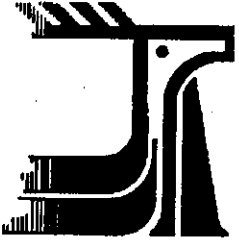


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COMMITTEE ON THE
STATUS OF ENDANGERED
WILDLIFE IN CANADA

OTTAWA, ONT. K1A 0H3
(819) 997-4991

COMITÉ SUR LE STATUT
DES ESPÈCES MENACÉES
DE DISPARITION AU
CANADA

OTTAWA (ONT.) K1A 0H3
(819) 997-4991

STATUS REPORT ON THE NORTHERN BOBWHITE

COLINUS VIRGINIANUS

IN CANADA

BY

ANNETTE M. PAGE

AND

MADELINE J. AUSTEN

STATUS ASSIGNED IN 1994

ENDANGERED

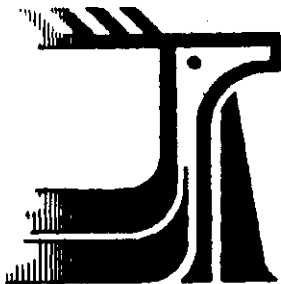
REASON: STEADY RANGE CONTRACTION AND POPULATION DECLINE THROUGH THIS CENTURY. POPULATION NUMBERING FEWER THAN 200 BIRDS; SEVERAL COVEYS ISOLATED AND NOT SUSTAINABLE. HABITAT FRAGMENTED.

OCCURRENCE: ONTARIO

COSEWIC - A committee of representatives from federal, provincial and private agencies which assigns national status to species at risk in Canada.

CSEMDC - Un comité de représentants d'organismes fédéraux, provinciaux et privés qui attribue un statut national aux espèces canadiennes en péril.

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Committee
on the Status
of Endangered
Wildlife
in Canada

Comité sur le
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menacées
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au Canada

JUNE 1990

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STATUS REPORT ON THE NORTHERN BOBWHITE

COLINUS VIRGINIANUS

IN CANADA

BY

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STATUS ASSIGNED IN 1994

ENDANGERED

TABLE OF CONTENTS

	page
A. ABSTRACT	1
B. DISTRIBUTION	2
B.1. Americas	2
B.2. Canada	2
C. PROTECTION	7
D. POPULATION SIZE AND TREND	8
Canada	12
E. HABITAT	16
E.1. Habitat preferences	16
E.2. Distribution of habitat	17
E.3. Trend in quality and quantity of critical habitat	17
E.4. Habitat protection	18
F. GENERAL BIOLOGY	19
F.1. Reproductive Capability	19
F.2. Species Movement	20
F.3. Behaviour/Adaptability	21
G. LIMITING FACTORS	23
G.1. Weather	23
G.2. Habitat loss	24
G.3. Food	24
G.4. Chemicals	25
G.5. Released Stock	25
G.6. Predation	25
G.7. Competition	26
G.8. Hunting	26
H. SPECIAL SIGNIFICANCE OF THE SPECIES	27
I. EVALUATION AND PROPOSED STATUS	28
J. REFERENCES	29
K. ACKNOWLEDGEMENTS	34

LIST OF FIGURES

1. Distribution of the Northern Bobwhite in North America. 3
2. Range fluctuations of the Northern Bobwhite in Ontario from 1856 to 1954
(from Clarke 1954) 4
3. Symbols denote 10-km squares (within 100-km blocks) in which the Northern
Bobwhite was reported to the Breeding Bird Atlas and the Ontario Rare
Breeding Bird Program in northern Ontario 5

LIST OF TABLES

1. Summary of Northern Bobwhite records from the Atlas of the Breeding Birds of
Ontario by Site Region. 6
2. Available State Nature Conservancy Ranks for the Northeastern and Northcentral
United States. 10
3. Breeding Bird Atlas Data Summaries for the Northeastern and Northcentral
United States. 11

A. ABSTRACT

The Northern Bobwhite is generally widespread and common throughout its range in eastern North America, with the exception of the western and northern peripheries. The species reaches the northern limit of its range in Ontario, the only province in Canada in which it is native. The species has been introduced in other provinces, including British Columbia and Nova Scotia, but no populations have become established outside of Ontario. Throughout its history in Ontario, the bobwhite has experienced large fluctuations in numbers and range. With European settlement and initial clearing of the land, together with "untidy" farming practices, the bobwhite flourished in Ontario. By 1856 it had expanded its range north and east to Georgian Bay, Muskoka, and Kingston, and was considered common throughout the southern portion of the province north to southern Georgian Bay and east to Durham County. However, severe winters, more intensive farming practices, and the use of herbicides have all taken their toll, and severe consecutive winters in the 1970s, plus further habitat destruction, have driven the species to near extirpation in Ontario. Numbers have not recovered in the 1980s, despite agricultural trends towards less intensive land uses, a new emphasis on conservation, and milder winters. Native bobwhites are now found only in extreme southwestern Ontario, primarily in Lambton, Middlesex, and Elgin Counties. In 1972-1973 there were 1,055 coveys (or 116 bobwhites per 10-km square) in the five counties of Middlesex, Elgin, Lambton, Kent and Essex, but a 1989-1990 survey estimated that a population of only 185 bobwhite existed in 16 coveys throughout Lambton, Middlesex, and Elgin Cos. The species has been released in many locations as far north as Ottawa, but release efforts have largely been unsuccessful due to a high mortality rate in released birds. It is likely that any bobwhites seen north of a line running from Hamilton to London are released stock or their progeny. The bobwhite responds well to management practices, and it seems clear that some sort of management program is needed in Ontario if the species is to survive. Because of this need for management practices, together with dramatic declines in both numbers and range, continued threats to remaining pockets of suitable habitat, and the current scattered, low population level in Ontario, it is recommended that the Northern Bobwhite be designated as "Endangered" in Canada.

B. DISTRIBUTION

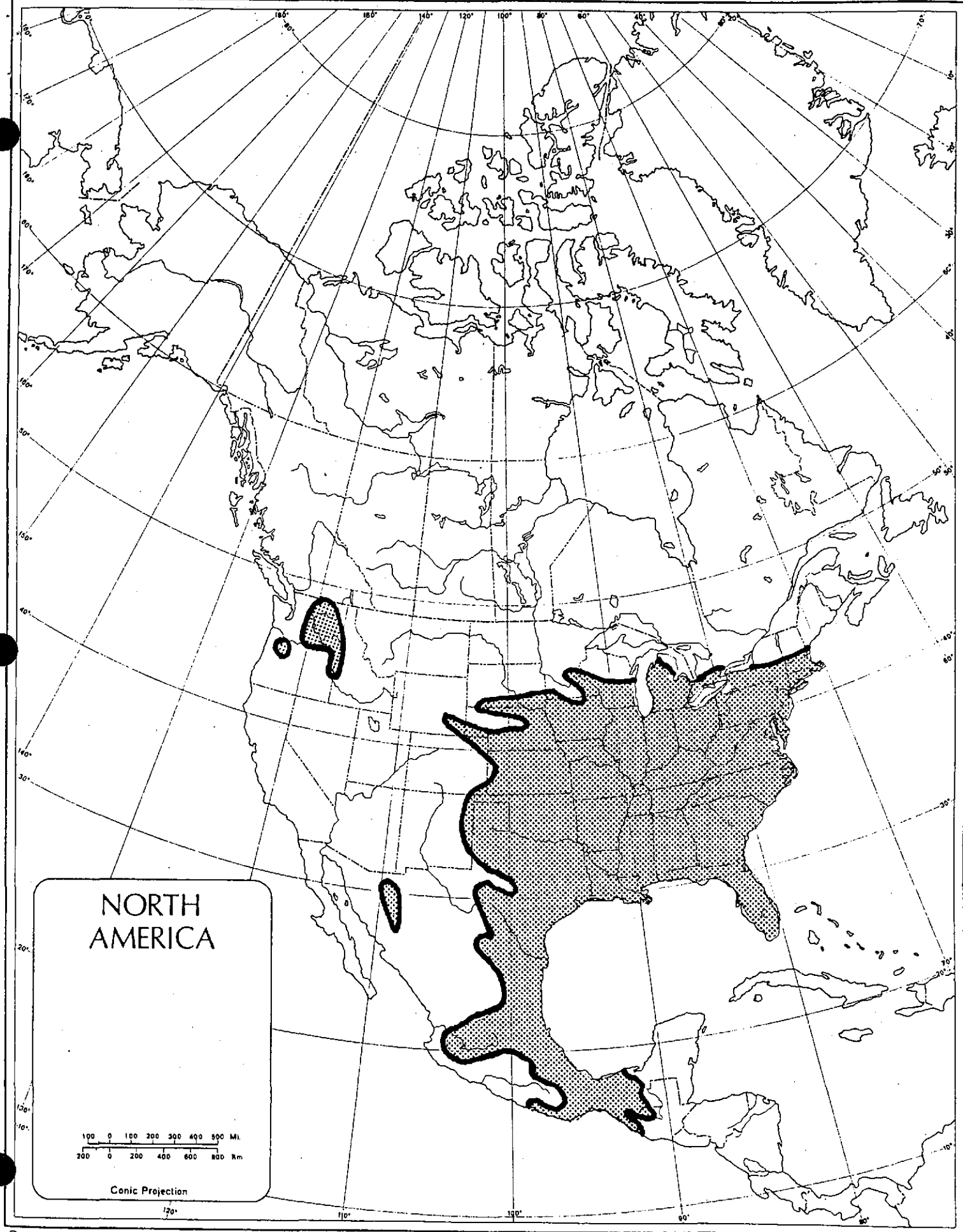
B.1. Americas

The Northern Bobwhite is a permanent resident from southeastern Wyoming, central South Dakota, southern Minnesota, southern Wisconsin, central Michigan, southern Ontario, southern New York, southern Vermont, southern New Hampshire and southern Maine south through the central and eastern United States (west to eastern Colorado, eastern New Mexico and west-central Texas) to Florida (except the Florida Keys), Cuba, the Isle of Pines, Gulf coast, and eastern and southern Mexico, west to eastern Coahuila, western San Luis Potosi, southeastern Nayarit, eastern Jalisco, Guanajuato, the state of Mexico, Puebla and Oaxaca, east to Tabasco, eastern Chiapas and extreme northwestern Guatemala (Nenton-Comitan valley), and in the Pacific lowlands from central Guerrero to southern Chiapas; also in southeastern Arizona (formerly, extirpated late 1890s, reintroduction attempts not certainly successful) and eastern Sonora (A.O.U. 1983; see Figure 1).

The species has been introduced and established in western North America (southwestern British Columbia, Washington, Oregon, Idaho and Montana), the West Indies (Hispaniola, Puerto Rico, St. Croix, and Andros and New Providence in the Bahamas) and New Zealand. Attempted introductions elsewhere (widely in the Hawaiian Islands, West Indies and Europe) have been unsuccessful as permanently established populations (A.O.U. 1983). Godfrey (1986) stated that the population in southwestern British Columbia (Huntingdon) persisted for several years, but had out.

B.2. Canada

In Canada, the Northern Bobwhite is a permanent resident only in southern Ontario, where its range has fluctuated greatly within historic times (Godfrey 1986; see Figure 2). The species was probably present in the extreme southwest (Kent and Essex Cos.) prior to European settlement (Lumsden 1987), but with the settlement and clearing of land the bobwhite spread rapidly; by 1856 it was found north to southern Georgian Bay, Muskoka, and Kingston (Clarke 1954). Since that time, however, the range has declined considerably. At present its distribution in Ontario is localized and confined largely to the Carolinian Forest Region and the Southern Great Lakes Forest Region (Table 1) in extreme southern Ontario, north to Lambton, Middlesex and Elgin Cos. and rarely to southern Huron Co. and Hamilton (Cadman *et al.* 1987; James 1991; see Figure 3). However, the species has been released in several localities in the province as far north as Ottawa (James 1991), and north of a line running from Hamilton through London it is believed that virtually all of the bobwhite records refer to stocked birds or their progeny; bobwhites are unlikely to survive winters north of this line (Lumsden 1987). Bobwhites are concentrated in southwestern Ontario, particularly in Elgin, Middlesex, and Lambton Cos. (OMNR News Release 1992; see Figure 3). Their scarcity in Essex Co. is due to the absence of woody cover and grassland. Lumsden (1987) noted that the bobwhite's distribution in Ontario was essentially complementary to the Ring-necked Pheasant, perhaps due to competition (Edminster 1954).



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Figure 1. Distribution of the Northern Bobwhite in North America.

THE BOB-WHITE QUAIL IN ONTARIO —

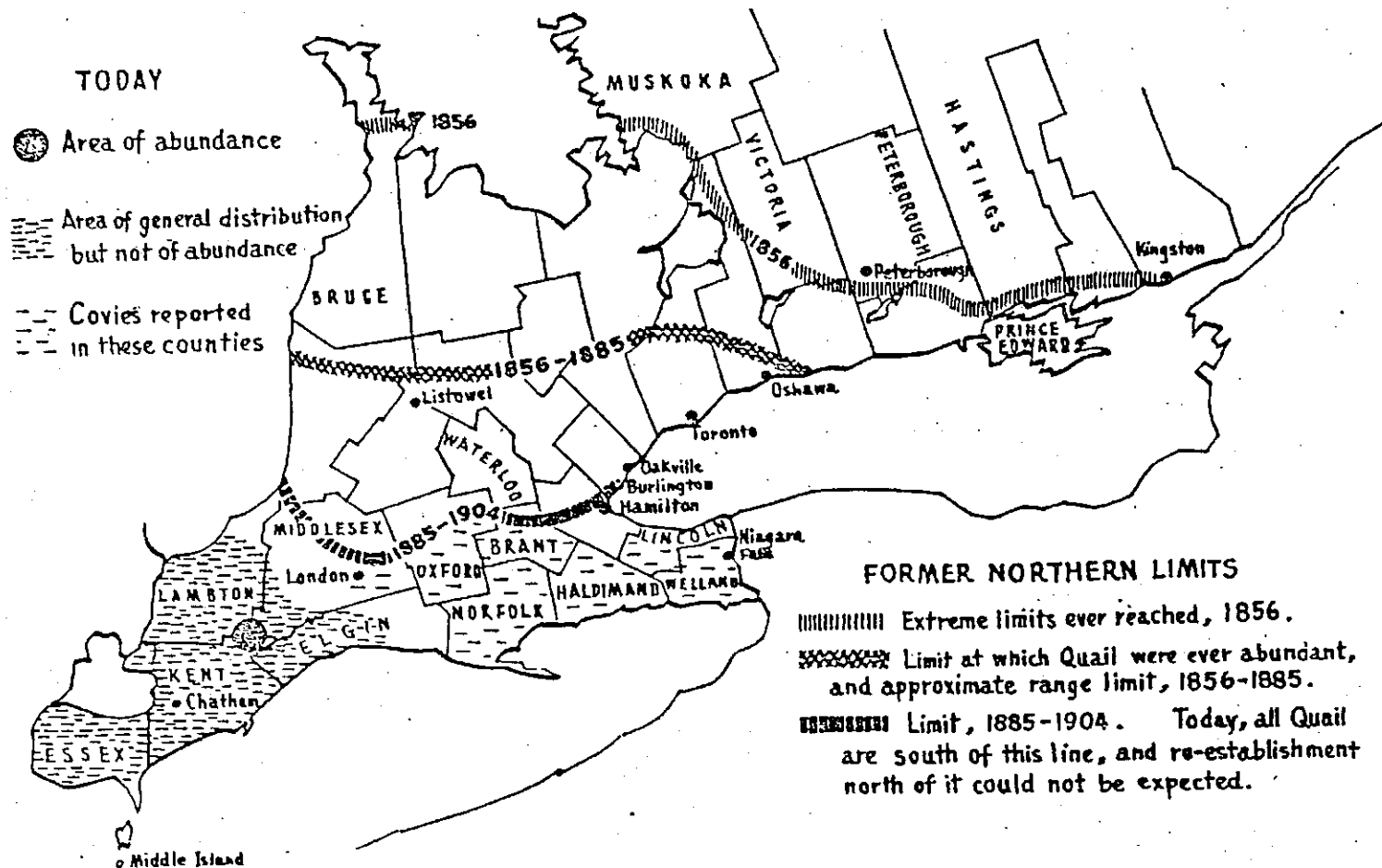


Figure 2. Distributional change of the Northern Bobwhite in Ontario, 1856 to 1954 (from Clarke 1954).

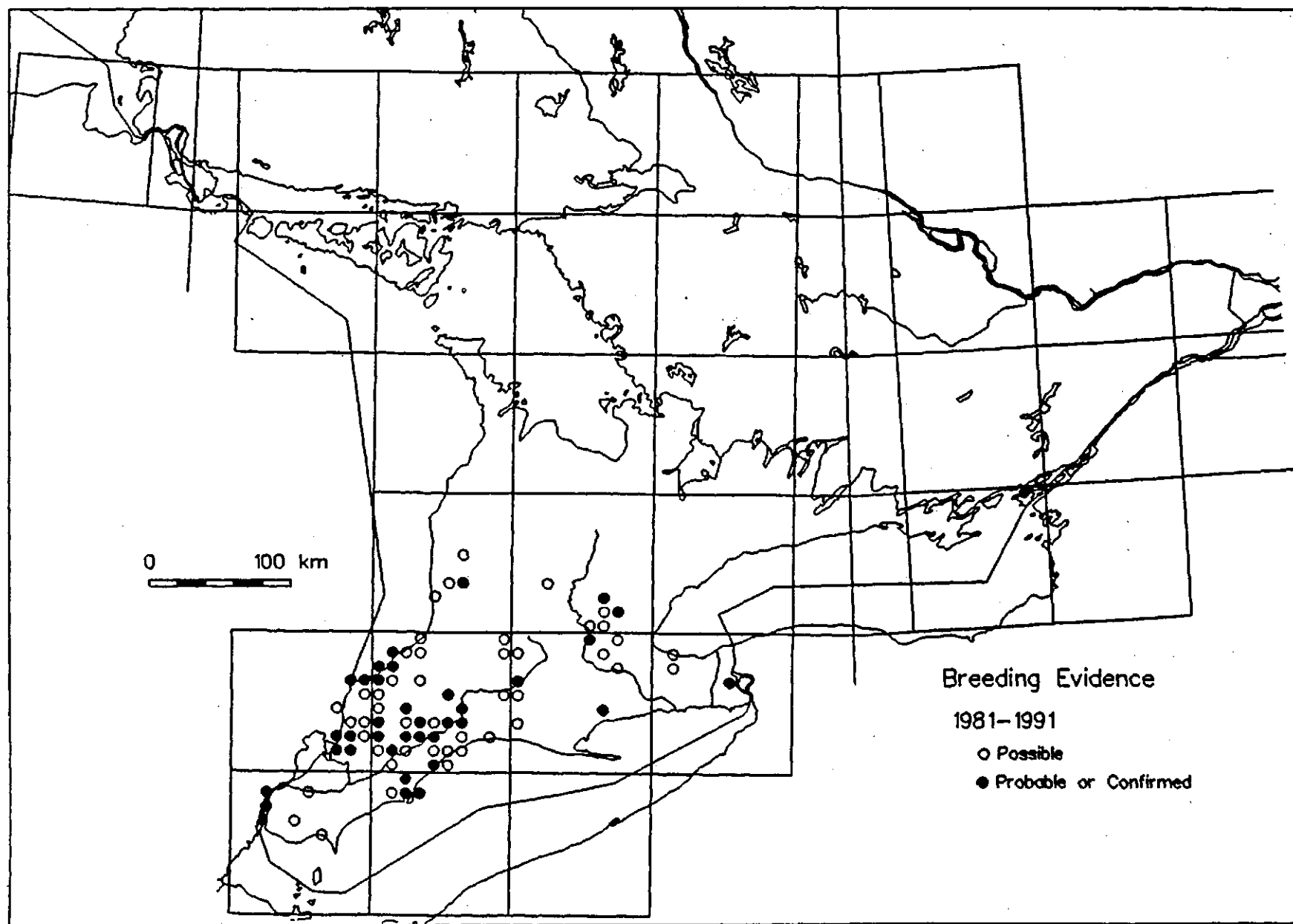


Figure 3. Symbols denote 10-km squares (within 100-km blocks) in which the Northern Bobwhite was reported to the Breeding Bird Atlas and the Ontario Rare Breeding Bird Program in Ontario.

Table 1. Summary of Northern Bobwhite records from the Atlas of the Breeding Birds of Ontario by Site Region.

<u>Region</u>	<u># of Squares</u>	<u>% of squares*</u>	<u>% frequency in Region</u>
1. Hudson Bay	0	0.0	0.0
2. Northern Boreal Forest	0	0.0	0.0
3. Boreal Forest	0	0.0	0.0
4. Southern Boreal Forest	0	0.0	0.0
5. Northern Great Lakes Forest	0	0.0	0.0
6. Southern Great Lakes Forest	17	2.7	21.5
7. Carolinian Forest	62	18.8	78.5

* Number of squares for which data were received during the breeding bird atlas:
 164 squares in Region 1 887 squares in Region 5
 368 squares in Region 2 638 squares in Region 6
 713 squares in Region 3 329 squares in Region 7
 558 squares in Region 4

During the Atlas of the Breeding Birds of Ontario (1981-1985), Northern Bobwhites were reported in only 79 (4%) of 1824 10-km squares surveyed, with breeding confirmed in 19 (24%) of these squares (Cadman *et al.* 1987). Bobwhites were reported to the ORBBP from six squares in four regions (Lambton, Hamilton-Wentworth-Brant, Wellington, and Peel-Halton): in Brant County a maximum of six singing males were heard in late May/early June, 1990 near Middleport; in Wellington County a singing male was heard near Conestogo Lake on July 1, 1989, but was not heard on the next two days or at the same time of year in 1990; an adult and brood were found at Mountsberg, Wellington County on July 31, 1985, even though bobwhites had not been released in the area for the preceding four years; a singing male (probably released stock) was found at Arkell, Wellington Co., on August 5, 1985, but no birds were reported at the site from 1986 to 1991; and in Lambton County in 1991, a minimum of three territories were reported to the ORBBP from Walpole Island in the area of the Chematogan Motel, and a singing male was reported near the Sombra sewage lagoons on May 12. Kelley (1978) reported that the bobwhite population had increased to "86 birds on a 1974 Breeding Bird Survey in Sombra Township", indicating that this is an important area for the species in Ontario.

Walpole Island appears to be one of the most important bobwhite locations in Ontario. The species was recorded in 23 natural areas on the island in 1986, 11 of which were of "confirmed" breeding (the observation of fledged young) (OMNR, unpubl. report). In 1993, during a Henslow's Sparrow survey conducted on Walpole Island, Madeline Austen recorded a minimum of seven singing males at three prairie sites (Pottawatamie Prairie, Altman Prairie, and the North Nature Trail). Northern Bobwhites appear to be relatively abundant on Walpole Island,

but that area was not thoroughly surveyed for them during the ORBBP. Suitable habitat (grassland, cropland, and brushy cover in close proximity to one another) is in good supply on Walpole Island, hence the species' relative "abundance" there.

The Northern Bobwhite has been introduced into many parts of southern Canada, mostly without permanent success (Godfrey 1986). In 1952, it was released in Nova Scotia, where known breeding occurred in 1954 and 1955 (Erskine 1992). The species was also introduced into southwestern British Columbia (Huntingdon) where it persisted for a number of years before dying out (Godfrey 1986).

C. PROTECTION

Legislation controlling hunting of the Northern Bobwhite in Ontario has changed many times since settlement, reflecting periods of ups and downs in the bobwhite's population in the province. A bobwhite hunting season was set in Ontario for the first time in 1839, when no hunting was allowed between March 1 and August 31 (Clarke 1954). There is no indication that this was due to any concern over bobwhite numbers. In 1856, the Game Laws of Upper Canada were adopted, stating that no bobwhites could be taken or killed between February 1 and October 1 in any year (Clarke 1954). Then, in 1868 the bobwhite season was cut to two months, and the season was closed from 1871 until 1877 because of concerns over bobwhite numbers in the province (Clarke 1954). The species recovered after that closure, but in 1885 there was another setback in the population and the season was closed in 1886 and 1887 (Clarke 1954). The season was closed again in 1904 and 1905, and from 1920 to 1923 inclusive (Clarke 1954). In 1924, 1925, 1932, and subsequent years up until 1944 the season was open for a few days, but Clarke (1954) stated that "1944 was the last. Then they had another setback and nobody has had the heart to shoot them since." Currently, it is illegal to shoot bobwhites in Ontario except during a limited hunting season, which ran from October 30 to November 7 in 1991, in Wildlife Management Unit 92 (Anon 1992). However, hunting pressure for, and harvest of, bobwhites in southwestern Ontario has been minimal to non-existent since the early 1980s (OMNR Fact Sheet 1992).

Two sites reported to the ORBBP (Mountsberg and Conestogo Lake in Wellington County) are publicly owned, but the species has not been reported from Mountsberg since 1985 or from Conestogo Lake since 1989 (ORBBP files). Most recent ORBBP records are from Walpole Island, owned by the Walpole Island Indian Band.

D. POPULATION SIZE AND TREND

Globally, the Nature Conservancy considers the Northern Bobwhite to be demonstrably secure, and Breeding Bird Survey (BBS) data indicate that it is generally widespread and common in the eastern United States, but there is evidence that the species has suffered declines throughout its range in North America. It was nominated for inclusion on the Blue List in 1975 (Western Great Lakes region), 1976 (Middlewestern Prairie region), 1977 (Middlewestern Prairie region) and 1978 (Western Great Lakes region), but was officially Blue Listed only in 1980 and 1981. The bobwhite was Blue Listed in 1980 because of two recent severe winters which decimated more northerly birds (Arbib 1979). In 1981, populations in most areas showing a decline the previous year were stable or recovering, but Missouri, Oklahoma, Kentucky, and Illinois still favoured retention (Tate 1981). By 1982, the bobwhite's recovery from previous severe winters seemed nearly complete, and the local problems remaining were suggested to be associated with land use patterns (Tate and Tate 1982). Consequently, in 1982 the species was removed from the Blue List and added to the "Species with Special Concerns" List, and in 1986 it was further upgraded to the "Local Problem Species" List. A Blue List has not been published since 1986.

Suitable bobwhite habitats are well covered by the Breeding Bird Survey (BBS). Because of this, and the fact that male bobwhites sing frequently during the breeding season and during morning hours when BBS routes are run, the species is well-represented by BBS results. The BBS is the best long-term survey that is available to examine trends in Northern Bobwhite populations and covers a large proportion of the species' breeding range. BBS data from 1966 through 1988 show a highly significant decrease ($p < 0.01$) in the North American (average rate of 2.3% per year), the eastern North American (average rate of 3.4% per year), and the U.S. (average rate of 2.3% per year) populations of the Northern Bobwhite (Austen and Cadman 1994). The species was recorded on too few routes in Canada to determine a population trend (Austen and Cadman 1994). Robbins *et al.* (1986) also found a significant decrease in the continental population from 1966 to 1979, with decreases in the Great Lakes states, the northeastern states, and the southeastern states. Declines were noted in populations in the eastern region in response to the harsh winters of 1976-1977 and 1977-1978 (Robbins *et al.* 1986), indicating the vulnerability of this species to colder than normal winters with prolonged snowfall. In addition, BBS data from 1966 to 1979 showed significant decreases in bobwhite populations in 15 states: Kansas, Missouri, Illinois, Indiana, Kentucky, Ohio, Michigan, New York, Pennsylvania, Maryland, Virginia, North and South Carolina, Tennessee, and Mississippi; only Texas showed an increase in bobwhite populations (Robbins *et al.* 1986), but Droege and Sauer (1990) found this to be a non-significant increase. Analysis of BBS data from 1966 to 1988 by Droege and Sauer (1990) found that 27 out of the 30 states with adequate sample sizes (more than nine routes with bobwhites recorded) had negative population trends, and 21 of the 27 negative trends were statistically significant ($p < 0.05$); the only significant increase in numbers was found in Wisconsin. BBS data also indicated that many populations north and east of Indiana underwent a sharp decline in the mid-1970s, while southern populations showed steady rates of decline (Droege and Sauer 1990).

According to the Nature Conservancy, the Northern Bobwhite is secure in the majority of the northeastern and northcentral United States, but is considered an accidental in Maine, an exotic in Vermont, and of historical occurrence in New Hampshire (Table 2). In Minnesota, the status of the species is uncertain and it is deemed "unrankable" at present, and in Ohio the status has not been decided (Table 2). Northern Bobwhites do not have an official status designation in any of the northeastern and northcentral states listed in Table 2.

State Breeding Bird Atlas data (Table 3) indicate that Northern Bobwhites are fairly common breeding birds in the northeastern and northcentral United States, with a few exceptions. Bobwhites did not breed in Maine, and were found in low numbers (less than 5% of blocks surveyed) in New Hampshire, New York, and Vermont. Although bobwhites were recorded as "possible" and "probable" breeders during the New Hampshire Atlas, the Nature Conservancy considers them to be historical breeders in the state (Table 2). Bobwhites observed in Vermont are assumed to be from release programs. In New York, bobwhites were found in only 4.4% of Atlas blocks surveyed, but the Nature Conservancy rank suggests that the species is apparently secure in the state (Table 2). The Northern Bobwhite was once well established in western New York (Robeson 1969-1970), but has greatly decreased in that state in recent years (Bull 1974). Eaton (1910) stated that it was formerly well distributed as far north as Jefferson, Oneida, Saratoga, and Washington Cos., but by 1910 the species had practically disappeared from the interior of the state and was rare everywhere except for Long Island, the Lower Hudson Valley, and the Delaware Valley. The bobwhite is now virtually confined to Long Island, and records from other locations in the state are probably of released birds raised in captivity for hunting (Levine 1988). Currently, the species is described as uncommon to rare in New York state (Levine 1988), but Christmas Bird Count data from Long Island (Kings, Queens, Nassau, and Suffolk Cos.), where the only really viable wild population now exists in the state, showed a maximum count of 828 bobwhites in 1972 but only 361 birds in 1985 (Levine 1988). Based on these data, Levine (1988) stated that "perhaps the word uncommon is too liberal a term to describe the status of the species" in New York.

The bobwhite is at the northern edge of its range in Michigan, where it is found in much of the Lower Peninsula but is well represented only in the southern portion (Dziepak 1991). Similar to Ontario, bobwhites were probably most common in southern Michigan during presettlement days, inhabiting prairie edges and oak savanna, and spread north throughout the Lower Peninsula with the clearing of land (Dziepak 1991). The Michigan Department of Natural Resources has conducted quail whistling counts since 1973 in 36 counties. Results show that the average number of quail heard per route dropped from between 21 and 29 (1973-1976) to between 1.6 and 5.3 since 1978 (Dziepak 1991). The marked decline in numbers was related to the severe winters of 1977-1978 and 1978-1979 and the reduction of old field and fence row acreage (Robbins *et al.* 1986; Adams *et al.* 1988). Low population numbers resulted in a closed hunting season on quail in Michigan from 1979 to 1987 (Nederveld, pers. comm. in Dziepak 1991), and the present area open to hunting consists of all counties east of a line from Saginaw, Ingham, Jackson, and Branch in the southeastern Lower Peninsula (Dziepak 1991). The species is still rebounding from the harsh winters of the late 1970s, and it is presently common in Michigan only in the southeastern Lower Peninsula (Dziepak 1991). In the southwest, bobwhites

Table 2. Available State Nature Conservancy Ranks and Official Status Designations for the Northeastern and Northcentral United States.*

<u>State</u>	<u>Rank</u>	<u>Designation</u>
Connecticut	S4	Not Listed
Delaware	S5	
Iowa	S5	
Illinois	S5	Not Listed
Indiana	S4	Not Listed
Kentucky	S4S5	Not Listed
Massachusetts	S5	Not Listed
Maryland	S5	Not Listed
Maine	SA	Not Listed
Michigan	S4	Not Listed
Minnesota	SU	Not Listed
New Hampshire	SH	Not Listed
New Jersey	S5	Not Listed
New York	S4	Not Listed
Ohio	S?	Not Listed
Pennsylvania	S4	Not Listed
Rhode Island	S4B,S4N	
Virginia	S5	Not Listed
Vermont	SE	Not Listed
Wisconsin	S3B,SZN	Not Listed
West Virginia	S5	Not Listed

* Ranks as of 1993; Designations as of 1990.

** B refers to breeding status; N refers to non-breeding status.

- S3 = Rare and uncommon in the state (21 to 100 occurrences)
- S4 = Widespread, abundant, and apparently secure in state, with many occurrences, but the species is of long-term concern (usually more than 100 occurrences).
- S5 = Demonstrably widespread, abundant, and secure in state, and essentially ineradicable under present conditions.
- SA = Accidental or casual in the state, including species recorded once or twice or only at very great intervals, hundreds or even thousands of miles outside their usual range.
- SE = An exotic established in the state; may be native elsewhere in North America (e.g., house finch).
- SH = The species occurred historically in the state (with expectation that it may be rediscovered), perhaps having not been verified in the past 20 years, and suspected to be still extant.
- SU = Unrankable. Possibly in peril in state but status uncertain; need more information.
- SZ = Zero occurrences: not of practical conservation concern in the state, because there are no definable occurrences, although the taxon is native and appears regularly in the state. Generally used for long-distance migrants whose occurrences during their migrations are too irregular, transitory, and dispersed to be reliably identified, mapped, and protected.
- S? = Unranked. Species is not yet ranked in the state.

Table 3. Breeding Bird Atlas Data Summaries for the Northeastern and Northcentral United States.

State	Years of Survey	# of blocks surveyed	# and % of blocks with breeding records				
			poss.	prob.	conf.	total	(%)
Conn.	1982-86	597	86	56	24	166	27.8
Del.	1983-87	222	10	142	68	220	99.1
Ill.	1986-90	1011	135	361	151	647	64.0
Ky.	1985-91	727	392	113	63	568	78.1
Me.	1978-83	706	0	0	0	0	0.0
Md.	1983-87	1256	555	187	312	1054	83.9
Mass.	1974-78	1116	35	120	124	279	25.0
Mich.*	1983-88	1896	271	125	70	466	24.6
N.H.	1981-86	178	5	1	0	6	3.3
N.Y.	1980-85	5323	50	67	119	236	4.4
Ohio	1982-87	969	108	203	135	446	46.0
Ohio**	1982-87	764	100	180	122	402	52.6
Penn.	1983-89	4928	405	233	75	713	14.5
R.I.	1982-88	165	13	30	12	55	33.3
Vt.	1976-81	179	5	1	0	6	3.4
W. Va.	1984-89	502	63	37	33	133	26.5

* = based on townships

** = priority blocks

may be scarcer now than at the time of settlement (Dziepak 1991). Atlas and BBS data show the bobwhite as scattered and rare in the northern Lower Peninsula, and most observations of Upper Peninsula birds are products of releases (Dziepak 1991).

In Ohio, bobwhites are also subject to dramatic fluctuations in response to winter weather conditions (Peterjohn and Rice 1991). Between 1970 and 1975, during a series of relatively mild winters, bobwhites became rather numerous within the southern half of Ohio and were fairly regularly encountered elsewhere. However, after the severe winters of 1976-1977 and 1977-1978, bobwhite numbers in Ohio were reduced by more than 90% (Peterjohn and Rice 1991). Since then, the population has slowly increased and the species was more numerous in 1986 and 1987, with concentrations in the Illinoian Till Plain region (Peterjohn and Rice 1991). These dramatic fluctuations can mask long-term trends but, despite this, bobwhite numbers showed a

noticeable decline when current peak numbers were compared with those of previous peaks (Peterjohn and Rice 1991). Loss of suitable habitat is believed to be the primary factor causing the decline in Ohio; fallow fields have been lost through secondary succession while pastures and hayfields have been converted to cultivated crops (Peterjohn and Rice 1991).

Canada

The Nature Conservancy considers the Northern Bobwhite to be rare or uncommon (on the order of 21 to 100 occurrences) in Canada and Ontario, the only province in which the species is native. The species is ranked as SE (an exotic established in the province) in British Columbia, but the bobwhite population in that province has apparently died out (Godfrey 1986). The species is not listed as a resident in Quebec by either Godfrey (1986) or the A.O.U. (1983), and it was not recorded during Quebec's Breeding Bird Atlas project (1984-1989) (J. Gauthier, pers. comm. 1992), but the Nature Conservancy has assigned the species a ranking of S1 (critically imperiled because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation) in Quebec.

Archaeological and historical evidence on the bobwhite's status in southern Ontario prior to European settlement is not clear (Prevett 1990 in Anon. 1992); it was probably rare at that time (Taverner 1919), but it was likely present in Kent and Essex Cos. where tall-grass prairie was common (Lumsden 1987). Advancing settlement opened up new ground for the species (Taverner 1919) and, it colonized Ontario further as forests were cleared, expanding to the east and the north. By 1810, it had spread eastward to Norfolk Co., and by 1816 it had been recorded in Hamilton.

William Pope, a naturalist that kept journals documenting his observations on wildlife in Upper Canada, noted the following observations about Northern Bobwhites: In May 1834, Pope marvelled at the great number of partridge [bobwhite] near Port Stanley. A total of 548 Bobwhite were shot by Pope from May 2, 1834 to June 3, 1835 on his first visit to Canada and the United States; the majority of birds shot (548 out of 1531, or 36%) were bobwhites (Barrett 1976). In 1843, Pope reported that the winter had been a very long and severe one, with snow depths of two feet or more, and that the bobwhite had suffered considerably as a result (Barrett 1976). In his diaries, Pope makes the following statements about the Partridge [bobwhite]: "of all the different descriptions of game to be found in Canada, the kind from which I derive the greatest sport...is the partridge...The birds being very plentiful and the coveys large" (Barrett 1976). Pope reports shooting 7 1/2 brace of partridges (15 birds) in a day in his journals. Pope also noted that bobwhites used to be trapped near barns in heavy snowfalls (Barrett 1976).

The bobwhite reached peak numbers in Ontario in the 1840s, and by 1856 it had attained its maximum range in the province, extending north to Georgian Bay and Muskoka, and east to Kingston (Clarke 1954; see Figure 2). However, its range as a "common" breeding species extended north to south Georgian Bay, and east only to Durham Co. (Baillie and Harrington 1936), with the centre of its abundance being London (Harris 1905 in Clarke 1954). The species was occasionally heard in the woods and fields near Toronto east to Port Hope as far back as

1853 (Fleming 1907), and in the early 1880s it was described as common by Morden and Saunders (1882). Four years later, however, McIlwraith (1886) stated that the bobwhite was "greatly reduced and in need of protection" in Ontario. He also noted that "sometime ago" the Ontario Government passed an Act prohibiting the killing of Quail for a period of three years, which, in combination with a series of mild winters, increased their numbers. Hard winters and more intensive agriculture caused a retreat, so that by the late 1800s and early 1900s, few bobwhites were found north of Hamilton and London (Chamberlain 1887; Clarke 1954; see Figure 2), and after 1904, London was at the fringe of the species' range in Ontario, not the centre (Clarke 1954). In 1816-1817, there were reports of "great numbers" of bobwhites along the lakeshore in Peel Co., and the species was plentiful in the county up until the 1860s and 1870s (Bull 1936). A "nice covey, the likes of which had not been seen for years", was found in Peel Co. in 1908, but wild birds have not been reported from there since (Bull 1936). None were present in the Kingston area after 1859 (Clarke 1954), and the species has never regained its foothold there (Weir 1989). It is currently considered to be a very rare permanent resident in the Kingston region that depends on restocking for its continued existence (Weir 1989).

The bobwhite was formerly very common in Haldimand-Norfolk R.M., and in the 1800s Norfolk Co. was ranked as one of the best districts for market shooting of the bird (Harris 1905 as cited by Snyder and Logier 1931). However, populations collapsed there by the turn of the century, after which there are very few records (McCracken 1987). In the 1950s, there was still plenty of good bobwhite cover in Norfolk Co., but the predominant tobacco crops provided no food at all (Clarke 1954). Similarly, although sufficient brushy cover remained at Point Pelee in the 1950s, the change from corn crops to asparagus crops and orchards resulted in very little available food for the species, and its status there consequently changed from abundant to almost non-existent by the 1950s (Clarke 1954). Alan Wormington (pers. comm. 1990) stated that the species still bred in agricultural lands immediately north of Point Pelee National Park in the late 1960s and early 1970s, but that it probably hasn't bred within the park in decades (although stray individuals were probably regular there). He believes that the harsh winters of the mid-1970s likely eliminated the remaining wild birds, and that all bobwhites now found in the Point Pelee area are from released stock. Bobwhites used to breed quite commonly throughout Middlesex Co., but their numbers became depleted until they almost disappeared (Saunders and Dale 1933). However, they also stated that recent protection of the species resulted in restoring it to a measure of its former abundance in the county. Baillie and Harrington (1936) referred to the bobwhite as very much reduced in numbers, and stated that it is found in numbers only in the southwestern counties bordering Lakes Erie and St. Clair.

Between 1856 and the 1930s, the bobwhite population in Ontario experienced several periods of decline in numbers and range, and then recovery (Clarke 1954). During the recovery periods, numbers always rebounded, but the lost range was never recovered. There was always a portion of the northern fringe of the range in which the species never again became really abundant, and which was lost in the next period of decline (Clarke 1954). Between the 1930s and the 1950s, the bobwhite's range stayed the same, but the area of abundance shrunk (Clarke 1954; see Figure 2).

By 1940, the species was locally extinct in Darlington, although it was formerly quite plentiful (Allin 1940). Snyder (1951) noted rare occurrences of bobwhites in Middlesex and Norfolk Cos., although they were normally restricted to Essex, Kent and Lambton Cos. Elgin Co. had flocks numbering as high as twenty birds recorded on occasion (Brooman 1954), and Snyder (1957) reported occurrences in southern Huron, Oxford, Brant, and Lincoln Cos.

By the 1950s, the area of abundance was limited to the Bothwell sands in portions of Lambton, Kent, and Middlesex Cos. Most other coveys in the province were in Lambton Co., but the species also existed in suitable spots in Essex, Kent, West Elgin, Haldimand, Norfolk, and Oxford Cos., the Niagara Peninsula, and the London area (Clarke 1954).

By the mid-1960s, the species was classed as an introduced, very rare species in the Niagara Frontier region (Beardslee and Mitchell 1965). Baillie (1967) stated that it had been reduced to a small remnant of its former population in the province, with local extirpations reported in Simcoe Co., where it was formerly common in the southern sections (Devitt 1967). At one time the bobwhite was abundant in Peterborough Co., but by the early 1980s it was no longer found within or near the county (Sadler 1983).

Northern Bobwhite numbers had become extremely low in Ontario by the 1980s (Eagles and McCauley 1982), and the species had retreated back into three or four counties in the extreme south of the province (Peck and James 1983). Holdsworth (1973) estimated that in 1972-1973 there were 1,055 coveys (or 116 bobwhites per 10-km square) in winter in the five counties of Middlesex, Elgin, Lambton, Kent and Essex. However, back-to-back severe winters in the 1970s, together with habitat destruction, drove the species to near extirpation in Ontario, and numbers have not recovered in the 1980s despite agricultural trends towards less intensive land uses, a new emphasis on conservation, and milder winters (Anon. 1992). During the Atlas period (1981-1985), the bobwhite was reported from only 79 squares in the province (Lumsden 1987). Converting Atlas figures to winter estimates (75% pairs successful, 3.38 immatures per adult, Edminster 1954), there could have been 20 to 135 birds per 10-km square during the Atlas years. Holdsworth's estimate is closer to the upper limit of this estimate, suggesting that a decline could have occurred since 1972-1973, which agrees with subjective assessments of knowledgeable birders (P.A. Woodliffe, pers. comm. in Lumsden 1987). The Atlas abundance estimate for bobwhites in Ontario was approximated to be 232 to 1545 breeding pairs (using a maximum limit of 100 breeding pairs per 10-km square), but a 1989-1990 rural mail card survey (Hunter 1990) estimated that a population of 185 quail existed in 16 coveys throughout Lambton, Elgin, and Middlesex Cos. Dave Ankney (pers. comm. 1993) estimated that in 1989, a population of approximately 200 birds, possibly as many as 400, existed in Ontario. Only 15 bobwhite nests have been reported to the Ontario Nest Record Scheme. ORBBP Regional Coordinators and other knowledgeable individuals noted rapid declines in bobwhite numbers between 1950 and 1990 in Elgin and Middlesex Cos., while slow declines were reported between 1950 and 1980 in Niagara R.M. and Wellington Co.; rapid declines in numbers were reported between 1981 and 1990 in Kent Co. and Niagara R.M. Between 1977 and 1990, the species was reported in only one year (1988) on the Blenheim (Kent Co.) Christmas Bird Count, but prior to 1977 it was seen nearly every year; in 1971, a high of 71 were counted (K. Burke, pers. comm. 1990). In Kent Co., bobwhites are found primarily on the Cedar Springs Rifle Range and Rondeau Provincial Park (K. Burke, pers. comm. 1990).

The native stock of Northern Bobwhite is definitely very low in Ontario; it is believed that the birds remaining in the extreme southwest are still wild stock, but any seen north of a line running from Hamilton to London are likely released stock or their progeny. Native populations are small and disjunct and persist only in the Aylmer and Chatham districts (e.g., Walpole Island) (Hunter 1990). The species is considered to be a regular, widespread breeder in Lambton Co., where it suffered a crash in the mid- to late-1970s and has now rebounded somewhat, but not to pre-1975 levels (S. Connop, pers. comm. 1990). Many bobwhite releases have been conducted in southern Ontario over the years (e.g., Muskoka/Parry Sound area in 1966 (Mills 1981); Manitoulin Island (Nicholson 1972); and the Oshawa-Lake Scugog region (Tozer and Richards 1974)) in an attempt to replenish numbers at least to a level where the population could sustain hunting. By 1976 the species had been released in several locations as far north as Ottawa (James *et al.* 1976), but release efforts appeared to be largely unsuccessful (Peck 1976). Near Hall's Pond in Wellington Co., a small population, doubtless of introduced stock, appeared to be maintaining itself as of 1977 (Brewer 1977); it seems likely, however, that this population perished during severe winters in the late 1970s, as no bobwhites were reported from that area during either the Atlas or the ORBBP. A high mortality (approximately 50%, D. Ankney pers. comm. 1993) occurs in released birds, and Speirs (1985) reported that these birds seldom survive more than one winter. For example, in 1987, 300 birds were released at the Hullett Provincial Wildlife Area near Clinton, but there was little or no survival (probably due to snow cover) and the project was discontinued (B. Pegg, pers. comm. 1990). Commercial breeders across Ontario are allowed to raise and release Northern Bobwhites, so the species can turn up anywhere (Lumsden 1987). The bobwhite is currently believed to exist only as released stock in Durham region (M. Bain, pers. comm. 1990), the Point Pelee area (A. Wormington, pers. comm. 1990), the Hamilton area (K. McLaughlin, pers. comm. 1990), Niagara District (B. Lewies, pers. comm. 1990), Lindsay District (B. Snider, pers. comm. 1990), Prince Edward Co. (T. Sprague, pers. comm. 1990), Cornwall District (M. Eckersley, pers. comm. 1990), and Simcoe District (D. Reid, pers. comm. 1990).

In addition to having low survival rates, released stock from other areas can reduce the vitality of the original native population, and this is cited as one of the reasons for the decline and reduction in range of the bobwhite in New York (Bull 1974). Released stock may also be contributing to the bobwhite's decline in Ontario, but a pilot bobwhite rehabilitation program will be implemented in 1993, using wild stock from southern Michigan populations. The Ontario Ministry of Natural Resources and the Ontario Federation of Anglers and Hunters are coordinating a program to release 300 bobwhites in southwestern Middlesex Co. (Bothwell area) and east-central Elgin Co. (Port Stanley) in an effort to link scattered bobwhite populations and increase their numbers within their range (Dear 1992; OMNR Fact Sheet 1992). Birds will be checked by the OMNR to ensure that they are genetically compatible with native populations and are disease-free (OMNR News Release 1992). The goal of the project is to reestablish larger sustainable populations of bobwhites in southwestern Ontario in order to provide recreational viewing and hunting opportunities (OMNR Fact Sheet 1992). The first release is expected to occur in March and April of 1994, with 200 to 300 more birds being released in the same two areas the following year (OFAH Fact Sheet; Dear 1992). Healthy bobwhite populations may be suitable indicators for monitoring the shrubland-forest ecotone and may help control some crop pests (Anon. 1992).

E. HABITAT

E.1. Habitat preferences

Because of its sedentary nature, the Northern Bobwhite requires grassland, cropland, and brushy cover in close proximity to one another throughout the year. The species was originally found on prairie fringes and savannas in Ontario, but is now usually associated with cultivated areas growing grain crops or corn, or weedy abandoned farms near brushy patches or edges which provide shelter. It requires grassland such as prairie, hayfields, drainage ditches, and roadside and pond edges in spring and summer for nesting cover, some feeding cover and limited roosting cover; croplands during the summer and fall for feeding, loafing, dusting, and limited roosting sites; and dense, brushy areas such as thickets, tangles, and shrubs on fence rows or woodlot borders throughout the year for escape and roosting cover, and for feeding during the fall and winter (Edminster 1954; Lumsden 1987). A maximum of habitat interspersion and edge margins between habitat types is also important. Based on information from the U.S., Rosene (1969) stated that as long as areas are managed properly, the percentage of land in cropland, forest, or idle land can vary tremendously. Preferred dusting areas in the U.S. are open, with dry and rather powdery bare soil and sparse vegetation less than 0.3 m high (Rosene 1969; Schroeder 1985). Many of the areas chosen for dusting have been burned over within the past year (Rosene 1969).

Throughout the year, the bobwhite prefers areas where approximately half of the ground is exposed, and half contains upright growth of herbaceous and woody vegetation (Rosene 1969). For protection, small shrubby thickets are needed on every 6 hectares or so in open woods or on field edges (Rosene 1969). Open herbaceous cover with nearly bare ground is required for nesting cover; the vegetation at nest sites is usually under 51 cm high, and the stems must be far enough apart for the birds to be able to walk through easily (Rosene 1969). The nest is usually in dead grass or other herbaceous vegetation which is required for lining the nest. Areas that were not burned the prior spring are preferred over burned areas (Rosene 1969), and areas with poor soil drainage are not used for nesting (Schroeder 1985). In Ontario, nests have been reported in agricultural areas in hay fields, fence rows, and roadsides (one record in a strawberry patch in an orchard); in city parks; and at the edges of golf courses (Peck and James 1983). Small open woodlots and heavy thickets were adjacent to several nests (Peck and James 1983). Rosene (1969) stated that most bobwhite nests are located less than 15 m from openings such as fields, disked strips, roadways, or paths.

The amount and quality of nesting cover in nonagricultural areas is largely dependent on succession, with intermediate successional stages providing better nesting habitat than early or late seral stages (Schroeder 1985). In addition, Schroeder (1985) found that small, isolated patches of potential nest cover located in or near nonbreeding habitats such as croplands or forests in Wisconsin were not frequently used.

According to Schroeder (1985), ideal winter cover in Wisconsin consists of dense thickets of low brush or young pine stands, and each winter covey range requires one to three shrubby thickets 0.05 to 0.2 ha in size. Winter coveys in southern Illinois were found to prefer well-drained spots with a southwest exposure for roosting, and over 60% of the roosts were on bare ground; roosts were in herbaceous plants with a mean height of 59 cm and stem density of 16.9 per square foot (Rosene 1969). Winter cover is relatively scarce in the northern portions of the bobwhite's range (Rosene 1969; Schroeder 1985). On Wisconsin farmlands, woody hedgerows at least 1.8 m wide provided primary winter cover, but bobwhites were eliminated from there as the amount of hedgerows was reduced from 1 km/113 ha to 1 km/164 ha (Schroeder 1985). Favoured wintering areas in New York contained wide hedge rows with dense brush and weed growth (Robeson 1969-1970).

E.2. Distribution of habitat

In Ontario, Northern Bobwhites are concentrated in the southwest, probably as a result of mild winters in that area rather than the habitat being especially good. In fact, even within this viable area, there is not much suitable bobwhite habitat because of intensive agricultural practices. However, where there is good habitat, there are generally bobwhites present, and on Walpole Island, which has a relatively large amount of suitable habitat, there is a relatively large bobwhite population. This suggests that the availability of good habitat within the viable area is restricting the population.

E.3. Trend in quality and quantity of critical habitat

Roseberry and Klimstra (1984) stated that "within any particular region, the long term abundance of bobwhites is mainly a function of habitat condition, specifically the quantity, quality, and distribution of resources such as food, cover, and nesting habitat. In general, cover is a limiting factor in the northern portion of this quail's range." Northern Bobwhite habitat in eastern North America probably initially increased with European settlement and the clearing of the forests, but it has been decreasing for the past century due to succession, urban development and expansion, continued deforestation, and increasingly intensive farming practices which leave little land in a grassy state (Clarke 1954; Lumsden 1987; Ludwig, pers. comm.). In addition to these, the use of herbicides such as atrazine (Lumsden 1987; Ludwig, pers. comm.) has also contributed to the documented declines in bobwhite numbers in eastern North America. According to Clarke (1954) and de Vos (1964 as cited in McCracken 1987), large-scale farming activities are the main reason for the decline in numbers in Ontario. Levine (1988) stated that "the small 19th-century farm with its diverse cereal crops, inefficient harvest techniques, weeds, large hedgerows, and limited predator populations must have presented perfect quail habitat, but as farming became cleaner, more mechanized, and more efficient, habitat quality declined; loss of farmland to forest succession and to development has only hastened the decline." In Michigan, the recent drastic drop in numbers is partially attributed to the reduction of old field and fence row acreage (Dziepak 1991), and similar declines in New

York were partially attributed to agricultural decline and destruction and subsequent development of open country (Bull 1974). In Ohio, long-term declines in bobwhite numbers are credited primarily to a loss of suitable habitat such as fallow fields where weedy vegetation is mixed with brushy cover and small openings, and grassy pastures and hayfields bordered by brushy fencerows and croplands; fallow fields were lost through secondary succession while pastures and hayfields have been converted to cultivated crops (Peterjohn and Rice 1991). In many counties in Ohio, especially those which are intensively farmed, suitable quail habitats have become scarce (Peterjohn and Rice 1991). The preceding is true for southwestern Ontario, as well. Brewer (1977) stated that the species flourished in Wellington Co., Ontario, at the time of early settlement, but as farming became more intensive and better managed it disappeared, probably in the second half of the nineteenth century. A decline in the amount of scrubby pastures on sandy soils and fencerows was noted in Elgin-West from 1950-1990 (H. Lancaster, pers. comm), and habitat declines have also been noted in Lambton Co., where very few fallow fields and vegetation along fence lines remain (S. Connop, pers. comm. 1990).

Shooting was probably less important as a cause of the bobwhite's disappearance in Ontario than habitat loss (Baillie 1967). Before European settlement, there were thousands of hectares of long-grass prairie in Kent and Essex Cos. (Lumsden 1987), but that area of the province has been intensively developed and farmed, and all but small fragments of the prairie habitat has been lost. In addition, the trend away from pasturing in Ontario and the eastern United States has reduced the amount of meadow and the number of grassy fields which provide bobwhite habitat. The area of pasture in Ontario has decreased steadily this century, from over 3 million acres (1.2 million ha) in 1921 to just over 1 million acres (405,000 ha) in 1986, or a 65% decline (Dominion Bureau of Statistics 1968; Statistics Canada 1987). Similarly, summer fallow land has decreased from 344,634 acres (139,577 ha) in 1931 to 198,517 acres (80,399 ha) in 1986, or a 42% decline (Dominion Bureau of Statistics 1968; Statistics Canada 1987). These decreases may be an important factor in the decline of the bobwhite in Canada during this century. It also seems feasible that as the amount of grassland habitat and hedgerows has declined, the patches of suitable habitat have become more fragmented, with greater distances between patches. This would make it more difficult for Northern Bobwhites to find suitable habitat, and would increase the significance of the remaining patches of extensive habitat. Because this species is essentially sedentary, habitat fragmentation would also undoubtedly make it difficult for bobwhite populations to move from disturbed or destroyed areas to new areas of suitable habitat. Roseberry and Klimstra (1984) stated that "isolated or 'island' populations [of bobwhite], which are becoming increasingly common as cover patterns are dissected, are especially vulnerable with recovery slow if at all." This may explain why large areas of apparently suitable habitat in southwestern Ontario are currently uninhabited by bobwhites (Hunter 1990).

E.4. Habitat protection

Bobwhite habitat is not currently protected, and urban development and modern agricultural practices still pose a threat to remaining habitat. Most known sites in Ontario are either on private land or on Walpole Island, which is managed by the Walpole Island Indian Band.

F. GENERAL BIOLOGY

F.1. Reproductive Capability

In early spring, male Northern Bobwhites begin to sing to attract a single mate (Dziepak 1991). Singing peaks in early June in Michigan, and nesting occurs throughout the northern parts of its range between May and September (Bull 1974; Peck and James 1983; Dziepak 1991; Peterjohn and Rice 1991). Both sexes pick the nest site and contribute to nest-building and incubation (Rosene 1969; Ehrlich *et al.* 1988). While one bird is incubating, the mate will avoid the nest and its immediate vicinity (Stoddard 1942). The average clutch size is 12 to 16 eggs, but anywhere from six to 28 eggs per clutch have been reported; in Ontario, clutch size averages 11 to 15 eggs (Peck and James 1983). When nesting cover is scarce and short, and bobwhites are abundant, two or even three females occasionally deposit their eggs in the same nest (Stoddard 1942). Late-season clutches tend to be smaller than early season clutches, and the likelihood of successful hatching declines as summer progresses (Rosene 1969; Johnsgard 1973). The egg-laying rate is approximately one per day, with about 18 to 20 days required to complete a clutch of 14 eggs (Johnsgard 1973). Incubation takes 23 to 24 days to complete, and the young, which are mobile, downy, and follow the parents at hatching, fledge in six to seven days (Ehrlich *et al.* 1988). Therefore, the total length of the nesting cycle (nest building to incubation) is approximately 47 to 55 days, depending on clutch size (Rosene 1969). Only one brood per season is typically raised in the northern portion of its range (Ehrlich *et al.* 1988), but the bobwhite is a persistent nester, and will renest until it successfully hatches young or until it becomes too late in the season (Lumsden 1987; Dziepak 1991). The young are brooded by both adults until they have grown their adult feathers at about two weeks of age, at which time they join other young and adults to form coveys (Rosene 1969; Lumsden 1987; Ehrlich *et al.* 1988; Dziepak 1991).

Egg dates in Ontario range from May 21 to September 19 (Peck and James 1983). Nests with eggs, as well as adults with broods, have been reported for each month, May to September inclusive, in the Detroit-Windsor area (Kelley 1978). In Ohio, nests with eggs have been noted through August 15, and adults with small young have been reported between April 27 and November 17, with most noted between May 20 and August 10 (Peterjohn and Rice 1991). In New York, egg dates range from May 25 to September 14; nestlings have been reported from June 11 to September 27, and fledglings from July 5 to October 11 (Bull 1974). On Long Island, New York, where there is a viable population, the species is double-brooded (Bull 1974).

Average nesting losses in a population may be 60 to 70 percent, but persistent renesting attempts probably result in at least three-fourths of the female population successfully hatching a brood (Roseberry and Klimstra 1984). Hatchability of eggs is usually high, and most chick mortality probably occurs during the first two weeks after hatching when they are most vulnerable to the weather (Rosene 1969). Rosene (1969) found mortality in chicks to be about 30%, while mortality during summer is close to 60% and winter loss is approximately 27%; overall, normal adult survival from year to year is around 30% (Rosene 1969). He also found

that highest summer losses were in areas where winter losses were the lowest, and vice versa. In general, about 80% of the fall population can be expected to consist of juvenile birds, and consequently the average annual mortality rate of the species is also likely close to 80% (Johnsgard 1973). Because of this high mortality rate, the life expectancy for a bobwhite is less than a year; therefore relatively few birds breed more than once (Johnsgard 1973). Each year-class is almost completely replaced every two years, whether the population is hunted or not, and the breeding population in any one summer consists primarily of adults in their first breeding season, nine to 15 months of age (Rosene 1969). Rosene (1969) found the average life expectancy of bobwhites on plantations in Alabama and South Carolina to be 9.1 to 11.7 months. Klimstra and Roseberry (1975) found that nesting success in Illinois was significantly higher on nonagricultural as opposed to agricultural lands. Overall, predatory animals accounted for 55.4% of the nest failures, and house cats and skunks were the two most common destroyers of quail nests on the study area. House cats were also the most common identified predators of nesting adults. Other causes of nest failures included farming activities (mowing - primarily hay cutting, interference by livestock, ploughing or discing, bulldozers or road graders, automobiles, and fire), abandonment, and weather (cool, moist summers are conducive to good reproduction whereas hot, dry summers are not).

When chicks hatch, their sex ratio is generally 50:50, and this sex ratio is maintained throughout the summer and into the winter. However, the percentage of adult males, after they pass through their first breeding season, averages closer to 60 (Rosene 1969). This change in sex ratio is considered to be normal (Rosene 1969).

F.2. Species Movement

Bobwhites are permanent resident, nonmigratory birds (Dziepak 1991), and are among the most sedentary of all quails (Johnsgard 1973). Robeson (1969-1970) stated that "all their needs may be met in 125 to 150 acres," and "probably many birds live and die without moving a quarter of a mile from the point of hatching." Virtually no major seasonal movements are normally undertaken (Johnsgard 1973). During the breeding season, bobwhites maintain and defend territories, but in fall (when the young reach three weeks of age), considerable reorganization occurs with the integration of broods into coveys (flocks consisting of two or more family groups) of up to 30 birds and a movement from herbaceous cover to dense woody vegetation; this period of instability has been called the "fall shuffle" (Rosene 1969; Johnsgard 1973; Robinson 1963 in Dziepak 1991). However, fall movements averaged less than summer movements, and the winter ranges of some family groups actually overlap their summer brood ranges (Johnsgard 1973). Under normal circumstances, daily winter movements are short, and cold temperatures, rain, snow cover, and wind restrict movements (Roseberry and Klimstra 1984). Roseberry (1964 in Roseberry and Klimstra 1984) found that winter coveys that did not have access to adequate food supplies near cover exhibited unusual movements and suffered relatively heavy losses, whereas those coveys which had access to food supplies near cover were relatively sedentary and suffered only light mortality.

Duck (1943 as cited in Johnsgard 1973) suggests that bobwhites sometimes move greater distances during the fall. Eleven quail that were banded during August and September and were recovered in December had moved an average distance of 9.7 miles and one was found 26 miles from the banding point (Duck 1943). However, bobwhites in general are not highly mobile, even during the fall period (Johnsgard 1973).

Bobwhites feed and roost in coveys in fall and winter, nestling together at night with tails inward, heads outward, and bodies touching on both sides (Ehrlich *et al.* 1988). This roosting behaviour serves to maintain body heat during winter (Johnsgard 1973), and is probably why the species appears to have a high tolerance to cold, considering its size (Roseberry and Klimstra 1984). The ideal size of a "roosting disk" is 10 to 15 birds; larger coveys will form two such disks, while coveys that become smaller will join with nearby groups in order to maintain this minimum roosting group size (Johnsgard 1973). In addition, bobwhites apparently shift their winter roost sites to denser cover as cold, snow, or wind become severe (Rosene 1969).

After the breakup of coveys in early spring, birds gradually move from their winter range into their nesting range, but the movements may not be very great (Johnsgard 1973). Six of nine coveys studied in Kentucky moved less than one-quarter of a mile between late winter and early spring, and none moved more than three-quarters of a mile. In Wisconsin, movements of birds averaged 0.6 miles from the winter range between April 8 and May 26, while between May 27 and June 23 the average distance was 1.3 miles from the winter range; this suggests that a considerable number of birds, perhaps unmated males, continue to move around for some time after the breakup of coveys (Johnsgard 1973). In summer, movements by mated pairs and pairs with broods are relatively negligible, but unmated males may undertake somewhat larger movements (Johnsgard 1973).

F.3. Behaviour/Adaptability

The Northern Bobwhite is monogamous, and there is evidence that pairs may remain mated from season to season if both individuals survive (Stoddard 1942). Males maintain territories throughout the breeding season, and fights that occur between defending and rival males may occasionally be fatal (Stoddard 1942; Ehrlich *et al.* 1988). Rosene (1969) stated that the saturation point (defined by Leopold as the point at which an adult population cannot be increased any further) is slightly over one bird per acre, and is reached in late fall on areas where coveys are optimum. However, there is one incident mentioned in the literature (Stoddard 1942) where as many as five nests in one acre hatched off successfully. In winter, bobwhite coveys establish territories of various sizes and shapes that offer protection, cover, and food, and sometimes two or more coveys will establish ranges which overlap (Rosene 1969). A covey does not use its entire range each day (Roseberry and Klimstra 1984). According to Robinson (1957 as cited in Schroeder 1985), the minimum area needed to support a covey of bobwhite quail is approximately 4.9 ha, and Johnsgard (1973) stated that a winter covey rarely occupies an area exceeding 50 acres (20.25 ha) in size. Of 1,154 coveys studied by Rosene (1969), range size varied from four to 77 acres (31.2 ha), and size and shape seemed to depend to some extent on the distribution of food and cover. Winter covey range tends to be somewhat smaller in the south of the species' range (Johnsgard 1973).

Elaborate displays are performed by males in order to establish social dominance upon initial exposure to a strange male or female. With feathers erect, wingtips touching the ground and elbows thrown forward to produce a "feathered wall", the male turns his head to the side displaying his white markings, and makes short rushes toward the other bird (Johnsgard 1973; Ehrlich *et al.* 1988). Strictly sexual displays of the male include lateral display, bowing, and tidbitting (food call of male used in conjunction with pecking movements); tidbitting probably serves as a major means of pair bond maintenance (Johnsgard 1973). Female displays include wing-quivering movements and an inconspicuous lateral presentation display (Johnsgard 1973). In addition, parents perform distraction displays (Ehrlich *et al.* 1988).

The nest is a shallow, saucer-like depression on the ground lined with plant material and covered with nearby grass and vines that are woven together and pulled over to hide the nest (Johnsgard 1973; Dziepak 1991). Nests are usually well concealed in brush or long grass near open or cultivated land, but are exposed in at least one direction (Lumsden 1987; Ehrlich *et al.* 1988). In Ontario, nests were characteristically shallow, grass-lined hollows placed in long grasses, and three nests were found, respectively, beside a fence, a telephone pole, and a small tree. Nearby grasses sometimes arched over the nests (Peck and James 1983).

During spring and summer, the bobwhite feeds primarily on insects, but it also eats greens, fruits, and seeds (Rosene 1969; Robeson 1969-1970; Dziepak 1991). In winter it feeds mostly on weed and row-crop seeds (Robeson 1969-1970; Dziepak 1991). The diet is not restricted to specific types of insects or seeds, but rather it varies from north to south and east to west, and may also differ between nearby areas from year to year (Rosene 1969). Seeds such as black locust, foxtail, and star thistle, and fruits of gray dogwood and wild grape were found to be important winter food items in New York (Robeson 1969-1970). Soybean and corn fields also provide important winter foods for the species, and green vegetation such as clover and grass are necessary to satisfy the species' Vitamin A requirements (Nestler 1946). The animal portion (insects) of the species' diet varies from roughly 30% in summer to only 5% in winter, with the balance each season being seeds and plant parts (Rosene 1969; Johnsgard 1973). Bobwhites shift to insects, which have a higher protein content than seeds, in early spring, and back to seeds in fall near the time of frost (Rosene 1969). This shift occurs even in the southern portions of the species' range, where more insects are available year-round, but the species only eats enough of them to satisfy its crude protein requirement which is higher during the breeding season than during the winter (Rosene 1969; Roseberry and Klimstra 1984). However, it is also extremely important that high energy food supplies are available during periods of cold stress in winter (Roseberry and Klimstra 1984). Bobwhite chicks apparently have relatively high protein requirements and feed primarily on insects for the first two weeks of their life (Hurst 1972 as cited in Schroeder 1985); animal foods, primarily beetles, bugs, and grasshoppers, provided 94.1% of the foods eaten during the first two weeks of life of bobwhite chicks in Tennessee (Eubanks and Dimmick 1974 as cited in Schroeder 1985). Once the young reach seven to nine weeks of age, their feeding habits are similar to those of adults (Schroeder 1985).

Because the bobwhite consumes many crop-damaging insects, as well as seeds of noxious weeds, it is generally viewed as an important species to conserve. MacClement (1915) stated that "No bird can show better reason for being carefully preserved and encouraged", and Nash (1908) stated that "Few birds are of greater utility than this. Its whole life is spent among the crops we cultivate, and its food consists during the summer months almost entirely of the insects which are injurious to plants. During the winter it consumes great quantities of weed seeds. The Quail is an important factor in keeping weeds in check."

G. LIMITING FACTORS

Overall, according to Lumsden (1987) and Weir (1989), harsh winters and more intensive agricultural practices caused initial retreat in Ontario, and herbicides and modern farming methods (including the removal of woody cover along cultivated lands) have caused further decline and shrinkage of the species' range. Hunter (1990) stated that the Northern Bobwhite has declined in Ontario due to the destruction and fragmentation of wildlife habitat and has now stabilized at a very low number.

G.1. Weather

One of the primary factors limiting bobwhite abundance in Canada and the rest of its range in the north is severe winter weather (such as prolonged higher snow depths and, to a lesser degree, cold temperatures and high winds), and this is thought to have become more significant as declines in the availability of suitable food and cover have become more pronounced (Brown 1956). During a period of severe winter weather, many birds in a population can die from starvation, being trapped under snow and ice, or from predators capturing them in open areas when they are foraging for food (Dziepak 1991). Rosene (1969) stated that snow over three inches deep, or a thin crusted-over covering, makes seeds on the ground unavailable to bobwhites, and Latham and Studholme (1952 as cited in Roseberry and Klimstra 1984) described prolonged higher snow depths as "the most detrimental of all environmental factors" to the bobwhite. One severe winter can result in a large reduction in numbers, and in Michigan a series of two or more mild winters are needed to rebuild quail numbers after a severe winter (Janson 1984 as cited in Dziepak 1991). Clarke (1954) stated that with Vitamin A, food, and cover, the bobwhite could stand 50 or more inches of snowfall, but without plenty of Vitamin A in its system (or available Vitamin A sources) it cannot stand winter storms (rain, sleet or snow) at all. He also stated that there must have been a long period of light snow before 1856, and that declines in that and following years were linked with bad winters that made food unavailable. Because of its susceptibility to harsh winter conditions, the bobwhite's range in Ontario is currently restricted largely to the southwest portion of Carolinian Forest Region. Following severe winters in the late 1970s, the range of native bobwhites in Ontario was further reduced and still has not recovered. Severe winter weather, and not habitat loss, is believed to be the main constraint to the bobwhite population in the Kingston region (Frontenac; Leeds; Lennox-Addington; Prince Edward) (R. Weir, pers. comm. 1990).

Heavy rains during incubation and early chick stages often result in substantial losses of nests and young, particularly in flat, poorly drained habitat such as in parts of the south (Rosene 1969; Roseberry and Klimstra 1984). Heavy fall rains may wash soil over small seeds, making them difficult or impossible to find (Rosene 1969). Edminster (1954) stated that although water is generally not an important limiting factor in most of the bobwhite's range in most years, occasional summer droughts may cause severe losses in quail numbers. Hot, dry conditions may increase nest abandonment, reduce hatchability of eggs, and reduce food supplies for chicks (Roseberry and Klimstra 1984).

G.2. Habitat loss

Previous research in Wisconsin demonstrated that the long-term decline in quail abundance there was a result of habitat deterioration, principally the loss of hedgerow cover, while short-term population fluctuations were mainly a function of adverse weather (Dumke 1982). Habitat loss is undoubtedly the main reason for the long-term decline in numbers in Ontario since the 1800s, as well, since climate overall has not changed since last century. Habitat loss and deterioration has resulted from continued deforestation (Clarke 1954); more intensive agriculture (Clarke 1954; Lumsden 1987); the use of herbicides such as atrazine (Lumsden 1987; Ludwig pers. comm.); and continued urbanization (Clarke 1954). A decline in the amount of scrubby pastures on sandy soils and fencerows was noted in Elgin-West from 1950 to 1990 (ORBBP files), and Klimstra and Ziccardi (1963 as cited in Schroeder 1985) stated that suitable roost cover is likely a limiting factor in certain habitats. Lack of winter cover was found to be the major limiting factor in Wisconsin and most other northern areas (Rosene 1969).

G.3. Food

Food can also sometimes be a limiting factor for bobwhites, particularly in the northern portions of their range. Reid and Goodrum (1979 as cited in Schroeder 1985) stated that spring is the most difficult time for bobwhites due to the low availability of seed and fruit crops. Food supplies may also become depleted during the winter, particularly during prolonged periods of deep snow when the species is unable to scratch the ground for food. Because the bobwhite is essentially a sedentary species, it is vital that adequate food supplies be in close proximity to suitable habitat, particularly in the winter. If plentiful food is not available, the species will probably not inhabit the area, regardless of how suitable the habitat may be otherwise. In Norfolk Co. and on Point Pelee, a change in the type of crops grown (i.e. from corn, which provided food, to tobacco in Norfolk Co. and to asparagus and orchards on Point Pelee) has been cited as one of the primary reasons for the species' decline in those areas (Clarke 1954).

G.4. Chemicals

Because of the large quantities of insects consumed by bobwhites, particularly during the breeding season, the use of certain pesticides and herbicides can be detrimental to the species in cropland habitats (Schroeder 1985). For example, intensive use of herbicides on croplands in Wisconsin was thought to have decreased the availability of weed seeds on both the cultivated fields and adjoining fencelines and roadsides (Dumke 1982), and nearly all bobwhites in an area of 11,744 acres (4756 ha) in southern Georgia Co. treated with Heptachlor (to combat fire ants) were killed (Rosene 1969). Adult summer loss on a plantation studied by Rosene (1969) was very high (76%) from 1958 to 1960, largely because of DDT spraying of soybeans in 1958. This also caused a general decline in the number of juveniles produced (number of young per adult female) from 1958 to 1960. DDT is no longer used. Human disturbance and pesticides are factors suggested to be influencing bobwhites in Middlesex Co., Ontario.

G.5. Released Stock

Release of pen-reared, non-native stock (which generally have low survival rates in the wild) can have a serious negative impact on wild populations (Clarke 1954; McCracken 1987; B. Buckland, pers. comm. 1990). As early as 1884, imported bobwhites were released in Ontario, and over the years a large number of non-native stock have been released (Clarke 1954). Because there have been so many releases (mostly undocumented) in Ontario, it is now not possible to determine the extent of releases in the province. Clarke (1954) stated that "those [released birds] that interbred with the native stock could only have done it harm." Release of domestic stock has been suggested as a factor contributing to bobwhite declines in Haldimand-Norfolk R.M. and Wellington Co. in Ontario. In addition, native bobwhite populations are very small and localized in Ontario, perhaps so small that inbreeding is affecting their productivity (D. Ankney, pers. comm. 1993).

G.6. Predation

In rural southern Illinois, Northern Bobwhites were killed by cats hunting in their breeding areas (M. George, pers. comm. 1993). Cats killed more bobwhites and Indigo Buntings than other breeding birds, and adults, especially females, were killed more often than young birds in the breeding season. M. George (pers. comm. 1993) noted, however, that at the end of 1980, after 12 years of continuous cat predation, the overwintering flock of bobwhites was about the same as in 1968. In the winter, Cooper's Hawk was the principal predator of bobwhite quail, not the domestic cat (M. George, pers. comm. 1993). Twenty-three (18%) of 126 breeding birds killed by cats in a 12-year period were bobwhites, but only 4 (4%) of 102 overwintering birds killed by cats were bobwhites (M. George, pers. comm. 1993). During Robeson's (1969-1970) study in New York, domestic dogs and cats were the main mammalian predators. Stoddard (1942) described the house cat as "the relentless enemy of the quail", and stated that it is more destructive to quail of all ages after hatching rather than to eggs. Eaton (1910) stated that

especially during the nesting season, or when the chicks are young, cats should not be allowed to roam the fields. The mortality of bobwhites as a result of depredation by domestic pets has not been studied in Ontario. However, it may be a problem in some areas of Walpole Island (e.g., Altman Prairie which borders on a residential area), and predation from feral cats and other predators is probably high in Haldimand-Norfolk R.M. (J. McCracken, pers. comm. 1990). In Simcoe Co. in 1822, the Reverend Thomas Williams (as cited in Devitt 1967) wrote that "We had also as a frequenter of our fields, the American Quail ... we did not think of shooting him ... my father once shot our cat because she caught the quails which came into our barnyard."

Other known predators of bobwhite nests and adults include Striped Skunk (Mephitis mephitis), Virginia Opossum (Didelphis virginiana), Red Fox (Vulpes vulpes), Grey Fox (Urocyon cinereoargenteus), Cotton Rat, Raccoon (Procyon lotor), Long-tailed Weasel (Mustela frenata), Mink (Mustela vison), Bobcat (Lynx rufus), Coyote (Canis latrans), Grey Squirrel (Sciurus carolinensis), Red Squirrel (Tamiasciurus hudsonicus), and Fox Squirrel (Sciurus niger); Cooper's Hawk (Accipiter cooperii), Sharp-shinned Hawk (Accipiter striatus), Northern Harrier (Circus cyaneus), Great-horned Owl (Bubo virginianus), Barred Owl (Strix varia), Blue Jay (Cyanocitta cristata), American Crow (Corvus brachyrhynchos), Wild Turkey (Meleagris gallopavo), and Domestic Turkey; numerous species of snakes; domestic dogs; hogs (which eat eggs); and red ants (which destroy nests by getting into pipped eggs and eating embryo flesh) (Rosene 1969; Roseberry and Klimstra 1984). Increased predation by raccoons with the reduction in cover was cited as a factor contributing to declines in Elgin Co., Ontario (ORBBP files).

G.7. Competition

Both pheasants and domestic hens have been known to lay eggs in bobwhite nests (and vice versa) (Stoddard 1942; Kelley *et al.* 1963; Rosene 1969), but Rosene (1969) stated that this happens infrequently and is of no consequence to the management of wild bobwhites. Robeson (1969-1970) observed no direct competition between pheasants and bobwhites present in the same range in New York, and on several occasions the two species were seen feeding together and using the same dust baths. Robeson (1969-1970) believed that the niches each species fills are probably different enough so that there is no true conflict. There may be, however, some competition for food with spring and fall migrants, resident and wintering birds (i.e. mourning doves and blackbirds), and small mammals such as the cotton rat in the southern United States (Rosene 1969; Roseberry and Klimstra 1984).

G.8. Hunting

Hunting pressure is not thought to have been responsible for bobwhite declines in Ontario, even though there were "100 years of first class quail shooting in Ontario" (Clarke 1954). Hunting pressure for, and harvest of, bobwhites has been minimal to non-existent since the early

1980s (OMNR Fact Sheet 1992). However, the Northern Bobwhite is the most popular game bird in the U.S. (Dziepak 1991); in 1970, the estimated kill was 35 million birds (Johnsgard 1973). According to the post-season surveys in 1957, 3,645,000 bobwhites were bagged in Kentucky, and this was more than the indicated kill of any other single species (Durell 1957). In some states (e.g. New York), unregulated hunting early in the century may have been a factor in the species' decline (Levine 1988).

H. SPECIAL SIGNIFICANCE OF THE SPECIES

The Northern Bobwhite is widespread and common throughout much of its range in North America, but is quite rare at the northern and western edges. Because it is a popular and challenging game bird, consumes large quantities of crop-damaging insects and noxious weed seeds, and is a pleasant aspect of the countryside due to its appearance and song, the bobwhite is important both aesthetically and economically (Rosene 1969; Robeson 1969-1970; Godfrey 1986). Rosene (1969) stated that "hunters spend the most money in pursuit of bobwhites. Bird watchers, farmers, and hunters alike rate this bird number one." Consequently, there is a high degree of public interest in conserving this species. In addition, creation and management of bobwhite habitat in Canada would not only benefit the bobwhite, but would benefit the Yellow-breasted Chat (Icteria virens virens) (Vulnerable status proposed for Canada), Loggerhead Shrike (Lanius ludovicianus) (officially Endangered in eastern Canada), Henslow's Sparrow (Ammodramus henslowii) (officially Endangered in Canada), Grasshopper Sparrow (Ammodramus savannarum), and other field and hedgerow-nesting species in eastern Canada. In addition to birds, there are several Vulnerable, Threatened and Endangered prairie plant species that would benefit from management of bobwhite habitat, including the Pink Milkwort (Polygala incarnata), Skinner's Agalinis (Agalinis skinneriana), Small White Lady's Slipper (Cypripedium candidum), Western Prairie Fringed Orchid (Platanthera praeclara), Colicroot (Aletris farinosa), Kentucky Coffee Tree (Gymnocladus dioica), Dense Blazing Star (Liatris spicata), and Eastern Prairie White-fringed Orchid (Platanthera leucophaea).

The bobwhite is at the northern edge of its range in Canada, and such marginal populations are considered to be valuable in terms of genetic composition and adaptability (Scudder 1989 in Cannings 1992). No other closely related species are considered to be Vulnerable, Threatened, or Endangered in Canada, but the Greater Prairie-Chicken is officially considered to be extirpated in Canada.

I. EVALUATION AND PROPOSED STATUS

The Northern Bobwhite is a permanent resident, non-migratory bird ranging from the Atlantic Coast to the Great Plains in North America, and south to Mexico (Lumsden 1987). In Canada, the species reaches the northern limit of its distribution in southern Ontario, where it is currently found locally in very low numbers.

Prior to European settlement, the Bobwhite was probably present in extreme southwestern Ontario, where there were large areas of land covered with tall-grass prairie and savanna habitat; the birds would have thrived on the brushy and forested edges of these habitats (Lumsden 1987). As southern Ontario's land was settled and cleared, the bobwhite flourished, and by the mid-1800s its range had expanded in the province north to Georgian Bay and Muskoka, and east to Kingston. The conversion of prairie and forest into fields, together with the switch to cleaner, more mechanized and efficient farming methods and the loss of agricultural land to forest succession and development, have reduced habitat quality and quantity for the species (Levine 1988). Breeding Bird Survey data show significant declines in bobwhite numbers from 1966 to 1988 in North America and Eastern North America. Declines have also been marked in Ontario, particularly following severe winters in the late 1970s, and bobwhite populations in the province have not fully recovered yet.

It is clear that range reductions and severe declines in bobwhite numbers have occurred in Ontario since the late 1800s, and more recently, since the harsh winters of the late 1970s. Although suitable habitat is still available in the province (i.e. on Walpole Island and other areas of Lambton Co.), the population did not recover in the 1980s, and it could be that losses in the late 1970s brought the population below a critical level. The province's bobwhite population is currently very small and restricted to a few disjunct areas, with approximately 200 birds known in 1989, possibly as many as 400 (D. Ankney, pers. comm. 1993). It appears that this low population level, and not habitat availability, is presently the main limiting factor in Ontario. Because bobwhites in Ontario are probably isolated from populations in the United States, recovery in Ontario may be even more difficult. It is uncertain as to the percentage of released birds that make up the existing population of bobwhites in Ontario, but it is believed that the birds remaining in the extreme southwest are still wild stock. The release of stocked bobwhite may be reducing the productivity and survivorship of native birds. Therefore, due to the small, localized populations of bobwhites in Ontario, continuing threats to their habitat, the release and presumed interbreeding of non-native stock (possibly another subspecies of the bobwhite) with native stock, and the dependence of the species' survival on release programs or other management practices, it is clear that the Northern Bobwhite should be designated as "Endangered" in Canada.

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