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PRODUCTIVITY OF GIANT CANADA GEESE IN WEST-CENTRAL ILLINOIS[1]

Key words: *(Branta canadensis maxima)*, Canada geese, Illinois, predation, productivity.)

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Branta canadensis maxima, the largest race of Canada geese, was thought extinct over 50 years ago, although there was some question as to the existence of a distinct subspecies at that time (Phillips and Lincoln 1930, McAtee 1944, Delacour 1954). Since Hanson's (1965) documentation of the race, efforts to establish and expand local populations have been widespread, with notable successes on public lands in the north-central United States (Nelson 1963, Dill and Lee 1970). However, published information on the productivity of re-established unconfined flocks has been sparse (Hunt and Jahn 1966, Szymczak 1975, Kaminski et al. 1979, Nigus and Dinsmore 1980).

In 1967, the Illinois Department of Conservation (IDOC), through the dedicated efforts of former Chief Waterfowl Biologist George C. Arthur, established a captive flock of *maxima* on private reclaimed surface-mined lands in west-central Illinois; 64 geese were released from holding pens in Fulton and Knox counties in early spring 1969. Juvenile geese used in the original stocking, which

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Hanson (1965) verified as *maxima*, were raised at the Des Plaines game farm near Wilmington, Illinois. Three hundred forty-five additional geese, purchased from private breeders, were released in Fulton, Knox, and Henry counties between 1969 and 1971. All townships designated as production areas have been closed to Canada goose hunting since 1969. Fall population estimates by the IDOC prior to 1979 were 500 in 1972, 700 in 1973, 950 in 1974, 1,200 in 1975, 1,500 in 1976, 2,000 in 1977, and 3,000-4,000 in 1978. These were based on results of banding operations, estimates of pioneering groups, and spring aerial surveys conducted some years.

The purpose of this study was to determine productivity of the established breeding population and to establish baseline data with management implications for evaluating population changes. During 1979 and 1980, size and distribution of the population, nest site characteristics, and reproductive success were evaluated. The findings presented are taken from a thesis submitted as partial fulfillment of the requirements for the M.A. Degree, Department of Zoology, Southern Illinois University at Carbondale.

STUDY AREA

The giant Canada goose production area is approximately 28,365 ha of surface-mined land in west-central Illinois (Illinois Dep. Mines and Minerals 1978, K. Russell, unpubl. data). This 4-county area includes 17,783 ha in Fulton, 8,362 ha in Knox, 1,137 ha in Peoria, and 1, 083 ha in Henry (Fig. 1). Water areas were largely permanent lakes and included approximately 2,244 ha (Haynes and Klimstra 1975, and unpubl. data from individual coal companies).

Forage production and grazing were the most common land uses on the area; principal species were brome (*Bromus* spp), sweet clover (*Melitotus* spp), fescue (*Festuca* spp), and alfalfa (*Medicago* spp). Only a small percentage of land was in row crop production, although this represented the major surrounding land use. Forested tracts, largely volunteer species, were common especially in Knox and Henry counties; cottonwood (*Populus deltoides*), black cherry (*Prunus serotina*), box elder (*Acer negundo*), black locust (*Robinia pseudocacia*), willows (*Ulum* spp), and oaks (*Quercus* spp) were locally dominant.

Impoundments ranged from approximately 0.2 — 60 ha and were characterized by irregular shorelines and numerous islands. Water quality was generally good, supporting a diversity of aquatic macrophytes and invertebrates. Konik (1980) indentified 71 invertebrate taxa in 2 Fulton County lakes and found abundant aquatic vegetation in depths up to 5 m; muskgrass (*Chara* spp), pondweeds (*Potamogeton foliosus, P. nodosus*), and southern naiad (*Najas guadalupensis*) were the principal species.

METHODS

Six aerial censuses (Cessna 210 fixed-wing and Enstrom F28-A helicopter) were conducted during 26 March — 30 April and one on 5 June in 1979; 5 were conducted during 18 March — 24 April in 1980 over all of the study area to determine size and distribution of the population. The 4-county study area was outlined on county highway maps and parallel transects were delineated which included all wetlands. Locations of all geese and the percent of paired individuals were recorded. Single geese exhibiting nest defense behavior along shoreline were recorded as pairs.

Based on aerial surveys and preliminary ground study, several locations were chosen for intensive nest study. The objective was to locate as many nests as possible and record number of eggs, nest type, nest material, and fate of each. During 1980, distance to and height above permanent water, surrounding vegetation, and the dimensions and distance to shore for island nest sites were also recorded. Each nest location was numbered, marked, and recorded by impoundment to facilitate relocation. Active nests were visited at intervals up to 7 days, decreasing to 1 day late in incubation.

Nest initiation was designated as the date the first egg was laid; dates for most nests were calculated by backdating from day of hatch, based on an incubation period of 28 days and a laying rate of 1.5 days/egg (Kossack 1950, Collais and Jahn 1959, Brakhage 1965). Nest success was the proportion of nests which produced 1 or more live goslings; egg success was the percent of all eggs which hatched; and hatching success was the proportion of eggs which hatched after being incubated full term. Nest terminations were classified as successful, destroyed by predator, abandoned, stolen by man, or destroyed by unknown causes. When goslings were not present in the nest, success was determined on the basis of eggshells and membranes characteristic of hatched eggs (Girard 1939, Sowls 1955). Eggs left unhatched in terminated nests were opened to determine cause of failure. Embryo mortality was assumed if the egg contained body tissue, a reddish discoloration near the air cell, or a smear of gray or black material suggesting the breakdown of hemoglobin (Kossack 1950, Cooper and Batt 1972, Raveling and Lumsden 1977). All other eggs were considered infertile.

Identification of the predator responsible for nest destruction was based on (1) appearance of eggshell remains at or near the nest site, (2) measurements between impressions made by paired canines in eggshells, (3) degree of nest disturbance, (4) tracks and scats at the nest site, and (5) guard hairs found stuck to eggshell remains or at destroyed nests. Rearden (1951) desribed waterfowl nest destruction by various predators, and guard hairs were identified using a key by Stains (1958).

Broods were recorded by location, size, and age class (Southwick 1953); only broods of apparent even-age composition were analyzed in an effort to exclude gang broods. On one area where nest searches were complete and all nests were thought located in 1980, total gosling production was compared to number of goslings trapped during July for an estimate of mortality.

RESULTS AND DISCUSSION

Aerial Census

The estimated breeding population on surface-mined areas was 1,698 geese in 1979 and 2,388 in 1980. Because several reports of geese nesting outside surface-mined areas were received in 1979, a sample of unmined areas was included in 1980 aerial census transects. The ratio of potential breeding habitat to goose-use on unmined areas censused was extrapolated to all available breeding habitat in the "pioneer range"; this calculation added 542 geese to the 4-county breeding population in 1980. Number and surface-water area of impoundments (>0.2 ha) were used as predictors of habitat availability, and the "pioneer range" was delineated by confirmed reports of geese nesting outside mined areas. The level of pair activity (Fig. 2) recorded during censuses, reached peaks of 56.7% on 30 April 1979 and 52.7% on 24 April 1980.

Nest Site Characteristics

Islands were preferred for nesting as 202 of 242 nests were on insular sites. A similar site preference has been described for Canada geese by other studies (Kossack 1950, Geis 1956, Klopman, 1958, Vermeer 1970, Raveling and Lumsden 1977, Giroux 1981). Nesting islands varied in shape, but generally reflected a long, narrow configuration and ranged in size from approximately 6 — 1,000 m^2 with a mean of 175 m^2. Nesting islands varied from 0.2 — 6.0 m above water level, and the majority (61.0%) were within 15 m of shore (Table 1). Nests on islands over 5 m from shore exhibited a much higher success (78%) than those 5 m or less (48%) because of reduced mammalian predation ($T = 2.81$, $P < 0.01$; Table 1). Nests over 5 m from shore were also surrounded by deeper water, usually at least 1-2 m in depth. This study does not support Giroux (1981:676) who suggested islands for waterfowl nesting be at least 170 m from shore to deter predation. Of 26 shore nests monitored in 1980, 23 (88.5%) were on peninsulas, several of which were islands the previous year when water levels were higher.

In 1980 mean distance to water was 1.8 m (0.1 - 9.0 m); 73.6% were 2 m or less. These distances are less than others reported for Canada goose nests (Williams and Sooter 1940, Dow 1943, Craighead and Craighead 1949, Kossack 1950, Klopman 1958, Cooper 1978). Nests on surface-mined lands were often limited to sites near water due to the topography of the surrounding terrain. The mean height above water level for all nests in 1980 was 1.4 m (0.1 - 6.0 m).

Vegetation recorded most frequently in the vicinity of 144 nests were grasses (brome and fescue) 55%, sweet clover 46%, and broad-leaved herbs 39%. Sweet clover was a preferred nest material composing the bulk of 37% of nests, followed by grasses 34% and broad-leaved herbs 15%.

The importance of visibility (Williams and Sooter 1940, Dow 1943, Craighead and Craighead 1949, Miller and Collins 1953, Cooper 1978) appeared to be modified by nest location; shore sites reflected high visibility of surrounding terrain and a minimum avenue of access from the mainland. This characteristic appeared to maximize the probability that the incubating female would be aware of intrusion, thus allowing prompt defense and/or escape. In contrast, Cooper's (1978:27) observations suggested females selected sites with high visibility only when isolated on an island or haystack. The visibility characterisites of 118 island nests recorded in 1980 suggested no apparent selection for optimum visibility ($X^2 = 3.10$, $P > 0.20$). In fact, in several island situations, geese selected sites with lower visibility, apparently to decrease visual contact with other nesting geese. If selection of sites with high visibility affords protection against predation (Williams and Sooter 1940, Dow 1943), that factor is probably less important on islands than on shore where encounters with mammalian predators are more likely.

Nest Phenology

The initiation of egg-laying for various populations of *maxima* encompasses several weeks (Hanson 1965) because of the wide latitudinal distribution of this race. Nesting was begun on 23 March 1979 and 17 March 1980 in west-central Illinois (Table 2); these dates are similar to other *maxima* populations in the Midwest (Kossack 1950, Collias and Jahn 1959, Brakhage 1965, Bednarik 1974, Nigus 1979). All nests were initiated during 22 and 37-day intervals in 1979 and 1980, respectively. Hatching occurred during a 23-day period in 1979, peaking around 8 May; and during a 42-day period peaking around 3 May in 1980. From first egg laid to last egg hatched, the observed span of the nesting season was 57 days in 1979 and 76 days in 1980. Although the nesting period in 1980 might suggest inclusion of continuation nests or second nesting attempts as found by Brakhage (1965) in Missouri, renesting was not recorded.

Productivity

Mean clutch size was 5.7 each year and is among the highest reported for giant Canada geese (Table 3); the range was 3-9 in 1979 and 2-10 in 1980. There was no significant difference between the mean clutch sizes of island nests (5.6, N = 65) and shore nests (6.1, N = 10) in 1979 (T = 1.02, P = 0.31), but island nests reflected a higher mean (5.8, N = 113) than those on shore in 1980 (5.1, N = 17, T = 2.30; P = 0.023). Field observations suggested that larger clutches on islands in 1980 were a result of earlier nest initiation (Cooper 1978) and a higher proportion of experienced breeders using islands because of intense competition for a reduced number of preferred sites (Hanson 1965, Brakhage 1965, Cooper 1978).

Nest Success. — Out of 242 nests monitored, 181 (74.8%) hatched at least 1 live gosling; this compares favorably with other *maxima* populations (Table 3). Predation accounted for 47 losses, 9 nests were abondoned. 2 were robbed by man, and 3 were undetermined.

Nests on preferred island sites were more successful (82.2%) than those on shore (37.5%; T = 5.5, $P < 0.001$). Nest success in 1980 was significantly lower than in 1979 (T = 2.58, $P < 0.01$, Table 4), reflecting a substantial increase in nest predation from 8.4% in 1979 to 25.2% in 1980.

Egg Success. — Egg sucess which averaged 76.5% was 81.6% in 1979 and 73.5% in 1980. Predation, the largest source of failure, accounted for 194 eggs (15.5%). Other sources of egg failure were embryo mortality 32 (2.6%), nest abandonment 16 (1.3%), infertile 14 (1.1%), displaced 12 (1.0%), stolen by man 12 (1.0%), dumped 2 (0.2%), and unknown 13 (1.0%). These results were similar to those in Missouri (Brakhage 1965) and Iowa (Nigus 1979), but were higher than those of several other *maxima* flocks (Table 3).

Hatching Success. — Overall hatching success averaged 96.8%; it was 95.4% in 1979 and 97.7% in 1980. Eggs in shore nests exhibited a slightly higher hatching success (100%, N = 80), compared with 96.5% (N = 910) for island nests ($X^2 = 2.91$, $P > 0.09$, Table 4). Because over 50% of shore nests were destroyed by predators, females successful in incubating clutches full term on shore were probably the most tenacious. Raveling and Lumsden (1977:40) observed higher predation of nests where the female left more often or fled secretively upon intrusion by investigators. It follows that in the absence of many predators capable of killing an adult goose and the presence of a high density of nest-destroying predators, a high level of tenacity and defense would both decrease the chance of nest predation and increase egg hatchability.

Nest Predation. — Predation, the largest factor contributing to nest and egg failure during both years, was higher (25.2%) in 1980 than in 1979 (8.4%; $X^2 = 9.7\%$, $P < 0.002$). With lower water levels in 1980, predation of island nest increased from 0% in 1979 to 19.5%. There were fewer isolated sites in both distance and water depth, resulting in greater predator accessibility. Density of nesting pairs at several sites increased markedly in 1980; the most extreme was one site which reflected 2.15 nests/usable ha in 1979 and 4.65 nests/usable ha in 1980. That area exhibited the highest increase in predation from 0% to 41%. As a result of higher nest densities which increased intraspecific strife and use of marginal nesting habitat, some females spent more time off the nest which enhanced predation. This finding supports that of Sherwood (1965) in studies at Seney, Michigan.

Raccoons were incriminated in 24 of 52 nest predations; 20 were on islands and 4 on shore. Nine nest losses on shore were attributed to striped skunk (*Mephitis mephitis*), 6 were suspected destroyed by dog or coyote (*Canis latrans*), and 13 were lost to unknown predators.

Nest desertion, found to be the major cause of nest failure by others (Geis 1956, Hanson and Eberhardt 1971, Ewaschuk and Boag 1972, Cooper 1978, Nigus and Dinsmore 1980) was unusually low (3.7%) in this study. Field observations supported Cooper (1978:63-64) who suggested that most deserting females never attained normal nest attentiveness and their mates contributed little to nest defense. These characteristics were also recorded for many of the pairs which lost nests to predators. The evidence suggested virtually all nest predation occurred while the female was absent from the nest site; and because most deserted nests were destroyed within 2 days, predators were seemingly aware of many nest locations but were unsuccessful in displacing attentive geese or reluctant to attempt it. Therefore, geese characteristically less tenacious were more likely to lose nests to predators. Regardless of the proximate cause of nest failure (predation or desertion), the ultimate cause may gave been maladaptive behavioral traits as proposed by Raveling (1981).

Broods

A total of 101 broods of apparent even-age compostion was observed; 41 in 1979 and 60 in 1980. However, the effort to exclude gang broods was unsuccessful; mean brood size decreased from 5.3 to 5.2 between class Ia and Ib broods, but increased to 5.4, 5.6, and 5.9 for classes IIa. IIb, and III, respectively. Warhurst (1974) reported that average brood size was over 2 goslings higher than the mean hatch per successful nest as a result of "ganging"; Williams and Marshall (1938), Miller and Collins (1953), and Geis (1956) observed similar increases.

Gosling mortality was estimated by comparing number of goslings produced on an isolated production area where all nests were located, with the number captured during the molt. During 1980 that area had 12 nests which yielded 56 goslings; 45 goslings were captured in July indicating a mortality of 19.6% between the hatch and the molt. Warhurst (1974) estimated a 15% mortality rate for goslings reared unconfined in a marsh at Crane Creek Wildlife Area, Ohio.

CONCLUSIONS

The population of giant Canada geese nesting in west-central Illinois is highly productive and is increasing in numbers and distribution. Quality of habitat, as afforded by impoundments resulting from surface mining, provides safe desirable nesting conditions (islands) and diversity of wetlands. Land use practices and associated forage production on uplands seem to provide satisfactory food supplies and nest cover. The vigor of this population should result in higher breeding populations and expansion into presently unoccupied habitat. Although predation was the largest factor limiting production, its effect was not severe. Further research into gosling survival and proportion of paired geese which do not attempt to nest is in order; this information would allow development of a workable model to estimate recruitment from counts of paired geese during the breeding season.

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LITERATURE CITED

Bednarik, K.E. 1974. Local Canada goose production survey. Performance Rep. W-104-R-16. Ohio Dep. Nat. Resour., Div. Wildl. 22pp.

Brakhage, G.K. 1965. Biology and behavior of tubnesting Canada geese. J. Wildl. Manage. 29:751-771.

Collias, N.E., and L.R. Jahn. 1959. Social behavior and breeding success in Canada geese (*Branta canadensis*) confined under semi-natural conditions. Auk. 76:478-509.

Cooper, J.A. 1978. The history and breeding biology of the Canada geese of Marshy Point, Manitoba. Wildl. Monogr. 61. 87pp.

Cooper J.A., and B.D.J. Batt. 1972. Criterion for aging giant Canada goose embryos. J. Wildl. Manage. 36:1267-1270.

Craighead, F.C., and J.J. Craighead. 1949. Nesting Canada geese on the upper Snake River. J. Wildl. Manage. 13:51-64.

Delecour, J. 1954. The waterfowl of the world. Vol. 1. Country Life Limited, London. 284pp.

Dill, H.H., and F.B. Lee. 1970. Home grown honkers. U.S. Dep. Inter., Fish and Wildl. Serv., Washington, D.C. 154pp.

Dow, J.S. 1943. A study of nesting Canada geese in Honey Lake Valley, California. Calif. Fish and Game. 29:3-18.

Ewaschuk, E., and D.A. Boag. 1972. Factors affecting hatching success of densely nesting Canada geese. J. Wildl. Manage. 36:1097-1106.

Geis, M.B. 1956. Productivity of Canada geese in the Flathead Valley, Montana. J. Wildl. Manage. 20:409-419.

Girard, G.L. 1939. Notes on the life history of the shovelor. Trans. N. Am. Wildl. Nat. Resour. Conf. 4:364-371.

Giroux, J.F. 1981. Use of artificial islands by nesting waterfowl in southeastern Alberta. J. Wildl. Manage. 45:669-679.

Hanson, H.C. 1965. The giant Canada goose. Southern Illinois Univ. Press, Carbondale. 226pp.

Hanson, W.C., and L.L. Eberhardt. 1971. A Columbia River Canada goose population, 1950-1970. Wildl. Monogr. 28. 61pp.

Haynes, R.J., and W.D. Klimstra. 1975. Illinois lands surface-mined for coal. Coop. Wildl. Res. Lab., Southern Ill. Univ., Carbondale, Ill. 201pp.

Hunt, R.A., and L.R. Jahn. 1966. Canada goose breeding populations in Wisconsin. Wis. Conserv. Dep. Tech. Bull. 38. 67pp.

Illinois Department of Mines and Minerals. 1978. Annual coal, oil, and gas report. Ill. Dep. Mines and Minerals, Springfield, Ill. 253pp.

Kaminski, R.M., J.M. Parker, and H.H. Prince. 1979. Reproductive biology of giant Canada geese reestablished in southeastern Michigan. Jack Pine Warbler. 57:59-69.

Klopman. R.B. 1958. The nesting of the Canada goose at Dog Lake, Manitoba. Wilson Bull. 70:168-183.

Konik, J. 1980. Some physical, chemical, and biological characteristics of non-problem waters occurring on lands surface-mined for coal Ill. Inst. Nat. Resour. Doc. 80/14. 90pp.

Kossack, C.W. 1950. Breeding habits of Canada geese under refuge conditions. Am. Midle. Nat. 43:627-649.

McAtee, W.L. 1944. Popular subspecies. Auk 61:135-136.

Miller, A.W., and B.D. Collins. 1953. A nesting study of Canada geese on Tule Lake and Lower Klamath national wildlife refuges, Siskiyou County, California. Calif. Fish and Game 39:385-396.

Nelson. H.K. 1963. Restoration of breeding Canada goose flocks in the north-central states. Trans. N. Am. Wildl. Nat. Resour. Conf. 28:133-149.

Nigus, T.A. 1979. Productivity and nest site selection of Canada geese in northwestern Iowa. M.S. Thesis. Iowa State Univ., Ames. 85pp.

Nigus, T.A., and J.J. Dinsmore. 1980. Productivity of Canada geese in northwestern Iowa. Proc. Iowa Acad. Sci. 87(2):56-61.

Phillips, J.C., and F.C. Lincoln. 1930. American waterfowl: their present situation and the outlook for their future. Houghton Mifflin Co., Boston. 312pp.

Raveling, D.G. 1981. Survival experience, and age in relation to breeding success of Canada geese. J. Wildl. Manage. 45:817-829.

Raveling, D.G., and H.G. Lumsden. 1977. Nesting ecology of Canada geese in the Hudson Bay lowlands of Ontario: evolution and population regulation. Ontario Minist. Nat. Resour., Fish and Wild. Res. Rep. 98. 77pp.

Rearden, J.D. 1951. Identification of waterfowl nest predators. J. Wildl. Manage. 15:386-395.

Sherwood, G.A. 1965. Canada geese of the Seney National Wildlife Refuge. U.S.D.I. Bur. Sprot Fish. and Wildl., Div. Wildl. Refuges, Region 3, Minneapolis, Minn. 222pp.

Southwick, C. 1953. A system of age classification for field studies of waterfowl broods. J. Wildl. Manage. 17:1-8.

Sowls, L.K. 1955. Prairie ducks, a study of their behavior, ecology, and management. Stackpole Co., Harrisburg, Pa. 193pp.

Stains, H.J. 1958. Field guide to guard hairs of middle western furbearers. J. Wildl. Manage. 22:95-97.

Szymczak. M.R. 1975. Canada goose restoration along the foothills of Colorado. Colo. Wild. Div. Tech. Publ. 31. 64pp.

Vermeer. K. 1970. A study of Canada geese, *Branta canadensis*. nesting on islands in southeastern Alberta. Can. J. Zool. 48:235-240.

Warhurst, R.A. 1974. Characteristics of giant Canada goose gang broods near southwestern Lake Erie. M.S. Thesis. Ohio State Univ., Columbus. 133pp.

Williams, C.S., and W.H. Marshall. 1938. Survival of Canda goose goslings. Bear River Refuge, Utah, 1937. J. Wildl. Manage. 2:17-19.

Williams, C.S., and C.A. Sooter. 1940. Canada goose habitats in Utah and Oregon. Trans. N. Am. Wildl. Nat. Resour. Conf. 5:383-386.

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Table 1. Success of 118 island nests versus distance to shore (m) for nesting islands in west-central Illinois, 1980.

	Distance from Shore (m)								
	5	6-10	11-15	16-20	21-25	26-30	31-35	36-50	50
Successful	12	19	16	5	13	3	4	12	4
Unsuccessful	13	3	4	0	3	0	2	3	2
Total	25	22	20	5	16	3	6	15	6

Table 2. Nest phenology of giant Canada geese in west-central Illinois, 1979-1980.

	Egg-laying Period	Incubation Period
1979		
First Nest (4 eggs)	23 March-28 March	29 March-26 April
Last Nest (5 eggs)	13 April-20 April	21 April-18 May
Peak Nesting Period	2 April-10 April	11 April-8 May
1980		
First Nest (4 eggs)	17 March-22 March	23 March-20 April
Last Nest (7 eggs)	22 April-2 May	3 May-31 May
Peak Nesting Period	27 March-4 April	5 April-3 May

Table 3. Clutch size, nesting success, and productivity reported for several populations of *Branta canadensis maxima*.

Location and Source	Year(s)	N	Mean Clutch Size	Nest Success (%)	Egg Success (%)	Hatching Success (%)	Goslings per Nesting Pr.	$\bar{x}$ Brood Size at Hatching
Dog Lake, Manitoba Klopman 1958	1954-55	104	5.1	46	51.4	96	-	-
Barrington, IL Kossack 1950	1945-46	140	5.0	57	55.6	-	-	-
Trimble, MO Brakhage 1965	1961-64	147	5.6	65	73	78	4.1	-
Marshy Point, Manitoba Cooper 1978	1969-71	473	5.6	75	67	97	3.8	5.1
Northwestern IA Nigus 1979	1977-78	211	6.0	79	77	86	4.2	5.3
Southeeastern MI Kaminski et al. 1979	1974-75	146	5.4	82	70	91	-	-
Mosquito Creek, Killdeer Plains, Mercer County, and Crane Creek, OH Bednarik 1974	1974	966	5.0	75	72	-	-	-
Central IL This Study	1979-80	242	5.7	74.8	76.5	96.8	4.0	5.2

Table 4. Relationship of nest site to clutch size, nesting success and ultimate productivity for giant Canada geese in west-central Illinois, 1979-1980.

	1979			1980			79-80
	Island	Shore	Total	Island	Shore	Total	Total
Nests Observed	69	14	83	133	26	159	242
Successful Nests	64	6	70	102	9	111	181
Nest Success (%)	92.8	42.9	84.3	76.7	34.6	69.8	74.8
Totally Predated Nests	0	7	7	26	14	40	47
Nests With Complete Clutches	65	10	75	113	17	130	205
Eggs Comprising Complete Clutches	366	61	427	658	87	745	1172
Mean Clutch Size	5.6	6.1	5.7	5.8	5.1	5.7	5.7
Eggs Laid	377	79	456	694	103	797	1253
Eggs Hatched	333	39	372	545	41	586	958
Egg Success (%)	88.3	49.4	81.6	78.5	39.8	73.5	76.5
Fertile Eggs Incubated Full Term	351	39	390	559	41	600	990
Hatching Success (%)	94.9	100	95.4	97.5	100	97.7	96.8
Mean Brood Size At Hatching	5.1	6.5	5.3	4.6	5.2	5.2	
Goslings Produced Per Nesting Pair	4.8	2.8	4.5	4.1	1.6	3.7	4.0

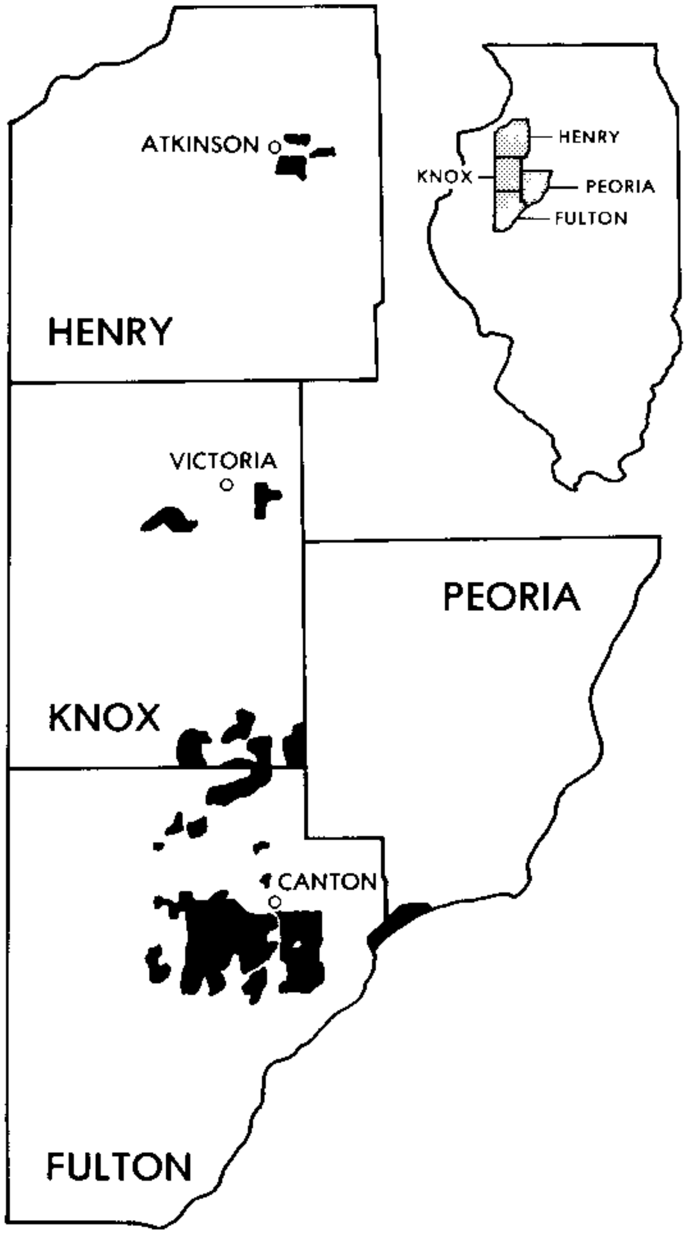

Figure 1. Giant Canada goose production areas in west-central Illinois.

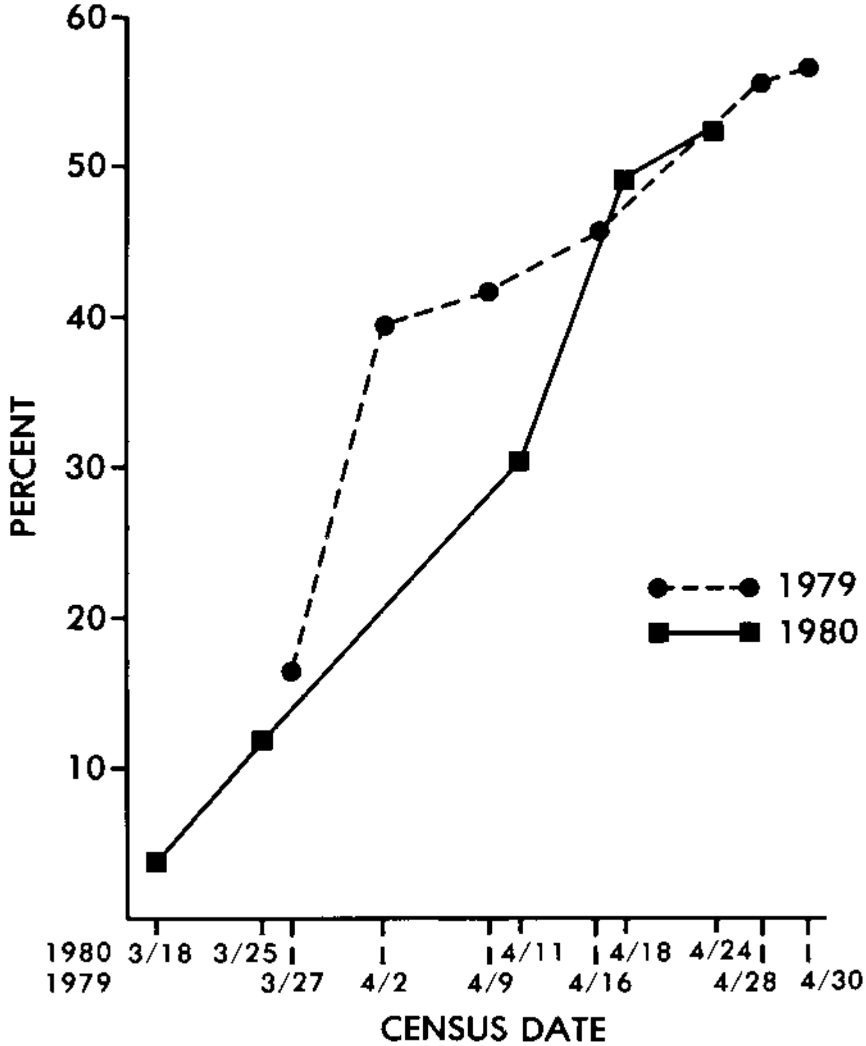

Figure 2. Proportion of geese recorded as paired during aerial censuses in west-central Illinois, 27 March - 30 April 1979, and 18 March - 24 April 1980.