MIGRATIONS OF THE AMERICAN BRANT (*BRANTA BERNICLA HROTA*)

BY HARRISON F. LEWIS[1]

THE Brant prefers, in general, haunts which are not those inhabited or frequently visited by man. It nests in the far north, migrates chiefly over the sea or over uninhabited lands, and usually feeds on tidal flats so extensive that it need not come near the shore. In consequence, our knowledge of the Brant and its ways has developed slowly and, although we no longer believe the fable that it is derived from a shell-fish, there are still many interesting details of its life history to be discovered.

In discussing the routes followed by the migrating Brant, I shall present observations relating only to the region between New York City and southern Baffin Island. South of New York City the migration of this species is principally a coastwise one, extending normally to the coastal sounds of North Carolina, while north and west of southern Baffin Island the routes followed by Brant are not well known and I can offer no new information about them.

It appears that the main body of Brant, after assembling in Great South Bay and lesser coastal waters of Long Island, New York, fly to Monomoy, Muskeget, and adjacent waters on the southeastern coast of Massachusetts. According to Dr. John C. Phillips (1) "the spring arrival of Brant at Monomoy may be said to begin about the second week in March, although sometimes they arrive the first week . . . The main concentration is between March 25 and April 20, and as a usual thing the Bay is nearly empty of birds by April 25." A letter, dated June 6, 1935, which I have received from Mr. Clarence L. Hauthaway, of Lynn, Massachusetts, an enthusiastic Brant hunter of long experience, indicates that Brant, while resting and feeding in this general region, may concentrate locally on favorite feeding-grounds at least as far west as "Great Island," between Hyannis and the mouth of Parker's River, and that in recent years Brant have spent a longer time in autumn in the harbor of Plymouth, Massachusetts, than they used to do. From Monomoy the majority of the Brant apparently fly directly to the waters of Northumberland Strait, which separates Prince Edward Island from the mainland of New Brunswick and Nova Scotia, in the southern part of the Gulf of St. Lawrence. Presumably the route taken leads up the Bay of Fundy and its northeastern arm, Chignecto Bay, and across the Isthmus of Chignecto. The time of arrival of the first Brant at

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Northumberland Strait in spring is commonly in the first week of April, and the numbers in that region increase steadily thereafter until they reach their maximum in the first week of May. Around the mouth of the Bay of Fundy some small groups of Brant are often deflected temporarily to one side or the other of the main route and are seen to pause for a while in the bays of the coast of eastern Maine, southwestern New Brunswick, and southwestern Nova Scotia. For example, Dr. Alfred O. Gross reports having counted, on May 24–26, 1935, two hundred fifty Brant that apparently were feeding in the sheltered harbor formed by Three Islands, near Grand Manan, New Brunswick, and adds that he was told that Brant visit these islands regularly every spring.

The existence of a minor migration route for Brant, leading from Long Island Sound northward across New England and southern Quebec to the St. Lawrence River, has been indicated by A. C. Bent (2) and E. H. Forbush (3), who adduced as their principal evidence the following observation, published by Dr. Louis B. Bishop (4): "Professor A. E. Verrill informed me that on May 17, 1914, he saw, with Mr. G. E. Verrill, many flocks of Brant flying north up the Housatonic Valley near the mouth of the Housatonic River; that most were high in the air, but some almost within gunshot; also that he saw others flying northwest while at Outer Island, Stony Creek, about May 22." There are indications of this overland migration route at other points farther north in New England. Thus, Mr. Aaron C. Bagg, of Holyoke, Massachusetts, wrote to me on May 3, 1935: "Brant use the Connecticut Valley very rarely since the turn of the century. The old-time hunters speak of seeing flocks occasionally. The only records of modern times that I know anything about are as follows. The late R. O. Morris of Springfield recorded a late record May 30, 1901, when he wrote, 'Observed a small goose at the lower end of Longmeadow that was probably a Brant.' On April 11, 1903, a young female was collected on the river near Northampton and is at present in the Springfield Museum collection. In 1928 (November 21), while watching a wedge of fifty Canada Geese or more at Holyoke, I discovered following at a short distance behind fifteen or twenty geese of smaller size that I marked down for Brant. Two Brant were shot near Westfield, October 13, 1931. At South Windsor, Connecticut, a short distance below our State line, a Brant or two were recorded March 28, 1931, by C. W. Vibert, a bird authority of many years' standing for that region. A flock of eighteen was observed there as early as March 8, 1932. They were seen by various members of the Hartford Bird Club and lingered thereabouts until March 25. At New Haven, which is not quite in the Valley but undoubtedly is on one of our migration lanes, 106 were counted May 17, 1933, by F. W. Loetscher, Jr., a reliable bird student, at that time attending Yale. These are about the only records we have for this species but un-

doubtedly there have been many others for the region and I agree with you that this is one of the minor migration routes for the species." In a subsequent letter, dated May 13, 1935, Mr. Bagg supplied the following additional record: "You doubtless will be interested in learning of a small flock of four Brant that flew up our Valley on May 10. When observed at Northampton they followed one of the bends in the river toward the west, going over to one of the tributaries, the Mill River, which leads in the northwest direction, as if heading in the direction of Lake Champlain."

Fortner, Smith, and Dole (5) say of the Brant in Vermont: "Rare migrant. Sight observations at St. Johnsbury, Wells River, and Woodstock." In a letter dated August 29, 1935, Mr. Wendell P. Smith has furnished me with the following additional information concerning his own observations of this species at Wells River: "October 12, 1921, forty-five late in afternoon: October 26, 1923, thirty in late afternoon: April 12, 1924, five flocks of perhaps twenty to twenty-five heard moving northward from 11.30 p. m. to 12.00 midnight."

The various observations cited may seem at first rather insufficient evidence of the existence of a regular, but minor, migration route of Brant across New England. The regular migration flights of large numbers of Brant across the Labrador Peninsula show, however, that this species may maintain regular overland migration flyways and that, when passing over such parts of their migration routes, they often fly so high that they may easily escape observation. There is, moreover, some evidence, now to be presented, of the arrival of Brant in spring on the lower St. Lawrence River by this cross-country route and of their departure from the lower St. Lawrence River over this route in the fall.

The principal feeding-grounds for Brant along the south shore of the estuary of the St. Lawrence River are at Kamouraska, which is about ninety miles below Quebec City, and at Ile Verte, which is about one hundred twenty-five miles below Quebec City and about opposite the mouth of the Saguenay River. On a visit to Ile Verte on April 24, 1930, I saw about seven hundred Brant. Local hunters informed me, as I recorded in my notes at that time, that the first Brant seen at Ile Verte in 1930 arrived there about April 8 and that both Brant and Canada Geese sometimes arrive there in spring by flying down the St. Lawrence River, that is, from the southwest, but that most of them at that season appear there coming overland, from a more southerly direction. In answer to a questionnaire sent to him, Mr. Victor Rivard, of Ile Verte, writing in April, 1935, stated that Brant were accustomed to arrive at Ile Verte from the south but that, up to the time of writing, none had arrived there in the spring of 1935. He also stated in the same communication that Brant were accustomed to depart southward when leaving Ile Verte in October and November; but that very few had been seen at that place in the autumn of 1934.

In reply to a similar questionnaire, Mr. Willie LaBrie, of Kamouraska, well known as a competent and reliable observer of birds, stated, on April 15, 1935, that he was not sure of the direction from which Brant came on their arrival at Kamouraska in the spring, but that when they left that place in the autumn they flew southwest. He added that there were only about one hundred Brant, divided into small groups, at Kamouraska in the autumn of 1934, and that none had arrived there up to the time of his writing in the spring of 1935.

Mr. C. E. Dionne (6) has published the statement that the Batture aux Loups-Marins, or Seal Islands, which are in latitude 47° 14′ N., longitude 70° 26′ W., are the approximate southwest limit of Brant on the St. Lawrence River, but local hunters tell me that, while this has been true in recent years, there was formerly a time when Brant were seen on the St. Lawrence as far up as Cap Tourmente, on the north shore, about twenty-eight miles below Quebec City.

To consider again the main northward flight of Brant, which proceeds by way of the Bay of Fundy and Northumberland Strait, it may be recorded as well known that the birds in this group spend the month of May in the southern and western parts of the Gulf of St. Lawrence. During that time they may be found scattered in various suitable harbors around Prince Edward Island, where, according to Mr. E. T. Carbonnell's statement as published by Forbush (7), they nearly always arrive in the night. They also spread northward along the eastern shore of New Brunswick where many shallow harbors and lagoons, such as the famous Tabusintac Lagoon, are admirably suited to their needs, and enter the Bay of Chaleur, near the head of which they are found on both its shores. At Shippigan Island, on the south side of the entrance to this great bay, Mr. Camille Guignard reported the first Brant in 1933 in the week ending April 8 and in 1935, in the week ending April 20. At New Richmond, Quebec, on the north shore of the bay, I saw five hundred Brant on April 22, 1927, and was told that they had then been there for at least a week. Other flocks of Brant, during April and May, frequent suitable shallow harbors, such as Malagash, Little Harbour, and Merigomish Harbour, on the north shore of Cumberland and Pictou Counties, Nova Scotia. In view of the regular occurrence of Brant in numbers in these harbors each spring and fall, as well as the frequent visits of smaller groups to the coast of the southwestern part of this province, the manner of occurrence of Brant in Nova Scotia cannot be considered merely "casual," as it is termed in the fourth edition of the A. O. U. Check-List (8).

Some flocks of Brant each spring fly out into the Gulf of St. Lawrence northeast of Prince Edward Island and visit for a time the Magdalen Islands, where two very large shallow lagoons provided, under normal

conditions, excellent feeding grounds for them. Their occurrence at these islands in both spring and fall was recorded by Cory (9). In 1924 I saw five hundred Brant at Grand Entry, Magdalen Islands, on May 18, one hundred twenty-five Brant at the same place on May 22, and twenty-five Brant between Grand Entry and Grindstone on the latter date. In 1933 I observed forty Brant at House Harbour, Magdalen Islands, on May 8 and fifty birds of this species between House Harbour and Grand Entry on May 9. After loitering in scattered flocks in the coastal waters of the Gulf of St. Lawrence, between Nova Scotia and the Gaspé Peninsula, Province of Quebec, during practically the entire month of May, the majority of the Brant resume their northward movement rather suddenly about the end of that month. Their departure from the Gulf is carried out chiefly in the first fifteen days of June, but may begin in the last week of May. In executing this part of their journey to their nesting-grounds, the Brant proceed northward to the north shore of the Gulf of St. Lawrence and there make a pause which for most of them is comparatively brief. Mr. W. B. Mershon has recorded (10) that many of the Brant from the Bay of Chaleur fly northward via the valley of the Grand Cascapedia River between June 3 and June 16, leaving the Bay of Chaleur about sunset. Presumably the birds using this route make a direct traverse from south to north across the Gaspé Peninsula. Apparently a large proportion of the Brant use a more easterly route, which leads them past the west end of the Island of Anticosti. As already published (11), I saw large flocks of Brant, totalling three thousand to four thousand birds, at Ellis Bay, Anticosti, on the evening of June 10, 1922. They flew in over the bay from the southward, cackling loudly, and passed on without alighting.

According to information furnished to me verbally on June 19, 1935, by Mr. Peter Wright, who has lived for many years at Pigou, near Cape Cormorant, on the north shore of the Gulf of St. Lawrence, the main stream of northward-flying Brant arrives at that shore in the vicinity of Cape Cormorant, in longitude 65° 32′ W., but the exact place of their arrival may vary within a few miles on different days. Mr. Wright thinks that this variation is governed by weather conditions. From Cape Cormorant, the flocks turn westward along the north shore of the Gulf, flying sometimes close to the land, sometimes a mile offshore. The flocks generally fly close to the water in recent years, but it was Mr. Wright's experience prior to the last four or five years that the last flocks of each year's northward migration used to fly high as they passed Pigou. A number of small flocks of Brant, however, regularly reach the north shore of the Gulf farther east, where it is bordered by the western half of the archipelago known as the Mingan Islands. The eastern limit of their regular annual occurrence in spring on this coast is at Havre St. Pierre, formerly known as Eskimo Point, which is about 86 miles

east of Cape Cormorant. There I saw a flock of eleven Brant on May 25, 1923, and other small flocks on various dates until June 1, 1923, the maximum number recorded in one day being twenty-seven on May 26. East of Havre St. Pierre Brant are, on the north shore of the Gulf of St. Lawrence, rare and accidental.

While tarrying for a time in spring in the vicinity of the western half of the Mingan Islands, Brant frequent, in small groups, not only the shallow bays along the mainland, but also the extensive reefs of limestone that border the southern sides of some of the islands. My earliest date for Brant in this region in any spring is May 20, 1925, when twenty were seen at Quarry Island. My latest date for them in this vicinity in any spring is June 13, 1923, when seven were seen on Niapisca Island. The largest number of Brant that I have seen alighted in this region in one day is 178, which were observed at Niapisca Island on June 2, 1927, but flocks of Brant containing a total of 225 individuals were seen migrating along the mainland shore near Mingan on June 9, 1921. The birds last mentioned, as well as all other flocks of Brant that I have seen in migration flight in this region, were traveling west, apparently to join the main flight near Cape Cormorant. In 1935, Brant were seen near Great Birch Island, in Birch Islands Bird Sanctuary, near Mingan, by Mr. George Maloney, the sanctuary caretaker, on four dates from May 21 to June 9. The largest number seen in any one of these observations was sixty-three on May 21.

The next place on the migration route of the Brant that requires special consideration is the Bay of Seven Islands. This is a sheltered body of water, about seven miles long and six miles wide, situated at the northwest angle of the Gulf of St. Lawrence, in latitude 50° 12′ N., longitude 66° 25′ W. In its entrance are six high, steep, rocky islands, one small island, and several rocks, but between the islands are broad, deep channels, giving easy access for shipping to the bay. The outer part of this bay is deep, but in the northern part are broad tidal flats suited to the needs of the Brant. North of the bay and in plain sight from it are ranges of wooded mountains reaching heights of 1300 to 1700 feet. No large stream flows into this bay, but the Moisie River, flowing from the north, debouches about fourteen miles east of it, and the Ste. Marguerite River, also flowing from the north, empties into the Gulf about five miles west of the bay. The fact that the Bay of Seven Islands is a notable point of concentration for the Brant on their northward migration was published by Townsend and Bent (12) and has been generally known for many years. Until very recently the first Brant at the Bay of Seven Islands in spring commonly arrived there each year at or before the middle of May. For example, I observed a flock of about 1100 Brant in the inner part of this bay on May 14, 1925. Mr. Ludger Boudreault, an experienced bird protection officer who was sta-

tioned at this place in the spring of 1930, reported that he saw the first Brant of the year there on May 5, an unusually early date.

While I have had little personal experience with these early Brant at the Bay of Seven Islands, beyond that just mentioned, the common opinions about them held by the hunters of Seven Islands village, who were accustomed to hunt Brant regularly in the spring prior to the passage of The Migratory Birds Convention Act, are sufficiently noteworthy to deserve mention here for what they are worth. According to these hunters, the early flight of Brant was a regular annual occurrence, quite distinct from the principal flight, which arrived there about the first of June. The early flight never contained more than a few thousand birds. These were reported to enter the bay by the southwestern pass, between all the islands and the western mainland shore, whereas the main flight of Brant entered the bay by the southeastern pass, between all the islands and the eastern mainland shore. Often the early flight had entirely left the bay before the main flight began to arrive. The birds in the early flight are said to have been so much darker in color than the birds of the principal flight that, while these French-Canadian hunters recognized that they were really Brant, or "bernaches," as they call the birds of the June flight, they seldom used that name for the birds in the early flight, but commonly referred to them as "les noirs," that is, "the black ones." In 1935 the local bird protection officer at Seven Islands, Mr. Christophe Doire, kept, under my instructions, a special watch, beginning on May 7, for the Brant of this early flight. I also watched for them at the Bay of Seven Islands on and after May 24, 1935. Neither of us saw anything of an early flight of Brant this year except one flock of five individuals which I saw entering the bay by the southwest pass on May 24.

Flocks of Brant that arrive on the north shore of the Gulf of St. Lawrence east of the Bay of Seven Islands, chiefly in the vicinity of Cape Cormorant, turn westward along that shore. As far as is known, most of them enter the Bay of Seven Islands by the southeast pass. According to all the information available, such flocks always enter this bay during daylight hours, chiefly in the morning. Some other flocks, however, turn northward at Matamek River, at the head of Moisie Bay, about twenty-two miles east of Seven Islands, for their overland flight across the Labrador Peninsula. Mr. P. A. Taverner, in 1928, observed two large flocks of Brant fly inland at Matamek River on the evening of June 5, after they had rested much of the day on the water in the head of Moisie Bay. On the next day, June 6, he observed another flock fly inland at this place and on June 8 he saw a flock of about one hundred Brant do the same thing. Captain Antoine Levesque, of Matamek River, wrote to me that he saw two flocks of Brant fly inland at that place in 1935, namely, a flock of sixty on June 10 and a

flock of one hundred on June 14. Local residents have told me that years ago some flocks of northbound Brant would turn inland at the mouth of the Moisie River and proceed directly up that river but that in recent years such flights have not been observed.

I have not succeeded in seeing the departure of migrating flocks of Brant from the Bay of Seven Islands when they continue their spring migration, but there can be no doubt that, on leaving this bay, these birds make a long flight overland. Local hunters tell me that the Brant always take their departure from this bay in the evening and that, when they are ready to leave, they fly upward in spirals until they attain a great height before they start northward toward the mountain barrier.

Where do the Brant go after they turn inland at the Bay of Seven Islands or at Matamek River? I know of only two places where Brant appear in spring as if at the end of an overland flight from the Gulf of St. Lawrence. These places are James Bay and Ungava Bay and it is probable that all Brant that leave the Gulf of St. Lawrence on their way to their nesting grounds direct their course first toward one or the other of these bays. The distance from the Bay of Seven Islands to the southern end of James Bay is 543 miles, while from the Bay of Seven Islands to Ungava Bay is 578 miles. Since Brant are by nature almost entirely maritime birds, it seems unlikely that they willingly alight during these long journeys overland. Indians of the Labrador Peninsula say that they sometimes see Brant on the lakes of the interior in the season of migration, but these are probably birds that have been forced down temporarily by adverse weather conditions.[1]

According to reports received from local observers, the flight of Brant that arrives at Ungava Bay is much larger than the flight of this species that arrives at James Bay. Because of the small numbers of Brant seen on James Bay in the spring, it is certain that the main northbound flight of Brant does not proceed by way of that bay, as some accounts published in recent years would indicate. Hitherto our knowledge of the arrival of Brant in spring at Ungava Bay has been derived almost wholly from the observations of Lucien M. Turner, who resided at Fort Chimo, on the Great Koksoak River, about twenty-seven miles above its point of discharge into southern Ungava Bay, from August 6, 1882, to September 4, 1884. Part of a quotation about Brant, taken from Turner's notes and published by A. C. Bent (2) is as follows: "At Fort Chimo they arrive from the 20th of

[1] Mr. W. E. Clyde Todd has very kindly authorized the publication here of the following statement: "On June 7, 1917, late in the evening, we saw flocks of Brant flying northward, following the course of the Ste. Marguerite River. This was at the Grande Portage (33 miles north of Seven Islands Bay). They were flying fast and very high, above the tops of the hills on either side, and although the hour was toward nightfall, they showed no signs of stopping. They were not flying in regular formation, as do the Canada Geese and some other species."

May to the 20th of June. They fly past the station of Fort Chimo over the water in the Koksoak. At times they are as high as 100 yards, and oftener only a few feet above the water or running ice. They come at a time when it is almost impossible to get at them on account of ice, and if this is not present they fly too high. They follow the sinuosities of the river and only cross such points that they can see over. Thousands of them are seen every spring and never one of them in the fall. They are reported by the Eskimo to fly southward over Hudson Bay . . . They appear fatigued when they reach Hudson Strait, but with rapid beat of wing they pursue their course to the unknown regions beyond."

On August 20, 1935, I had the pleasure of an interview with Mr. J. W. Payne, an accountant in the employ of the Hudson's Bay Company who was then stationed at Blanc Sablon, Quebec, but who resided at Fort Chimo for seven years, from 1924 to 1930. Without knowing anything of Turner's observations of Brant at Fort Chimo, Mr. Payne gave me the following information about the occurrence of that species in that vicinity as he had observed it. Brant fly down the Koksoak River past Fort Chimo in early June. They generally arrive there in the evening and are usually observed passing in silent, low-flying flocks containing from fifty to one hundred thirty birds each. Their regular stopping-place in that region is in a big arm or inlet on the east side of the Koksoak River, below Fort Chimo and about twelve miles above the river-mouth. That part of the river is tidal and there are large flats in the inlet that are uncovered at low tide to a distance of about half a mile from the shore. No one lives near the inlet and the Brant are seldom hunted or disturbed there. Mr. Payne did not know of any other resting-ground for Brant about Ungava Bay. He did not know what the Brant eat when they are in this inlet, but he did not think that any eel-grass (*Zostera marina*) grows there. In fact, the only place about Ungava Bay where he knew that eel-grass grows is the estuary of False River, about twenty miles east of the mouth of the Koksoak River. The Brant generally stay at their resting-place in the inlet beside the lower Koksoak River for only two or three days in June, after which they continue their flight toward the north. In the fall a smaller number of Brant return past Fort Chimo, southbound, over the same route used in spring. They pass Fort Chimo on their southward migration about the end of September or the first of October and may then pass at any hour of the day. There is not much hunting of Brant near Fort Chimo in the fall.

It will be noted that when northbound the Brant both depart from the Bay of Seven Islands and arrive at Fort Chimo in the evening. Probably they fly up the Ste. Marguerite River or the Moisie River to the vicinity of the height of land and there cross directly to streams belonging to the Koksoak River system, by descending which they reach Fort Chimo. Such a

route, because of sinuosities in the streams followed, is probably at least six hundred miles long. If it is made in one non-stop flight, in twenty-four hours, the speed of flight must be about twenty-five miles an hour. G. Webster, manager of the Hudson's Bay Company Post at Fort McKenzie, on the Koksoak River one hundred fifty miles south of Fort Chimo, has reported in a letter received in the spring of 1936 that Brant to the number of three or four thousand fly down the Koksoak past Fort McKenzie about June 10, but that this species is not seen there at any other time of year.

What may be the next regular stopping-place of the northbound Brant after they leave the Koksoak River I do not know, although it may be remarked that J. Dewey Soper (13) saw "a number of migrants" of this species at Lake Harbour, on the eastern part of the south coast of Baffin Island, in late June, 1931. It seems doubtful if the birds that take the Koksoak River route include those that are seen in southwestern Baffin Island in spring. Bernhard Hantzsch (14) has recorded that, near Port Burwell, Quebec, on the eastern side of Ungava Bay, Brant are not rare migrants, often appearing in considerable flocks. The manager of the Hudson's Bay Company Post at Leaf River, on the southwest coast of Ungava Bay, has reported in a letter received in the spring of 1936 that there is a large coastwise flight of Brant in that vicinity on both the northward and the southward migrations, but that only a few small flocks pause to feed there. According to Wells W. Cooke (15), on their nesting grounds in latitude 82° 33′ N., in 1876, Brant arrived June 9 and the first Brant eggs were found June 21. These observations were made in northern Ellesmere Island.

For information concerning the movements and numbers of Brant in James and Hudson Bays I am greatly indebted to Mr. J. W. Anderson, district manager of the James Bay District of the Hudson's Bay Company, who, at my request, has repeatedly and painstakingly gathered information about Brant at the various trading posts in his district. The information thus gathered, which Mr. Anderson has sent to me from time to time, is my authority for the following remarks about Brant in the region of James and Hudson Bays, except in the few cases where some other authority is explicitly stated. Prior to very recent years, Brant appeared fairly regularly in small numbers in spring at Rupert's House, Eastmain, and Fort George, which are posts on the east coast of James Bay, and which I have named in order from south to north. At Rupert's House it is said that they arrived from the south, that is, from overland, about May 1, and that they departed for the north about the end of May. At Eastmain they are said to have arrived about May 25 from the south, that is, coastwise, and to have departed for the north and northwest after feeding in that vicinity for two or three weeks. Near this post they were commonly observed in flocks

of from two hundred to three hundred individuals. At Fort George, it is stated, they arrived about the middle of May from the east, that is, descending the Fort George River, and without stopping flew on in a northerly or westerly direction. It will be observed that the dates given for the arrival of Brant in spring at these three posts on James Bay are all earlier than the time of arrival of the principal flight of Brant at the Bay of Seven Islands, on the north shore of the Gulf of St. Lawrence.

At Charlton Island, which is in the southern part of James Bay, about twenty-two miles west of the east coast, the occurrence of Brant in the spring was, it is said, only casual.

Indians of the vicinity of Attawapiskat, on the west coast of James Bay, claim that formerly Brant occurred in "large numbers" in spring on the northeast point of Akimiski Island, which is a large island near Attawapiskat, but none of these Indians had visited that vicinity for some years. This claim should be received with caution. At Great Whale River, on the east coast of Hudson Bay, Brant are now seldom seen in spring, but in each year from 1930 to 1933 several large flocks, northward bound, passed there between June 6 and June 9. On the Belcher Islands, a large group of islands lying about fifty miles offshore on the east side of Hudson Bay, Brant are said to have occurred until recent years in considerable numbers every spring. In the spring of 1935 the status of Brant at the points mentioned, except Akimiski Island, from which there is no information, was as follows: Rupert's House, none; Eastmain, only two flocks (size not stated); Fort George, none; Charlton Island, six Brant; Great Whale River, two Brant; Belcher Islands, none. The total of these reports for the spring of 1935 is two flocks and eight other birds. J. Dewey Soper (16) has recorded three small flocks of Brant at Gordon Bay, southern Baffin Island, on June 21 and 22, 1926, and, in a later paper (13), has stated that this species was a common migrant at his Camp Kungovik, near Bowman Bay, on the west coast of southern Baffin Island, from June 7 to 24, 1929, and that it there fed on the tundra. George M. Sutton (17) has recorded the arrival of Brant at Southampton Island, at the north end of Hudson Bay, on June 18 and 19, 1930, and the discovery on that island of a nest containing five fresh eggs of this species on June 25, 1930.

At this point I wish to turn for a moment from the reporting of observed facts to what is admittedly theory. It seems quite likely that the Brant that fly across New England and southern Quebec, from Long Island Sound to Kamouraska and Ile Verte, on the south shore of the estuary of the St. Lawrence River, are the same birds that compose the early flight of Brant arriving at the Bay of Seven Islands, at the northwest angle of the Gulf of St. Lawrence, in mid-May. This identity appears probable because the early flight at the Bay of Seven Islands enters the bay from the south-

west, whereas the main flight from the southern part of the Gulf of St. Lawrence enters that bay from the southeast, because the early flight at the Bay of Seven Islands arrives there before Brant are known to have left the Bay of Chaleur or the southern part of the Gulf of St. Lawrence, and because the flight of Brant at Kamouraska and Ile Verte and the early flight at the Bay of Seven Islands appear to have shrunk simultaneously, in the last year or two, to nearly nothing. It also seems worth suggesting that the early flight of Brant at the Bay of Seven Islands, which often leaves that bay before the main spring flight of Brant arrives there, is identical with the flight of Brant seen in spring in James Bay. Reasons for this suggestion are that the time of departure of the early flight of Brant from the Bay of Seven Islands and the time of arrival of Brant in spring on the east coast of James Bay correspond fairly well, that the Brant arriving at James Bay in May cannot belong to the principal flight of Brant at Seven Islands because that flight does not arrive at Seven Islands until after the Brant are at James Bay, that the early flight of Brant at the Bay of Seven Islands, leaving there in May, apparently does not go to Fort Chimo, where Brant commonly arrive in June, and that the early flight at the Bay of Seven Islands and the spring flight at James Bay appear to have shrunk simultaneously, in the last year or two, to nearly nothing.

It also seems probable that the flight of Brant visiting the east coast of James Bay in the spring was the flight that supplied the breeding birds of southwestern Baffin Island, Southampton Island, and possibly other islands at the northern end of Hudson Bay. The larger body of migrants that goes north by way of Ungava Bay somewhat later in the season is presumably the breeding Brant of the more northern Arctic islands. If the hunters at Seven Islands are correct in maintaining that the birds in the early flight of Brant at that place were easily distinguishable from the birds in the main flight by morphological characters, then the group of Brant migrating north by way of the Connecticut River, Ile Verte, Seven Islands, and James Bay, and having breeding grounds around the north end of Hudson Bay, more or less distant from those of the majority of the Brant of eastern North America, may have become sufficiently differentiated from other Brant to form a recognizable race. However that may be, this smaller group of Brant, with the more western spring migration route, appears to be nearly extinct at present.

As for the southward migration in the fall, it may be said that in general it follows, in the reverse direction, the routes travelled by the Brant in spring, but there are exceptions to this statement along some parts of the way.

The southward flights of Brant in autumn past Leaf River, on Ungava Bay, and Fort Chimo, on the Koksoak River, have already been mentioned.

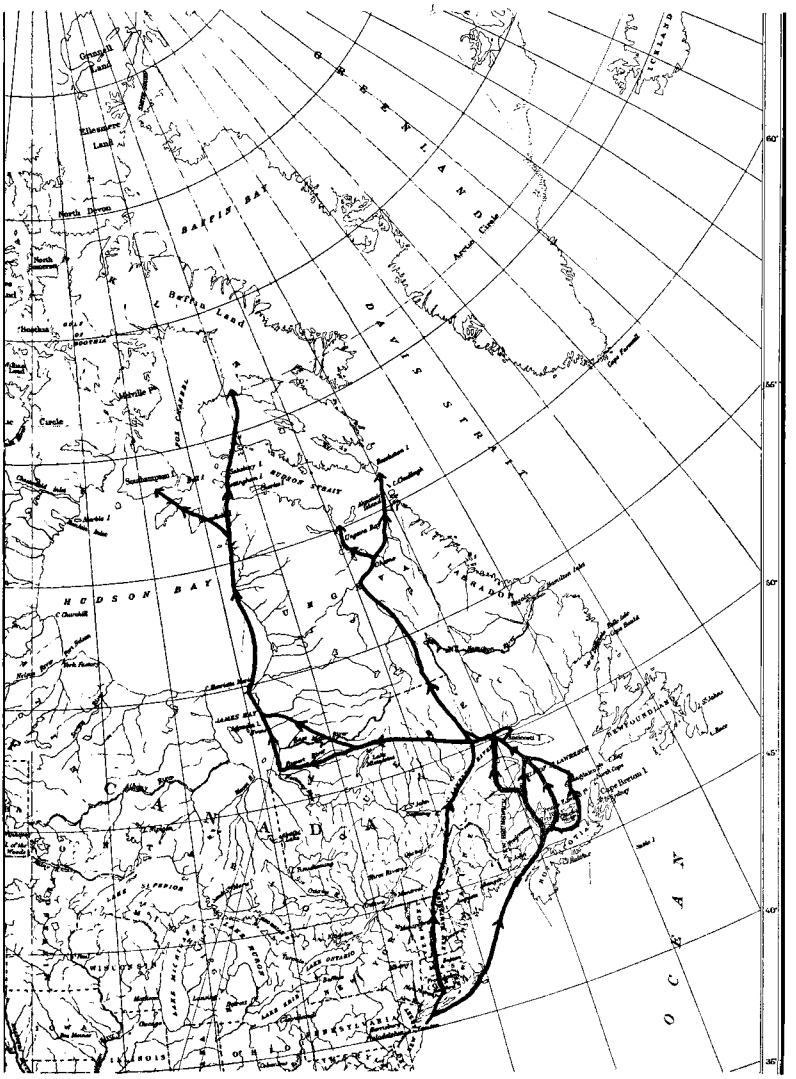

FIG. 1.—Spring migration routes of the American Brant.

The heavy lines indicating migration routes represent an attempt to present on a map available information on the subject. Uncertainty in various degrees concerning some parts of these routes is indicated in the accompanying text.

There is a southward movement of Brant in fall along the east side of Hudson Bay, passing in part across the Belcher Islands, where this species normally occurs in considerable numbers at that season, and in part along the mainland coast. At Great Whale River, it was formerly normal to see about six hundred Brant in fall, but in the fall of 1934 only one flock of twenty to thirty Brant was seen there. Apparently most of the southward flight of Brant, on reaching the mouth of James Bay, is deflected westward, to the vicinity of Cape Henrietta Maria, on the west coast of that bay, for a considerable gathering of Brant is reported to occur annually in September along the shore just south of that cape. This feeding-ground may very well be reached by direct flight from the Belcher Islands.

It has frequently been said that a large flight, if not the principal flight, of Brant in the fall travels south along the west coast of Hudson Bay, but there seems to be little trustworthy evidence to support such a statement. Brant are not included, even in hypothetical status, in Taverner and Sutton's list (18) of the birds of Churchill, Manitoba. The only reliable report of American Brant on the west coast of Hudson Bay to come to my attention has been furnished by Arthur C. Twomey who states, in a letter dated November 9, 1936, that he saw small flocks of American Brant following the shore line of the bay in front of the town site at Churchill, on September 5 and 10, 1936. The flocks flew fairly low over the water, about two hundred yards from shore. Two flocks, containing a total of thirty-five individuals, were seen on the 5th and five flocks, containing a total of seventy-two individuals, were seen on the 10th. Small flocks of Brant reported by Sutton (17) as flying westward in southern Southampton Island in September, 1929, may have been following a migration route that would lead them past Churchill.

Reports received from employees of the Hudson's Bay Company, through Mr. J. W. Anderson, contain some indication that the flocks of Brant near Cape Henrietta Maria in the fall proceed from there to the northeast point of Akimiski Island and from that place to Charlton Island, where they arrive about October 1 every year to the number of about two thousand. This is apparently the principal fall flight of Brant in the James Bay area. It is reported to have been of normal size in the fall of 1934. There is at the same time a smaller flight of Brant that follows the more direct route south along the east coast of Hudson and James Bays, past Fort George, Eastmain, and Rupert's House. The birds in this flight often stop near Eastmain for two or three weeks in late September and early October, as they do in spring. Various cross-currents and more or less erratic flights about James Bay, which contains many islands and extensive tidal flats, seem to link these two main flights in that region. From southern James Bay the Brant presumably fly overland to the estuary of the St. Lawrence River.

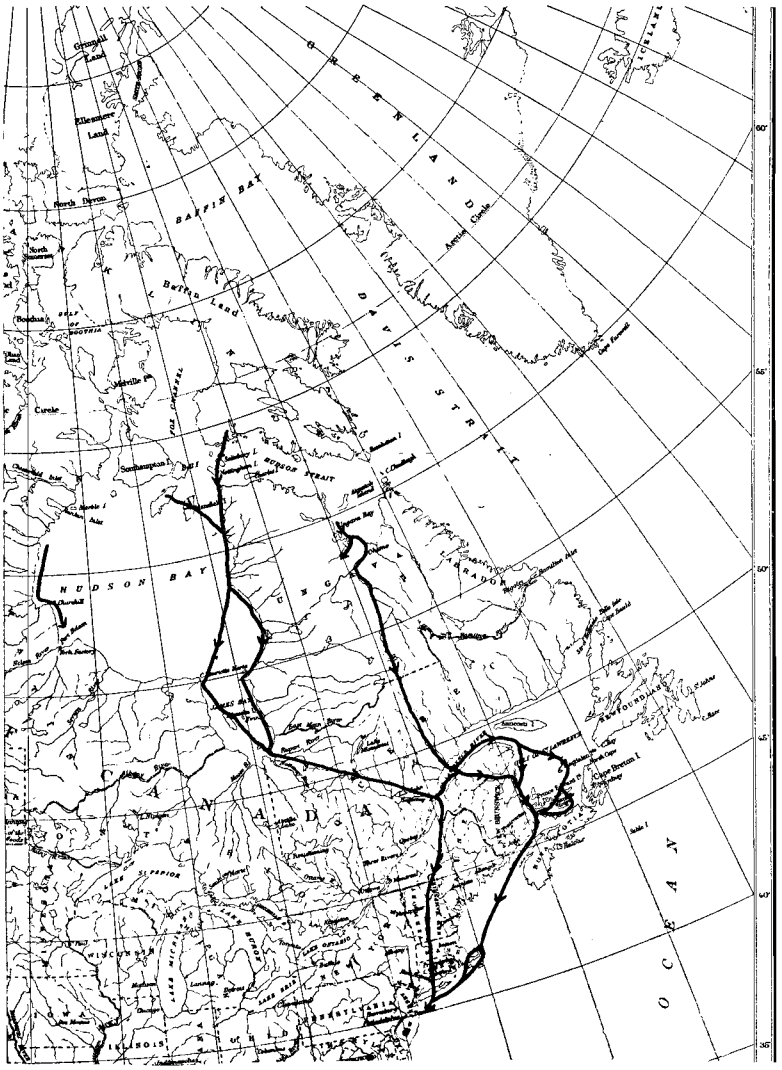

FIG. 2.—Autumnal migration routes of the American Brant.

The heavy lines indicating migration routes represent an attempt to present on a map available information on the subject. Uncertainty in various degrees concerning some parts of these routes is indicated in the accompanying text.

Since the autumn flight of Brant in the James Bay region, although not very large, seems to be a good deal larger than the spring flight of this species in that region, and since the reverse condition is reported at Fort Chimo, it is probable that some of the Brant that fly north via the Koksoak River return southward by way of Hudson and James Bays. At what point the southbound Brant from Ungava Bay and James Bay arrive at the estuary of the St. Lawrence River I do not know. Their route in fall on this part of their journey appears to lie farther west than the one they follow in spring, for they are seldom seen in autumn at the Bay of Seven Islands, or along the north shore of the Gulf of St. Lawrence east of that bay. A small flight of Brant still appears in fall at Ile Verte and Kamouraska, on the south shore of the St. Lawrence estuary, and presumably flies overland from that vicinity to Long Island Sound.

The main autumnal flight of Brant proceeds south via the lagoons on the east coast of New Brunswick, and the shallow harbors of Prince Edward Island and the Counties of Cumberland and Pictou, in Nova Scotia. There is normally a considerable migration of Brant to these places through the Bay of Chaleur in October and early November, and Forbush (3) states, on the authority of Mr. R. D. Ware, that these birds reach the bay by a flight across the Gaspé Peninsula. Other flocks of Brant may reach the southern part of the Gulf of St. Lawrence by flying between the Gaspé Peninsula and Anticosti. A part of the flight visits the Magdalen Islands in the fall as well as in the spring. From Northumberland Strait, at the southern end of the Gulf of St. Lawrence, the main flight of Brant apparently recrosses the Isthmus of Chignecto, flies down the Bay of Fundy, and continues on by sea to the waters south of Cape Cod and subsequently to the bays about Long Island, where the vanguard may appear as early as mid-September, although the maximum abundance is usually in November.

From May 24 to June 21, 1935, I was at the Bay of Seven Islands, on the north shore of the Gulf of St. Lawrence, for the express purpose of watching the northward migration of the Brant. One flock of five birds was seen entering the bay from the southwest on May 24, but the principal flight, coming from the southeast, occurred at this point only from May 31 to June 14, both dates inclusive. During the period of observation I boarded in the village of Seven Islands, about two miles north of Pointe aux Basques, the eastern entrance point of the bay, which was selected as the best place for observing the Brant migration. Each morning I walked from my boarding-place to the beach at Seven Islands wharf and then followed the beach to Pointe aux Basques, so that, if any Brant should enter the bay so early, I could see them, if there were enough light, even if I had not yet reached the point itself. The time of beginning observation at Seven Islands wharf varied during the period of Brant migration, from 3.01 a. m.

to 3.55 a. m., and the time of my arrival at Pointe aux Basques varied from 3.47 a. m. to 4.37 a. m. during that period. The earliest flock of Brant observed on any day passed Pointe aux Basques at 4.18 a. m. on June 2.[1] I continued observation each day at Pointe aux Basques until about 2.00 p. m., thus including in my hours of observation the part of the day when the majority of the Brant entered the bay. Mr. Christophe Doire, the local bird-protection officer, usually visited the inner part of the Bay of Seven Islands by motorboat each morning, to make sure that the numbers of Brant there were not in disagreement with our observations at Pointe aux Basques. At about 2.00 p. m. each day he replaced me at the post of observation on Pointe aux Basques, where, under my instructions, he continued until sunset, the watch for migrating Brant. Local hunters, who took much interest in this work, assured me that the majority of the incoming Brant arrived at the Bay of Seven Islands in the morning and that none ever arrived there between sunset and dawn, and all my observations were in agreement with these views.

Pointe aux Basques is not a narrow point or spit, but is merely a rounded right-angle turn in a fine sand beach bordering an extensive tract of low sandy land. The outer part of the point is bare of trees, so that an observer there has a clear view along shore for miles in both directions, but the base of the point is covered with mixed woods which continue over the country to the northward. South of the point, at a distance of two-thirds of a mile, is a large rocky island, 500 feet high, called Great Basque Island. The incoming flocks of Brant all flew from the east over the passage between this island and Pointe aux Basques, with the exception that a few flocks cut over the tip of the point, two or three even passing so far back that they flew above the woods, but in plain sight of an observer stationed on the point. The Brant that flew above the water were never on the side of the passage toward the island, but always on the side toward the mainland, because they had to turn about Pointe aux Basques to enter the bay and the closer they flew to the point, the shorter was their route. A good deal of fog was experienced this year at this place during the period of the Brant migration, but there were very few minutes at any time during the observations when it was so foggy that Great Basque Island was not visible from Pointe aux Basques. These favorable conditions of observation, combined with the fact that most of the flocks of Brant contained less than fifty birds each, while the largest flock contained less than two hundred birds, made it comparatively easy to observe and count the Brant as they passed. A record was made of the size of each flock entering the bay and the time

[1] Atlantic Standard Time, which is the time of the meridian of 60° W. and is one hour earlier than Eastern Standard Time, is used for all my records at Seven Islands involving reference to the hour of the day. As the Bay of Seven Islands is in longitude 66° 25′ W., Atlantic Standard Time is about 26 minutes earlier than the local mean time at that place.

when it passed Pointe aux Basques. The total number of flocks recorded was 155. No Brant were ever seen to fly out of the bay.

The earliest flock of Brant seen to enter the Bay of Seven Islands in any day passed Pointe aux Basques at 4.18 a. m. on June 2. The latest flock of Brant recorded in any day passed that point at 7.45 p. m. on June 12, but

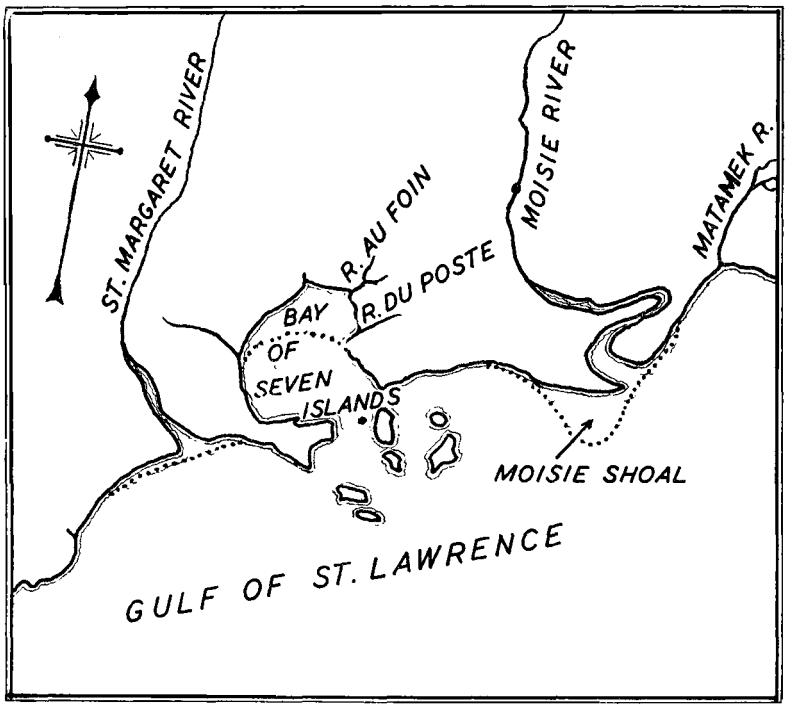

FIG. 3.—Vicinity of Bay of Seven Islands.

this is the only flock seen to enter the bay later than 5.30 p. m. The number of flocks entering the bay before 10.00 a. m. was 114, or 74 per cent of the total. There was a noticeable tendency for the larger part of the day's migration to arrive fairly early, after which there would be a lull for two or three hours, then one or two flocks, frequently rather large, about 12.00 or 1.00 o'clock, then only a few small, scattered flocks during the afternoon. Incoming flocks seldom flew at an elevation of more than one hundred feet and were often rather close to the water. Sometimes they flew in long files, one bird behind another, sometimes in one or more lines at right angles to the line of flight, with the birds abreast, sometimes in ragged bunches. Perhaps the commonest formation was a long line of birds abreast, with a

group of birds bunched irregularly somewhere along the line. The formations of the flocks frequently altered as they flew. Several times individual Brant were observed, just after they had passed Pointe aux Basques and arrived at a position from which they could see the broad expanse of the Bay of Seven Islands, to make a sharp downward swoop at an accelerated speed, followed by horizontal advance at the new level. It looked like a leap of exultation at beholding again the desired haven and resting-place; perhaps it was. The flocks of Brant were usually silent as they passed Pointe aux Basques, but occasionally a few birds uttered their vigorous, resonant note. A few flocks were noisy.

Mr. Doire told me that he had never known Brant to alight near Pointe aux Basques before entering the bay, but I observed that they did so in the following instances. A flock of thirteen Brant, when first noticed by me, at 4.55 a. m. on June 3, in fine, calm weather, was resting on the water off the point. These birds soon rose and flew into the bay. At 5.25 a. m. on June 6, in foggy weather, with a light southeast wind, a flock of twelve Brant, after passing Pointe aux Basques, wheeled about and, after making one pretended attempt at alighting and then circling around again, alighted in the lee of the point, among some Red-breasted Mergansers. Here they were joined, fifteen minutes later, by another incoming flock containing five Brant. The united flock worked along the shore of the point, sometimes swimming close to shore, sometimes walking on the lower part of the sandy beach. They seemed to be looking for food, but there was little or none there for them. At 6.40 a. m., the fog having cleared a good deal, they took flight and proceeded into the bay.

Formerly the extensive tidal flats in the Bay of Seven Islands produced great stands of eel-grass, which formed an abundant supply of nutritious food for Brant resting in the bay. This presumably helped to put them in good condition for the long flight overland from that place to James Bay or Ungava Bay. In May and June, 1935, I made two visits in search of eel-grass, to the flats referred to, and travelled over them for miles, but did not find one living eel-grass plant. The eel-grass here, as at most places along the Atlantic coast of North America where it was formerly abundant, had died away since 1930 until almost none was left. That there was a small quantity of living eel-grass somewhere around the bay was attested by my finding a few diminutive green eel-grass plants washed up on the beach on June 13, but there certainly was very little of it. The migrating Brant coming into the bay, presumably hungry and weary, were not to find any appreciable quantity of their favorite food there and their only hope lay in pushing on as soon as possible on their journey of some six hundred miles across the rough Labrador Peninsula, in an attempt to reach Ungava Bay before their strength gave out. That they were leaving the Bay of Seven

Islands soon after their arrival, instead of resting there two or three days as they used to do, is indicated by the fact that on none of his morning trips by boat into the inner part of the bay to look for them could Mr. Doire find more than a few, generally only a small part of the number known to have entered the bay on the previous day. Since the disappearance of most of the eel-grass, the preferred food of the Brant, along the eastern coast of North America, there has been a great and very evident decrease in the numbers of Brant frequenting that coast. It seems reasonable to suppose that the disappearance of the eel-grass has been responsible to some extent, at least, for the accompanying diminution in the numbers of Brant.

Because of the reduction in the numbers of these birds, special care was exercised to obtain as accurate a count as possible of the Brant entering the Bay of Seven Islands in the spring of 1935. The small size of the flocks as they arrived at the bay made it possible to record their numbers with reasonable accuracy. Of the 155 flocks of Brant recorded, 128, containing 2200 birds, were flocks of less than 50 birds each; 19, containing 1278 birds, were flocks of from 50 to 99 birds each; and 8, containing 1030 birds, were flocks of 100 or more birds each. No single birds were observed, but five "flocks" containing only two Brant each were recorded. The largest flock noted, which arrived at 7.05 a. m. on June 10, was estimated to contain 170 birds. The following table shows the variation from day to day in the numbers of Brant observed to arrive at the Bay of Seven Islands and the weather conditions predominant each day.

Date	Weather	Number of Brant	Number of flocks	Average number in a flock
May 31	Fine, clear, wind S.	5	1	5
June 1	Fine, clear, wind S. W.	28	3	9
June 2	Fine, partly cloudy, wind S.	272	11	25
June 3	Fine, partly cloudy, wind S. E.	524	21	25
June 4	Cloudy, wind S. E.	1075	37	29
June 5	Cloudy, foggy, wind S. E.	332	12	28
June 6	Cloudy, foggy, wind S. E.	91	7	13
June 7	Cloudy, foggy, wind E.	197	6	33
June 8	Cloudy, foggy, gale from E.	485	18	27
June 9	Cloudy, foggy, wind S.	557	8	70
June 10	Partly cloudy, calm	682	13	52
June 11	Cloudy, foggy, rain, gale from E.	18	2	9
June 12	Cloudy, foggy, rain, wind E.	45	3	15
June 13	Fine, clear, wind S. W.	63	7	9
June 14	Partly cloudy, showers, wind S. E.	129	5	26

The total number of Brant in this record, plus five seen on May 24, is 4508, of which 441 were recorded by Mr. Christophe Doire, whose period of observation was the part of the day when incoming Brant were least to be

expected, and 4067 were recorded by me. As all records were made on a conservative basis when precise counts were not possible, there is no reason to think that the total number of Brant that entered the Bay of Seven Islands in the spring of 1935 was less than the number above stated. Any possible errors in estimating numbers of Brant must be considered as making possible a greater, not a smaller, actual number of birds. Most of the flocks containing less than fifty birds each were counted with absolute accuracy. For all flocks of this size-group an allowance of 3 per cent of possible error is very generous.

For the flocks containing from 50 to 99 birds each an allowance of 10 per cent of possible error is sufficient, as is also an allowance of 15 per cent of possible error for the flocks containing a hundred or more birds. When these allowances for possible error in estimating are included, there results a possible total of 4900 Brant in the flocks observed. We may increase this again by making another allowance of 10 per cent for possible flocks entering the bay without being observed at all, though I have no evidence that there actually were any such flocks. This gives a figure of 5444 as the theoretically greatest number of Brant that may have entered the Bay of Seven Islands in the spring of 1935.

Consideration must also be given to the route that turns inland at Matamek River, where, in fragmentary and unorganized observation, Captain Antoine Levesque saw 160 Brant start their overland flight in 1935. After the migration of Brant at the Bay of Seven Islands had ended for the year, I went to Matamek River and interviewed Captain Levesque concerning his observations of migrating Brant at that place. As a result of the information thus obtained, I believe that, while the data are admittedly very unsatisfactory, the number of Brant that turned inland at Matamek River in the spring of 1935 was not more than 1000 at most. I also visited Moisie, at the mouth of the Moisie River, and interviewed suitable persons there and elsewhere with a view to ascertaining if any Brant had ascended the lower reaches of the Moisie River in the spring of 1935, but I was unable to satisfy myself that any had done so.

If we add 1000, representing the possible number of Brant turning north at Matamek River, to the possible total of 5444 Brant turning inland at the Bay of Seven Islands, we obtain only 6444 as the total number of Brant passing through these two migration channels in the spring of 1935. This figure corresponds as well as could be expected with the number of Brant passing through Nova Scotia, Prince Edward Island, and New Brunswick in the spring of 1935, as indicated by weekly counts made by twenty-seven selected observers stationed at points favorable for such work and reporting to the National Parks of Canada, Department of the Interior.

From Mr. Clarence Cottam, of the United States Biological Survey, Mr.

Charles A. Urner, Dr. William Tod Helmuth, 3d, Mr. William Vogt, and Mr. Seth H. Low, to all of whom I am greatly indebted, I have received information indicating that the number of Brant that wintered on the Atlantic coast of the United States in the winter of 1934–35 was between 15,000 and 45,000. Their excellent data seem to indicate clearly that these wintering Brant were not less than 15,000 in number.[1] If not more than about 6500 of these migrated north in spring through the Maritime Provinces of Canada and along the route that passes Matamek River and the Bay of Seven Islands, by what flyway migrated the more numerous remainder, which were not observed in those places?

LITERATURE CITED

1. PHILLIPS, JOHN C. Fluctuations in numbers of the Eastern Brant Goose. The Auk, vol. 49, no. 4, pp. 445–453, October 1932.
2. BENT, ARTHUR CLEVELAND. Life histories of North American wild fowl. Order Anseres (Part). Bull. U. S. Nat. Mus., no. 130, Washington, 1925.
3. FORBUSH, EDWARD HOWE. Birds of Massachusetts and other New England States. Vol. 1. Mass. Dept. of Agr., 1925.
4. BISHOP, LOUIS B. Notes from Connecticut. The Auk, vol. 38, no. 4, pp. 582–589, October 1921.
5. FORTNER, H. C., WENDELL P. SMITH, and E. J. DOLE. A list of Vermont Birds. Dept. of Agr. (Vermont), Montpelier (not dated, received 1933).
6. DIONNE, C. E. Les oiseaux de la Province de Quebec. Quebec, 1906.
7. FORBUSH, EDWARD HOWE. A history of the game birds, wild-fowl and shore birds of Massachusetts and adjacent States. 2d ed. Mass. State Board of Agr. Boston, 1916.
8. AMERICAN ORNITHOLOGISTS' UNION. Check-list of North American Birds. 4th ed., Lancaster, Pa., 1931.
9. CORY, CHARLES B. A naturalist in the Magdalen Islands. Boston, 1878.
10. MERSHON, W. B. Notes on the migration of Brant. The Auk, vol. 44, no. 4, pp. 557–558, October 1927.
11. LEWIS, HARRISON F. List of birds recorded from the Island of Anticosti, Quebec. Canadian Field-Naturalist, vol. 38, no. 4, pp. 72–75, April 1924.
12. TOWNSEND, CHARLES W., and A. C. BENT. Additional notes on the birds of Labrador. The Auk, vol. 27, no. 1, pp. 1–18, January 1910.
13. SOPER, J. DEWEY. Interesting bird records for southern Baffin Island. Canadian Field-Naturalist, vol. 48, no. 3, pp. 41–44, March 1934.
14. HANTZSCH, BERNHARD. Contribution to the knowledge of the avifauna of northeastern Labrador. Canadian Field-Naturalist, vol. 42, no. 9, pp. 221–227, December 1928.
15. COOKE, WELLS W. Distribution and migration of North American ducks, geese and swans. U. S. Dept. Agr., Biol. Surv. Bull. no. 26, Washington, 1906.

[1] The number of Atlantic Brant wintering on the eastern coast of the United States a year later, in January, 1936, was estimated by the Biological Survey to be 47,900. Mr. Charles A. Urner reports at least 25,000 of this species at Absecon Bay and Lake Bay, New Jersey, in December, 1935.

16. SOPER, J. DEWEY. A faunal investigation of southern Baffin Island. Nat. Mus. Can., Bull. no. 53, Biol. Ser., no. 15, Ottawa, 1928.
17. SUTTON, GEORGE MIKSCH. The exploration of Southampton Island, Hudson Bay. Part II, Zoölogy. Sect. 2. The birds of Southampton Island. Mem. Carnegie Mus., vol. 12, pt. 2, sect. 2, Pittsburgh, May 31, 1932.
18. TAVERNER, PERCY A., and GEORGE MIKSCH SUTTON. The birds of Churchill, Manitoba. Ann. Carnegie Mus., vol. 23, pp. 1–83, pl. 1–14, 1934.