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COMMITTEE ON THE
STATUS OF ENDANGERED
WILDLIFE IN CANADA

OTTAWA, ONT. K1A 0H3
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COMITÉ SUR LE STATUT
DES ESPÈCES MENACÉES
DE DISPARITION AU
CANADA

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

STATUS REPORT ON THE CERULEAN WARBLER *DENDROICA CERULEA* IN CANADA

BY

J.D. MCCRACKEN

STATUS ASSIGNED IN 1993
VULNERABLE

REASON: A RELATIVELY SMALL POPULATION, SUBJECT TO HABITAT LOSS AND ALTERATION, THAT IS LIKELY TO CAUSE CONTINUING SLOW DECLINES.

OCCURRENCE: ONTARIO AND QUEBEC

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

Committee on the Status of Endangered Wildlife in Canada

Comité sur le statut des espèces menacées de disparition au Canada

JUNE 1990

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Ottawa, Ont. K1A [illegible] 997-4991

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EXTINCT SPECIES: Any species of fauna or flora formerly indigenous to Canada but no longer known to exist anywhere.

STATUS REPORT ON THE CERULEAN WARBLER
DENDROICA CERULEA

IN CANADA

BY

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A. ABSTRACT

In Canada, the Cerulean Warbler (Dendroica cerulea) breeds locally in southern Ontario, east to extreme southwestern Quebec. Its core North American breeding range includes much of the eastern U.S. Its winter range is restricted to a narrow belt in northeastern South America, east of the Andes.

The Cerulean Warbler currently has no special protection in Canada, but it is considered Threatened in Minnesota and Rare to Imperiled in several other States. It is a Species of Research and Management Concern in the northcentral U.S.

The Cerulean Warbler is in a general period of decline in many parts of its core breeding range in the U.S., but its range has also experienced some expansion in the northeast. Suggested reasons for the decline include loss and degradation of breeding and wintering habitats, coupled with an increased level of cowbird parasitism. Range expansions **may** be partially due to loss of breeding habitat effectively forcing birds to occupy new areas.

In Canada, the population appears to be fairly stable. There have been signs of both local declines in extreme southwestern Ontario and local increases northeast to Quebec. The overall Canadian breeding population is estimated to comprise about between 700 and 3000 breeding pairs. Most of it is concentrated in inland areas bordering the east ends of Lakes Erie and Ontario.

Large (probably >100 ha) tracts of mature, deciduous forest (especially lowlands) provide essential habitat. The Cerulean Warbler is very much a canopy-dwelling species.

The biology of this species is poorly known, but it is probably quite sensitive to changes in forest structure and age. It is generally a forest-interior species, but it can apparently tolerate low levels of habitat disturbance. Its rather strict habitat requirements account for its propensity towards "coloniality". Any changes which a) reduce canopy cover (probably to levels <75%), b) set back the successional stage of the forest, c) decrease the areal extent of the forest, or d) fragment it are likely to have a negative impact on breeding populations of the Cerulean Warbler.

The Cerulean Warbler's status in Canada should be carefully considered in view of a) significant population declines through much of its U.S. breeding range, b) distressingly high losses of breeding and wintering habitat, c) the small amount of information which is known about its basic biology, d) a general lack of quantitative data on Canadian population trends, e) a rather local and peripheral breeding range in Canada, and f) a rather small Canadian breeding population. As such, the Cerulean Warbler should be viewed as being "rare" in Ontario and "vulnerable" in Canada.

B. DISTRIBUTION

1. Canada

Breeding

The Cerulean Warbler's Canadian breeding range is restricted to the southern Great Lakes-St. Lawrence Forest and Carolinian Forest zones of southern Ontario and extreme southwestern Quebec (Godfrey 1986),

During the Ontario breeding bird atlas, it occurred in two apparently distinct distributional bands (Eagles 1987 -- see Figure 1). The southern band extends from lower Lake Huron and Lake St. Clair, east to Lake Ontario, with concentrations occurring at the east end of Lake Erie. The northern band extends from the Bruce Peninsula east to the Ottawa River, with concentrations occurring on the Frontenac Axis at the east end of Lake Ontario.

The Quebec population can be considered to represent a third band of occurrence in Canada. It also marks the extreme northeastern edge of the Cerulean Warbler's North American breeding range. In Quebec, its principal breeding distribution includes areas south of the St. Lawrence River, primarily south and east of Montreal nearly to Sherbrooke (Ouellet 1967 -- see Figure 1).

Migration

In Ontario, the Cerulean Warbler is generally present from 10 May -22 September (James et al. 1976), but both earlier and later records have been reported in seasonal summaries in American Birds. It is an early fall migrant throughout its range (Griscom and Sprunt 1957). In Ontario, it is one of the earliest passerines to migrate south; most have probably left the province by mid August. There is a real dearth of fall records.

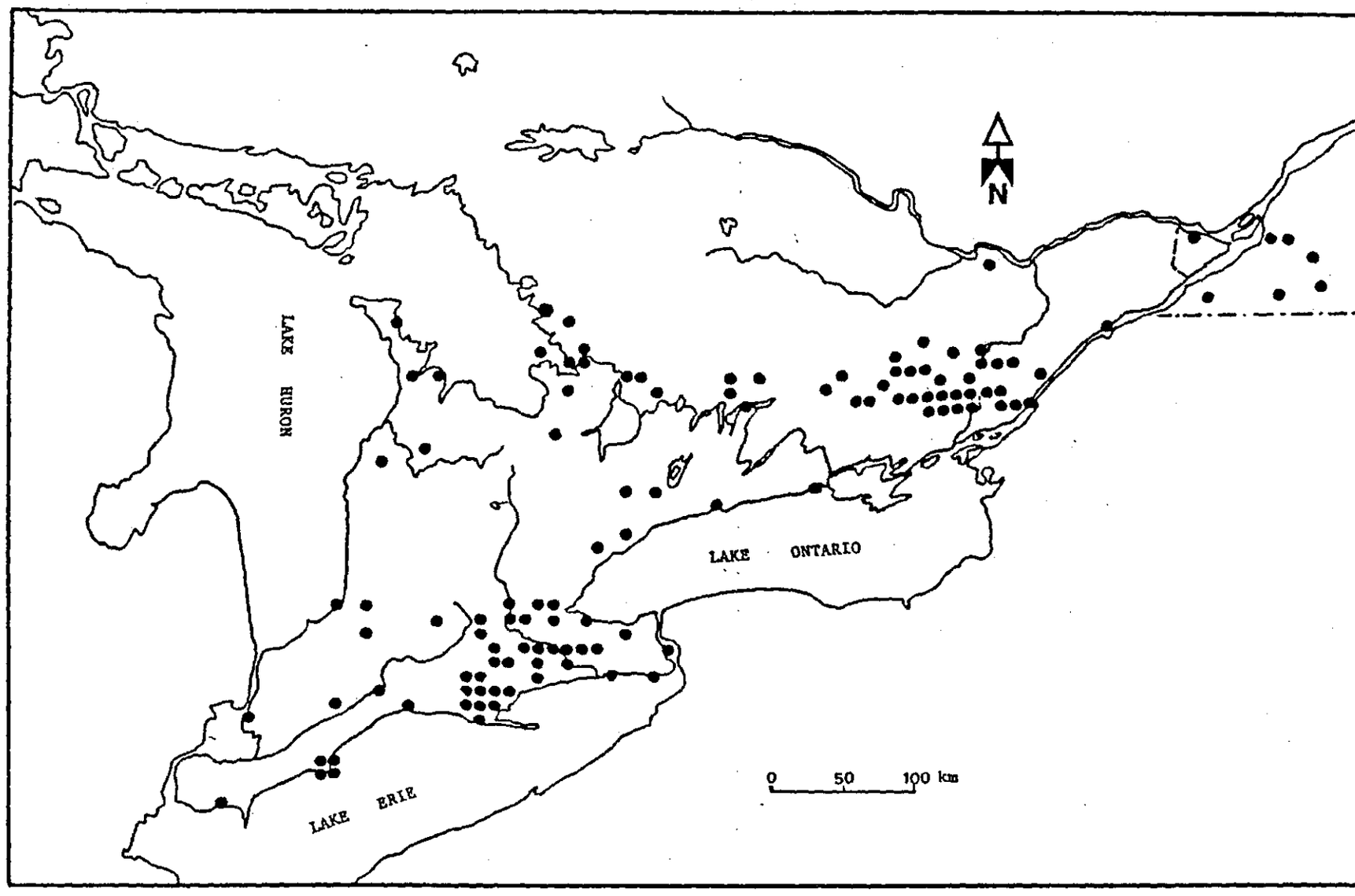

Figure 1. Current (post-1960) breeding distribution of the Cerulean Warbler in Canada (based primarily on Ouellet 1967; Eagles 1987 and material published in American Birds seasonal summaries).

The Cerulean Warbler is of casual occurrence in southeastern Manitoba; there are also a few sight records for Nova Scotia and New Brunswick (Godfrey 1986).

2. Americas

Breeding

The Cerulean Warbler breeds from southeastern Nebraska, northern Iowa, central and southeastern Minnesota, southern Wisconsin, southern Michigan, southern Ontario, southwestern Quebec, western and southeastern New York, northwestern Vermont and central Connecticut south to eastern Oklahoma, northcentral Texas, southern Arkansas, southeastern Louisiana, central Mississippi, central Alabama and central Georgia, and east to northern New Jersey, southern Delaware, eastern Maryland, central Virginia and central North Carolina (American Ornithologists' Union 1983 -- Figure 2).

The Cerulean Warbler is local throughout much of its range (Bent 1963). It is most common in the Ohio River valley (Farrand 1983) -- in West Virginia, Kentucky, Tennessee, and Ohio (Robbins et al., in prep.).

Migration

Judging from data provided in Murray (1965) and Stevenson (1957) and by comments made by Bent (1963) and Chapman (1968), the bulk of Cerulean Warbler migration (spring and fall) occurs along the Mississippi Valley rather than along the east coast. It is a trans-gulf migrant (Stevenson 1957), crossing the Gulf of Mexico

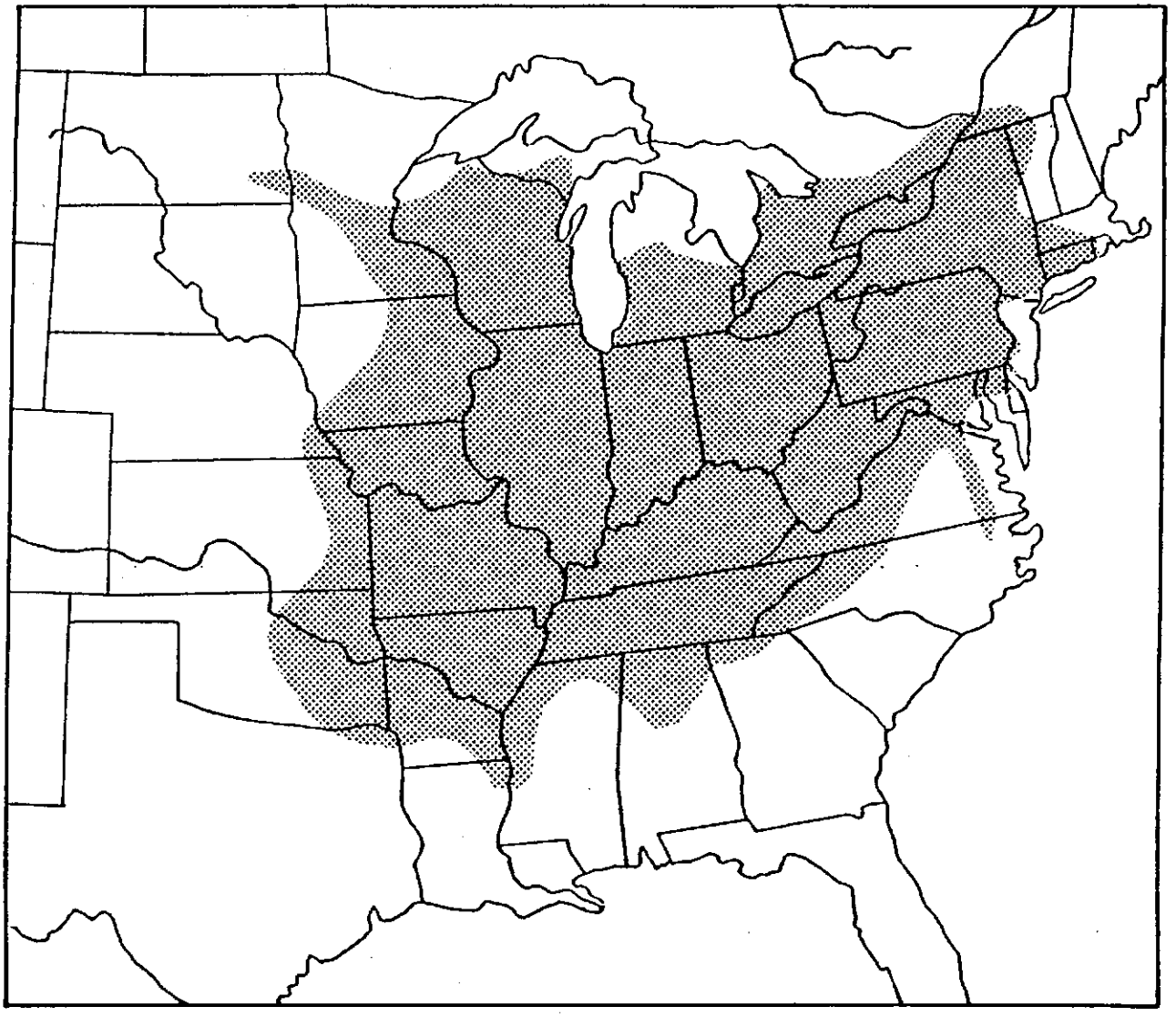

Figure 2. Breeding distribution of the Cerulean Warbler in North America (after American Ornithologists' Union 1983; Hands et al. 1989; Robbins et al., in prep.).

chiefly via Louisiana and Mississippi (Bent 1963). It occurs as a casual transient on some of the Gulf islands (Chapman 1968; American Ornithologists' Union 1983). It is rare in Central America, especially on the west side (Jehl 1974). It is a rare migrant in Veracruz, Mexico (Loetscher 1955; Andrle 1966) and generally absent elsewhere in Mexico (Griscom and Sprunt 1957). It has been recorded off the coast of the Yucatan Peninsula during fall (Paynter 1953).

Extra-limital records have been reported from southwestern Manitoba, North Dakota, northern Minnesota, New Hampshire and Maine, and in western North America to California, northern Baja California, southern Nevada, Colorado and New Mexico (American Ornithologists Union 1983).

Winter

As far as is known, the Cerulean Warbler has a limited winter range (Figure 3). It winters from Columbia and Venezuela south, mostly east of the Andes, to eastern Peru and northern Bolivia (American Ornithologists' Union 1983). Its chief wintering area appears to be in Peru, though it has been found as far north as Panama (Bent 1963). "Flocks of considerable size" have been reported also for Columbia and Ecuador (Griscom and Sprunt 1957).

C. PROTECTION

Apart from general protection afforded through the joint Canada/U.S. Migratory Birds Convention, there is no specific legislation aimed at protecting this species in Canada. None is warranted at this time, but regulations and policies which promote protection of large tracts of mature deciduous forest would clearly benefit the species.

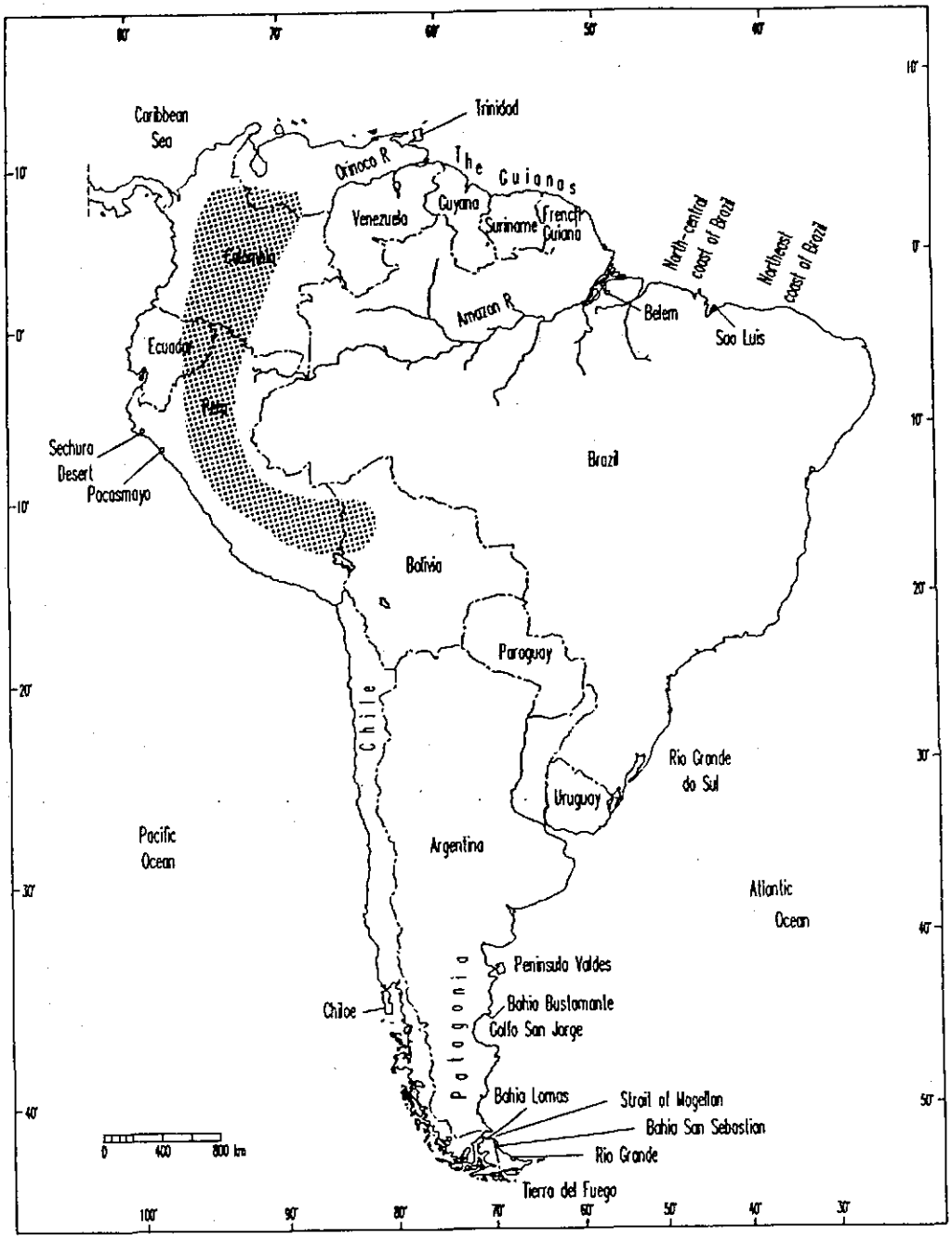

Figure 3. Winter distribution of the Cerulean Warbler (based on Bent 1963; Pearson 1960; American Ornithologists' Union 1983).

D. POPULATION SIZE AND TREND

Macoun and Macoun (1909) considered the Cerulean Warbler as common in the southwestern part of Ontario, but noted that it was not found much farther north than London. More recently, James et al. (1976) and Eagles (1987) regarded it as an uncommon local breeding species throughout much of southern Ontario. Based solely on the **proportion** of the Cerulean Warbler's breeding range that occurs in Canada, the Canadian population likely accounts for less than 10% of the continental total.

Eagles (1987) felt that the Cerulean Warbler's population had probably declined in Ontario, following the clearing of the deciduous forest at the time of European settlement. As has been the case in the U.S., however, the species has also apparently expanded its range north and eastward in Canada since the turn of the century. Still, the evidence for a range expansion in Ontario is largely circumstantial. Much of it arose as a direct result of intensive surveys conducted during the breeding bird atlas. Such heightened coverage would be expected to result in the discovery of hitherto unknown populations.

Indeed, Baillie and Harrington (1937) felt that the Cerulean Warbler's breeding range may have been broader than was known at that time, suggesting that populations were already established in eastern Ontario well before the atlas (Eagles 1987). As early as the 1920s, DeLury (1922) felt that "the Cerulean Warbler would be found more frequently [in the Ottawa district] if searched for diligently". Broley (1929) believed that it bred north of Kingston as early as 1929, and although Quilliam (1965) regarded it as a "newcomer" to the Kingston area, she apparently felt that it was well established there by 1950. Toner et al. (1942) stated that it probably bred in Leeds Co. Devitt (1967) presumed that it had expanded its range into Simcoe Co., but did not state when. It was probably well established in the Minesing Swamp by the 1950s, and

perhaps earlier. Even in Quebec, there are records which suggest that the species was established there by 1950 (Ouellet 1967). Finally, neither Snyder (1957) nor Baillie (1967) mention the Cerulean Warbler in their discussions of species whose ranges had expanded in Ontario.

Range expansions have occurred in New York state (Griscom 1929; Connor 1988) and generally in areas northeast of the Allegheny Mountains (Brooks 1952; Chapman 1968; Robbins et al., in prep.). Much of the expansion in New York was attributed to birds entering the state via Ontario, particularly the Niagara corridor (Bull 1985; Connor 1988). This provides additional circumstantial evidence for an Ontario range expansion.

Together, the above information suggests that if a range expansion has in fact occurred in Canada, then it has been a very gradual one and very poorly documented. The perceived expansion has probably been fueled by local population increases (e.g. Weir 1989) and in-filling of gaps, coupled with progressively more thorough ornithological coverage of the province.

The Cerulean Warbler often occurs in loose "colonies" (e.g. Kolb 1943; Griscom and Sprunt 1957; Linehan 1973) in pockets of suitable habitat. In the heart of its breeding range in Ohio, breeding densities of up to nearly 300 pairs/sq km have been reported (Hellman 1950).

In Ontario, "colony" size ranges from a few pairs to a reported maximum of 58 that were present in the Minesing Swamp on 14 June 1974 (Goodwin 1974). In a census area at the north end of Lake Simcoe, Speirs (1974) reported a breeding density of 124 pairs/sq km, making the Cerulean Warbler the third most common species on the plot.

Such high populations at the northern edge of the species' range suggest at least two things -- that its breeding range may

extend even farther north than is presently known, and that it may be more ubiquitous than was depicted in the breeding bird atlas (Figure 1). Moreover, it seems unusual that a species, which is presumed to have expanded its breeding range, would maintain such high peripheral populations.

During the Ontario Breeding Bird Atlas, the Cerulean Warbler was recorded in 108 (6%) of 1824 10-km squares in southern Ontario. However, as Eagles (1987) pointed out, the species was apt to have been under-recorded, owing to its localized distribution and general inconspicuousness.

Assuming that the species actually occurs in 200 10-km squares, and assuming that the proportioning of density estimates provided by the atlas (Eagles 1987) is reasonable, and assuming a maximum density of 50 pairs/10 sq km, then the breeding population in Ontario is estimated to fall within the range of 680-2880 pairs. Including a few dozen pairs to be found in Quebec, the entire Canadian population is estimated to include about 700-3000 pairs.

There are too few quantitative data in Canada to assess population trends for this species. The only reported decline was noted for Middlesex Co. (Saunders and Dale 1933), but other localized declines have undoubtedly occurred in extreme southwestern Ontario (Eagles 1987). Given the continued loss of deciduous forest in Quebec, Aubry et al. (1989) expressed concern about the future status of the Cerulean Warbler in that province. Nevertheless, based on the scant database, no current trend in Canadian numbers is apparent. Hence, the Canadian population is tentatively viewed as being stable, but it should be monitored, particularly in view of the situation in the U.S. (see below).

There are many references which suggest that a significant reduction in numbers has occurred in the U.S. during the present century (e.g. Mayfield 1977; Adams et al. 1988; Adams 1989, in Hands et al. 1989; Robbins et al., in prep.). Since 1966, Cerulean

Warbler populations declined by 3.1% per year in the northcentral states and by 3.4% per year throughout the U.S. (Hands et al. 1989). This was the greatest decline noted for any species of warbler and one of the highest for any bird species recorded on the U.S. Breeding Bird Survey routes (Robbins et al., in prep.). The greatest rate of decline was recorded in Tennessee and Kentucky.

According to the U.S. Fish & Wildlife Service (1987), the Cerulean Warbler is now considered a "species of research and management concern" in the northcentral U.S. Apart from Wisconsin, where it is considered Threatened, it does not have any special legal status in any other areas (Hands et al. 1989). However, numerous local state Natural Heritage programs list the species as Critically Imperiled, Imperiled, or Rare (Robbins et al., in prep.).

While the Cerulean Warbler has declined markedly in some parts of its primary breeding range in the U.S., it has also experienced range expansions in other parts of eastern North America. Perhaps the two are related. Perhaps loss of core habitat essentially "forces" birds to expand their range. On the other hand, some of the "new" areas into which the birds are reported to be expanding may have been overlooked in the past. Much more research is needed in assessing the status of the continental population. In the meantime, there is cause for concern. Indeed, without protection of breeding and wintering habitat, Robbins et al. (1989) believed that the future of this species was in "serious jeopardy".

E. HABITAT

Mature deciduous forest is the Cerulean Warbler's typical breeding habitat (Bent 1963). Although it occupies both upland and lowland forest, lowland (mesic to wet) sites are preferred (Griscom and Sprunt 1957; Bent 1963; Chapman 1968). In Ontario, Peck and James (1987) noted that it also occupied second-growth deciduous woods and occasionally mixed woods, preferring to nest at interior-forest edges and near clearings of open stands. Canopy height and structure are probably critical habitat features (pers. obs.), but very little quantitative work has been done.

In Michigan, Adams (1989, in Hands et al. 1989) reported that Cerulean Warblers occurred in mature lowland forests dominated by silver maple (Acer saccharinum), American elm (Ulmus americana), and ash (Fraxinus sp.) as well as in upland deciduous forests dominated by beech-maple (Fagus-Acer).

Farther south, in river bottomland sites in North Carolina, Cerulean Warblers were reported in forest dominated by sycamore (Platanus occidentalis), green ash (Fraxinus pennsylvanica), and sugarberry (Celtis laevigata -- Lynch 1981, in Hands et al. 1989). The highest densities occurred in sites having a 25-30 m closed canopy, a distinct shrub layer, and 100% ground cover.

In studies conducted in Tennessee, Robbins et al. (1989) reported that Cerulean Warblers typically occurred above the middle of the trees, but seldom at the top, that their territories tended to include the larger-diameter trees, and that they were most numerous in the larger tracts of forest.

Forest size and linkage are important components of Cerulean Warbler habitat, particularly in upland sites. In Wisconsin, Bond (1957, in Hands et al. 1989) detected Cerulean Warblers in a greater proportion of medium (16-32 ha) and large (>32 ha) forest

tracts than in small (<16 ha) tracts. Moreover, upland xeric tracts were only occupied if they were large (>16 ha).

Robbins et al. (1989) found that Ceruleans selected large tracts of mature, semi-open, deciduous forest. Their distribution was positively correlated with forest area, basal area of the trees, and percent ground cover, and negatively correlated with coniferous tree cover. Robbins et al. (1989) concluded that breeding densities were maximized in forests of at least 3000 ha and that the minimum areal requirement was about 140 ha of contiguous habitat. In Ontario, Eagles (1987) mentioned only that the Cerulean Warbler occupies "substantial blocks of forest".

Little is known about habitat use during the nonbreeding seasons (Hands et al. 1989; Robbins et al., in prep.). However, during winter, forested montane areas are apparently preferred. In Peru, Cerulean Warblers were most frequently detected at elevations of 3000 - 4000 m (Bent 1963).

In Ontario, most Cerulean Warbler nests have been found in oaks, followed by maples, basswood, elm and chestnut (Peck and James 1987). An affinity for these species has also been reported elsewhere in the northern part of the Cerulean Warbler's breeding range (e.g. Bent 1963; Chapman 1968; Harrison 1975; Bull 1985; Connor 1988).

The nest is generally placed high up (4.5-20 m) in a medium to large deciduous tree. It is usually saddled on a substantial limb (often at the fork) within 3 m of the trunk (Peck and James 1987). Robbins et al. (in prep.) caution that while most nests have been found at heights of 9-12 m, the actual mean height is probably much greater, due to detection difficulties for higher nests. Because of their great height, nests are very difficult to find (e.g. Eagles 1987).

The nest is a rather frail, shallow cup composed of herbaceous fibres and bark and lined with animal hair, fine grasses, fine bark strips, mosses, and rootlets (Saunders 1900; Bent 1963; Peck and James 1987). The exterior is lined with bark, spider webs, plant fibres, rootlets, lichens, and pine needles (Saunders 1900; Bent 1963; Chapman 1968; Peck and James 1987).

The amount of habitat, which is available to permit an expanding population in Ontario and Quebec, is unknown. Judging from the distribution of the species throughout its range, suitable habitat (late successional deciduous forest) is quite localized.

There is little doubt that the amount of suitable habitat in many parts of southwestern Ontario has been severely reduced (> 50%) since European settlement. The present rate of habitat loss has not been quantified, but it has undoubtedly slowed down markedly from the dramatic rate of loss that was experienced in the 19th century. Of course, this is partly because most of it has already disappeared.

Due to their affinity for large forested tracts, perhaps as much as 50% of the habitat presently occupied by Cerulean Warblers in Ontario occurs in "protected" areas or is Crown land. However, experience shows that most "protected" areas are not adequately protected from intensive logging practices or drainage. In fact, there are extremely few large, mature tracts of deciduous forest which are actually protected in Ontario.

In summary, the Cerulean Warbler has quite specialized habitat requirements, preferring the tall canopies of large (> 100 ha), late-successional, wet to mesic deciduous woodlands. Such habitat should be considered essential to the species.

F. GENERAL BIOLOGY

1. Reproductive

The breeding biology of the Cerulean Warbler is among the poorest known of all North American passerines, no doubt due to the great heights at which this species typically nests and forages. For instance, there are no data on nest success, productivity, renesting potential, site fidelity, mate fidelity, or age/sex ratios.

The Cerulean Warbler attains breeding maturity after its first year. There is no evidence to suggest that the species is anything more than single-brooded.

As mentioned earlier, the Cerulean Warbler is often loosely "colonial". However, such "coloniality" can be attributed to groups of birds being concentrated in pockets of suitable habitat (Griscom and Sprunt 1957; Farrand 1983). Apart from habitat requisites, no other special breeding requirements have been identified.

Mortality rates are unknown; the maximum longevity is reported to be about 12 years (Hands et al. 1989), but this is clearly atypical. Like most small song-birds, its normal life-span is probably 2-3 years.

Egg dates in Ontario range from 24 May to 27 June (Peck and James 1987). Clutch size ranges from 3 to 5 eggs and averages 4 (Bent 1963; Peck and James 1987). Incubation period is unknown, but is probably about 12-13 days (Harrison 1975). Young probably remain in the nest for about 9 or 10 days, but there is a great dearth of information about their care and development (Bent 1963).

2. Movement

As noted by Bent (1963) and Griscom and Sprunt (1957), the Cerulean Warbler generally migrates singly or in very small groups. Even at Long Point, a principal "fall out" area for most species of warblers during migration, the species is uncommon and irregular at best. Daily censuses conducted at field stations there since 1960 have detected only about 30 birds (Long Point Bird Observatory, unpubl. data), despite a healthy breeding population farther inland. A count of three birds is the maximum daily number ever recorded at Long Point (Long Point Bird Observatory, unpubl. data). Similar results were reported for Prince Edward Point, Lake Ontario (Weir 1989). The maximum daily number of Ceruleans at Point Pelee is 25 (Stirrett 1960), but this was clearly an unusual occurrence.

The general infrequency of Cerulean Warblers at traditional song-bird, stop-over areas on the Great Lakes may be partly due to an inland, possibly riverine, migratory strategy. In any event, no areas of migratory concentration have been identified, or are likely to occur, in Canada. During the breeding season, Cerulean Warblers are loosely "colonial". The species also appears to concentrate on the wintering grounds (see above).

Due to their tree-top behaviour, fewer than 1000 Cerulean Warblers have been banded in North America since 1950 (Robbins et al., in prep.). Hence, exceedingly little is known about migration and dispersal patterns, longevity, site-fidelity, and local movements.

3. Behaviour/Adaptability

The diet of the Cerulean Warbler is poorly documented, but it is believed to be entirely insectivorous (e.g. Hymenoptera, beetles, weevils and caterpillars). It forages among the branches of both the canopy and shrub layer and also catches insects on the wing (Bent 1963).

Because of its affinity to mesic and wet woods, the Cerulean Warbler is probably susceptible to drainage of swampland and the effects of drought. The effects of timber management on this species have not been investigated, but it can probably tolerate low levels of lumbering (e.g. highly selective cutting and small patch cuts), providing that such activities do not set back the stage of forest succession over a wide area. A significant percentage of late successional deciduous forest must remain in order to provide optimum habitat. No other special conditions affecting this species have been identified apart from habitat loss and degradation.

No attempt has been made to breed the Cerulean Warbler in captivity or transplant populations. Although wild individuals are available for such purposes, there is presently no clear need to do so in Canada.

G. LIMITING FACTORS

The Cerulean Warbler is regarded as both a long-distance migrant and a forest-interior species. These species are apt to be the most sensitive to habitat losses on the breeding and wintering grounds and their future has recently been the centre of considerable concern and debate (e.g. Robbins 1979; Blake and Karr 1984; Robbins et al. 1986; Hutto 1988).

The major cause of declines of Cerulean Warblers in the U.S. is believed to be due to forest fragmentation and degradation and general loss of large tracts of mature, deciduous forest, particularly in lowlands (Mosely 1947; Griscom and Sprunt 1957; Connor 1988; Hands et al. 1989; Robbins et al., in prep.). Any declines which have occurred in Canada almost certainly also stem from loss and degradation of breeding habitat.

Little information is available about tolerance to habitat disturbance. In Ontario, the Cerulean Warbler was found to be in a group of species that was most common in relatively undisturbed habitats that were characterized by reduced amounts of edge (Robertson and Flood 1980). In Ohio, Adams and Barrett (1976) found that Cerulean Warblers were common in a virgin forest, but that they were absent from a similar, but disturbed (selectively-cut) multi-layered forest. In a much broader study, Noon et al. (1979) found that Ceruleans were restricted to mature, undisturbed habitats. However, the species is reasonably common in the Regional Municipality of Haldimand-Norfolk in Ontario, a region where virgin forest is essentially absent and selective cutting is practised extensively. It would seem that if selective cutting is to be undertaken, extreme caution should be exercised.

Some populations of Cerulean Warblers have declined even in areas where loss or degradation of breeding habitat has apparently not been a factor. For example, their populations declined significantly in undisturbed forest plots in southern Wisconsin, where other forest-dwelling, long-distance migrants also generally declined (Ambuel and Temple 1982). The inference here was that there is some other mechanism driving population declines.

Hands et al. (1989) and Robbins et al. (in prep.) felt that habitat losses in South American wintering areas could be an additional factor responsible for population declines of this species in the U.S. At present, however, there is little actual evidence that tropical deforestation has been significantly related

to declining populations of neotropical migrants (e.g. see Hutto 1988). Much more research is clearly needed in the tropics. Still, Robbins et al. (in prep.) warned that the Cerulean Warbler "occupies one of the most specialized and threatened wintering habitats of any nearctic migrant".

Virtually nothing is known about other potential causes of population decline (e.g. pesticides, predation, competition, diseases and parasites, and severe weather) in this poorly studied species.

Apart from changes in habitat, perhaps one of the strongest factors limiting reproductive output of the Cerulean Warbler may stem from Brown-headed Cowbird (Molothrus ater) parasitism (Mayfield 1977). No doubt because of the relative inaccessibility of Cerulean Warbler tree-top nests, parasitism has been only seldom reported. Nevertheless, of 39 nests whose contents were checked in Ontario, 7 (18%) were parasitized (Peck and James 1987). As noted by Trapp (1967), the Cerulean Warbler is probably a much more common victim of cowbird parasitism than is realized. Moreover, the incidence of parasitism can be expected to increase as forests become more fragmented and cowbird populations continue to expand (Mayfield 1977; Peck and James 1987; Robbins et al., in prep.).

Robbins et al. (in prep.) summarized the chief constraints on populations of the Cerulean Warbler on the breeding grounds as follows:

1) loss of mature deciduous forest, especially along stream valleys.
2) fragmentation and increasing isolation of the suitable habitat that remains.
3) change to shorter rotation periods so that less deciduous forest attains maturity.
4) environmental degradation from acid rain and stream pollution.

5) loss of key tree species, particularly oaks (from Oak Wilt and gypsy moths), elms (from Dutch Elm Disease) and American chestnut (from Chestnut Blight).

6) nest parasitism by the Brown-headed Cowbird (probably an increasing phenomena due to recent range and population expansions of cowbirds).

H. SPECIAL SIGNIFICANCE OF THE SPECIES

The Cerulean Warbler is considered a "Species of Research and Management Concern" in the northcentral U.S. (U.S. Fish & Wildlife Service 1987). It is considered Threatened in Minnesota (Hands et al. 1989) and numerous local state Natural Heritage programs regard it as Critically Imperiled, Imperiled, or Rare (Robbins et al., in prep.). In Ontario, it is considered locally uncommon in the southern part of the province (James et al. 1976; Eagles 1987).

Public regard for the species is primarily limited to specialized interest on the part of bird-watchers who consider it a "good find", due its uncommonness, inconspicuousness and general beauty. The Cerulean Warbler is neither hunted, captive reared, commercially exploited, or subject to adverse public attitudes. Two other members of the genus Dendroica are considered Endangered or Rare in Ontario (Kirtland's Warbler D. kirtlandii and Prairie Warbler D. discolor respectively).

There are several other Carolinian bird species which may be considered rare in Canada and which are apt to occur in the same habitats as the Cerulean Warbler. Based on Hellman (1950), Adams and Barrett (1976) and personal observations, these include Red-bellied Woodpecker (Melanerpes carolinus), Acadian Flycatcher

(Empidonax virescens), Tufted Titmouse (Parus bicolor), Carolina Wren (Thryothorus ludovicianus), Louisiana Waterthrush (Seiurus motacilla), Kentucky Warbler (Oporornis formosus), and Hooded Warbler (Wilsonia citrina).

I. EVALUATION AND PROPOSED STATUS

Populations of the Cerulean Warbler are reported to have declined dramatically in many parts of the U.S. Although range expansions have occurred in the eastern states, it is believed that the U.S. population is generally declining. Much of the decline is attributed to habitat loss, fragmentation, and degradation both on the breeding grounds and in tropical wintering areas. Additional negative impacts may have been imposed by heightened incidences of cowbird parasitism over historical levels.

In Canada, the Cerulean Warbler is at the northern periphery of its breeding range. There have undoubtedly been local population declines of the species in Ontario, especially in the extreme southwest where habitat loss has been most severe. However, there is also some evidence to suggest that the species has undergone a concurrent, slow expansion of its range north and eastward.

Unlike the situation in the U.S., there is no quantitative data available to indicate that the species is in a period of decline in Canada. The overall Canadian population is regarded as being locally rare to uncommon but more or less stable.

Much more research is needed on this little-studied species. Until such research is conducted or until such time as evidence to the contrary is presented, the Cerulean Warbler should be classed as "rare" in Ontario and "vulnerable" in Canada.

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APPENDIX 1. MANAGEMENT CONSIDERATIONS AND RESEARCH NEEDS

With only minor modifications, the following material is directly quoted from Hands et al. (1989), who provided an excellent overall summary of Cerulean Warbler management concerns and research needs.

1. Habitat Preservation

Because habitat availability apparently is the major factor affecting Cerulean Warbler populations, large (possibly >700 ha) tracts of mature, deciduous forests, primarily in lowland areas, should be preserved. However, better information regarding the minimum size of forest tracts necessary to support stable breeding populations of Cerulean Warblers is needed. In addition, younger hardwood stands adjacent to mature stands supporting Cerulean Warblers should be protected from timber harvest to ensure that habitat for these warblers is available in the future. Habitat supporting Cerulean Warblers can be preserved with conservation easements on, and purchases of, large forest tracts. Enforcement of existing wetland-protection regulations also should help protect lowland hardwood forests for Cerulean Warblers.

2. Habitat Management

When preservation of Cerulean Warblers is one of the management priorities for a forest tract, habitat management consists mainly of protecting the site from timber harvest, preventing chemical contamination, and maintaining the natural hydrology.

3. Population Management

More data on population trends, nest success, productivity, and mortality rates are needed to better assess the population status of the Cerulean Warbler. If surveys detect a population decline, studies of breeding success and productivity should be initiated.

4. Predator Management

Recommendations regarding predator management cannot be made until information regarding predators and the frequency of predation (and nest parasitism) is available. Even then, such management is probably not feasible. While cowbird control may have been an important tool in the preservation of the Kirtland's Warbler in Michigan, it is difficult to see how such management could be reasonably directed at the Cerulean Warbler, a species which is geographically widespread and which nests in inaccessible parts of the forest canopy.

5. People Management

Humans probably disturb Cerulean Warblers primarily by destroying and degrading mature forests. Thus, management plans for Cerulean Warblers should include programs to educate landowners and land managers of the habitat needs of this species. These educational programs should stress the need for protection of large tracts of mature, deciduous, primarily lowland forests.

6. Information and Research Needs

a) regularly survey Cerulean Warbler populations at several sites, both on the breeding grounds and in wintering areas.

b) monitor nesting habitat availability and quality.

c) describe the habitat used by nesting Cerulean Warblers in more detail. Specifically determine the following:
   i) size, approximate age, density, canopy cover, shrub cover, structure and species of trees;
   ii) soil moisture and frequency and duration of flooding events; and
   iii) minimum size of forest tracts and width of riparian forest corridors needed to sustain a stable breeding population.

d) describe the habitats occupied in the wintering areas, and monitor availability and quality.

e) identify acceptable levels and types of lumbering operations in breeding and wintering areas.

f) preserve forested tracts that Cerulean Warblers use during the breeding and migratory periods with conservation easements, land purchases, and enforcement of existing wetland-protection regulations and incentives.

g) determine migration routes and wintering areas.

h) identify the causes of egg and nestling losses.

i) determine the extent of nest-site and mate fidelity.

j) describe the diet of adults and juveniles during the breeding and migratory periods.

k) estimate the mortality rates of adults and juveniles through banding and colour-marking.

l) identify the causes of mortality of adults and juveniles.

m) determine and periodically monitor the levels and effects of contaminants on Cerulean Warblers and their eggs.

n) identify competitors of Cerulean Warblers.

o) identify the diseases and parasites inflicted upon Cerulean Warblers and their effects on the population.

p) determine the effects of weather on Cerulean Warblers.

q) evaluate the effects of human disturbance.

r) cooperate with biologists from other parts of North and South America on research and management.