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MOLT MIGRANT CANADA GEESE IN NORTHERN ONTARIO AND WESTERN JAMES BAY

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Abstract: We undertook migration monitoring surveys and analysis of long-term banding data to determine if there was a significant premolt movement of Canada geese (*Branta canadensis*) from restored and reintroduced populations in southern Canada and midcontinent United States into northern Ontario and western James Bay. We examined migration chronology, origins, and demographic characteristics of molt migration of Canada geese in northern Ontario and on Akimiski Island, Northwest Territories. From 1985 to 1989, a conspicuous northward migration of large Canada geese was documented throughout northern Ontario from mid-May to the end of June, well after the April migration of the subarctic nesting subspecies of Canada geese (*B. c. interior*); most nesting interior Canada geese in the Hudson Bay and James Bay lowlands were incubating eggs at this time. Summer-banded Canada geese originating from populations in 26 states and 6 Canadian provinces were captured in coastal areas of James Bay and Hudson Bay between the borders of Quebec and Manitoba. Morphometric discrimination indicated the presence of molting giant Canada geese (*B. c. maxima*). Most foreign, summer-banded birds were yearlings (53%) and 2-year-olds (17%), but birds up to 15 years old were captured. Approximately 58% of 2–15-year-old females had brood patches, which indicated a nesting attempt in the year of recapture. We suggest that increasing populations of giant Canada geese and declining habitat availability on northern brood-rearing areas will result in increasing levels of competition between populations of Canada geese. Presence of molt migrants on northern breeding areas will also complicate management of some Arctic and subarctic nesting populations of Canada geese.

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Key words: banding, *Branta canadensis*, Canada geese, competition, Hudson Bay, James Bay, molt migration, Ontario, population, waterfowl.

Movements of giant Canada geese and western Canada geese (*Branta canadensis moffitti*) from southern breeding areas to northern molting locations have been reported throughout North America (Kuyt 1962, Sterling and Dzubin 1967, Davis et al. 1985). These movements are called molt migrations (Hanson 1965:78–82; Salomonsen 1968, Hohman et al. 1992), and most migrants are nonbreeding yearlings and 2-year-olds; some unsuccessfully nesting and nonnesting adults ≥3 years old also participate (Sterling and Dzubin 1967, Zicus 1981, Lawrence et al. 1998). Krohn and Bizeau (1979) also suggested some successful breeders abandon broods and undergo molt migrations. Molt migrations may be relatively localized, involving distances of <300 km (Walker 1970, Abraham 1980), but some migrations can exceed 1,000

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km (Kuyt 1966, Sterling and Dzubin 1967). Molt migrants frequently undergo wing molt on nesting and brood-rearing areas of other populations or subspecies of geese.

Populations of giant Canada geese have increased significantly over the past 30 years (Rusch et al. 1996*b*), complicating winter inventory of sympatric giant Canada geese and large-bodied northern subspecies (e.g., *B. c. interior*, *B. c. canadensis*), which cannot be differentiated during aerial surveys. For example, increasing populations of giant Canada geese in the United States and southern Canada have masked declines in the Southern James Bay Population (SJBP) and Atlantic Population (AP) of Canada geese (Hestbeck 1995, Leafloor et al. 1996). Population monitoring efforts are now focused on northern breeding areas (Rusch et al. 1996*a*), because most Canada goose populations are thought to occupy relatively discrete geographic areas during nesting and brood-rearing periods. However, occurrence of molt migrations has resulted in overlapping populations of Canada geese on several breeding areas. Morphometric discrimination has been used to differentiate among sympatric breeding *B. c. interior* geese and giant Canada geese (Moser and Rolley 1990, Merendino et al. 1994). Leafloor and Rusch (1997) used measurements of skull length of adult geese and found evidence of molting giant Canada geese occupying coastal areas of western James Bay and on Akimiski Island, Northwest Territories.

We undertook migration monitoring surveys and analysis of long-term banding data to determine if there was a habitual and significant movement of giant Canada geese into northern Ontario and western James Bay, and to determine if migration chronology, origins, age, sex, and breeding status of the geese involved were consistent with them originating from restored and reintroduced giant Canada goose populations in southern Canada and midcontinent United States.

STUDY AREA AND METHODS

Migration Chronology

We established a network of people from the Ontario Ministry of Natural Resources (OMNR) and naturalist groups across northern Ontario to record observations of migrating Canada geese between 15 March and 30 June 1985–89 (Fig. 1; Tacha et al. 1991). For each observation of migrating geese, observers recorded date, nearest town or water body, and numbers of geese. Although the calendar period was the same in each year, the number of people or stations reporting and their time afield varied among years. We made no attempt to control volunteer effort; thus, differences in total number of reports and geese among years may reflect relative effort and not real annual variations in magnitude of movements. However, within each year, each reporting station did so throughout the entire observation period; thus, observations relative to timing were valid. Here, we limit reporting to the range of dates when migrating geese were observed, and the week with the largest number of observations was designated as peak migration.

Origins and Demographic Characteristics

Capture of flightless young and adult geese for banding occurred each year along the coasts of James Bay and Hudson Bay, Ontario, and on Akimiski Island, Northwest Territories, during early July–early August 1976–95, using methods described by Leafloor and Rusch (1997). Capture efforts were concentrated on brood flocks (i.e., containing both adults and goslings). Flocks containing only adults (presumed to be non- or failed nesters) were avoided, but small groups of these birds were captured incidentally because they occupied the same areas as broods. After 1992, we made extra efforts to reduce captures of non- and failed nesters (including presumed molt migrants) because of concerns about incorrectly neck-banding birds from southern populations. We recorded leg band number, neck band color and code, date of capture, age, sex, and location of capture of all previously banded geese. Data from all previously banded geese were merged with original banding records; all geese banded outside the northern Ontario and western James Bay breeding range of interior Canada geese are hereafter referred to as foreign-banded (these all came from south of 50° N latitude). For analysis of origins, age, and sex of presumed molt migrants, we used only foreign-banded geese banded while flightless from June to early August (hereafter referred to as summer-banded) to ensure our sample did not include interior Canada geese banded on migration or wintering areas. From 1992 to 1996, we recorded skull length of 30 foreign-banded geese captured on Akimiski Island to determine if molt migrants were

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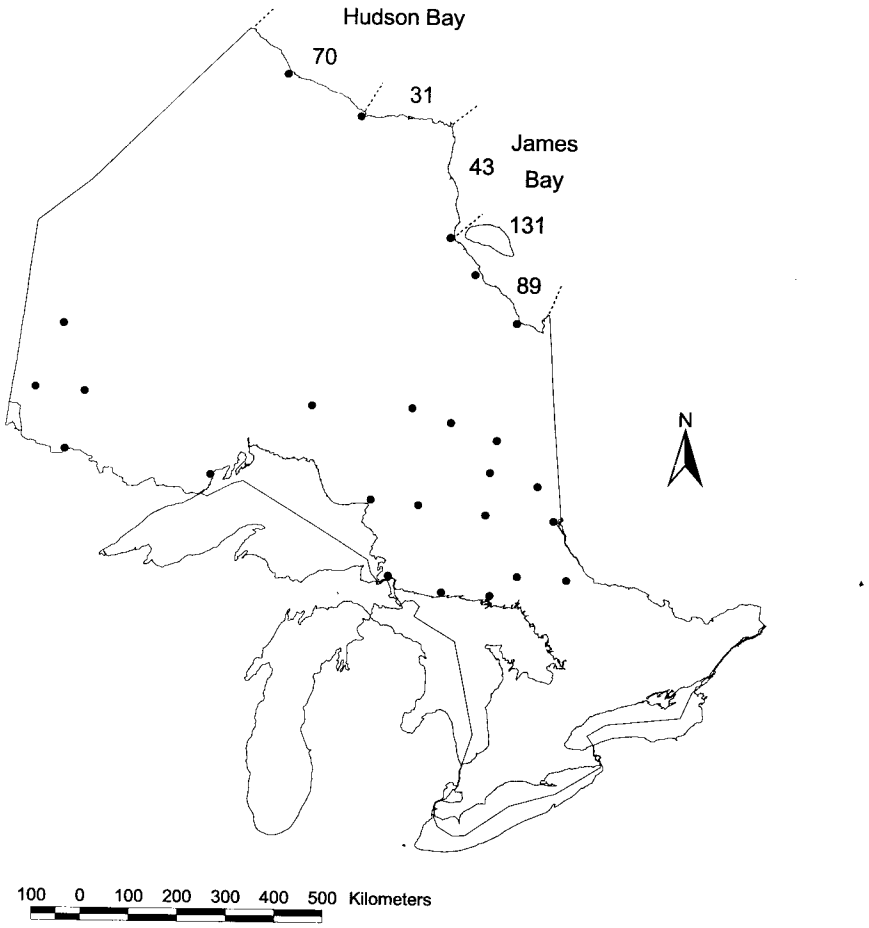

Fig. 1. Locations from which northward movements of Canada geese were reported in Ontario, 1985–89 (darkened circles), and number of foreign, summer-banded Canada geese captured 1976–95 in coastal segments (dashed lines).

larger than Canada geese nesting on the island (Leafloor and Rusch 1997). Beginning in 1984, we recorded presence or absence of a brood patch on all previously banded females to determine which had made a nesting attempt (Hanson 1959). Although nesting by yearling Canada geese is unusual (Hall and McGilvrey 1971), our records indicated 5 (7%) of 68 captured yearlings were recorded with brood patches. Molt of body feathers on the abdomen might be mistaken for a brood patch, or recording errors may have occurred. We do not view these data as convincing evidence of nesting by yearling giant Canada geese. We also acknowledge the possibility of similar errors in the data for older females, but at this level it does not affect interpretation of the results.

RESULTS

Migration Chronology

Two distinct migration periods were observed (Fig. 2). Canada geese migrated into northern Ontario from late March through early May in 1985–89, with peak migrations occurring between 15 and 25 April. These migrations coincided with arrivals of interior Canada geese along Hudson Bay and James Bay and peak spring hunting reported by native Cree hunters (Tacha et al. 1991, Bruggink et al. 1994; J. E. Thompson and W. A. Hutchison, OMNR, unpublished data). After a brief drop in observed migration (about 10–20 May), large Canada geese, presumably molt migrant giants, migrated through northern Ontario from late May to mid-June 1985–89, with peak migrations occur-

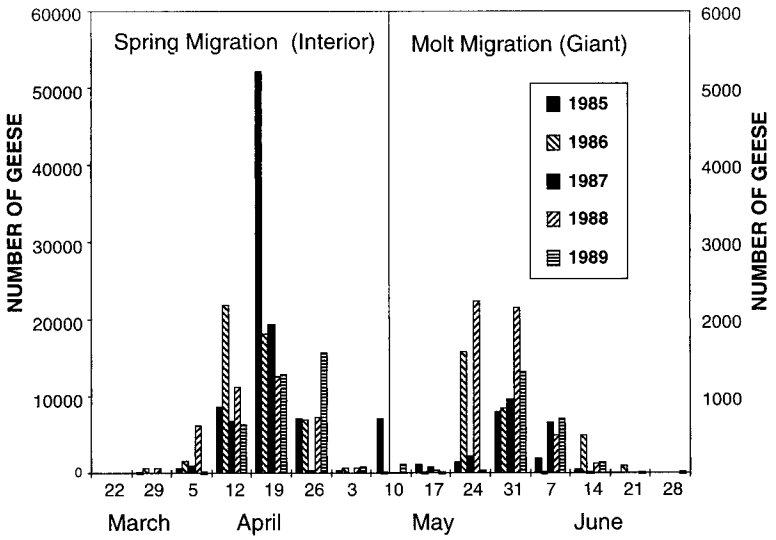

Fig. 2. Timing of northward migration of Canada geese in Ontario, 1985–89. *X*-axis values are midweek dates. Note 10-fold difference in scale used for spring migration of interior Canada geese (left side) versus molt migration of giant Canada geese (right side).

ring between 25 May and 5 June each year (Fig. 2). This pattern of migration has continued through 1998, and the May–June migration has become increasingly conspicuous as giant Canada goose populations have grown (K. F. Abraham, unpublished data).

Origins and Demographic Characteristics

We captured 364 Canada geese summer-banded in 26 states and 6 provinces. Of these geese, 71% originated in the eastern Mississippi Flyway (Ohio: 124; Michigan: 68; Indiana: 25; Illinois: 22; Kentucky: 17; Tennessee: 2; Alabama: 1), 8.8 % were from the western Mississippi Flyway (Wisconsin: 25; Arkansas: 3; Missouri: 2; Iowa: 2), 4.4% were from the Central Flyway (Oklahoma: 5; Kansas: 3; Nebraska: 2; Utah: 2; Colorado: 1; North Dakota: 1; South Dakota: 1; Wyoming: 1), 2.7% were from the Atlantic Flyway (West Virginia: 3; New York: 2; Georgia: 1; Massachusetts: 1; New Jersey: 1; North Carolina: 1; Pennsylvania: 1), and 12.9% were from Canada (southern Ontario: 19; Manitoba: 13; British Columbia: 5; Alberta: 4; Quebec: 4; Saskatchewan: 2). Sixty-nine percent (n = 252) were summer-banded flightless goslings, providing convincing evidence that the birds were from local breeding populations in the above states and provinces, including giant Canada goose and western Canada goose stocks.

Number of foreign-banded captures (presumed molt migrants) increased up until 1992, when we took extra precautions to avoid capturing non- and failed nesters. Fifty-three percent (n = 135) of known-age geese were yearlings, and 17% (44) were 2-year-olds when captured in our study area. However, 29% (73) of the captured geese were 3–15 years old. Sex ratio (48.6% males) did not differ from unity (χ^2_1 = 0.10, P = 0.75). Seven percent of yearling, 37% of 2-year-old, and 70% of 3–15-year-old females had brood patches. Skull lengths ($\bar{x}$ ± SE) of banded molt migrants captured on Akimiski Island conformed to those of giant Canada geese (M: 131.7 ± 1.45 mm, n = 13; F: 123.5 ± 1.19 mm, n = 17); only 1 foreign-banded female was smaller than the discrimination criterion (skull length = 118 mm) recommended by Merendino et al. (1994) for separating giant Canada Geese from interior Canada Geese on Akimiski Island.

DISCUSSION

Observations of migrant Canada geese during late May and early June in northern Ontario corresponded to departure dates of molt migrants previously reported from southern nesting areas (Zicus 1981, Lawrence et al. 1998; K. F. Abraham, unpublished data). Timing of molt migration was fairly consistent over 5 years and was distinct from spring migration of interior Canada geese that nest in the Hudson Bay Low-

land (Tacha et al. 1991, Bruggink et al. 1994, Leafloor et al. 1999). Molt migration and wing molt in other geese generally coincides with onset of vegetation growth and peak seasonal nutrient availability in forage plants (Owen and Ogilvie 1979, Madsen and Mortensen 1987, Loonen et al. 1991). In our study area, flightless Canada geese were first observed around 20 June each year, and "green up" of graminoid forage occurred between mid-May and mid-June (K. F. Abraham, unpublished data).

Most molt migrants we captured were yearlings and apparently nonnesting 2-year-olds, but over half of breeding age female molt migrants had made a nesting attempt the same year. Some of the variation in numbers of molt migrants from different states and provinces was undoubtedly influenced by banding effort there (we did not correct for this effort). For example, the 2 largest contributing states, Ohio and Michigan, both have large summer banding programs for Canada geese. However, other agencies with large banding programs (e.g., Missouri, Minnesota, Iowa, Illinois) contributed few molt migrants to our study area. We attribute this difference, in part, to the predominance of capture effort and hence data from the James Bay portion of our study area (Fig. 1), and in part because in the Hudson Bay portion of our study area, dispersion of flocks permitted us to be much more successful at avoiding flocks of non- and failed nesters, thus reducing sample size. In addition, Zicus (1981), Davis et al. (1985), and Lawrence et al. (1998) all provided evidence that some giant Canada geese from these more westerly nesting areas molted in more westerly areas (e.g., Minnesota, Manitoba, west coast of Hudson Bay). A gap in reports of molt migrants between Lake Superior and Lake of the Woods (Fig. 1) suggests 2 different migration routes: an easterly route to Hudson Bay, Ontario, and James Bay, and a westerly route to Hudson Bay, Manitoba.

Zicus (1981) and Lawrence et al. (1998) showed that 50–60% of their local giant Canada goose populations (essentially all the nonnesting segment) emigrated during summer to other, often northern molting areas. Hanson (1965: 78–82) discussed prerestoration era evidence for nonbreeding giant Canada geese molting in Arctic and subarctic areas of Canada, and their numbers, age, sex, origins, and presumed migration routes. The numbers of geese observed migrating and the geographically widespread origins of molt migrants in our study suggest molt migration is a behavior now common to most temperate-nesting populations of restored or reintroduced giant Canada geese. Our capture of hundreds of banded geese from these populations suggests the coastal habitats of Hudson Bay and James Bay provide important habitat for many thousands of molt migrants annually (given that each banded goose represents hundreds or thousands of unmarked geese).

Because molt migrants arrived while most locally nesting interior Canada geese were still incubating eggs (Bruggink et al. 1994, Leafloor et al. 1999), these migrants occupied brood-rearing habitats along the coast before nesting geese and their offspring. Molting geese probably occupy coastal areas because of availability of preferred foods and access to large water bodies for escape from predators (Owen 1980, Hohman et al. 1992). Capture of molt migrants with brood-rearing geese on the same feeding areas showed overlap in habitat use of these different populations. Despite our efforts to reduce capture of molt migrants and non- or failed nesting geese after 1992, giants accounted for 19, 7, 13, 10, and 8% of all adult Canada geese captured on Akimiski Island from 1992–96, respectively (J. O. Leafloor, unpublished data), according to the skull length criteria of Merendino et al. (1994).

Large expanses of coastal grass and sedge habitats in the Hudson Bay Lowland have been lost over the past 3 decades because of the population increase of lesser snow geese (*Chen caerulescens caerulescens*) and their destructive foraging activities (Kerbes et al. 1990, Abraham and Jefferies 1997, Jano et al. 1998). Concurrently, populations of giant Canada geese have increased more than 10-fold (Rusch et al. 1996*b*). We suggest this population increase has resulted in increased grazing effect by molt migrants on brood-rearing areas in the Hudson Bay Lowland. Canada Geese nesting on Akimiski Island were structurally smaller than those on the mainland of James Bay (Leafloor and Rusch 1997), although island goslings fed ad libitum food grew to the same asymptotic size as mainland goslings (Leafloor et al. 1998). Leafloor et al. (1998) suggested that differences in body size of island and mainland geese were a result of resource limitation due to high densities of geese, including molt migrants, occupying prime brood-rearing habitats on the north shore of the island. Ankney (1996) suggested

that increasing numbers of molt migrants may be partly responsible for reduced productivity and subsequent declines in the numbers of nesting Canada geese on Akimiski Island (Leafloor et al. 1996) and in northern Quebec. Madsen and Mortensen (1987) described a relevant case of exploitative competition for food resources and escape cover that caused displacement of molting barnacle geese (*Branta leucopsis*) by pink-footed geese (*Anser brachyrhynchus*) in Greenland.

MANAGEMENT IMPLICATIONS

Syntopic populations of Canada geese on northern nesting areas present management difficulties. Spring population estimates of interior races of Canada geese (AP, SJBP, Eastern Prairie Population [EPP], Mississippi Valley Population [MVP]) are likely to be biased upward if surveys are flown after molt migrants arrive, because the subspecies cannot be distinguished from the air. For example, in 1994, there were an estimated 24,326 nonbreeding (i.e., flock size ≥3 birds) Canada geese on Akimiski Island, an increase of 370% from the previous year, but numbers of breeding pairs did not change (Leafloor et al. 1996). The increase in nonbreeding geese was attributed to an influx of molt migrants prior to the surveys. Nonbreeding geese declined by 270% the next year, while the number of breeding pairs again was unchanged (Leafloor et al. 1996). We suggest this fluctuation in the nonbreeder component of the population estimate occurs largely because molt migrants tend to occur in flocks rather than as single geese or pairs, thereby augmenting the local nonbreeders and exaggerating the count. Therefore, estimates of nesting pairs may provide the most reliable information for monitoring trends in breeding populations of Canada geese (Kaminski 1979). Wherever possible, banding efforts should focus on locally nesting geese. Molt migrants can generally be avoided by selecting flocks that include large numbers of goslings, but if migrants are captured they can be identified and banded appropriately by use or development of morphometric discrimination techniques (Moser and Rolley 1990, Merendino et al. 1994, Leafloor and Rusch 1997).

The effect of increasing numbers of molt migrant giant Canada geese on *B. c. interior* Canada geese nesting in the Hudson Bay Lowland is presently unknown. We recommend studies to assess feeding or interference competition between molt migrants and nesting birds on subarctic and Arctic brood-rearing areas, and the effects of molt migrants on forage availability in those areas.

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