plumage. On January 26, 1938, the writer drove his car to within a hundred yards of a large feeding flock at Pea Island. As small units flew from the rear to the front of the flock the individuals in 78 groups were counted. A total of 380 birds was tallied; of this number 257, or 65.8 plus per cent, were in the gray plumage of the young, and 133, or 34.1 plus per cent, were white. Of these 78 units, 61 had one or two adults and one or more juveniles, five had no juveniles, and nine had more than two adults. The average size of a unit was a little over five birds.

The following winter there were rumors that there were very few birds in the juvenile plumage at Pea Island or Back Bay. On January 6 and 7, the writer with the aid of a binocular made counts while the flock was on the ground and in the water. Such enumerations are much less satisfactory than when the birds are in the air in small

bunches, as the geese stay so close together that counting is difficult. The most satisfactory method when they are on the ground is to note the birds at each end of the flock where they spread out more than they do nearer the center. Of 290 birds counted, 36, or 12.4 plus per cent, were in juvenile plumage and 254, or 87.5 plus per cent, were in the white plumage of the adult. Counts of such small numbers probably do not reveal the true percentages, but they do give a good enough approximation to indicate considerable variation in the ratio of young to adults from year to year.

BLUE GEESE

The appearance of Blue Geese in the flocks of Greater Snow Geese in North Carolina and Virginia seems to be a phenomenon of recent years. Records of this bird's occurrence in the East were comparatively rare until the winter of 1934-35. Since then there has been a general increase in numbers in the States along the Atlantic coast. The cause of this sudden and continued appearance is not known, but Cottam (1935) advances the suggestion that it may be due to a combination of factors, including strong north and northwest winds during migration, increase in population forcing dispersion, disturbance on wintering grounds causing wandering, and drought along the migratory lane. Cottam, Nelson, and Williams noted small flocks of Blue Geese on Pea Island and Bodie Island for the three years prior to 1937. On January 14, 1938, James O. Stevenson and the writer observed seven adult and nine immature Blue Geese among the flock of Greater Snow Geese on Pea Island, and January 7, he noted four Blue Geese and one White-fronted Goose (*Anser albifrons*) at Back Bay, Virginia.

PREDATORS

From information at hand, predators do not seem to be of great importance to the wintering Greater Snow Geese. While at Pea Island they are safe from molestation by foxes and roving dogs, as there is no way for these mammals to reach the island. At Back Bay the situation is different, foxes being present. During the winter of 1938-39, evidence disclosed that eleven Snow Geese had been eaten by foxes. Sufficient proof to convict the fox as a serious predator in this area is lacking, and it is thought that the evidence probably represents predation on crippled or sick birds, and is of little importance. Likewise, from present information, the Eagle and Duck Hawk cannot be considered as doing much damage. At various times the writer has seen a Bald Eagle (*Haliaeetus leucocephalus*) or a Duck Hawk

(*Falco peregrinus anatum*) fly over a flock of Greater Snow Geese. The birds became alarmed and left the ground in a body, but their fright seemed of short duration, as they soon settled to earth after the raptors had left. The same behavior resulted when a Great Blue Heron (*Ardea herodias herodias*) or an airplane flew over them.

When a Duck Hawk or a Bald Eagle was on the ground, the geese paid it little attention. Even one of these birds feeding upon a goose in the midst of a flock occasioned little notice; the geese continued to feed as though the occurrence was a perfectly natural one. Inquiry among local observers failed to reveal any records of geese being struck on the wing by an Eagle or a Duck Hawk, but James O. Stevenson reported seeing a Duck Hawk make a few swoops at geese on Pea Island. He thought the hawk was playing, since its attempts at capture did not seem serious. McIlhenny describes Eagles and Duck Hawks killing Blue Geese, and Bent quotes Audubon as mentioning "White-headed Eagles and other rapacious birds" attacking Greater Snow Geese.

Flocks of Greater Snow Geese, while resting and feeding, are occasionally intermingled with small groups of Canada Geese, but the two species rarely fly together. Blue Geese and Greater Snow Geese mingle, but as Cottam, Nelson, and Williams have observed, there is a tendency for the former to maintain their position as small units of the larger group. This is true at least while the birds are on the ground.

PROTECTION AND MANAGEMENT

Hunting of all Snow Geese in the States bordering the Atlantic Ocean has been prohibited since the Migratory Bird Treaty Act was passed in 1918. According to statements of an old-time market hunter, they were never held in high repute as a gamebird along the North Carolina coast. Pearson, Brimley, and Brimley (1919) state that "the White Brant's flesh is not very palatable, and the birds are seldom, if ever, hunted in this State." These large white geese used to be considered a nuisance because they ate the grain set out for other waterfowl. If a few of them happened to fly over a blind they were likely to be killed, but apparently they were never subjected to heavy hunting pressure by sportsmen. They were, however, a favorite object of 'fire-lighting' by local pot hunters. Now, of course, they enjoy the protective efforts of both Federal and State Governments.

The Biological Survey is taking definite steps to preserve some of the winter range for the Atlantic Coast flock of Snow Geese and has established waterfowl refuges along the coast in several States. From

early indications, the protective and restorative measures taken at the waterfowl refuges at Pea Island and Back Bay will be of considerable benefit to this species as well as to other migratory waterfowl. Restoration work by CCC camps at both these refuges includes such activities as control of wind erosion, building of freshwater ponds and experiments in food planting. Because the places where the geese feed revegetate very slowly, experiments to renew the denuded stands of cord grass are being undertaken in connection with other phases of management.

Steps are under way at the present time to create the Cape Hatteras National Seashore, which will embrace most of the North Carolina coast from near the Virginia-North Carolina state-line to the lower tip of Ocracoke Island. When established, the National Seashore will be under the jurisdiction of the National Park Service, of the Department of the Interior, and thus a large part of the wintering grounds of the Snow Geese along the Atlantic coast will be in Federal ownership. Encroachment on the wintering grounds of the Greater Snow Geese seems to be definitely halted.

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