STATUS OF THE CONNECTICUT WARBLER
IN BRITISH COLUMBIA

by
J. M. Cooper
K. A. Enns
M. G. Shepard

Wildlife Working Report No. WR-83
February 1997
British Columbia, Canada’s most westerly province, has a bounty of biological diversity. British Columbia’s snowclad peaks, rain-drenched forests, arid grasslands, all sizes of rivers, lakes, and wetlands, and a long and rugged coast provide habitats for more species of living organisms than are found anywhere else in Canada. However, this very diversity means that there is much to be discovered about these organisms — their distribution, abundance, habitat requirements, and interrelationships with their environment. Increasing our knowledge of this biodiversity will help us with the complex task of sustainably managing our land and waters.

In 1992, the Provincial Government initiated a co-operative biodiversity research program with funding from the Corporate Resource Inventory Initiative, the British Columbia Ministries of Forests (Research Branch), Environment, Lands, and Parks (Wildlife and Habitat Protection Branches), and Tourism and Culture (Royal B.C. Museum); and the Forest Resource Development Agreement (FRDA II). In 1996, funding from Forest Renewal BC (FRBC) was received for a biodiversity research extension proposal. One goal of the original research program, and more recently the FRBC extension project, is to extend information to scientists, resource managers, and the public through biodiversity publications. These publications are intended to increase awareness and understanding of biodiversity, promote the concepts and importance of conserving biodiversity, and communicate provincial government initiatives related to biodiversity. We hope that they will be used as tools for the conservation of British Columbia’s rich, living legacy.

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“Wildlife Working Reports frequently contain preliminary data, so conclusions based on these may be subject to change. Working Reports receive little review. They may be cited in publications, but their manuscript status should be noted. Copies may be obtained, depending upon supply, from the Ministry of Environment, Lands and Parks, Wildlife Branch, 780 Blanshard Street, Victoria, BC V8V 1X4.”

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FOREWORD

In cases where a Wildlife Working Report or Bulletin is also a species status report, it may contain a status recommended by the author for the species. This recommended status is the opinion of the author and may not necessarily reflect that of the Wildlife Branch.

Official status designation will be made by the Wildlife Branch in consultation with experts, and the data contained in the status report will be considered during the evaluation process.
ABSTRACT

The Connecticut Warbler (*Oporornis agilis*) is an uncommon, forest-interior, neotropical migrant that is locally distributed in the Boreal Plains and Taiga Plains ecoprovinces of northeastern British Columbia. Its distribution is linked with the distribution of mature and old-growth deciduous (mainly aspen) forests with shrubby understories. Very few data exist on populations, habitat use, or breeding ecology. Existing data suggest that it will not occur in logged areas until forests regenerate to the late pole stage (30-40 years after harvesting).

The Connecticut Warbler is severely threatened in the northeast by plans to harvest mature and older aspen stands for pulpwood. Although it can be fairly common in suitable habitat, most of its habitat is targeted for harvesting. Because of the short rotations forecast for second passes, none of the harvested stands will be allowed to return to older age-classes preferred by this warbler.

Because of its restricted distribution, small populations, and serious threats to habitat, the Connecticut Warbler should be retained on the B.C. Wildlife Branch Red List. It should also be given a high priority by wildlife managers because of the severe short- and medium-term threat to its habitat.
ACKNOWLEDGEMENTS

This project was managed and funded by the Ministry of Environment, Lands and Parks, and production of the final report was made possible by the financial support of the Wildlife Branch, B.C. Ministry of Environment and Forest Renewal British Columbia (FRBC). Myke Chatter and Syd Cannings provided comprehensive and constructive reviews of earlier drafts of this manuscript. Ted Lea provided an extensive review of the section on habitat in an earlier draft. Jim Schieck sent us his unpublished manuscript on warbler habitat use in Alberta which provided useful context. Rhonda Millikin gave us her thoughts on the relative status of, and our provincial management responsibilities for, the Connecticut Warbler. Art Lance generously provided us with reports and unpublished information from his study near Dawson Creek. Wayne Campbell provided comments on status and access to some literature. Laura Darling gave us useful information from her study in the northeast. Mike Vislai, Richard Kabzems, Dave Parminter, Frank McAllister, Brian Churchill, Andrew Harcombe, John Parminter, Bob Ferguson, Ken Bolan, Everett Peterson, Merle Peterson, Nicola Parfitt, and Colin Woods all provided considerable help with the habitat section. We thank them all for their generous help and Myke, especially, for his encouragement. English and copy editing were done by Ted Wagstaff, and the final figures and page layout were done by Gail Harcombe.
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1.0 INTRODUCTION

The Connecticut Warbler (Oporornis agilis) is a long-distance, forest-interior, neotropical migrant that is restricted in British Columbia to the northeastern corner of the province. Populations are thought to be small and local. Because of its restricted distribution and low populations, the Connecticut Warbler is listed on the B.C. Wildlife Branch Red List as a candidate for threatened or endangered status (B.C. Wildlife Branch 1993).

Recent studies have indicated a widespread decline in populations of neotropical migrant songbirds (those that breed in temperate regions and winter in tropical regions), and that these declines have accelerated for some species in recent years (Robbins et al. 1989; Askins et al. 1990; Finch 1991; Hagan and Johnston 1992). Causes of these declines are diverse, but are widely thought to occur on breeding, wintering, or migrating areas, or a combination of the three (Terborgh 1989; Sherry and Holmes 1993).

This report contains a synthesis of available information on Connecticut Warblers including an overview of the species’ biology, habitat requirements, limiting factors, distribution, status, and prognosis for the future. Information was gathered from published and unpublished literature, personal records, and personal communication with biologists. It also contains recommendations for management techniques and additional research that are needed to maintain populations in British Columbia in the future.

This report is one of six status reports on six northeastern songbirds commissioned by the B.C. Wildlife Branch during 1994, and is part of an ongoing program to more effectively manage species at risk for long term viability. The other five species are Bay-breasted Warbler (Dendroica castanea), Black-throated Green Warbler (Dendroica virens), Cape May Warbler (Dendroica tigrina), Canada Warbler (Wilsonia canadensis), and Philadelphia Vireo (Vireo philadelphicus).

2.0 DISTRIBUTION

2.1 Global

The Connecticut Warbler breeds in a narrow band across Canada from northeastern British Columbia east to western Quebec and, in the USA, in northern Minnesota, Wisconsin, and Michigan (Godfrey 1986; Figure 1). Most of its breeding range is in Canada. It winters from northern Venezuela to central Brazil, mainly in the Amazon River basin (American Ornithologists’ Union 1983).

2.2 British Columbia

The Connecticut Warbler occurs mainly in the Peace Lowland and Kiskatinaw Plateau ecossections of the Boreal Plains Ecoprovince (Godfrey 1986; Enns and Siddle 1992; Figure 2). Small numbers have been reported from near Fort Nelson (Erskine and Davidson 1976; Siddle 1992) in the Fort Nelson Lowland Ecosection of the Taiga Plains Ecoprovince. Connecticut Warblers reach the northwestern extremes of their range in central Alberta and northeastern British Columbia.

Connecticut Warblers are probably more widespread in northeastern British Columbia than currently documented. Recent surveys have found populations from areas where there were no previous reports, e.g., northeast of Chetwynd (L. Darling, pers. comm.), and south of Dawson Creek (Lance and Phinney 1994).

3.0 POPULATION SIZE AND TRENDS

3.1 Population Size

There are few data on population sizes in British Columbia, but a few studies provide conflicting results. Although Siddle (1992), and Enns and Siddle (1992), reported Connecticut Warblers to be the third and second, respectively, least
frequently recorded warbler species in the north-east. Lance and Phinney (1994) considered it to be “common” in aspen forest south of Dawson Creek, and the second most frequently recorded “northeastern” warbler, after the Ovenbird. Maximum counts of four pairs each were found in two of their study plots (32 and 72 ha, respectively). Northeast of Chetwynd, it was also found to be fairly common in suitable habitat (L. Darling, pers. comm.).

We feel that Lance and Phinney’s (1993, 1994) studies suggest that Connecticut Warblers are more widely distributed and more numerous (but still of local occurrence) than previously thought in the Boreal Plains. Data from the Fort Nelson Lowland are few, but we believe that Connecticut Warblers occur there more frequently than is currently known. Flack (1976) also suspects that, throughout its range, the Connecticut Warbler is more locally common and widely distributed than generally thought.

Figure 1. Breeding and wintering distribution of the Connecticut Warbler.
Figure 2. Locality records for the Connecticut Warbler in British Columbia.
The Connecticut Warbler has been found to be sparsely and locally distributed in central Alberta during recent atlas surveys (Semenchuk 1992); our data indicate that it may be more abundant in British Columbia, but still locally distributed, than in northern Alberta. We believe that in British Columbia, Connecticut Warblers have relatively small populations, but can be fairly common in local areas with good habitat.

### 3.2 Population Trends

There are no data on population trends in British Columbia, although some authors believe that all northeastern warblers are in decline (e.g., Siddle 1992). There are insufficient data to analyze breeding bird survey trends in British Columbia (Erskine et al. 1992). In a comprehensive analysis of northeastern North American breeding bird surveys, Sauer and Droege (1992) found no significant population trends for the Connecticut Warbler in the long-term (1966-1988), but found a significant increase in the short term (1978-1988).

It is important to consider that widespread population declines are difficult to detect because a given species might contract its range, occupy fewer habitats, decline in abundance, or a combination of the three, and there may be significant errors in counting methods (Wilcove and Terborgh 1984). However, because neotropical migrants are thought to be suffering widespread population declines (Morton and Greenberg 1989; Terborgh 1989; Finch 1991), because there is an overall paucity of records for Connecticut Warblers in British Columbia, and because Connecticut Warblers require mid-to-late seral stands (which are being rapidly harvested, see HABITAT), it is probable that populations are stable or declining, and improbable that populations are increasing.

The impression we hold from our own field studies is that Connecticut Warblers occur in all suitable habitats at reasonable densities, but we cannot estimate the degree of saturation. A contrary view is that Connecticut Warblers do not occur regularly between years in specific sites (Siddle 1992).

An evaluation of Lance and Phinney’s (1994) data indicate that this warbler will be eliminated in the short term (30-40 years) from clearcut blocks of aspen forest. Because mature aspen forests are being rapidly harvested in the northeast and harvesting rotations will be shortened, it is inevitable that British Columbia populations will decline in the future (see HABITAT).

### 4.0 GENERAL BIOLOGY

#### 4.1 Reproductive Capability

There are no data on the breeding ecology of Connecticut Warblers in British Columbia and, like the Canada Warbler, many details of breeding are completely lacking from anywhere in its range. The following information is taken from studies in eastern North America.

Connecticut Warblers usually lay a clutch of 4 or 5 eggs, sometimes 3 eggs (Bent 1953; Harrison 1978; Ehrlich et al. 1988). Egg-laying likely occurs mainly in mid-to-late June in northeastern British Columbia, as it does in Alberta (Salt 1973). The incubation period is unknown, but is probably 12-13 days, as in the closely related and similarly-sized Kentucky Warbler (*Oporornis formosus*; Bent 1953).

Nestlings are likely present from late June through mid-July. The nestling period is unknown, but is also probably similar to the Kentucky Warbler, whose nestlings leave the nest after 8-10 days, but cannot fly until about a week later (Bent 1953; Harrison 1978). A single brood is probably raised each year in British Columbia, a widespread pattern in warblers (Morse 1989). Double-brooding is rare in warblers, even in species nesting in the southern USA. (Nolan 1978). There are no data for Connecticut Warblers on hatching success, survival of nestlings, or fledging success. Numbers of young produced are
limited by clutch size (3-5 eggs) and numbers of broods produced (1 brood).

Under normal circumstances, recruitment will replace mortality. The growth potential of populations under managed conditions is limited to an unknown degree by events occurring elsewhere in its range. In general, the annual reproductive potential of most neotropical migrant warblers is relatively low compared to many other small, short-distance, migrant or resident songbirds (Morse 1989). The maximum life span reported for this warbler is 4-5 years (Klimkiewicz et al. 1983).

Age/sex ratios of populations in British Columbia are unknown. However, most warbler populations are thought to have a surplus of males (Stewart and Aldrich 1952; Ficken and Ficken 1962; Proctor-Gray and Holmes 1981). Connecticut Warblers can breed as one-year-olds, but some individual yearlings likely do not breed, as in some other warblers (Morse 1973).

The Connecticut Warbler is thought to be monogamous (Ehrlich et al. 1988). Upon arriving on the breeding grounds, males select nesting territories and defend them from other conspecific males. There are no data on breeding territory size, but territories of warblers are typically small (e.g., 0.4-1.0 ha; Morse 1976). In west-central Alberta, density of territorial males in 30-year-old aspen forest was 4.4/100 ha (Westworth and Telfer 1993).

4.2 Species Movement

Connecticut Warblers winter further south than most other North American warblers and so have a longer distance to travel during migration. They arrive in Canada later, and leave earlier, than most other warblers except for Mourning, Canada and Blackpoll warblers (Cowan 1939; Salt 1973; Keast 1980; Francis and Cooke 1986). Males probably arrive slightly earlier than females, a general pattern in many bird species. Spring migrants enter the province through northern Alberta, beginning in the last few days of May, with most probably arriving in early June. Early arrivals in Alberta also appear in the last few days of May (Salt 1973; Salt and Salt 1976).

After nesting is completed, adults probably begin to migrate south in mid-to-late July and juveniles follow in mid-August, earlier than the mid-August to early September fall movement in central Alberta (Salt 1973; Salt and Salt 1976).

4.3 Behaviour/Adaptability

4.3.1 Tolerance to human disturbance

Connecticut Warblers are not unduly sensitive to human disturbance except for activities that affect habitat integrity (logging, agricultural clearing) or prey base (pesticide spraying). Their sensitivity to heavy grazing and selective logging in breeding areas is unknown (see LIMITING FACTORS). Large-scale spraying of insecticides in deciduous forest habitat would inevitably reduce their insect prey base (see Freedman et al. 1981). Application of herbicides to eliminate deciduous forest and understories would reduce available habitat (see HABITAT).

4.3.2 Food

The Connecticut Warbler is a mainly ground-dwelling, insectivorous bird that eats a variety of small insects, spiders, snails, eggs of spiders and insects, berries, and seeds (Bent 1953). It feeds mainly by gleaning prey from the ground, along fallen logs, and from foliage of low shrubs and herbs (Bent 1953; Griscom and Sprunt 1957; Curson et al. 1994). In British Columbia, most foraging is done within the shrub layer or along the ground (Enns and Siddle 1992).

4.3.3 Response to sudden environmental change

There are no data to suggest that populations expand and contract in response to sudden
changes in prey availability, as do Cape May and Bay-breasted warblers to spruce budworm outbreaks (Morse 1978). In general, late spells of cold weather are known to cause mortality in early migrant warblers (Morse 1976).

4.3.4 Causes of mortality

Specific data are lacking for this species, but predation and cowbird parasitism are the two leading causes of nest mortality for neotropical migrants in general (Martin 1992). Predation and cowbird parasitism are known to increase with increasing habitat fragmentation (Wilcove 1985; Martin 1992). Migrating warblers suffer mortality from natural environmental effects and from human-related factors such as collision with light-towers (e.g., Crawford 1978; Ralph 1981).

4.3.5 Protection of areas of concentration

Like all warblers, this species is widely scattered on the breeding and wintering grounds. In British Columbia, small numbers are likely protected in various reserves/parks, but data are lacking. Siddle (1992) lists Gundy (north of Tupper) and Cecil Lake as areas of consistent occurrence, but densities of birds and status of lands are uncertain.

5.0 HABITAT

5.1 Description of Habitats

The Connecticut Warbler is a bird of mature and old-growth, deciduous-dominated forests with rich understories, including both pure deciduous and mixedwood stands. Understorey development is critical for this warbler as it forages almost exclusively on, or very near, the ground. Populations in different geographic regions may occupy somewhat different forest types, but all descriptions of habitat in Saskatchewan, Alberta, and British Columbia include deciduous (mainly aspen) forest. Habitat descriptions include:

- Saskatchewan — aspen groves with a well-developed shrub and ground understorey (Johns 1993);
- Alberta — open, deciduous forests, with scattered jackpine at times, and along the margins of meadows (Salt 1973); small prairies scattered through aspen forest (Henderson in Bent 1953); small dry ridges with aspen forest above bogs (Taverner 1928); young (23-26 years), pole (30 years), mature (51-63 years), and old (80 years) aspen forests (Westworth and Telfer 1993); and old-growth (>120 years) aspen forests near Lac La Biche (J. Schieck, pers. comm);
- Southern Manitoba — open tamarack/moss swamp (Seton 1884);
- Minnesota — spruce and tamarack swamps (Roberts in Bent 1953).

J. Schieck’s (pers. comm. 1994) study found no utilization in recent clearcuts and highest utilization in old aspen forests (>120 years). In D.A. Westworth Ltd. (1984), Connecticut Warblers were most frequently associated with high amounts of deciduous canopy cover typical of 60-80-year-old stands. Westworth and Telfler’s (1993) study, with four age classes of forest, found highest utilization in mature, open, deciduous stands.

In northeastern British Columbia, Connecticut Warblers were found in:

- The edges of old-growth and younger stage stands of aspens and white spruce near Swan Lake (Cowan 1939).
- Mixed balsam poplar and white spruce islands in the Peace River (Penner 1976).
- Old-growth aspen stands with white spruce sapling understorey near Tupper, Cecil Lake, and Fort Nelson (Siddle 1992).
• White spruce/trembling aspen or pure aspen forests on flat or gentle slopes, with understories less than 3 m high (Enns and Siddle 1992).

• Pole, mature, and old-growth seral stages of trembling aspen (Lance and Phinney 1993, 1994).

Some common characteristics of reported Connecticut Warbler breeding habitat in British Columbia include (from sources listed above):

• Flat to gently sloping sites with variable-aged, but almost always large, aspen in a widely spaced configuration.

• High, thin crowns with few lower lateral branches and plenty of free, mid-canopy-level space.

• Noticeable gaps in cover between the dense, shrubby understory and the even, high canopy of aspen.

• Well-developed understory, usually <3 m. Associated species include tall bluebell, white geranium, baneberry, rose, northern bedstraw, red-osier dogwood, willow, bluegrass, wildrye, timothy, paintbrush, junegrass, bunchberry, soopolallie, fireweed, American vetch and purple peavine.

• Spruce are often interspersed sporadically throughout the stand.

Nesting and foraging habitat requirements are similar except that territorial males may perch in middle canopy levels when singing (Enns and Siddle 1992). Otherwise, this warbler rarely occurs more than 2 metres above ground.

We have evaluated some data summarized during research on bird use of aspen forests in the Peace Lowland (Lance and Phinney 1994). Because Connecticut Warblers were not found in recent clearcut slash, sapling, or early pole seral stands during this study, nor were they found in recent clearcuts or sapling stands in west-central Alberta (Westworth and Telfer 1993), we believe that Connecticut Warblers will be eliminated from aspen stands after clearcutting and will not recolonize clearcut blocks until the regenerating forest reaches the late pole stage (dbh >10 cm and age >35-40 years). The data provided in these studies reaffirm our view that Connecticut Warblers in British Columbia occur mainly in mature to old-growth aspen stands. Pole stage forests are the minimum growth stage suitable. Note that Westworth and Telfer (1993) did find this species in 23-26 year-old stands, the youngest stage reported to be used, but early pole stages are probably not “good” habitat.

5.2 Nest Site Specialization

Nest site microhabitat seems to be relatively constant throughout its range, but no data are available from British Columbia. The ground cover at nest sites can be characterized as richly vegetated. An overstorey of late pole or older stage aspen is required.

Nests are compact, deep cups of fine grass and rootlets lined with finer grass and hair. Nests are placed on the ground among herbs and grass or at the base of a sapling, in mossy hummocks, or a few inches off the ground in the base of a shrub (often wild rose), and are usually well-concealed by overhanging vegetation (Bent 1953; Harrison 1978; Harrison 1984).

5.3 Distribution of Habitat

The distribution of potential Connecticut Warbler habitat can be described with three general classifications (Biogeoclimatic Zones, Ecoregions, and Broad Habitat Classes) that are currently used in British Columbia.
5.3.1 Biogeoclimatic Zones (BGZ)

The Connecticut Warbler occurs in two variants of the Boreal White and Black Spruce (BWBS) Biogeoclimatic Zone: the BWBSmw1 variant (Peace Moist Cool Boreal White and Black Spruce) and the BWBSmw2 variant (Fort Nelson Moist Cool Southern Boreal White and Black Spruce) (DeLong et al. 1990; Meidinger and Pojar 1991). The BWBSmw1 is generally aligned with the Boreal Plains Ecoprovince and the BWBSmw2 is aligned mainly with the Taiga Plains Ecoprovince (Demarchi 1993).

The BWBS is the most widespread BGZ in Canada (DeLong et al. 1990) and occupies virtually all of the Boreal Plains and Taiga Plains ecoprovinces. The BWBS also occurs west of the Rocky Mountains in northern British Columbia, mainly along major river valleys, but the Connecticut Warbler does not occur there.

The Connecticut Warbler occurs mainly within the White spruce - Wildrye - Peavine (03) site series (Meidinger and Pojar 1991). This site unit has at least 50% trembling aspen occurring in submesic, coarse- to fine-textured soils, on a variety of materials with an upper-, mid-, or level slope position.

5.3.2 Ecoregions

The Connecticut Warbler has been recorded in the following ecosections within its normal range in British Columbia (Figure 2):


It is unlikely to occur in any other ecosections in these ecoprovinces.

5.3.3 Broad Habitat Class (BHC)

The Connecticut Warbler has been recorded using three BHCs in the Boreal Plains and Taiga Plains ecoprovinces (Lea and Harcombe 1992). Descriptions of these BHCs and general abundances of each BHC in Ecossections (Figure 2) where the Connecticut Warbler is known to occur are included in Table 1.

5.4 Present Habitat Availability

Connecticut Warbler habitat is distributed over much of the Peace Lowland and parts of the Fort Nelson Lowland. Note that there is considerable uncertainty in the amount of suitable habitat available in British Columbia because Connecticut Warblers are found almost always in pure aspen stands, not in aspen-dominated mixedwoods (Enns and Siddle 1992; Lance and Phinney 1993, 1994; L. Darling, pers. comm.).

5.5 Trends in Quantity and Quality of Critical Habitat by Time

Trends in habitat quality and quantity over time for Connecticut Warblers are directly linked with harvesting of mature aspen stands, particularly in the Peace Lowland. Quantity and quality of habitat are judged to be currently declining. Increasing harvesting rates, silviculture, and agricultural conversion will be the primary limiting factors for Connecticut Warblers in the northeast (see LIMITING FACTORS).

5.6 Rate of Habitat Change

The changes that are expected to take place in Connecticut Warbler habitat are directly linked with forestry effects, especially rates of harvest (B.C. Ministry of Forests 1994). Aspen mixedwood harvesting is at approximately 40 000 to 100 000 m³ annually, which is the current industry capacity. Because the average aspen stand contains about 250 m³/ha, an estimated 1800-4000
Table 1. Broad Habitat Classes (BHCs) used by the Connecticut Warbler and general distribution of the BHCs in ecossections where the Connecticut Warbler occurs (adapted from Lea and Harcombe 1992; Enns and Siddle 1992). Distributions are cross-referenced with Bonnor (1985).

<table>
<thead>
<tr>
<th>Broad Habitat Class and distribution in ecossections</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA Boreal White Spruce-Trembling Aspen</td>
<td>Typically a dense, broad-leaved, mixed or coniferous mixed forest, with shrub and herb dominated understories, which includes plant communities that succeed through trembling aspen seral forests to a white spruce climax. Includes all of the pure aspen areas around Ft. St. John and Dawson Creek.</td>
</tr>
<tr>
<td>Distribution of BA in ecossections:</td>
<td></td>
</tr>
<tr>
<td>PEL: widespread</td>
<td></td>
</tr>
<tr>
<td>KIP: widespread</td>
<td></td>
</tr>
<tr>
<td>CLH: localized to widespread</td>
<td></td>
</tr>
<tr>
<td>FNL: widespread to localized</td>
<td></td>
</tr>
<tr>
<td>PR Boreal White Spruce-Balsam Poplar Riparian</td>
<td>Typically a deciduous, mixed or coniferous forest with dense shrub understories, found on or in association with fluvial sites, which include plant communities that succeed through deciduous forests to a white (or hybrid) spruce climax.</td>
</tr>
<tr>
<td>Distribution of PR in ecossections:</td>
<td></td>
</tr>
<tr>
<td>PEL: widespread to localized</td>
<td></td>
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<tr>
<td>KIP: widespread to localized</td>
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<td>CLH: widespread to localized</td>
<td></td>
</tr>
<tr>
<td>FNL: widespread to localized</td>
<td></td>
</tr>
<tr>
<td>AC Trembling Aspen Copse</td>
<td>Not a recognized class in the Boreal and Taiga Plains (Lea and Harcombe 1992); but is common throughout. Typically a dense deciduous forest, with a shrub-dominated understory, which includes plant communities that succeed through shrub thickets to an edaphic climax of trembling aspen, found in association with shrub/grasslands.</td>
</tr>
<tr>
<td>Distribution of AC in ecossections:</td>
<td></td>
</tr>
<tr>
<td>PEL: widespread</td>
<td></td>
</tr>
<tr>
<td>KIP: widespread</td>
<td></td>
</tr>
<tr>
<td>CLH: localized</td>
<td></td>
</tr>
<tr>
<td>FNL: widespread to localized</td>
<td></td>
</tr>
</tbody>
</table>

1 PEL-Peace Lowland  
KIP-Kiskatinaw Plateau  
CLH-Clear Hills  
FNL-Fort Nelson Lowland

ha are being harvested annually (B.C. Ministry of Forests 1994).

There are a number of constraints to the quality of 223 000 ha of aspen reported (see 5.7.1) for the Dawson Creek Timber Supply Area (TSA). About 112 000 ha, or a large proportion of the harvestable area in the TSA, is currently covered by deciduous forest greater than 80 years (includes primarily aspen and about 10% cottonwood). It is projected that age class distribution will be primarily <50 years of age in 50 years. In 100 years, less than 12 000 ha of deciduous forest is forecast to be >80 years. Further, forest managers are uncertain about how to treat these older stands: should they be left for habitat, or logged and the intrinsic silvics of aspen allowed to take its course? In addition, the conservation of habitat for the Connecticut Warbler is not currently part of the aspen forest harvest planning process.
At present there are no plans to allow older age classes of aspen into the harvesting rotation, other than those stands which have a poor operability. This poor operability translates into poor access (i.e., steeper slopes), and other factors that may not be suitable for Connecticut Warblers. In other words, we do not know how much, if any, “good” habitat will remain in the long term.

At the present time, all aspen harvesting is supposed to be taking place on private lands, with no harvest occurring on Crown Lands (D. Parminter, pers. comm. 1994). However, most mature aspen that is accessible is targeted for harvest at some point (B.C. Ministry of Forests 1994). Rates of change of mature aspen on flat, rolling topography, to clearcuts should be classed as rapid because of easy access. Demand for British Columbia hardwoods is expected to increase in the near term also because 100 truckloads/day coming from Alberta will be shifted to a new mill in Grande Prairie, Alberta in 1996, and profitability is high (Massie et al. 1994).

5.7 Legal Status of Habitat

The legal status of lands with potential habitat for the Connecticut Warbler is discussed below.

5.7.1 Timber Supply Areas (TSA)

Estimates of potentially suitable aspen-dominated habitat in northeastern Timber Supply Areas (Figure 3) are given below:

- **Fort St. John TSA**: 190 000 ha of aspen-deciduous seral stages in age classes 21-60 years. Older age classes (>60 years) include an additional 30 000 ha (B.C. Ministry of Forests 1994).

- **Dawson Creek TSA**: 223 000 ha of young to mature (21-100 years) deciduous forest (B.C. Ministry of Forests 1994).

- **Fort Nelson TSA**: 28 000 ha of aspen-deciduous forest types where spruce is a minor component (41-60 years) and 40 000 ha of cottonwood-deciduous >101 years (Massie et al. 1994).

Pulpwood Agreements 10 and 13, both with Louisiana-Pacific Panel Products Ltd., cover roughly 75% of the Dawson Creek TSA and probably all of the habitat suitable for Connecticut Warblers on Crown Land. In comparison, the private landbase in the Dawson Creek TSA is about 800 000 ha of aspen-dominated forest. Protection of habitat on private lands is currently at the discretion of the owners.

5.7.2 Protected areas

A few areas with habitat suitable for Connecticut Warblers are currently protected in British Columbia (B.C. Ministry of Forests 1993).

**Provincial Parks**

Several Class A parks that are within the known range and habitat type of the Connecticut Warbler include:

- Beatton, northwest of Fort St. John (312 ha) in a trembling aspen upland.
- Taylor Landing, 16 km northeast of Fort St. John (2102 ha) in riparian mixedwood, and trembling aspen upland.
- Kiskatinaw River, 34 km northeast of Dawson Creek (1148 ha) in riparian cottonwood and mixedwood forest.
- East Pine, 24 km east of Chetwynd (14 ha) in mixed deciduous riparian.

**Ecological Reserves**

Ecological Reserves that may have small amounts of suitable habitat include:

- No. 8, Clayhurst, on the Peace River near the Alberta border (316 ha), in dry aspen parkland.
- No. 62, Fort Nelson River, 20 km northeast of Fort Nelson (121 ha) in cottonwood riparian forest.
Proposed Protected Areas

There are several areas that have been proposed as protected areas (proposed status uncertain) that may include small amounts of good habitat, including:

- Belcourt River, a large area in the southeastern border of the Boreal Plains south of Dawson Creek (37 441 ha) in a pine-aspen and mixedwood riparian forest.
- Prophet River, an old-growth riparian ecosystem including mixed cottonwood and white spruce.
- Conroy Creek an old-growth riparian ecosystem including mixedwood riparian.

5.8 Can Critical Habitat be Protected by Means Other Than Acquisition?

Critical habitat for Connecticut Warblers can certainly be protected on Crown Lands at present, while there is no aspen harvest allowed. Habitat protection by way of Wildlife Habitat Areas (for other species), Protected Area Strategy initiatives (i.e., additional parks and reserves), and harvesting methodologies (i.e., Forest Ecosystem Networks and Riparian Management Areas) are viable methods of protecting small amounts of habitat.

Figure 3. Timber Supply Areas in northeastern British Columbia.
The Biodiversity Field Guide of the Forest Practices Code states that, for wildlife listed on the Red List, habitat capability/suitability maps must be completed for the area of an operational plan and the habitat needs of those species must be addressed. This presumably means that a certain amount of suitable habitat must be retained during forest or range development. Implementation of the Forest Practices Code may be critical for the survival of this species in British Columbia (see LIMITING FACTORS).

6.0 LEGAL PROTECTION


7.0 LIMITING FACTORS

The factors that are likely to limit populations of the Connecticut Warbler in British Columbia are predominantly forest harvesting and silviculture in the Boreal Plains Ecoprovince. However, additional factors are likely to have some impact on populations and all of these are discussed below.

7.1 Breeding Habitat

Connecticut Warblers are dependent on mature or older, open aspen forests. Aspen forests on flat or rolling areas and along river valleys are prime habitats and are, with few exceptions, targeted for harvesting. Harvesting of mature aspen stands will remove the clearcut blocks as suitable habitat for at least 30-40 years, until second-growth stands reach the late pole stage.

There are few data available on the direct effect of habitat loss, habitat fragmentation, or forest succession on Connecticut Warblers. One study in Saskatchewan (Johns 1993), however, determined that the presence of Connecticut Warblers was:

1. positively related to aspen grove area (i.e., the larger the grove the more likely it would contain Connecticut Warblers), and

2. negatively related to isolation of the grove (the further away from other groves the less likely that it would contain Connecticut Warblers.

These results suggest that as suitable habitat becomes increasingly fragmented in unit size and distance between units, then fewer Connecticut Warblers will occur because they are relatively sensitive to area effects (Thompson et al. 1993b). There are no data available for British Columbia but, in Saskatchewan, Connecticut Warblers were not found in groves less than 3.5 ha. Lance and Phinney (1994) do not have data on minimum areas, but did record Connecticut Warblers in study plots as small as 4 ha.

In general, forest fragmentation and loss of forest habitat has been widely blamed for declines in warbler breeding populations, and changes in overall bird community structure (e.g., Titterington et al. 1979; Whitcomb et al. 1981; Askins et al. 1987; Terborgh 1989; Freemark and Collins 1992; Maurer and Heywood 1993); and there is no reason to believe that Connecticut Warblers will respond differently to change in habitat than many other neotropical migrants.

7.2 Silviculture

Alternatives to clearcut logging are not likely to be adopted by foresters trying to promote a new aspen crop. Methods such as natural selection logging are not of benefit in trembling aspen stands because of clonal suppression. Forms of selective logging have been used to suppress deciduous trees in areas desired for conversion to coniferous crops, which is of equal concern (Peterson and Peterson 1992).
The forest management imperative is unquestionably away from long rotations of trembling aspen. In a synopsis of interviews with silviculturalists in regions with boreal mixedwood, conducted in 1988, Peterson et al. (1989) found the following concerns expressed that run counter to habitat requirements by the Connecticut Warbler:

- Softwood and hardwood harvesting on the same lands (e.g., two-pass system) is to be expected.

- Shorter rotations will be the norm; pure deciduous stands will be harvested at 35-45 years.

- Decay in aspen is viewed as a problem in older stands, therefore shorter rotations may also be viewed as a prophylactic for *Hypoxylon* spp. and other decay organisms associated with older age classes.

- Vegetation management is still prevalent in boreal hardwood stands, at least in younger seral stages. Effects of herbicide are usually lost within a decade of treatment (Santillo et al. 1989, Bell 1991). The long-term effects of mechanical site preparation on species composition and organic material in older stands, and thus the quality of the understorey, is poorly known (Enns 1994).

As fragmentation of aspen forest land base advances, crown character is expected to change. Unless longer rotations are allowed to occur, crown development typical of suitable Connecticut Warbler habitat will not be achieved, nor will adequate understoreys.

### 7.3 Forest Succession

Connecticut Warblers do not use recently clearcut or sapling stage forests in British Columbia, but do occur in late pole, mature, and old stage forests, an evaluation of data in Lance and Phinney (1993, 1994). Enns and Siddle (1992), and Siddle (1992) found Connecticut Warblers only in mature or old-growth forest. The suitability of small pole stages is uncertain, but is likely poor. Our analysis of the available data suggests that aspen forests will regenerate into “useable” habitat (late pole stage) after about 30-40 years. However, one major question needs to be answered before we can assume that late pole stage forests will provide “suitable” habitat — is reproductive success similar in late pole and mature and older stage forests? If reproductive success is lower in late pole stage forest than in mature or older forest, then forest succession will not replace any lost habitat for even a short period of time (assuming that forests will be harvested again after 35-45 years). If it is equal or higher, which is unlikely, then forest succession will replace lost habitat more quickly. The effect of various forestry practices on breeding productivity of neotropical migrants is largely unknown, and much remains to be determined for Connecticut Warblers.

### 7.4 Brown-headed Cowbird Parasitism

The impact of nest parasitism by Brown-headed Cowbirds is thought to be severe on neotropical migrant songbirds, especially in fragmented forests (Brittingham and Temple 1983; Askins et al. 1990; Robinson et al. 1993). Cowbird parasitism and predation are the two leading causes of nest mortality (Martin 1992; Sherry and Holmes 1993). Although the Connecticut Warbler has not been reported as a host-species for cowbirds (Friedmann and Kiff 1985), we believe this may be because of a combination of the general paucity of nest records for this elusive warbler, and its forest-interior preference. The closely related Mourning (*Oporornis philadelphia*) and MacGillivray’s (*O. tolmiei*) warblers are common cowbird hosts, but are both “edge” species, rather than forest-interior species. There is little reason to believe that Connecticut Warblers will not be routinely parasitized as well, if cowbirds are present. So, if we accept that Connecticut Warblers are not regularly parasitized because
they are a forest-interior species, then the rate of parasitism can only increase with increasing fragmentation of northeastern forests.

7.5 Predation

Fragmentation through clearcutting, road building, agricultural clearing, etc., also increases edge habitat favoured by predatory species such as jays, crows, magpies, squirrels and weasels. Because the probability of predation on forest songbird nests increases with increasing forest fragmentation (Wilcove 1985; Yahner and Scott 1988; Askins et al. 1990), it is likely that Connecticut Warblers will face increasing predation intensity as forests are cleared.

7.6 Grazing

Connecticut Warblers inhabit forests with a moderately rich ground cover of saplings, shrubs, and herbs. High-intensity grazing by cattle may destroy much of the structural integrity of the lower shrub layer in local sites and seriously degrade habitat. Grazing, thinning, or control of shrub layers is a potential cause of population decline for ground-dwelling species dependent on rich understories (see Askins and Philbrick 1987; Bock et al. 1993). However, at least two of ten locations for Connecticut Warbler in the northeast were noticeably grazed by cattle (Enns and Siddle 1992), which suggests tolerance of at least minimal grazing. Note also that Brown-headed Cowbirds are attracted to cattle.

7.7 Agriculture

Many of the pure aspen stands of large stem size occur on private lands adjacent to agricultural fields in the Dawson Creek TSA. Harvesting is currently taking place on private lands, and an unknown proportion of these lands are being converted to agriculture. Lands cleared for agriculture are likely permanently lost as habitat for this warbler. Brown-headed Cowbirds are also attracted to clearings.

7.8 Urban Development

Urban development has not advanced as rapidly in the range of Connecticut Warbler as in other areas of British Columbia, but human settlements provide habitat for predators such as jays, magpies, crows, domestic cats, and squirrels.

7.9 Fire Suppression

Fire has a vital role in the regeneration of aspen forests. Fires are rarely severe in older mesic stands on rolling topography, especially in the absence of heavy debris fuels in the understorey (Brown and Simmerman 1986). Cool ground fires in these stands may act to rejuvenate shrub and herbaceous subcanopies that appear to be required by Connecticut Warblers. Fire suppression has a secondary effects which is the eventual dominance of spruce understories; suppression in this case acts as a very patient agent of stand conversion that is detrimental to Connecticut Warblers.

Prescribed fire may also be used to remove what foresters may perceive as “decadent old aspen stands,” which are very good habitats for Connecticut Warblers. Impacts of fire in aspen are reviewed by Peterson and Peterson (1992).

Ungulate forage enhancement using prescribed fire may occur in some habitat types frequented by Connecticut Warblers. This will have an unknown impact on habitat suitability over the long-term but short-term effects will be negative because of the destruction of vegetation understories.

7.10 Air Pollution

Mapping of pulpwood, oil and gas-related emissions in the northeast (Parfitt 1994) indicates an overlap with Connecticut Warbler habitat in the Fort Nelson, Dawson Creek, and Fort St. John areas. Emissions from sour gas processing, exploitation well venting, and the kraft pulping process, (eg., SO₂, NO₃, H₂S, TRS and particulate matter)
have relatively severe effects on trembling aspen and cottonwood, in comparison to other species (Malhotra and Blauel 1980). Trembling aspen near Alberta sour gas processing plants show increased mortality in high-impact zones, a higher incidence of Armillaria root-rot and Hypoxylon canker, as well as depression of annual volume increments (Maynard et al. 1994.). A somewhat unpredictable, but voluminous increase in sour gas exploration (and SO₂ venting) is expected in the northeast. The threshold for maintaining healthy stands of deciduous Connecticut Warbler habitat is unknown.

7.11 Seismic Lines and Roads
Gas and oil exploration in the Dawson Creek area is not as prevalent as near Fort Nelson, but the impact of seismic line gridlock in aspen ecosystems is likely to affect habitat quantity and quality over the long-term through removal of habitat, and create edge habitat favoured by cowbirds and predators.

7.12 Winter Habitat
Connecticut Warblers winter in the jungles of the Amazon River basin, and this habitat is relatively secure compared to the winter habitats of most other neotropical migrants. Loss of montane and tropical forest habitat (about 2% annually) is a widespread problem for neotropical migrants in Latin America and is undoubtedly of long-term significance for Connecticut Warblers, but the effect is buffered by the vastness of the Amazon River basin (Ehrlich et al. 1988; Terborgh 1989; Finch 1991; Hartshorn 1992), and by the ability of Connecticut Warblers to occupy moderately disturbed winter habitat (Petit et al. 1993). However, if the rate of habitat loss is accelerated in the Amazon River basin, then the effects on Connecticut Warbler populations will also accelerate. In addition, low-density populations, particularly those at the edge of a species' range are thought to be the first to decline when overall numbers decline (Wilcove and Terborgh 1984). For British Columbia populations, we believe it is obvious that effects of habitat loss on the wintering grounds are substantially less significant than the loss of breeding habitat in the Peace and Fort Nelson lowlands, and the Kiskatinaw Plateau.

8.0 SPECIAL SIGNIFICANCE OF THE SPECIES

8.1 Status
The Connecticut Warbler is widely considered to be an uncommon and poorly known warbler throughout its range (Bent 1953; Godfrey 1986; Ehrlich et al. 1988; Curson et al. 1994). In British Columbia, Munro and Cowan (1947) referred to it as “known only from a few specimens in the Peace River”. Its status has changed little since then except that it is known to be more widely distributed (Erskine and Davidson 1976; Enns and Siddle 1992; Lance and Phinney 1994), and may be fairly common in local areas (Lance and Phinney 1994).

In British Columbia, the Connecticut Warbler should be considered as a rare to locally fairly common breeder in deciduous forests of the northeast.

8.2 Degree of Public Interest
Connecticut Warblers are highly valued by birdwatchers because of their rarity and the difficulty of finding them in the dense undergrowth that they frequent. This species is a definite “highlight” bird on any trip to the northeast. Otherwise, this species probably goes unnoticed by the general public.

8.3 Related Species
Two other Oporornis warblers also occur in British Columbia. The Mourning Warbler is restricted in British Columbia to the northeast, but is much more common than the Connecticut Warbler
(Enns and Siddle 1992). The MacGillivray’s Warbler is widely distributed over most of the province (Godfrey 1986).

9.0 RECOMMENDATIONS AND MANAGEMENT OPTIONS

In British Columbia, retention of mature to old-growth deciduous (aspen/cottonwood) stands is critical for maintaining populations of Connecticut Warblers. Connecticut Warblers are in serious jeopardy of near-extirpation if current aspen harvesting plans are carried out. The first priority for management is to establish reserves of mature aspen in areas with core populations. Provisions within the Forestry Practices Code (Riparian Management Areas, Forest Ecosystem Networks, Wildlife Habitat Areas) may be sufficient to satisfy the habitat requirements for sustainable populations, but only if Connecticut Warbler habitat requirements are used as a primary determinant in selecting those reserves.

Because populations are local, and pairs may be fairly common in those areas, then Oldgrowth Management Areas and Riparian Management Areas centred on Connecticut Warbler populations would help to maintain habitat for this species. The creation of Wildlife Habitat Areas (WHA) in areas of concentration are recommended because of the forecast of almost complete loss of potential habitat (old aspen) and the unknown value to Connecticut Warblers of the remainder. The WHAs should be relatively large (minimum 500 m diameter) so as to include at least several breeding pairs and to discourage parasitism by Brown-headed Cowbirds. Combinations of the above-mentioned reserves are the best method of conserving habitat if we assume that logging will continue to occur.

Habitat corridors that connect isolated patches of forest with continuous forest are proving to be an important factor in retaining bird community diversity in those isolated patches and may reduce the impact of clearcutting (MacClintock et al. 1977). Johns (1993) suggested that small patches of aspen (i.e., <3.5 ha), even if too small to support breeding pairs, may provide foraging habitat and corridors for pairs moving to larger, or more isolated, reserves.

If we assume that the goal of managing for biodiversity is to maintain natural populations and patterns across broad landscapes, then a number of general guidelines apply (from Hutto et al. 1993):

1. Manage for desired landscape patterns with a clear picture of land-use trends and conditions over a broad landscape, not by harvest-by-harvest decisions.

2. Allow natural processes to occur - fire, insect outbreak, blowdowns, etc., because the adaptive histories of most species in natural ecosystems are linked to natural periodic disturbances.

3. Use knowledge of local ecology and be wary of extrapolating results from other regions.

4. Manage for multiple species except when single species become species of special concern (e.g., Red and Blue List). The Connecticut Warbler may require species-specific management.

5. Monitor populations of forest birds to keep current on effects of silvicultural practices.

Other general principles provided by Robbins et al. (1993) are appropriate for management of Connecticut Warblers and other neotropical migrants:

1. Maximize size of forest reserves and minimize edge and isolation.
2. Promote microhabitat diversity by providing uneven-aged forests and precluding grazing by domestic stock which destroys the ground layer.

3. Preserve as much old-growth forest as possible.

4. Promote public awareness of the plight of neotropical migrants. Project Wild would be an appropriate vehicle for some education programs.

10.0 RESEARCH REQUIREMENTS

Additional research is required to improve our ability to manage habitat for Connecticut Warblers in British Columbia:

1. Examination of Landsat Imagery to determine locations of all potential breeding habitat.

2. Studies of habitat utilization for nesting and foraging, and comparative reproductive success related to stand age structure and patch size.

3. Field studies to locate and map distribution of core populations.

4. A further review of the harvesting plans for aspen forests in the northeast to refine estimates of mature aspen forest loss.

5. Studies of cowbird parasitism and predation in fragmented stands.


7. Migration surveys to determine importance of habitats other than on breeding grounds.

8. Banding of breeding birds to study site fidelity.

11.0 EVALUATION

In British Columbia, the Connecticut Warbler has localized populations in the northeast that are mainly associated with rich understories in stands of mature or older aspen. In suitable habitat, recent studies have found it to be a fairly common warbler. However, its habitat is under severe pressure from timber harvesting, and there are no alternative habitats available. The effects of habitat fragmentation (including increased cowbird parasitism and predation) are projected to be relatively severe compared to most other species. Very little habitat is protected in existing reserves. There are few data on habitat use and no data on reproductive success related to the impacts of forestry practices.

Thompson et al. (1993a) ranked Connecticut Warblers as the twelfth out of 110 midwestern North American, neotropical migrants for management priority, mainly because of relatively small, scattered populations and sensitivity to breeding habitat fragmentation. However, Reed (1992) ranked it as a species with a low overall probability of extinction. Our outlook for this species in British Columbia is more comparable to Thompson et al. (1993a).

This warbler is seriously imperilled by aspen forest harvesting and may face local and regional extirpation in the medium term, given current harvesting trends. The Connecticut Warbler is more seriously imperilled than other songbird species of concern in the northeast (Table 2). Protection of sizeable areas of suitable habitat must occur in the near to mid term to ensure that stable, representative populations remain in British Columbia.

For the above reasons, the Connecticut Warbler should be considered as Threatened, and should remain on the Red List.
Table 2. Comparison of six rare songbirds restricted to northeastern British Columbia. Species are ranked in order of conservation priority.

<table>
<thead>
<tr>
<th>Species</th>
<th>Recommended Status</th>
<th>Primary Habitat</th>
<th>Major Threats</th>
<th>Population Size and Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connecticut Warbler</td>
<td>Red</td>
<td>Old-growth aspen forest</td>
<td>Logging, Agriculture, Silviculture, Fragmentation</td>
<td>Small and local</td>
</tr>
<tr>
<td>Black-throated Green Warbler</td>
<td>Red</td>
<td>Old-growth riparian mixedwoods</td>
<td>Logging</td>
<td>Small and local</td>
</tr>
<tr>
<td>Cape May Warbler</td>
<td>Red</td>
<td>Old-growth spruce</td>
<td>Logging forest</td>
<td>Very small and scattered</td>
</tr>
<tr>
<td>Bay-breasted Warbler</td>
<td>Red</td>
<td>Old-growth spruce forest</td>
<td>Logging</td>
<td>Very small and scattered</td>
</tr>
<tr>
<td>Canada Warbler</td>
<td>Blue</td>
<td>Mature/old-growth aspen forest</td>
<td>Logging, Silviculture, Fragmentation</td>
<td>Small and local</td>
</tr>
<tr>
<td>Philadelphia Vireo</td>
<td>Blue</td>
<td>Habitat generalist</td>
<td>Fragmentation</td>
<td>Small and local</td>
</tr>
</tbody>
</table>

12.0 LITERATURE CITED


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Wildlife Working Reports may be cited, but the preliminary nature of the data they contain should be noted. Working Reports 1-15 (and others) are presently out of print, but photocopies may be available through the Wildlife Branch, Ministry of Environment, Lands and Parks.

Continued from inside back cover:


