

# **SURVIVAL AND DISTRIBUTION OF CANADA GEESE FROM BALLARD COUNTY, KENTUCKY**

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*Abstract:* We banded 1,987 Canada geese (*Branta canadensis*) at Ballard Wildlife Management Area (WMA), Kentucky 1974 - 81. Additionally we observed 1,459 neckbanded individuals at Ballard WMA 1977 - 81 and obtained 11,649 observations of these individuals in the Mississippi Flyway. Analysis of these observations and 195 hunting recoveries indicated a strong association between Ballard WMA and Wisconsin. Average annual survival was estimated as 72% for geese banded at Ballard WMA 1974 - 79. Of 783 movements between refuges in southern Illinois and Ballard WMA, 73% were movements into Kentucky. Sixty individuals originally banded on the Hudson-James Bay coast were observed at Ballard WMA 1977 - 81. The origin of these individuals does not suggest a strong association between Ballard WMA and a particular segment of the breeding range.

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The possibility of managing portions of the major Canada goose populations independently was first proposed by Crissey (1968). Current Canada goose management of the Mississippi Valley Population (MVP) (Hanson and Smith 1950) is directed at increasing goose numbers in some areas, particularly south of the 36° parallel, while maintaining or decreasing goose numbers in the remainder of the MVP range (U.S.F.W.S. 1979). Historically numerical objectives for Canada geese have been achieved more easily than changes in distribution. One method of influencing distribution could be through management of individual segments within the MVP.

The objectives of our study were: (1) to describe the temporal and geographic distribution of Canada geese subsequent to their capture or observation at Ballard WMA, Kentucky; (2) to determine which other major Canada goose concentration areas in the Mississippi Flyway were used by Canada geese from Ballard WMA; and (3) to determine the survival rate of Canada geese from Ballard WMA. Such data could lead to improved identification of manageable segments within the MVP. In addition, such information can be used to develop a specific management plan for Ballard WMA which would be consistent with the overall MVP plan.

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### METHODS

Ballard WMA consists of 3,300 ha located adjacent to the Ohio River 13 km upstream from the confluence of the Ohio and Mississippi Rivers (Fig. 1). Approximately 37% of the area is agricultural, 10% is permanent water and the remainder is bottomland hardwoods. Approximately 17% of the area is maintained as a waterfowl refuge with the remaining area open to managed public hunting.

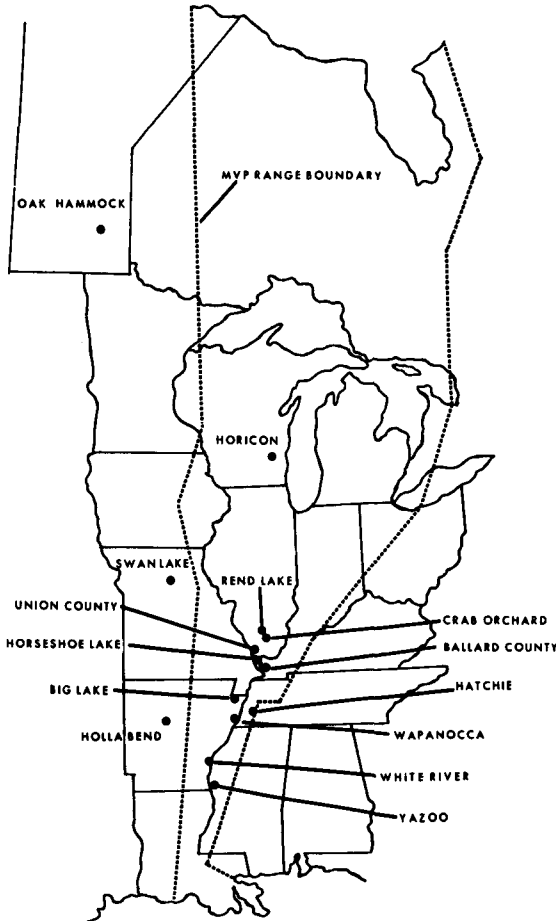


Fig. 1. Location of Canada goose refuges on which observations are conducted for neckbanded Canada geese in the Mississippi Flyway.

Geese were captured with rocket and cannon nets (Dill and Thornsberry 1950) propelled over corn bait after the close of the waterfowl season at Ballard WMA (Table 1). Beginning in the winter of 1977 - 78 some geese were marked with neckbands (Ballou and Martin 1964, Craven 1979) in addition to standard U.S. Fish and Wildlife Service legbands. All subsequent references to marked individuals refer to the unique 4 digit, alpha-numeric code engraved on each neckband. An observation refers to a code which was identified in the field. Field crews of 3 - 4 people were employed in Wisconsin, southern Illinois and Western Kentucky to observe and record marked geese in conjunction with a continuing study of the distribution and migration of Canada geese in the Mississippi Flyway. Additional observations were provided by cooperating federal, state, and provincial wildlife agency personnel.

Table 1. Numbers of various sex-age classes, totals and percentages of males and immatures among Canada geese banded at Ballard WMA, Kentucky, 1974 - 81.

	1974	1975	1976	1977	1978	1979	1980	1981
Adult Males	94	35	103	142	163	123	33	39
Adult Females	75	25	79	82	117	96	16	29
Immature Males	33	12	54	118	30	15	20	47
Immature Females	45	36	74	120	55	23	9	46
Totals	247	108	310	462	365 <sup>a</sup>	256 <sup>b</sup>	78 <sup>b</sup>	161 <sup>b</sup>
Percent Males	51.4	43.5	50.6	56.3	52.9	53.9	67.9	53.4
Percent Immatures	30.4	44.4	41.3	51.5	23.2	14.8	37.2	57.8

<sup>a</sup> 20 individuals were neckbanded in 1978.

<sup>b</sup> All individuals were neckbanded in 1979 - 81.

Observations of neckbanded geese were conducted daily at Horicon National Wildlife Refuge (NWR) and the surrounding east-central Wisconsin Area (Craven 1978). In southern Illinois geese were observed at Rend Lake Conservation Area (CA), Crab Orchard NWR, Union County CA and Horseshoe Lake CA. Observations were conducted a minimum of 2 and a maximum of 7 times at each refuge during each 2-week period. Those refuges with larger numbers of geese, as determined from the aerial counts, were visited more frequently. All unique neckband codes observed in each 2-week period were used as the combined neckband sample. We attempted to observe all geese at a given refuge during each visit; we assumed that geese sufficiently mixed between visits to provide adequate independence of samples.

A sample of neckbanded geese seen or marked at Ballard WMA was used to investigate the population affiliation between Ballard WMA and other goose refuges in the Mississippi Flyway. Estimates of populations of neckbanded Canada geese follow the procedures described by Jolly (1965) and Seber (1973:196). Survival estimates for legbanded geese are from computer programs obtained from the U.S. Fish and Wildlife Service Bird Banding Laboratory (Brownie et al. 1978). Aerial counts were obtained from the periodic Canada goose inventories conducted during the fall and winter by the U.S. Fish and Wildlife Service, Region III.

## RESULTS AND DISCUSSION

### Hunting Recoveries

During 1974 - 81, 1,987 Canada geese were banded at Ballard WMA; of these 195 were shot and reported by hunters to the U.S. Fish and Wildlife Service Bird Banding Laboratory from 1974 - 79 (Tables 1, 2). Data from the 1980 hunting season are currently unavailable. The distribution of these recoveries is similar to that of other recognized MVP refuges in Wisconsin and Illinois (Craven 1978; Wright and Kasul 1979) (Fig. 2). Direct recovery rates averaged 5.1% for the time period 1974 - 79. This compares to an average of 5.5% for 15,482 Canada geese banded at Horicon NWR during the same time period (Craven and Rusch, unpubl. data). The largest proportion of the reported harvest of geese banded at Ballard WMA 1974 - 79 occurred in Wisconsin (Table 2). However, recovery rates are partially dependent on reporting rates which may be subject to regional bias; this recovery distribution should therefore be interpreted with caution.

Table 2. Distribution and number of both direct and indirect recoveries by year and state for Canada geese banded at Ballard WMA, Kentucky, 1974 - 79<sup>a</sup>. Direct recoveries are in the 1st hunting season after banding while indirect recoveries are recoveries in all subsequent hunting seasons.

Year after banding	State				Total
	WI	IL	KY	Other	
1 <sup>a</sup>	41	17	9	22	89
2	21	6	3	14	44
3	9	3	2	10	24
4	4	3	2	4	13
5	6	0	1	2	9
6	1	0	0	0	1
unknown	3	2	1	9	15
Total	85	31	19	60	195

<sup>a</sup> All banding was post season, in 1978, 20 individuals were also neckbanded and in 1979 all geese were neckbanded. Neckbanding is known to increase the recovery rate (Craven 1979).

Analysis of the legband recoveries (program BROWNIE; Brownie et al. 1978:88) indicated that geese banded as immatures did not differ in survival from geese banded as adults ( $P > 0.9$ ) during 1974 - 79. This result was not surprising because all banding was post-season, hence immatures had already survived their 1st hunting season. No differences between yearling and adult survival were indicated by this analysis, perhaps due to lack of real differences in yearling and adult survival or perhaps due to small sample sizes. We feel the latter explanation is more likely because data from a much larger sample in nearby southern Illinois indicated survival was lower for yearlings (Kasul and Wright 1980).

We employed program ESTIMATE (Brownie et al. 1978) to find the most general model of survival and recovery rates which fit the recovery data for geese

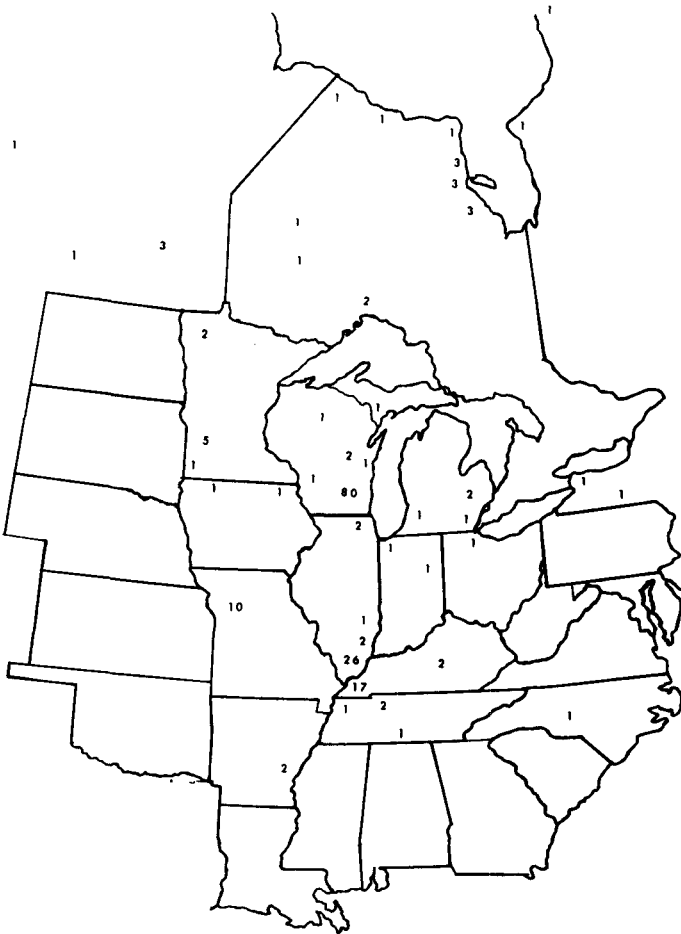


Fig. 2. Location of recoveries of Canada geese originally banded at Ballard WMA, Kentucky, which were subsequently killed by hunters in the Mississippi Flyway.

banded at Ballard WMA. Model 3 (constant survival and recovery) was chosen over Model 1 (time specific survival and recovery) ( $P > 0.4$ ) and Model 2 (constant survival and time specific recovery) ( $P > 0.25$ ). Average annual survival was estimated to be 72% (SE = 5.3%) and recovery rate 3.6% (SE = 0.4%) for the period 1974 - 79. It is possible that the small sample sizes may have masked annual differences in survival and recovery rates.

Fourteen geese were reported shot at widely distributed locations near the coasts of Hudson's and James' Bay (Fig. 2). Sixty marked Canada geese observed at Ballard WMA were originally banded on the breeding grounds. Five were banded between the Nelson River and Cape Churchill in Manitoba, 36 were banded between Fort Severn East to Cape Henrietta Maria in Ontario, and 19

individuals were banded between Hannah Bay north to Cape Henrietta Maria on the James Bay coast in Ontario. The widespread recoveries and origins of banded geese suggest to us that geese which wintered at Ballard WMA were not likely derived from a restricted portion of the MVP breeding range.

### Neckband Observations

During 1977 - 81, 1,459 marked Canada geese were observed at Ballard WMA 2,776 times, and we obtained 8,863 additional observations of these geese in the Mississippi Flyway. We detected no difference ( $P > 0.78$ ) in the distribution, in Wisconsin and Southern Illinois, of the observations of geese marked at Ballard WMA (541 in Ill.; 567 in Wis.) when compared to geese observed at Ballard WMA but marked elsewhere (2481 in Ill.; 2831 in Wis.). Therefore, we combined the 2 groups of observations and assumed these neckbanded individuals were representative of the population of Canada geese which used Ballard WMA. Ninety-three percent of these observations were in either Wisconsin, southern Illinois, or Kentucky. These observations reflect the distributions of marked geese and observer effort as well as differential observability (Trost et al. 1980). However, 71% (138 of 195) of all Canada geese banded at Ballard WMA were also recovered in these states (Fig. 2). We agree with Raveling's (1978) conclusion that Canada geese in the Mississippi Flyway are primarily concentrated on refuges during the waterfowl season; and we feel our sampling program on all of the major MVP refuges provided adequate samples of the neckbanded geese in the MVP.

We employed the methods of population estimation described by Jolly (1965) and Seber (1973:196) to estimate numbers of neckbanded individuals (of those neckbanded geese known to use Ballard WMA) in Wisconsin, southern Illinois, and Kentucky in 2-week intervals 1978 - 81 (Fig. 3). We omitted the 1977 - 78 field season from this analysis because we did not begin regular observations at Ballard WMA until mid-January. However, we included the codes of marked geese observed during the 1977 - 78 field season in our sample of neckbands.

The sum of neckbanded geese estimated in Wisconsin, southern Illinois or Kentucky represent the number of individual Canada geese from our population of neckbanded geese known to use Ballard WMA which we can account for in any given 2-week interval. The percentage of this sum in any one area is an estimate of the proportional distribution of this population in the total area examined. The area under each of the respective population curves (Fig. 3) expressed as a percent of the total area of the population curve for all areas is our overall estimate of the amount of use each of these 3 areas received by the population of neckbanded geese known to use Ballard WMA. The area under these curves indicates that the population of Canada geese which were known to use Ballard County spent about 35% of fall and winter in Wisconsin and southern Illinois and 30% in Kentucky. Prior to 20 January, these geese spent 49%, 32%, and 19% in Wisconsin, southern Illinois, and Kentucky respectively. Obviously a substantial portion of goose use in Kentucky occurred after the close of their waterfowl season (20 January).

The association between geese in Wisconsin, southern Illinois, and Kentucky is also illustrated by examining the number of marked Canada geese common to each area within years. Of the 1,615 marked geese observed within years in Kentucky from 1977 - 81; 50% (805 of 1,615) were also in Wisconsin in the same year, and

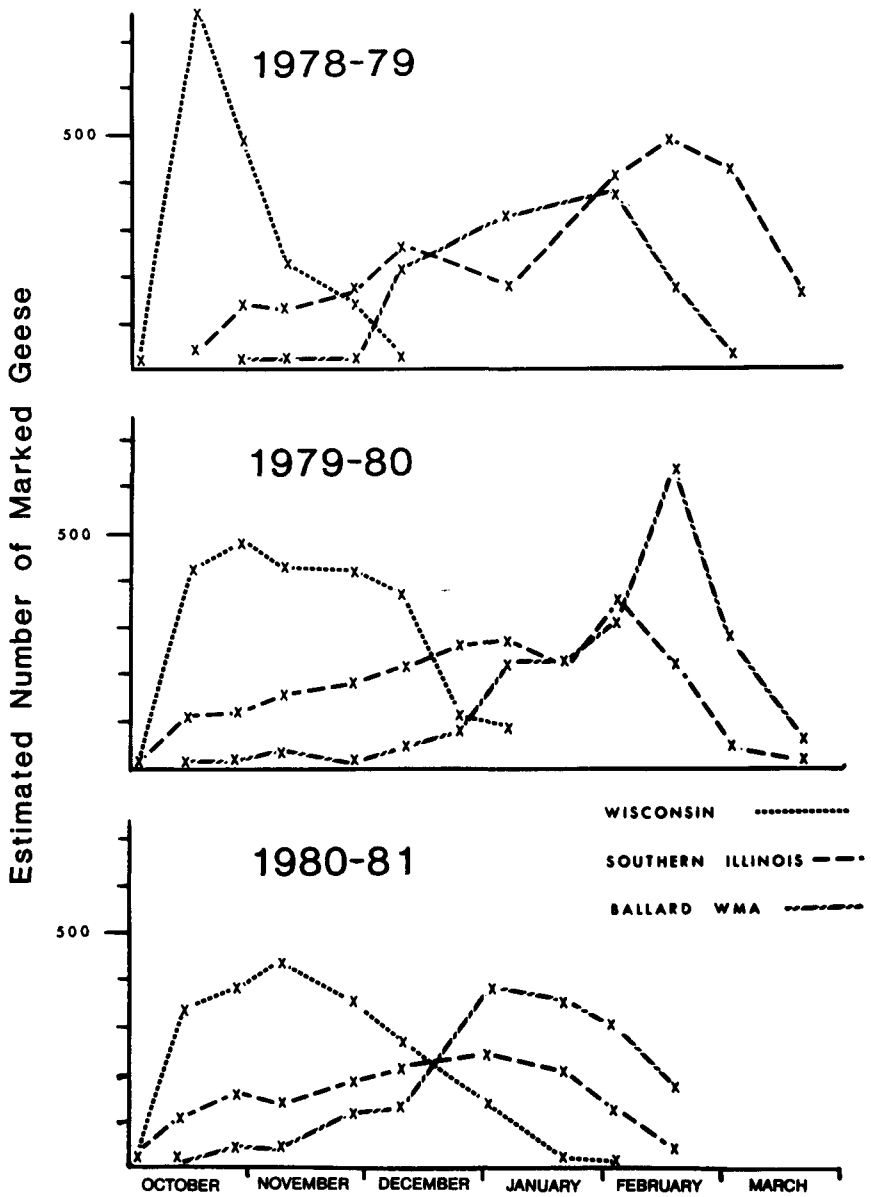


Fig. 3. Estimated number of neckbanded Canada geese present at 2-week intervals in Wisconsin, southern Illinois, Kentucky during 1979 - 81. Average coefficients of variation were 0.26, 0.19, and 0.30 for Wisconsin, southern Illinois and Kentucky, respectively.

39% (638 of 1,615) were seen previously or subsequently in southern Illinois. However, 39% (249 of 638) of the individuals seen in both southern Illinois and Kentucky were also seen in Wisconsin in the same year.

During 1977 to 1981, the largest number of Canada geese counted at Ballard WMA in the periodic fall and winter aerial Canada goose census conducted by the U.S. Fish and Wildlife Service was 125,000 on 30 January 1978 (Fig. 4). Unfortunately, this is the only year during our study in which aerial counts were conducted after 31 December. Prior to the major migration from Wisconsin very few geese were in Kentucky (Fig. 4).

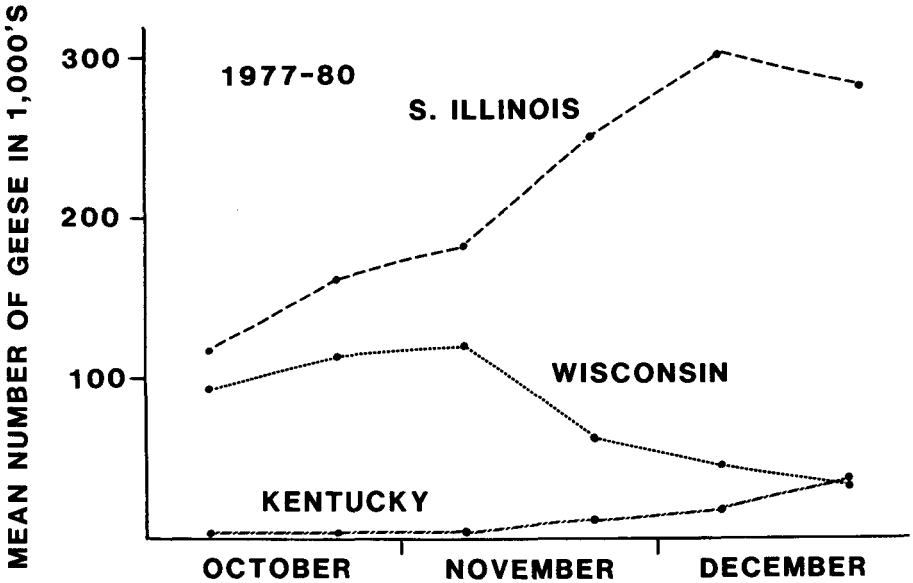


Fig. 4. Mean number of Canada geese counted during aerial censuses in Wisconsin, southern Illinois and Kentucky, 1977 - 80.

We have documented 783 movements between refuges in southern Illinois and Ballard WMA within the same year during 1977 - 81 (Table 3). Sixty-nine percent (544 of 783) of these movements took place after the hunting season closed in the Illinois quota zone and 53% (414 of 783) occurred after the waterfowl season closed in both Illinois and Kentucky. Most movements (73%) were from Illinois to Kentucky. The proportion of all movements was 50%, 30%, 14%, 6%, for Horseshoe Lake CA, Union County CA, Crab Orchard NWR, and Rend Lake CA, respectively. As these refuges are all increasingly distant from Ballard WMA, the amount of interchange would seem to be a function of distance (Fig. 1).

Estimated neckbanded populations, observations of individuals, and aerial counts, suggested that disappearance of geese from Wisconsin was followed by appearance of additional geese in Kentucky. We believe this increase was primarily due to migration of geese from Wisconsin to Kentucky. Kennedy and Arthur (1974)



Table 3. Movements of Canada geese between refuges in southern Illinois and Ballard WMA, Kentucky, 1977 - 81. Movements are described for 3 time periods: A) prior to and during the goose hunting season in the Illinois quota zone; B) after the goose hunting season in the Illinois quota zone and during the goose season in Kentucky; and C) after the goose seasons in both Illinois and Kentucky.

Time period	Rend Lake		Crab Orchard		Union Co.		Horseshoe Lake	
	CA		NWR		CA		CA	
	To <sup>a</sup>	From	To	From	To	From	To	From
A	6	8	51	6	55	15	69	18
B	0	0	11	0	16	8	60	35
C	16	18	39	2	77	60	159	43
Total	22	26	101	8	159	83	288	96

<sup>a</sup> All movements are to or from Ballard WMA; To indicates a movement from the refuge in southern Illinois to Ballard WMA, Kentucky and From is movement from Ballard WMA, Kentucky to a refuge in southern Illinois.

postulated the existence of 2 segments within the MVP; an early-migrating segment associated with southern Illinois and a late-migrating segment associated with Wisconsin. If this hypothesis is correct, it would seem that most of the geese associated with Ballard WMA are a part of the late-migrating segment of the MVP.

## SUMMARY

Evidence from recoveries of legbands, observations of neckbands, and aerial census indicated that Canada geese associated with Ballard WMA were also closely associated with Wisconsin. Forty-six percent of all direct recoveries and 43% of total recoveries of Canada geese banded at Ballard WMA were reported from Wisconsin. Sixty-seven percent of all neckbanded geese seen at Ballard WMA in any given year were observed in the same year in Wisconsin. Calculations based on neckband observations indicated that prior to 20 January neckbanded geese associated with Ballard WMA spent 49% of their time in Wisconsin in fall and winter prior to 20 January. Aerial census figures indicated that the number of geese in Kentucky prior to the major migration from Wisconsin was small. We therefore feel that the status of the Ballard WMA Canada goose resource is closely related to harvest and population management practices in Wisconsin. We also feel the small early segment of geese which use Ballard WMA early in fall should be fostered in order to increase the diversity and stability of Canada goose numbers at Ballard WMA. We recommend that banding and marking continue in order to assess the impact of current and future management practices in the MVP.

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