Population Dynamics of the Canaan Valley West Virginia Canada Goose Population

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Abstract: The Canaan Valley, West Virginia, Canada goose (*Branta canadensis*) flock is a discrete population that resulted from birds released in the late 1960s and early 1970s. This flock is the only flock in West Virginia that regularly migrates out of the state during winter and returns for nesting. It remains discrete even though other populations exist within 27 km to the east and west. This is the southernmost migratory flock of geese in the eastern United States. Helicopter surveys were conducted from 1982 to 1993 to estimate population size, and banding was conducted from 1977 to 1993 to examine demography and movements of this flock. The Canaan Valley goose population increased from <100 birds in 1982 to >500 by 1991. We banded 679 geese (379 adults and 300 juveniles) between 1977 and 1993. Eighty recoveries of geese banded in Canaan Valley were reported to the Bird Banding Lab: 52 from West Virginia, 9 from New York, 6 from North Carolina, 5 from Virginia, and 8 from 5 other states. Primary harvest pressure on this flock is within Canaan Valley and migratory movements away from the Valley are multi-directional, with North Carolina a major wintering site. Direct recovery rates averaged 4.8% for adults and 1.3% for juveniles. Based on band returns, juveniles were less vulnerable to harvest than were adults. Low recovery rates indicate that Canaan Valley geese experience low hunting pressure and/or mortality allowing for steady population growth.

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West Virginia has never had abundant waterfowl due to its mountainous terrain and lack of natural lakes and other wetland habitats. West Virginia also lies outside major migration corridors (Bellrose 1980). Canada geese apparently did not nest in West Virginia in pre-settlement days (Hall 1983), and were first transplanted into West Virginia in 1954 when the West Virginia Department of

Natural Resources (WVDNR) released birds from southern Illinois onto the McClintic Wildlife Station near the Ohio River to establish a wintering flock that would attract migrating geese to the refuge (Moser 1973, Waggy 1973). After 1954, a few sporadic family-unit liberations of McClintic-produced geese occurred in various parts of West Virginia, but only those released in Canaan Valley were successful. Sixty-five geese were released into Canaan Valley between 1967 and 1971.

The McClintic flock was composed predominantly of the giant subspecies of Canada geese (*B. c. maxima*) as confirmed by morphological measurements (Moser 1973, Waggy 1973). The Canaan Valley flock originally consisted of the giant subspecies, but probably is now a mixture of giant and interior (*B. c. interior*) subspecies due to the release of 5,500 geese from northeastern states into other regions of West Virginia during 1976–1983 by the WVDNR.

West Virginia currently supports many local flocks; most breed and winter in the state. However, the harsh climate of Canaan Valley prevents geese from wintering there. The Canaan Valley flock is the only distinct population that nests in West Virginia and migrates to a more southern state. Geese typically return to Canaan Valley the first week of March and leave during November. Goose hunting is permitted throughout most of Canaan Valley, except for Canaan Valley State Park (2,434 ha) and Timberline (1,803 ha), a private ski resort and vacation home development.

Banding data from West Virginia Canada geese were previously analyzed (Clark 1985, Zielske 1993), but not specifically for geese banded in Canaan Valley. The objectives of this study were to evaluate demography and movements of the Canaan Valley goose flock using data from helicopter surveys, ground surveys, and band-recoveries.

Methods

Canaan Valley is located in Tucker County near Davis, and is encircled by mountain ridges over 306 m above the valley floor which lies at an elevation of 917 m. Climate is similar to that of southeastern Canada, with a growing season of 92–93 days (Weedfall and Dickerson 1965). Mean average daily temperature for the last 10 years was 8 C, ranging from −6 C in January to 18 C in July. Mean annual precipitation for the last 10 years was 137 cm, with total snowfall averaging 356 cm per year.

The Blackwater River and its major tributaries drain Canaan Valley. The Canaan Valley watershed is 14,165 ha, including 4,541 ha of potential goose habitat in the form of wetlands (3,238 ha), beaver ponds, farm ponds, water treatment ponds, and lakes (81 ha), pastures and hayfields (931 ha), and the Canaan Valley golf course and related recreational lands (291 ha). No crops other than hay are grown in Canaan Valley.

Goose abundance was estimated from helicopter surveys (pilot and 3 observers) and ground surveys during May, August, and November from 1982 to

1993. The Canaan Valley golf course and all bodies of water throughout the Valley were systematically searched and the location and size of all flocks sighted were recorded.

U. S. Fish and Wildlife Service (USFWS) aluminum leg bands were affixed to each goose originally released into Canaan Valley. Beginning in 1977, drive-netting was conducted in Canaan Valley during June and July by the WVDNR and all geese captured were banded. Beginning in 1991, trapping was directed at neck-collaring adult geese. Geese were considered juvenile or local (L) if they were hatched during the spring they were banded. Geese were considered adults, or after hatching year (AHY), if they were at least 1 year old. Age determinations were based on plumage and other morphological characteristics (Hanson 1967), not breeding status.

Temporal and spatial harvest, movements, and harvest vulnerability were estimated using band recovery data (1977–1993) obtained from the Bird Banding Laboratory (BBL) in Laurel, Maryland.

Results

Total number of geese banded fluctuated annually with only 15 banded in 1977 and then none until 1981, when only 7 were banded. Beginning in 1986 geese were banded consistently, except for 1990 when none were banded (Table 1).

The unweighted mean annual juvenile:adult ratio of banded geese for 1986–1993 was 1.12:1.00. Considerable annual variation in juvenile to adult ratios occurred (Table 1). Juvenile:adult ratio peaked in 1989 (3.21:1.00), then declined to 0.45:1.00 in 1993. Trapping during 1986–1989 targeted broods, whereas that during 1991–93 targeted adults.

Helicopter surveys indicated an increasing population from 1982 to 1992 (Table 2), representing an annual rate of increase of 12% for May residents and 16% for August residents. May, August, and November counts showed erratic

Table 1. Age ratios of Canada geese banded in Canaan Valley, West Virginia, 1986–1993

Year	Total	Adults	Juveniles	% Juveniles	Juveniles/ adults
1986	143	114	29	20.3	0.25
1987	69	36	33	47.8	0.92
1988	116	46	70	60.3	1.52
1989	80	19	61	76.3	3.21
1991	77	44	33	42.9	0.75
1992	117	67	50	42.7	0.75
1993	77	53	24	31.2	0.45
Total	679		300		
Mean		379		45.9	1.12

Table 2. Numbers of Canada geese estimated from helicopter surveys in Canaan Valley, West Virginia, 1982–1993.

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
May	62	37	43	73	92	78	170	109	152	218	219	216
Aug	91	94	107	54	160	180	282	370	372	508	549	450
Nov	40	120	105	160	36	58	221	58	404	456	326	233

increases, with the largest in 1988 and 1991. Several geese were apparently not located, although probably present, during the 1985 August survey. Flocks of geese regularly changed locations throughout the southern half of Canaan Valley and could easily have been missed during helicopter surveys. Canada geese leave the Valley in November, and in some years, many birds had migrated prior to the November survey.

Eighty geese (48 adults and 32 juveniles) banded in Canaan Valley were recovered and reported to the BBL. Twenty-seven banded geese were recovered during 1978–1990, compared to 28 in 1991, 12 in 1992, and 13 in 1993. Locations of recoveries included West Virginia (52 geese), New York (9), North Carolina (6), Virginia (5), Pennsylvania (3), Ohio (2), and 1 each from Maryland, Michigan and Wisconsin. Between 1986 and 1993, 54 Canaan Valley-banded geese were recovered during the hunting season (includes all geese shot and/or found dead during the hunting season), 41 adults (75.9%), and 13 juveniles (24.1%).

Geese harvested as adults outside West Virginia, with the exception of 1 from southern Virginia, were from locations north of Canaan Valley: 3 from Virginia, 2 from Pennsylvania, and 1 each from Maryland, Michigan, and Ohio. The remaining 32 adult geese (78.0%) were harvested in West Virginia. No juvenile geese were harvested north of Canaan Valley; 3 were recovered in North Carolina, 1 in Virginia, and 9 (55.6%) in West Virginia. Most Canaan Valley banded-geese harvested in West Virginia were taken in Canaan Valley, 84.4% of adults and 77.7% of juveniles.

Indirect recoveries and recaptures, including neck collar sightings reported to the WVDNR (but not included in data obtained from BBL), indicate almost twice as many juveniles as adults were recovered in North Carolina (11 juveniles and 6 adults). Observations indicate that many Canaan Valley geese winter on a preserve near Durham, North Carolina.

Harvest mortality, based on direct recoveries of banded geese, averaged 4.8% for adults and 1.3% for juveniles. Relative vulnerability of juveniles (juvenile recovery rate/adult recovery rate) was 0.27.

Discussion

Size of the goose flock in Canaan Valley apparently peaked in 1991, with number of adults returning during nesting season stabilizing at 216–219. The summer population declined somewhat during 1993. The carrying capacity (es-

pecially suitable nesting sites) may have been reached at these population levels. The decline in juvenile:adult ratio from 1991 through 1993 indicates that productivity was decreasing. However, the redirected trapping effort toward adults as part of the Atlantic Flyway neck collar study could have accounted for part of this apparent decrease.

A few conclusions regarding population structure and stability can be reached from banding age ratios. Juvenile:adult ratios can provide an indirect indication of a population's annual production (Allin 1980). Hanson and Smith (1950) reported that first year birds in Illinois comprised 53% of the flock, while Grieb (1970) reported that first-year immatures formed 40% of the population in southeastern Colorado. Allin (1980) stated that 40%–44% juveniles at banding indicates a normally productive population that can maintain itself, which is close to the Canaan Valley average banding rate from 1986 to 1993 of 45.9%. The pattern exhibited by the Canaan Valley flock of initial low productivity followed by years of high reproductive success and then low productivity would be expected if reproduction is density dependent.

Annual juvenile:adult ratios of banded geese averaged 1.12:1.00, indicating that brood production was fairly high in certain years. The juvenile:adult female ratio may reflect productivity where one would expect more young than adults within a normally productive population (Allin 1980). The increase in size of the Canaan Valley goose flock from < 100 to > 500 can be accounted for by an annual productivity rate of 1.12 juveniles/adult. This productivity rate, combined with the low mortality rate, should have resulted in a population considerably larger than 500 geese. Apparently the mortality rate is higher than that indicated by band recoveries and/or juveniles are not returning to Canaan Valley to nest as adults. The mean annual decrease from August population densities to the subsequent May population densities indicates that approximately 46% did not return.

The 12%–16% annual rate of increase for the Canaan Valley geese was considerably higher than the 3.6% reported by Trost and Malecki (1985) for the Atlantic flyway at-large. A population will double in 20 years with a 3.6% annual rate of increase, whereas only 5–6 years are required with a 21%–25% rate of increase. The mean annual recovery rate for geese banded in Canaan Valley and harvested during hunting season (4.8% for adults, 1.3% for juveniles) was similar to that reported by Hestbeck and Malecki (1989) for geese in the Atlantic flyway (3.7%). Low hunting pressure in Canaan Valley may account for the population increase from 1982 to 1992. Hunting was prohibited on Canaan Valley State Park and most of the privately-owned property in the southern end of Canaan Valley where geese concentrated during the hunting season. Hunter harvest and the attendant crippling loss appear to be the only major sources of mortality on Canada geese (Trost and Malecki 1985).

Adult geese appeared to have been multi-directional in their movements during the hunting season, whereas most juveniles migrated to the Chesapeake/North Carolina area. Locations of hunting recoveries give an indication of

goose movement during fall and winter. Nearly 70% of recovered/harvested Canaan Valley-banded geese (adults and juveniles combined) were recovered/harvested in West Virginia, consistent with previous findings for West Virginia geese (Zielske 1993). Most of Canaan Valley banded-birds harvested in West Virginia were taken in the Canaan Valley.

Recovery data for geese banded in Canaan Valley indicate that juveniles are less vulnerable to harvest than are adults. This contradicts the usual observation that juveniles are typically more vulnerable and have higher mortality than do other age classes. As age and experience increase, typically so does survival rate as geese become less vulnerable to hunting. The lower vulnerability of Canaan Valley juvenile geese is due in part to their migrating directly from Canaan Valley to a preserve near Durham, North Carolina. An analysis of all geese banded in West Virginia indicated that juveniles throughout West Virginia were less vulnerable to harvest than were adults (Zielske 1993).

Canaan Valley can apparently support a nesting population of Canada geese at the present hunting pressure. However, an increased harvest of juveniles will reduce the population growth. Age structure and age-specific recruitment should be considered when forecasting production and setting harvest goals (Hardy and Tacha 1989). The reproductive potential of a Canada goose is not realized nor does it contribute to the population until the bird reaches its third spring of life, or an age of 2 years (Allin 1980). Thus, some geese designated as AHY are actually subadults, or nonbreeders. Our data set does not distinguish among these 3 age classes. Therefore, while juvenile:adult (HY:AHY) ratios are known, ratios of juveniles to breeding geese are not. The number of AHY geese that breed is lower than the total number of adults present. More accurate reproduction data (e.g., breeding:nonbreeding ratio) would give better insight into production and growth potential of the Canaan Valley flock and provide a biological basis for setting harvest goals.

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