

COSEWIC
Assessment and Update Status Report

on the

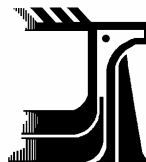
Cerulean Warbler
Dendroica cerulea

in Canada



SPECIAL CONCERN
2003

COSEWIC
COMMITTEE ON THE STATUS OF
ENDANGERED WILDLIFE
IN CANADA



COSEPAC
COMITÉ SUR LA SITUATION
DES ESPÈCES EN PÉRIL
AU CANADA

COSEWIC status reports are working documents used in assigning the status of wildlife species suspected of being at risk. This report may be cited as follows:

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Cerulean Warbler — Photo courtesy of Jason Jones.

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COSEWIC Assessment Summary

Assessment Summary – May 2003

Common name

Cerulean Warbler

Scientific name

Dendroica cerulea

Status

Special Concern

Reason for designation

This species breeds in mature deciduous forests in southern Ontario and southwestern Quebec, a habitat which has disappeared from much of its Canadian range in the last 200 years. The species has been steadily declining in numbers (three per cent per annum over the last 30 years), but most of this decline has been occurring in the core of the species' range in the U.S. and numbers may be relatively stable in eastern Ontario. Numbers in southwestern Ontario, however, have declined markedly, and overall numbers in Canada are low – less than 2000 mature individuals. The two dominant limiting factors for this species are habitat destruction on breeding, migration, and wintering grounds, and fragmentation of existing habitats.

Occurrence

Ontario, Quebec

Status history

Designated Special Concern in April 1993. Status re-examined and confirmed as Special Concern in May 2003. Last assessment based on an update status report.



COSEWIC
Executive Summary

Cerulean Warbler
Dendroica cerulea

Species information

The Cerulean Warbler (*Dendroica cerulea* Wilson, Paruline azurée) is a small (8-10g) wood-warbler.

Distribution

This species breeds in the deciduous forests of eastern North America but has a very patchy distribution. The Cerulean Warbler winters in the Andes Mountains of South America, from Venezuela to Bolivia. The Canadian breeding range consists of two main geographic clusters in Ontario and a small number of breeding individuals southwestern Quebec.

Habitat

On the breeding grounds, Cerulean Warblers are associated with mature deciduous forest with large and tall trees and an open understory. They are found in both wet bottomland forests and upland locations on dry ridges. In Ontario, they also occupy older second-growth deciduous forests. At smaller spatial scales, Cerulean Warblers exhibit strong preferences for certain microhabitats. Canopy configuration (e.g. foliage stratification, gap distribution, tree species distribution) may be the most important predictor of breeding habitat suitability for Cerulean Warblers.

In eastern Ontario, 70-80% of the original deciduous forest had been removed by the 1880s. However, over the last century, there has been substantial re-growth of forests in eastern Ontario that parallels what has been observed in the northeastern United States over the last several decades. Cerulean Warblers winter in mature, humid evergreen forests in South America, which are also ideal for human settlement and agriculture, notably the production of coffee. As a consequence, large tracts of winter habitat have been drastically altered. Fortunately, Cerulean Warblers can use modified forests (e.g. shade-coffee plantations) as winter habitat.

Biology

Despite broad interest in the Cerulean Warbler, the basic biology of this species remains poorly documented and understood. Breeding pairs generally raise only a single brood per year, although double brooding has been recorded. Over an 8-year period in eastern Ontario, average fecundity was 1.9 fledglings per breeding pair although there were large annual fluctuations. In a genetic study of five Cerulean Warbler geographic clusters throughout the breeding range (including 2 in Ontario), estimates from microsatellite data revealed sufficient levels of gene flow to prevent genetic differentiation through drift. Thus, dispersal between geographic clusters (presumably by young birds) undoubtedly plays an important role in Cerulean Warbler population dynamics.

Individuals appear to be strictly insectivorous during the breeding season but will avail themselves of nectar during the non-breeding season. Nestlings and fledglings are fed larval lepidopterans almost exclusively.

The species appears to be relatively resilient in the face of habitat disturbance, both anthropogenic and natural. In eastern Ontario, it breeds successfully in forests managed for the production of maple syrup and for shelterwood silviculture. Cerulean Warblers have also exhibited resilience to habitat damage resulting from the January 1998 ice storm.

Cerulean Warblers exhibit two behaviours that may render them particularly vulnerable. The first is the high site fidelity exhibited by adults. Despite their apparent resilience to certain disturbances, the fact that adults seem unable to “recognize” habitat degradation may keep birds in unsuitable habitats. The second is their protracted migration periods in both spring (2 months) and fall (4 months). This long traveling period could be subjecting individuals to high physiological stresses and high probability of predation, as well as habitat disturbances along the length of their migration routes.

Population sizes and trends

The Cerulean Warbler exhibited the greatest decline in abundance for any species of North American wood-warbler for the period 1966-2000. However, it is thought to be expanding its range in the northeastern United States and in southern Ontario and Quebec. It is unclear if the apparent increase in Canadian Cerulean Warbler populations over the last 50 years represents a true range expansion into new areas, a re-colonization event, or an artifact of the increase in public and scientific interest.

The Canadian population is estimated to be 500 - 1,000 breeding pairs. Unfortunately, given the patchiness of its habitat and the difficulties associated with surveying this species, it is difficult to predict where the high end of a population estimate would fall. Current best estimates of the size of the North American population range between 85,000 - 287,000 pairs.

Limiting factors and threats

The three dominant limiting factors for this species are: habitat destruction on breeding, migration, and wintering grounds; fragmentation of existing habitats; and environmental degradation (e.g. acid rain).

Special significance of the species

The Cerulean Warbler has generated considerable public, scientific, and conservation interest. The positive regard in which this species is held has led to an intense public interest in its conservation. While it does not appear to fulfill any critical ecological role, it has become a symbol of the health of mature deciduous forests in eastern North America. In Ontario, management of forested habitats for Cerulean Warblers will likely have a positive effect on other forest-interior species of interest.

Existing protection or other status designations

The Cerulean Warbler is not federally listed in the United States and is considered a Species of Special Concern in Canada by COSEWIC. The Migratory Bird Treaty Act of 1918 provides protection against direct take. NatureServe gives it a global rank of G4 (common).

Summary of status report

Since the publication of the first status report for the Cerulean Warbler in Canada, the Canadian population appears to have remained stable or possibly to have decreased, both in terms of population size and distribution. Given what is known about Cerulean Warbler habitat requirements, the dominant limiting factors for this species will always be limiting, regardless of population size. However, the largest potential threat to the long-term health of this species is that its basic biology remains poorly documented and understood which has direct impact on our ability to manage and sustain its populations, most notably in the areas of mating and social systems, landscape-scale habitat selection, and migration stopover ecology.



COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) determines the national status of wild species, subspecies, varieties, and nationally significant populations that are considered to be at risk in Canada. Designations are made on all native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fish, lepidopterans, molluscs, vascular plants, lichens, and mosses.

COSEWIC MEMBERSHIP

COSEWIC comprises representatives from each provincial and territorial government wildlife agency, four federal agencies (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biosystematic Partnership), three nonjurisdictional members and the co-chairs of the species specialist groups. The committee meets to consider status reports on candidate species.

DEFINITIONS

Species	Any indigenous species, subspecies, variety, or geographically defined population of wild fauna and flora.
Extinct (X)	A species that no longer exists.
Extirpated (XT)	A species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A species facing imminent extirpation or extinction.
Threatened (T)	A species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.
Not at Risk (NAR)**	A species that has been evaluated and found to be not at risk.
Data Deficient (DD)***	A species for which there is insufficient scientific information to support status designation.

* Formerly described as “Vulnerable” from 1990 to 1999, or “Rare” prior to 1990.

** Formerly described as “Not In Any Category”, or “No Designation Required.”

*** Formerly described as “Indeterminate” from 1994 to 1999 or “ISIBD” (insufficient scientific information on which to base a designation) prior to 1994.

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list.



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The Canadian Wildlife Service, Environment Canada, provides full administrative and financial support to the COSEWIC Secretariat.

**Update
COSEWIC Status Report**

on the

Cerulean Warbler
Dendroica cerulea

in Canada

2003

TABLE OF CONTENTS

SPECIES INFORMATION.....	3
Name and classification.....	3
Description.....	3
DISTRIBUTION.....	3
Global range.....	3
Canadian range.....	5
HABITAT.....	7
Habitat requirements.....	7
Trends.....	8
Habitat protection/ownership.....	8
BIOLOGY.....	8
General.....	8
Reproduction.....	9
Survival.....	9
Movements/dispersal.....	9
Nutrition and interspecific interactions.....	10
Behaviour/adaptability.....	10
POPULATION SIZE AND TREND.....	11
LIMITING FACTORS AND THREATS.....	13
SPECIAL SIGNIFICANCE OF THE SPECIES.....	14
EXISTING PROTECTION OR OTHER STATUS.....	14
SUMMARY OF STATUS REPORT.....	16
TECHNICAL SUMMARY.....	17
ACKNOWLEDGEMENTS.....	19
LITERATURE CITED.....	19
BIOGRAPHICAL SUMMARY OF CONTRACTORS.....	21
AUTHORITIES CONSULTED.....	22
COLLECTIONS EXAMINED.....	25

List of figures

Figure 1. Male Cerulean Warbler.....	3
Figure 2. Breeding distribution of the Cerulean Warbler in North America.....	4
Figure 3. Winter distribution of the Cerulean Warbler in South America.....	5
Figure 4. Current breeding distribution of the Cerulean Warbler in Canada.....	6

List of tables

Table 1. NatureServe ranks for the Cerulean Warbler in the United States (taken from Hamel 2000b and updated (S. G. Cannings pers. comm.).....	15
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SPECIES INFORMATION

Name and classification

English name: Cerulean Warbler
Scientific name: *Dendroica cerulea* Wilson
French names: Paruline azurée

Description

The Cerulean Warbler is a small (8-10g) wood-warbler with relatively long wings and a short tail. The adult male is deep blue above, white below, and has a blue-black band across the throat (Figure 1). The adult female is blue-green above, whitish below (often with yellow wash) and has a yellow-white eyebrow or supercilium. Both sexes have 2 prominent white wing-bars and white tail spots. Young individuals (second-year) tend to be similarly marked to adults but duller and less boldly marked. However, there is little consensus on what plumage colour characteristics best distinguish female age classes. For complete descriptions of plumage characteristics, refer to Dunn and Garrett (1997), Pyle (1997), and Hamel (2000a).



Figure 1. Male Cerulean Warbler (photo courtesy of Jason Jones).

Confusion with other species is unlikely for the adults of either sex. Immature birds in their first fall can look superficially similar to young female Blackburnian Warblers (*Dendroica fusca*). However, young Cerulean Warblers tend to be yellow-white below while Blackburnian Warblers tend to be buffy. In addition, Blackburnian Warblers have pale streaking on the sides of the back that is not seen in Cerulean Warblers.

DISTRIBUTION

Global range

The Cerulean Warbler breeds mainly from north-central Minnesota, northern Wisconsin, the central Lower Peninsula of Michigan, southern Ontario, New York, and western

Vermont, south through Massachusetts, Connecticut, New Jersey, Pennsylvania, northern Delaware, West Virginia, North Carolina, and northern Georgia, and west to central Arkansas, Missouri and Iowa. Local breeding has also been recorded in the north (southeastern Quebec), south (northern Mississippi) and west (eastern Oklahoma, Kansas and Nebraska) (Figure 2; Dunn and Garret 1997; Hamel 2000a; Rosenberg et al. 2000). The Cerulean Warbler is not uniformly distributed throughout this range with notable concentrations in the Cumberland Mountains of Tennessee, the Montezuma Wetlands complex in New York, southern Illinois, southeastern Ontario, and West Virginia. Casual records exist in North America in both Canada (Manitoba, northern Ontario, New Brunswick, Newfoundland, Nova Scotia) and the United States (Arizona, California, Colorado, Nevada, New Hampshire, New Mexico, North Dakota).

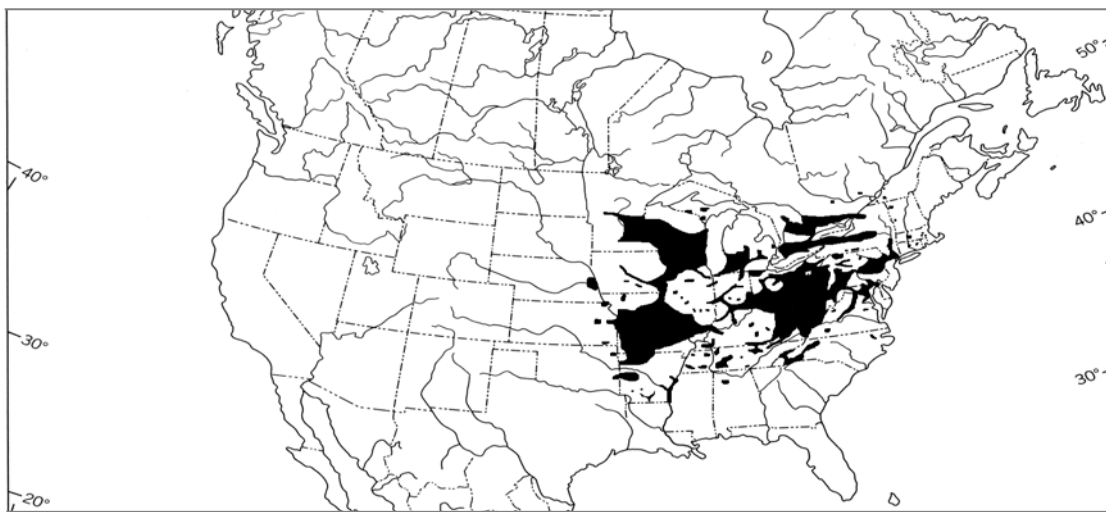


Figure 2. Breeding distribution of the Cerulean Warbler in North America (modified from Hamel 2000a).

The Cerulean Warbler winters in the Andes Mountains of South America (Figure 3). The range includes northern and western Venezuela, both slopes of the Andes in Columbia, and the eastern slope of the Andes in Ecuador, Peru, and Bolivia (Ridgely and Tudor 1989; Robbins et al. 1992). Extralimital sightings include 2 sightings from southeastern Brazil (Ridgely and Tudor 1989), occasional sightings from eastern Venezuela and the western slope of the Andes in Ecuador (Dunn and Garrett 1997) as well as winter sightings from the Grand Caymans, Costa Rica and Panama (Bent 1953; Hamel 2000a). This species tends to be restricted to elevations between 500 and 1,500 m (Robbins et al. 1992).

The bulk of Cerulean Warbler migration (both spring and fall) appears to occur along the Mississippi and Ohio River valley (Hamel 2000a). This species generally migrates across the Gulf of Mexico and, to a lesser extent, along the Caribbean coast of Central America (Parker 1994; Howell and Webb 1995; Hamel 2000a). Fall records from Bermuda and the West Indies indicate that some of the population migrates through the Greater Antilles (Dunn and Garrett 1997).



Figure 3. Winter distribution of the Cerulean Warbler in South America (modified from Ridgley and Tudor 1989). Star represents extralimital sighting in southeastern Brazil.

Canadian range

The Canadian breeding range for the Cerulean Warbler has not changed appreciably since McCracken's 1993 initial COSEWIC status report. There still appear to be two main breeding geographic clusters in Ontario (in southern Ontario in Carolinian forests between lower Lake Huron and Lake Ontario, and a more northerly band between the Bruce Peninsula east to the Ottawa River with concentration on the Frontenac Axis at the east end of Lake Ontario). There is also a small number of breeding individuals in southeastern Quebec (Figure 4). Although incomplete, the current Ontario breeding bird atlas effort (www.birdsontario.org/atlas/atlasmain.html) indicates that the two Ontario geographic clusters are still present (with some local extinctions and colonizations of sites). Records from the Banque de données sur les oiseaux menacés du Québec (BDOMQ; Shaffer pers. com. 2002) indicate that singing males have been recorded in Quebec at 14 sites since 1965. However, only 8 of these sites have had more than one individual and breeding has only been confirmed at 6 of these 8 (Figure 4).

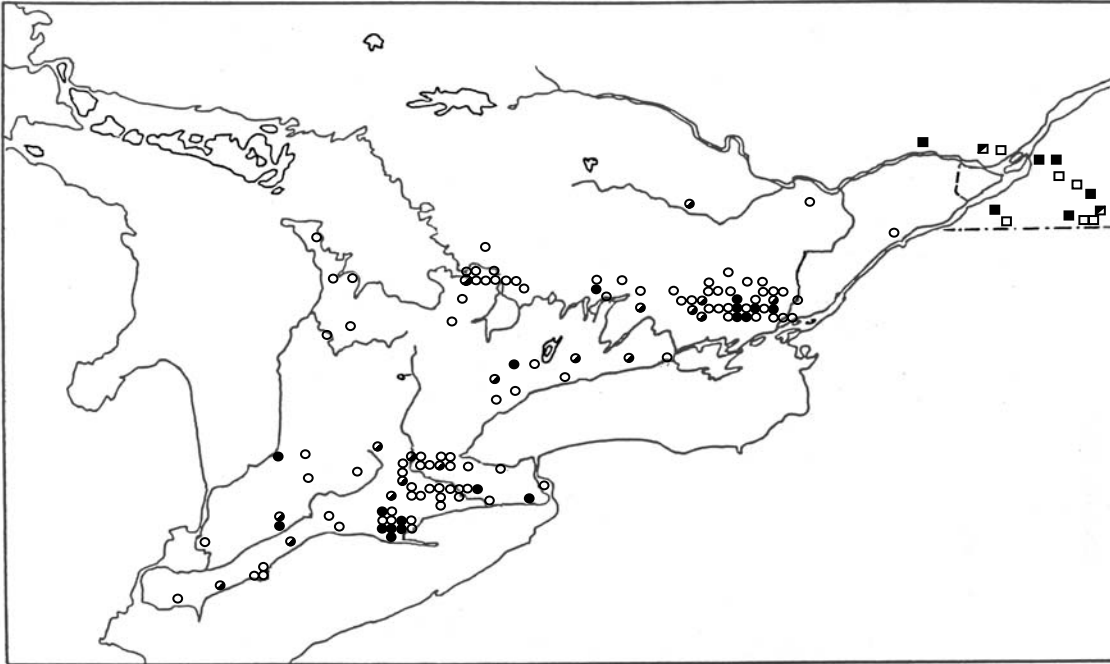


Figure 4. Current breeding distribution of the Cerulean Warbler in Canada (modified from Ouellet 1967, Eagles 1987, McCracken 1993, Cyr and Larivée 1995 and the 2001-2 Ontario Breeding Bird Atlas). Circles refer to detections during the 1st and 2nd (2001-2 only) Ontario Breeding Bird Atlas projects (Closed circles = detected in both atlases; open circles = detected in 1st atlas, not yet detected in 2nd; bottom-filled circles = detected in 2nd atlas only). Squares refer to Quebec locations (open squares = detected only once; top-filled squares = sightings in multiple years; filled squares = breeding evidence).

Cerulean Warblers are very rarely caught at banding stations (e.g. 35 records from the Long Point Bird Observatory, 1967-2002, Francis pers. com. 2002). The earliest documented arrival in Ontario is 18 April (Hamel 2000a) and 6 May in Quebec (David 1996). At one site in eastern Ontario (Queen's University Biological Station), there appears to have been a shift towards earlier arrival over the last 8 years (13 May in 1994, 2 May in 2001; Jones et al. unpubl. data). Most adult birds have left Canadian breeding sites by late August.

Cerulean Warblers are considered accidental in Nova Scotia (17 records; Currie pers. com. 2002) and in New Brunswick (6 records; Christie pers. com. 2002), and rare in Newfoundland (7 records, Montevecchi pers. com. 2002). A single female found near Whitewater Lake, Manitoba, on 2 June 1924 represents the only confirmed record in Canada west of the Manitoba-Ontario border (Taylor pers. com. 2002).

HABITAT

Habitat requirements

a. Breeding grounds — Cerulean Warblers are traditionally associated with forested landscapes, particularly mature deciduous forest with large and tall trees and an open understory (Hamel 2000a). They are found in both wet bottomland forests as well as upland locations on mesic slopes. In Ontario, they also occupy older second-growth deciduous forests (Peck and James 1987; Jones and Robertson 2001). The Cerulean Warbler is usually considered an area-sensitive species (Robbins et al. 1992; Hamel 2000a). Minimum area requirements reported in the literature range from 20-30 ha in Ohio to 1600 ha in Tennessee (Robbins et al. 1992; Hamel 2000a). In eastern Ontario, Cerulean Warblers have been found breeding successfully in forest fragments as small as 10 ha (Jones and Robertson unpublished data). The spatial distribution of forest patches (especially distance between suitable patches) undoubtedly plays an important role in settlement patterns and area sensitivity. This needs further study.

At smaller spatial scales, Cerulean Warblers exhibit strong preferences for certain microhabitats. Territories are usually characterized by well-spaced large trees, with high canopies and dense foliage cover in the upper midstory and canopy, and birds tend to avoid areas of dense understory (Hamel 2000a; Jones and Robertson 2001). Individuals spend the majority of their time in the upper reaches of the canopy. There appears to be no consistent tree species preference for nest locations (Oliarnyk and Robertson 1996; Hamel 2000a; Jones and Robertson 2001). Several researchers have reported on the apparent importance of internal canopy gaps as a component of successful Cerulean Warbler territories (Bent 1953; Harrison 1984; Oliarnyk and Robertson 1996).

In eastern Ontario, Cerulean Warblers do not use all parts of their territories equally (Barg 2002). Male Cerulean Warblers have distinct areas of high use (hereafter referred to as core areas) that are associated with concentrated singing activity. These core areas are both vegetatively and structurally distinct from the rest of the territory. In particular, core areas are dominated by bitternut hickory (*Carya cordiformis*), a species that is among the last to fully leaf-out in eastern Ontario. As the Cerulean Warbler song does not appear to be particularly well suited for transmission in densely forested habitats (Woodward 1995), it is hypothesized that males are selecting these core areas to maximize song propagation (Barg 2002). It appears that canopy configuration (e.g. foliage stratification, gap distribution, tree species distribution) may be an important predictor of breeding habitat suitability for this species.

b. Migration — Very little substantive information exists on habitat requirements during migration. Individuals have been observed in lower montane wet forest in Belize (Parker 1994), as well as in primary and secondary forests in Guatemala (Land 1970), Costa Rica (Stiles and Skutch 1989) and Panama (Ridgely and Gwynne 1989).

c. *Winter grounds* — Cerulean Warblers winter on the eastern slope of the Andes Mountains of South America in mature, humid evergreen forests. They also use modified forests (e.g. shade-coffee plantations) as overwinter habitats (Jones et al. 2000b, 2002).

Trends

In eastern Ontario, 70-80% of the original deciduous forest had been removed by the 1880s, largely through the establishment of settlers and the logging industry (Keddy 1994; OMNR 1997). However, shallow soils rendered much of the cleared land un-arable and, over the last century, there has been a gradual shift away from agriculture as a dominant economic force in the region. As a consequence, there has been substantial re-growth of forests in eastern Ontario; the average overall forest cover in eastern Ontario is expected to level out at approximately 40% (OMNR 1997). This re-growth parallels what has been observed in certain parts of the eastern United States over the last several decades (Askins 1993). However, without detailed assessments of site fidelity and reproductive success it is difficult to determine whether this apparent increase in habitat availability is paralleled by a simultaneous increase in habitat quality. Furthermore, this apparent increase in habitat availability is highly regionalized. In southwestern Ontario, mature growth stands are becoming increasingly rare, in part due to a lack of involvement by the Ontario Ministry of Natural Resources in the management of private woodlots (Friesen pers. comm. 2002).

On the wintering grounds in South America, the preferred habitats of Cerulean Warblers occur in a landscape that is also ideal for human settlement and agriculture, notably the production of coffee, cacao, tea, hill rice, and coca (Robbins et al. 1992; Stotz et al. 1996). Other than the Atlantic forests of Brazil, the humid montane forests of South America have been altered more drastically than any other South American forest type (Robbins et al. 1992; Stotz et al. 1996).

Habitat protection/ownership

The bulk of Cerulean Warbler habitat in Ontario is privately owned although relatively large numbers are found on public protected lands (Jones pers. obs.). At this point, more precise estimates on the numbers of birds breeding on these lands are unavailable. Based on preliminary evidence (Jones unpubl.data), we estimate that 10-20% of the Canadian population is found on public protected lands but further surveys are needed to increase the precision and accuracy of this estimate.

BIOLOGY

General

Despite broad public and scientific interest in the Cerulean Warbler, the basic biology of this species remains poorly documented and understood. Although considerable advances have been made in the last 10 years (e.g. Oliarnyk and

Robertson 1996; Hamel 2000a; Jones and Robertson 2001; Jones et al. 2001; Barg 2002), there remain considerable gaps in our knowledge. Rather than go into an exhaustive review of research to date, this discussion of Cerulean Warbler biology is restricted to those aspects directly relevant to the status update and survival of the species.

Reproduction

Cerulean Warblers generally raise only a single brood per year, although double-brooding has been recorded (Barg et al. unpublished data). Pairs will re-nest up to 4 times in a season following nest failure (Hamel 2000a; Barg et al. unpubl. data). Female Cerulean Warblers typically lay 3 or 4 eggs per clutch. Incubation generally lasts 11-12 days and the nestlings typically fledge after 8-10 days (Oliarnyk 1996; Hamel 2000a; Barg et al. unpublished data). Over an 8-year period in eastern Ontario, average fecundity was 1.9 fledglings per breeding pair (Jones et al. in review). Most successful pairs fledged 3 or 4 fledglings but, in any given season, only two-thirds of pairs have successful nests. There can be large fluctuations in annual fecundity, ranging from 0.4 to 2.2 fledglings per breeding pair (Jones et al. 2001, unpubl. data).

Brood parasitism by Brown-headed Cowbirds (*Molothrus ater*) has been suggested as an important factor in the decline of the Cerulean Warbler in the core of its breeding range (Robbins et al. 1992). However, there is considerable variation in its prevalence (Hamel 2000a). At the Queen's University Biological Station, no cowbird fledglings have been produced by Cerulean Warblers in the last 8 years (Oliarnyk 1996; Jones et al. unpubl. data). Parasitism rates are much higher elsewhere (e.g. Mississippi Alluvial Valley, Hamel 2000a).

Survival

Jones et al. (in review) used capture-mark-recapture models to estimate survival for adult male Cerulean Warblers in an eastern Ontario population that has been studied since 1994. Adult male survival probability (49%) was constant over time in the best-supported model. No estimates exist for females or juveniles. The current longevity record is an 8-year-old male that was banded in eastern Ontario in 1997 as an adult (i.e., at least 3 years old), and has been present every year since then, including in 2002 (Jones and Barg unpubl. data). Typical life span for males is likely 3-4 years.

Movements/dispersal

As of 1999, 1,399 Cerulean Warblers had been banded in North America (Hamel 2000a). Only 1 of these birds has been recovered away from the banding location (Leberman and Clench 1975 in Hamel 2000a) suggesting strong site-fidelity in adults (Hamel 2000a, Jones et al. in review, Barg et al. unpubl. data) and limited gene flow among locations. In a genetic study of five Cerulean Warbler geographic clusters throughout the breeding range (including 2 in Ontario), estimates from microsatellite data revealed sufficient levels of gene flow to prevent genetic differentiation through drift (Veit 1999). Thus, dispersal between populations (presumably by young birds)

undoubtedly plays an important role in Cerulean Warbler population dynamics. Some evidence exists for limited natal philopatry in this species (Barg et al. unpubl. data).

Migration appears to occur over approximately 2 months in spring and 4 months in fall (Hamel 2000a). Fall migration tends to start early; there are records of individuals arriving in South America in August (Dunn and Garrett 1997).

Nutrition and interspecific interactions

Cerulean Warblers appear to be strictly insectivorous during the breeding season, consuming homopterans, larval lepidopterans, dipterans and coleopterans (Sample et al. 1993, Hamel 2000a, Barg et al. unpublished data). Cerulean Warblers will avail themselves of nectar resources during the non-breeding season in South America (Jones et al. 2000b). Nestlings and fledglings are fed larval lepidopterans almost exclusively. No empirical evidence exists to support the conjecture that food availability is limiting in Cerulean Warbler populations; however, it likely plays an important role in population regulation given the well-documented importance of food abundance to breeding migrant songbirds (Newton 1998).

Aggressive interactions between Cerulean Warblers and Least Flycatchers (*Empidonax minimus*), Red-eyed Vireos (*Vireo olivaceus*), and American Redstarts (*Setophaga ruticilla*) are common in Ontario but their consequences are unknown (Varey 1998; Barg pers. obs.).

Behaviour/adaptability

There has been conjecture in the literature that the Cerulean Warbler exhibits a degree of “coloniality” during the breeding season (Robbins et al. 1992), likely due to conspecific attraction. This phenomenon has not been studied in any detail but could have significant bearing on conservation or management plans for this species if confirmed. At QUBS, territory size ranges from 0.1 to 2.4 ha (Oliarnyk 1996; Barg 2002). However, territory size does not appear to be directly related to pair density (Jones pers. obs.); large portions of apparently suitable habitat go unoccupied each breeding season.

Cerulean Warblers appear to be relatively resilient in the face of habitat disturbance, both anthropogenic and natural (Jones 2000, Jones et al. 2000b, 2001, 2002). In eastern Ontario, they breed successfully in forests managed for the production of maple syrup and for shelterwood silviculture (Oliarnyk 1996, Jones 2000). On the wintering grounds, they can be found in good numbers in shade coffee plantations (Jones et al. 2000b, 2002). Similarly, this species is frequently found in second-growth habitat during migration (Land 1970, Ridgely and Gwynne 1989, Stiles and Skutch 1989).

Jones et al. (2001) examined the effects on forest structure and Cerulean Warbler reproductive success of the January 1998 ice storm (the worst in documented Canadian history, Kerry et al. 1999). This storm resulted in a significant reduction in the amount of

foliage in the forest canopy of the study area in eastern Ontario the following spring. This was followed by a significant decline in Cerulean Warbler reproductive output in the 1998 breeding season. In 1999, Cerulean Warblers demonstrated a significant increase in territory size and a significant shift in nest-site location patterns; these shifts were accompanied by a significant increase in reproductive success. The 1999 shifts in territory size and nest-site location patterns were effected by the same individuals that were failed breeders in 1998. This suggests that Cerulean Warblers possess a degree of plasticity in their habitat preferences and that this plasticity rendered the population somewhat resilient to certain disturbances. One of the more reliable locations for Cerulean Warblers in Quebec (Mont Saint-Hilaire) was damaged by an ice storm in the early 1980s; very few sightings have been recorded there since the storm (Bannon and Robert 1996).

Cerulean Warblers exhibit two behaviours that may render individuals particularly vulnerable. The first is the high site fidelity exhibited by adults. Despite their apparent resilience to certain disturbances, the fact that adults seem unable to “recognize” habitat degradation may keep birds in unsuitable habitats. The second is their protracted migration periods in both spring (2 months) and fall (4 months). It is unclear whether the protracted appearance of Cerulean Warbler migration is due to individuals taking a long time to migrate or due to the species taking a long time to migrate (i.e. some individuals migrate early and some late). If the former scenario is true, this long traveling period could not only be subjecting individuals to high physiological stresses but may also be exposing them to high probability of predation (more travel days = more days at risk) as well as habitat disturbances along the length of their migration routes. Migration has been implicated as a major time of mortality for Cerulean Warblers (Jones et al. in review) and other wood-warblers (Sillert and Holmes 2002).

POPULATION SIZE AND TREND

The Cerulean Warbler has exhibited the greatest decline in abundance for any species of North American wood-warbler — an average decline of 3% per year based on Breeding Bird Survey data for the period 1966-2000 (Robbins et al. 1992, Link and Sauer 2002). In fact, only six species of passerine exhibited more severe declines. The greatest declines were reported at the core of the breeding range (Tennessee, Kentucky, Ohio and West Virginia) where abundances were highest (Robbins et al. 1992, James et al. 1996, Villard and Maurer 1996).

In the northeastern United States and in southern Ontario and Quebec, the Cerulean Warbler is currently thought to be expanding both its range and its abundance (Hamel 2000a, Rosenberg et al. 2000). Unfortunately, it is difficult to place the status of the current Canadian population into a historical context. Early reports of this species in Ontario are inconsistent and make it difficult to ascertain whether or not its apparent increase over the last 50 years represents an expansion into new areas (i.e., Cerulean Warblers are new to Ontario), a recolonization (i.e., Cerulean Warblers were once common in Ontario and are only now returning as forests re-grow, especially in eastern

Ontario) or an artifact of the increase in the ability and desire of bird-watchers and researchers to locate this inconspicuous species.

Macoun and Macoun (1909 in McCracken 1993) classified the Cerulean Warbler as common in southwestern Ontario at the turn of the last century. It is not considered a common bird in the same area today. Eagles (1987) classified it as an uncommon local breeding bird in southern Ontario. This possible change in abundance is likely due to the continued historical loss of breeding habitat in the region (Eagles 1987). The historical status of the Cerulean Warbler in eastern Ontario is even less clear. In the 1920s, DeLury (1922) felt that the Cerulean Warbler was more common in eastern Ontario (even as far north as the Ottawa Valley) than people assumed. Broley (1929) believed that Cerulean Warblers bred north of Kingston as early as 1929 although the first documented nest in the Kingston region was found in the early 1950s (Quilliam 1965).

The database of the Ontario Natural Heritage Information Centre (NHIC) lists 45 Element Occurrences in Ontario; most of these occurrences represent small numbers of individuals. The largest geographical cluster in southwestern Ontario only supports 20-30 breeding pairs annually. In fact, there are probably fewer than 100 breeding pairs of Cerulean Warblers in southwestern Ontario (NHIC data). The single largest geographical cluster (~250 pairs) in Canada is currently on the property of the Queen's University Biological Station north of Kingston, ON (Jones 2000; Jones et al. 2000a).

The initial results of the current Ontario breeding bird atlas project (2001-2 data) imply that the distribution of Cerulean Warblers has possibly contracted since the first atlas of 1981-5 (Figure 4). For example, in the Perth Region, 7 atlas squares reported breeding evidence in 1981-5; only 2 have done so in the current atlas effort. Similarly, in the 1000 Islands, 5 squares reported breeding evidence in the first atlas versus 0 in the current effort. Once the current atlas effort is completed, it will be possible to make a more accurate determination of a population trend.

The only long-term demographic data set (1994 to present) on Cerulean Warblers in Ontario indicates that the local "population" at the Queen's University Biological Station has remained relatively constant over the last 8 years (Jones et al. in review). However, this persistence is likely only due to birds immigrating from other areas as it is not producing enough fledglings to sustain itself (Jones et al. in review); the reasons why not are unclear at this time.

Most of the land that comprises the range of Cerulean Warblers in Ontario is privately owned. However, the species is found in some protected areas including national parks (e.g., St. Lawrence Islands National Park, Leggo pers. com. 2002), as well as provincial parks in both Ontario (e.g., Charleston Lake Provincial Park, Jones pers. obs.) and Quebec (e.g., Parc du Mont Saint-Bruno, Shaffer pers. com. 2002). Other protected areas include forests owned and managed by the Middlesex County and forests in Haldimand/Norfolk (owned and managed by the Long Point Region Conservation Authority).

The population of breeding birds in Quebec is at least as old as the population in eastern Ontario (first confirmed record in 1950) but the number of breeding birds is very small (less than 40 pairs; BDOMQ; Shaffer pers. com. 2002).

The combination of the NHIC data with the trends exhibited by the current Ontario Breeding Bird Atlas and data from researchers at Queen's University (Jones et al. unpublished data) lead us to estimate that the current population of Cerulean Warblers in Canada is between 500 and 1000 breeding pairs. The bulk of this population is found in eastern Ontario.

Current estimates of the size of the North American Cerulean Warbler population range from 85,000 to 287,000 pairs (Rosenberg et al. 2000, pers. comm. 2002).

LIMITING FACTORS AND THREATS

Factors thought to be limiting Cerulean Warbler populations are well documented in Robbins et al. (1992) and Hamel (2000a).

Breeding grounds

1. loss of mature deciduous forest
2. fragmentation of remaining deciduous forest
3. changes in forest silviculture practices that result in fewer forests reaching maturity
4. loss of important tree species due to disease (e.g. oak wilt) and infestation (e.g. gypsy moth)
5. environmental degradation (e.g. acid rain and stream pollution)
6. brood-parasitism by Brown-headed Cowbirds.

In Canada, factors 1,2, and 5 are probably the most important.

During migration

Very little information exists on Cerulean Warbler migration patterns and habitat requirements. Presumably, they need safe stopover locations close to the coast of the Gulf of Mexico and on the Caribbean coast of Central America. Cerulean Warblers fall victim to light pollution during migration. For example, 93 Cerulean Warblers were killed at a Leon County, FL, TV tower between 1956 and 1966 (Stoddard and Norris 1967).

Winter grounds

1. loss of humid montane forest
2. fragmentation of remaining montane forest
3. use of a narrow elevational range

SPECIAL SIGNIFICANCE OF THE SPECIES

The Cerulean Warbler has generated considerable public, scientific and conservation interest lately. Much of this interest is generated by bird-watching (the fastest growing leisure activity in North America); the Cerulean Warbler is highly sought after by bird-watchers due to its inconspicuousness and beauty. Indeed, bird-watchers were among the first to document localized population declines of this species (Robbins et al. 1992). The positive regard in which this species is held has led to an intense public interest in its conservation.

There is no recorded information from aboriginal traditional sources specific to this species.

While the Cerulean Warbler does not appear to fulfill any critical ecological role (in the sense of a keystone species), it has become a symbol of the health of mature deciduous forests in eastern North America. In Ontario, management of forested habitats for Cerulean Warblers will likely have a positive effect on other species of interest (McCracken 1993). These include the Red-bellied Woodpecker (*Melanerpes carolinus*), Acadian Flycatcher (*Empidonax virescens*), Louisiana Waterthrush (*Seiurus motacilla*), Kentucky Warbler (*Oporornis formosus*), and Hooded Warbler (*Wilsonia cistrina*).

EXISTING PROTECTION OR OTHER STATUS

The Cerulean Warbler is not federally listed in the United States (Hamel 2000b) and is considered a Species of Special Concern in Canada (COSEWIC 2000). The Migratory Bird Treaty Act of 1918 provides protection against direct take. NatureServe gives the Cerulean Warbler a global rank of G4 (i.e., common and secure).

In Canada, the Cerulean Warbler is considered Vulnerable in Ontario (by the Ontario Ministry of Natural Resources). It appears on the list of species susceptible to be designated at risk in Quebec (Société de la Faune et des Parcs du Québec). It is ranked by NatureServe as S3B (very rare or otherwise vulnerable) in Ontario and S1B (critically imperiled) in Quebec and N3B nationally.

In the US, as of 2000 (Hamel 2000b), the Cerulean Warbler was on Watch Lists in three states (Illinois, Maryland, Missouri), listed as Threatened in 2 states (Rhode Island, Wisconsin), of Special Concern or Interest in 8 states (Indiana, Kansas, Louisiana, Michigan, Minnesota, New York, Ohio, Vermont) and as Significantly Rare in 1 state (North Carolina). NatureServe ranks the Cerulean Warbler in all states where it occurs (Table 1) and gives the species a rank of N4B (widespread) for the US as a whole.

Table 1. NatureServe ranks for the Cerulean Warbler in the United States (taken from Hamel 2000b and updated (S. G. Cannings pers. comm.)).

State	State Rank ^a (season)
Alabama	3
Arkansas	4
Arizona	A (non-breeding)
California	A
Delaware	1 (breeding)
Georgia	3
Illinois	3
Indiana	2
Iowa	2 (breeding)
Kansas	1 (breeding)
Kentucky	4
Louisiana	1 (breeding)
Maryland	3 (breeding)
Michigan	3
Mississippi	Z (non-breeding)
North Carolina	3 (breeding) Z (non-breeding)
Nebraska	2
New Hampshire	1 (breeding)
New Jersey	3
New Mexico	1 (non-breeding)
Nevada	A
New York	4 (breeding)
Oklahoma	2 (breeding)
Pennsylvania	4 (breeding)
Rhode Island	1 (breeding) 2 (non-breeding)
South Dakota	1 (breeding)
Tennessee	3
Texas	3 (breeding)
Virginia	4
Vermont	1 (breeding) Z (non-breeding)
Wisconsin	2 (breeding) Z (non-breeding)
West Virginia	4 (breeding)

^a1 - critically imperiled within the geographic area (< 5 occurrences), 2 - imperiled within the geographic area (6-20 occurrences), 3 - either very rare and local or found only in restricted range within the geographic area (21-100 occurrences), 4 - widespread, abundant and apparently secure within the geographic area (>100 occurrences), 5 - demonstrably widespread, abundant and secure within the geographic area, A - accidental, Z - of regular temporal occurrence within the geographic area, but not at a specific site.

SUMMARY OF STATUS REPORT

Since the publication of the first status report for the Cerulean Warbler in Canada (McCracken 1993), the Canadian population appears to have experienced a range contraction. However, given the discreet nature of this species, it is difficult to assess how much of an effect this has had on population size. The current best estimate of the Canadian breeding population is 500 to 1000 breeding pairs.

The three dominant limiting factors for this species are continued habitat destruction on breeding and wintering grounds, as well as during migration, continued fragmentation of existing habitats, and environmental degradation (e.g. acid rain). Given what is known about the habitat requirements of this species, these factors will always be limiting, regardless of population size.

However, the largest potential threat to this long-term health of this species is that the basic biology of this species remains poorly documented and understood, which limits our ability to manage and sustain populations of this species, most notably in the areas of mating and social systems, landscape-scale habitat selection, and migration stopover ecology. Given past research successes on this species in Canada, there exists an important opportunity to manage and promote this species before its continental population decreases beyond a critical point.

TECHNICAL SUMMARY

Dendroica cerulean

Cerulean Warbler
Ontario, Quebec

Paruline azurée

Extent and Area information	
• extent of occurrence (EO)(km ²)	About 85,000 km ²
• specify trend (decline, stable, increasing, unknown)	Stable
• are there extreme fluctuations in EO (> 1 order of magnitude)?	No
• area of occupancy (AO) (km ²)	Less than 100 km ² . Based on number of pairs multiplied by a liberal estimate of average territory size of 2ha.
• specify trend (decline, stable, increasing, unknown)	Possibly decreasing
• are there extreme fluctuations in AO (> 1 order of magnitude)?	No
• number of extant locations	More than 100. A location is defined as a woodlot or occupied sector of larger forest stands
• specify trend in # locations (decline, stable, increasing, unknown)	Possibly decreasing
• are there extreme fluctuations in # locations (>1 order of magnitude)?	No
• habitat trend: specify declining, stable, increasing or unknown trend in area, extent or quality of habitat	Probably increasing
Population information	
• generation time (average age of parents in the population) (indicate years, months, days, etc.)	2 - 3 years
• number of breeding pairs in the Canadian population (or, specify a range of plausible values)	500 - 1000
• total population trend: specify declining, stable, increasing or unknown trend in number of mature individuals	Unknown
• if decline, % decline over the last/next 10 years or 3 generations, whichever is greater (or specify if for shorter time period)	n.a.
• are there extreme fluctuations in number of mature individuals (> 1 order of magnitude)?	No
• is the total population severely fragmented (most individuals found within small and relatively isolated (geographically or otherwise) populations between which there is little exchange, i.e., ≤ 1 successful migrant / year)?	No
• list each population and the number of mature individuals in each	n.a.
• specify trend in number of populations (decline, stable, increasing, unknown)	n.a.
• are there extreme fluctuations in number of populations (>1 order of magnitude)?	n.a.
Threats (actual or imminent threats to populations or habitats)	

Threats to the species overall are currently poorly known but likely include:	
<ul style="list-style-type: none"> - habitat losses on migration and wintering grounds - habitat fragmentation and deterioration on breeding ground 	
There is currently no major threat operating in Canada.	
Rescue Effect (immigration from an outside source)	Moderate
• <i>does species exist elsewhere (in Canada or outside)?</i>	Yes
• <i>Status of the outside population(s)?</i>	Large but declining
• <i>is immigration known or possible?</i>	Known
• <i>Would immigrants be adapted to survive here?</i>	Yes
• <i>is there sufficient habitat for immigrants here?</i>	Yes
Quantitative Analysis	None available

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Jennifer J. Barg graduated with an M.Sc. in 2002 from Queen's University, Kingston, ON. Over the last 10 years, Ms. Barg has worked extensively with migratory birds, specifically wood-warblers. She was a member of Richard Holmes' research group at Dartmouth College working on Black-throated Blue Warblers at the Hubbard Brook Experimental Forest in the White Mountains of New Hampshire for 6 years. This work entailed research both on the breeding grounds and on the wintering grounds in Jamaica. For her M.Sc. research, Barg focused on within-territory spatial and habitat use patterns of male Cerulean Warblers and their behavioural counterparts.

Jason Jones received his Ph.D. in 2000 from Queen's University. His dissertation focused on habitat selection and conservation ecology of Cerulean Warblers in eastern Ontario. He currently holds the position of Croasdale Fellow in Vertebrate Biology in the Department of Biological Sciences at Dartmouth College, Hanover, New Hampshire.

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COLLECTIONS EXAMINED

None.