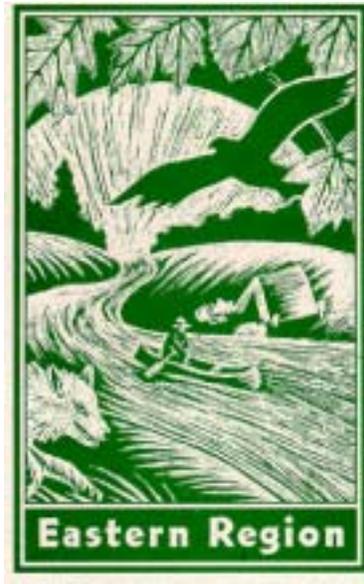


*Conservation Assessment  
for  
Connecticut Warbler (*Oporornis agilis*)*



*USDA Forest Service, Eastern Region*  
August 2002

Prepared by:  
Janet Kudell-Ekstrum  
Wildlife Biologist  
Hiawatha National Forest



*This Conservation Assessment was prepared to compile the published and unpublished information on the subject taxon or community; or this document was prepared by another organization and provides information to serve as a Conservation Assessment for the Eastern Region of the Forest Service. It does not represent a management decision by the U.S. Forest Service. Though the best scientific information available was used and subject experts were consulted in preparation of this document, it is expected that new information will arise. In the spirit of continuous learning and adaptive management, if you have information that will assist in conserving the subject taxon, please contact the Eastern Region of the Forest Service - Threatened and Endangered Species Program at 310 Wisconsin Avenue, Suite 580 Milwaukee, Wisconsin 53203.*

**Table of Contents**

<b>EXECUTIVE SUMMARY .....</b>	<b>4</b>
<b>ACKNOWLEDGEMENTS .....</b>	<b>6</b>
<b>NOMENCLATURE AND TAXONOMY .....</b>	<b>7</b>
<b>DESCRIPTION OF SPECIES.....</b>	<b>7</b>
<b>LIFE HISTORY .....</b>	<b>8</b>
<b>HABITAT .....</b>	<b>10</b>
<b>DISTRIBUTION AND ABUNDANCE (RANGEWIDE/REGIONWIDE) .....</b>	<b>15</b>
<b>STATUS .....</b>	<b>17</b>
<b>STATE SUMMARIES.....</b>	<b>22</b>
<b>POPULATION BIOLOGY AND VIABILITY.....</b>	<b>26</b>
<b>POTENTIAL THREATS AND MONITORING .....</b>	<b>26</b>
<b>SUMMARY OF LAND OWNERSHIP AND EXISTING HABITAT PROTECTION .....</b>	<b>29</b>
<b>MANAGEMENT ACTIVITIES FOUND IN LITERATURE .....</b>	<b>31</b>
<b>PAST AND CURRENT CONSERVATION ACTIVITIES.....</b>	<b>32</b>
<b>RESEARCH AND MONITORING .....</b>	<b>32</b>
<b>REFERENCES .....</b>	<b>38</b>
<b>APPENDIX.....</b>	<b>Error! Bookmark not defined.</b>
<b>LIST OF CONTACTS.....</b>	<b>45</b>

## EXECUTIVE SUMMARY

The Connecticut warbler *Oporornis agilis* is designated as a Regional Forester Sensitive Species on the Superior, Chippewa, Chequamegon-Nicolet, Hiawatha, Huron-Manistee and Ottawa National Forests in the Eastern Region of the Forest Service. It breeds on all of the above mentioned National Forests except the Huron-Manistee National Forest. The purpose of this document is to provide the background information necessary to prepare a Conservation Strategy, the later which will include management actions to conserve the species.

The Connecticut warbler, first described by Alexander Wilson in 1812 (Huff 1929), was poorly known at the turn of the twentieth century and still is the least known member of the genus *Oporornis* partly due to it's secretive nature and habit of nesting in dense vegetation (Pitocchelli et. al. 1997). This species is still not well known today due to not being easily observable and occurrence in areas that are not easily accessible to humans (Hamady 2002). In addition this species has a naturally spotty distribution, even in suitable habitat (Callog 1994 In McPeck and Adams ). Nests are well concealed, constructed on the ground. Discovery of nests are made even harder by the habit of the adult birds landing 30 to 40 feet from the nest and walking to it (Callog 1994 In McPeck and Adams ). Although the male's song is loud and distinctive, he sings ventriloquially while perched motionless often far from the nest site (Binford 1991). The female plumage is so similar to that of the Mourning warbler that specimens have been misidentified ( Zimmerman 1955, Walkinshaw and Dryer 1961); inexperienced birders may confuse the song of the Connecticut warbler with that of Mourning warblers (C. Schumacher personal communication 2001). In addition, this species is not tied to a single habitat type, it is found in a wide variety of habitats. Due to these factors, this species is likely to be under- recorded on surveys and confirming a breeding occurrence is difficult.

The Connecticut warbler has the most restricted breeding distribution of any northern warbler, aside from the Kirtland's warbler, ranging from eastern British Columbia east across south-central Canada to Quebec and south to northern Minnesota, Wisconsin, and the Upper Peninsula and northern Lower Peninsula of Michigan (Binford 1991). Breeding habitat consists of spruce-tamarack bogs, muskeg, poplar woodlands and moist deciduous forests ( Pitocchelli, J. et. al. 1997), and jack pine (Robbins 1974, Binford 1991). The Connecticut warbler has been found in fifteen forest types in the United States consisting of jack pine, red pine, black spruce, mixed swamp conifer, northern white cedar, fir/aspen/paper birch, sugar maple/basswood, ash/elm/red maple, tamarack, paper birch, quaking aspen and a variety of openings, upland, wetland bog and wetland sedge meadow (see Table 1) ( Niemi et al. 2002a, 2002b, 2002c). Eighty-five percent of the North American breeding range of the Connecticut warbler is in Canada (CWS 2001).

Although not listed as Federally or State threatened, endangered or species of special concern in the Great Lakes Region, or designated by the Committee on the Status of Endangered Wildlife in Canada (COSWEIC), the Connecticut warbler is a high priority on the National Audubon Watchlist for Michigan, Minnesota, and Wisconsin. It has a 2001 Partners in Flight (PIF) status of 21 (PIF 2002) previously status 23 in 2001 and is a Tier 1 species ( Butcher 2001) in the Boreal Hardwood Transition Physiographic Region. Tier 1 means it is a very high conservation priority. For the time period 1966 to 2001 (Sauer et al. 2002) the Connecticut warbler shows declines in some regions and increases in other regions. The North American Breeding Bird Survey trends show a significant decline in the Eastern Breeding Bird Survey region and a non-significant declining trend in the survey wide region while the United States region it shows a

nonsignificant increasing trend. The survey wide region includes Canada and all of the United States with the exception of Alaska.

Without a great deal of information available on this species, the suspected threats may or may not be limiting factor (s) for the Connecticut warbler. The following lists threats as determined by a review of literature and discussions with wildlife and research wildlife biologists within the Great Lakes Region. Threats may vary by region, as habitat use varies by locality.

The landscape needs (patch size, distribution, etc) for this species are unknown (USDA 2000a). The Connecticut warbler may be sensitive to habitat fragmentation due to increases in nest predation and parasitism that may accompany decreases in forest interior habitat (Niemi et al. 2001d, Matthiae 2001); however, Connecticut warblers have been found in association with open forest habitats. Cowbird parasitism may be a threat (USDA 2000).

Effects of different land-uses on this species are unknown (Canadian Wildlife Service, 2001). Peat mining may pose a threat to Connecticut warbler habitat. Peat mining is a large industry in Canada and has started in the United States at Pine Island in Koochiching County Minnesota ( Hamady 2002).

Towers and structures have been reported as specific threats (USDA 2000b).

The Connecticut warbler may be vulnerable to habitat loss on its wintering grounds (Rappole 1995).

It is felt jack pine was the critical habitat for maintaining viability on the Chequamegon-Nicolet National Forest although this warbler will use lowland conifer especially adjacent to wetlands (USDA 2000b). Threats to this species may include loss of jack pine due to budworm (USDA 2000c). The loss of pine barrens and fire suppression were listed as causes of fragmentation and loss of habitat on the Chequamegon-Nicolet National Forest (USDA 2000b).

The Connecticut warbler has not been the primary subject of any biological research and a study on any aspect of its general biology would be valuable (Pitocchelli, et al. 1997). Specific research priorities listed in the species account for the Connecticut Warbler in *The Birds of North America* (Pitocchelli et al. 1997) include feeding habits on breeding and wintering grounds and during migration; fledging development and age of departure; extent of parental feeding and protection after young leave the nest; development, growth rate, locomotion and temperature regulation; brooding; extent of parasitism by brown-headed cowbird; reproductive success; breeding and wintering ranges and threats to these areas; geographic variation, sexual dimorphism , age variation; vocal differences between sexes and birds of different ages; vocal behavior on wintering grounds and during migration; micro- and macro geographic variation among songs of the male Connecticut warblers; effects of degradation of habitat, especially on wintering grounds. Pitocchelli et al (1997) thought the study of the Connecticut warblers' general biology on the breeding ground is probably the highest priority and also deserving of immediate attention is a comprehensive description of its distribution on the wintering grounds. Through this assessment, the other research needs that have become apparent are the use of habitat by this species across the northern Great Lake States; age of first breeding or intervals between breeding; territory size; patch size; kinds of mammalian or avian predators; disease and parasites. The status of the Connecticut warbler needs to be studied and clarified (Pitocchelli et al. 1997).

Other research priorities identified are to collect data on the shrub densities at nest sites, development of better techniques to detect Connecticut warblers through breeding and wintering surveys; and to compare current habitat with historic habitat (USDA 2000b).

For developing management guidelines on the National Forests', the primary research priority is determining the density and species composition of overstory and especially understory habitats Connecticut warblers are using across various forest types and across geographic regions.

## **ACKNOWLEDGEMENTS**

Information was provided by the following individuals: Mary Shedd, Wildlife Biologist, Kawishiwi Ranger District, Superior National Forest; Susanne Adams, Wildlife Biologist, Medford Ranger District, Chequamegon-Nicolet National Forest; Carl Racchini, Acting Forest Wildlife Biologist, Huron-Manistee National Forest; Chris Schumacher, Wildlife Biologist, Cadillac-Manistee Ranger Station, Huron-Manistee National Forest; Phil Huber, Wildlife Biologist, Mio Ranger District, Huron-Manistee National Forest; Ray Adams, Ornithologist Kalamazoo Nature Center and co-author of the Atlas of Breeding Birds in Michigan; Jan Green, Minnesota Ornithologist Union, University of Minnesota; Linda Parker, Forest Ecologist, Chequamegon-Nicolet National Forest; Kevin Doran, Wildlife Biologist, Munising Ranger District, Hiawatha National Forest; Steve Sjogren, Wildlife Biologist, St. Ignace Ranger District, Hiawatha National Forest; Eric Epstein, Wisconsin Department of Natural Resources; Greg Corace, PhD candidate Michigan Technical University; Maya Hamady, Nongame Specialist, Region 2, Minnesota Department of Natural Resources; Wayne Russ, Wildlife Biologist, Tofte Ranger District, Superior National Forest; Jim Lind, Field Technician, Natural Resource Research Institute; Robert Aho, Wildlife Habitat Biologist, Michigan Department of Natural Resources; Mike Tansey, Wildlife Biologist/Refuge Manager, Seney National Wildlife Refuge; Steve Babler, Wildlife Biologist, Kenton and Iron River Ranger Districts, Ottawa National Forest; Robert Evans, Wildlife Biologist, Watersmeet Ranger District, Ottawa National Forest; JoAnn Hanowski, Natural Resources Research Institute, Duluth Minnesota; Robert Doepker, Wildlife Biologist, Western Upper Peninsula Management Unit, Michigan Department of Natural Resources; Judith Kennedy, Landbird Conservation Biologist, Canadian Wildlife Service; Max Holden, USDI National Park Service, Sleeping Bear Dunes National Lakeshore; Erwin and Sharon Drabek, volunteer birders Ottawa National Forest; Andy Pils, Biological Science Technician, Bessemer Ranger District, Ottawa National Forest; Greg Butcher, Midwest Coordinator for Partners in Flight; Brian Bogaczyk, Wildlife Biologist, Bessemer Ranger District; Tom Matthiae, District Wildlife Biologist, Great Divide Ranger District, Chequamegon-Nicolet National Forest; Nancy Berlin, R9 Threatened, Endangered, Sensitive Species Biologist; Paul Makela, Forest Wildlife Biologist, Hiawatha National Forest. Laura Hutchinson, Library Services Leader, North Central Research Station in St. Paul Minnesota conducted a literature search on this species.

## NOMENCLATURE AND TAXONOMY

Scientific name:	<i>Oporornis agilis</i> (Wilson, 1812) When first described in Birds of America by John James Audubon, listed as <i>Sylvia agilis</i>
Subspecies:	none
Common name:	Connecticut warbler
Order:	Passeriformes
Family:	Parulidae
Synonym (s):	Paruline a' gorge grise (French name), Reinita ojianillada and Chipe de Connecticut have been listed as Spanish names.

## DESCRIPTION OF SPECIES

### Measurements

The Connecticut warbler is 13-15 cm in length (Pitocchelli et al. 1997) and weighs about 13 ( Humberto Elizondo 2000) to 15 grams (Pitocchelli J. et. al. 1997). Measurements of the adult male are wing, 68.8-73.5 (71.2) mm (Godfrey 1986); tail 47.5-52.5 (49.5) mm; exposed culmen 11.7-12.9 (12.2) mm; tarsus 20-22.5 (21.3) mm. The adult female wing is 67.5-71.8 (69.3)mm (Godfrey 1986). Jahn et al (1999) reported measurements that were slightly different than those above, it was not specified if the measurements were for a male or female but was a first winter Connecticut warbler. These measurements are tail 43 mm, wing-tail 22 mm, bill length 11.95 mm, tarsus 19.65 mm, body mass 12.5 grams.

### Plumage

The plumage is predominately olive to olive brown above, yellow to yellowish white below, with a gray or brownish hood extending to the lower throat, and a complete, whitish eye-ring in all plumages and all ages (the exception is the juvenile nestling ( Walkinshaw and Dryer 1961). The sexes are similar throughout the year, but females are duller than males and immatures are duller and with browner heads and paler throats than adults. Both sexes have pink legs (Bernstein 2000). The female plumage is so similar to that of the Mourning warbler (in which adults also have an eye ring) that even specimens have been misidentified (Binford 199, Walkinshaw and Dryer 1961). Connecticut warblers can usually be separated from Mourning warbler (*O. philadelphia*) by wing-tail value equal to 19mm or more (Olaf et al. 1999), especially in the fall. Females and immatures of *O. philadelphia*, *O. tolmiei* (MacGillivray's warbler) and *O. agilis* are easily confused without careful measuring of both wing and tail (Hicks 1967), but the Connecticut warblers can most often be distinguished by its larger size and its complete eye-ring which is not broken or lacking (Pitocchelli et al. 1997). Adult male Connecticut warblers lack the black feathering found on the upper breast of adult male Mourning warbler and MacGillivray's warblers ( Pitocchelli et. al. 1997). Immature Connecticut warblers have a buffy colored throat and have underparts that are duller yellow compared to Mourning and MacGillivray's warblers (Pyle and Henderson 1990).The Nashville and Connecticut warbler could be confused, however the white-eye ring of the Nashville warbler is connected by a white line to the base of the bill ( Nearctica.com Inc. 2001).

In juvenile plumage upperparts and head olive brown; eye-ring buffy, not white. Olive brown breast, flanks merge with buffy yellow belly (Pitocchelli et al. 1997). There are other plumages ( Basic I plumage, Alternate I plumage, Definitive Basic plumage, Definitive Alternate plumage) listed in Pitocchelli et al. 1997).

## **Song and Call Notes**

The Connecticut warbler has song and call notes. Various descriptions of the song have been published: “beecher-beecher-beecher-beecher-beecher-beecher”; “fru-chapple fru-chapel fru-chapel whoit ( Pitocchelli et al 1997); “whip-pity, whip-pity, whip” (Bent 1953); “tu-chibee-too, chibee-too, chibee-too”; and “chap-el-free chap-el-free chapel-free-chap, cluckety chuckety chuckety chuck, chipety chipety chip” (Allin 1957). Huff (1929) reported the two syllables “freecher” are always included in its song. No spectrographic analyses of vocal behavior have been conducted for this species (Pitocchelli et al. 1997). The song, regardless of the words put to it, is described as building in emphasis from weaker first notes to more emphatic ones at middle and end (Allin 1957). The primary song published by Pitocchelli et al 1997 is described as a loud ringing song in which a 2-part or (more typically) 3-part phrase is repeated several times in a row, similar in rhythm and pitch to that of a Kentucky warbler or Ovenbird. A variation of the song has been described as including 4-part phases. There is variation in repertoire and delivery of songs among males (Bent 1953). The extent of variation is unknown. Huff (1929) reported the volume may be changed or syllables changed or omitted, but the quality of the tone is unique and practically invariable as regards to two syllables ‘freecher’ always included in his song.

There are several call notes described in the literature: a sharp “peek” or “witch”, a metallic “plink” (Bent 1953 In Pitocchelli et al. 1997), a softer “poit” call (Shanahan 1992). The “peek”, “plink” and “witch” calls have been used to scold intruders near fledglings or the nest. The “poit” may be an alarm call to warn young birds about the presence of predators (Shanahan 1992). Males and females may share call notes; vocalization of young birds is unknown (Pitocchelli et al. 1997). The Connecticut warbler is said to be silent in the fall except for its distinctive call notes ( Bent 1953), however they were recorded singing during fall migration by Tyler and Faxson in 1910 (Bent 1953).

A male was observed singing from three to ten feet above the ground (Robbins 1974); Huff (1929) found singing males in the crowns of trees “situated thirty feet or more above”. The song is heard primarily on the breeding grounds, and during spring migration (Bent 1953, Granlund et al. 1994). Song activity is greatest early in the morning (Walkinshaw and Dryer 1961) the song being repeated several times each minute with short intervals of five to ten minutes of rest (Huff 1929). Males begin singing around sunrise or soon after in June and early July in Michigan (Walkinshaw and Dryer 1961). Males also sing during the morning during migration (Pitocchelli et al. 1997). The male sings ventriloquially while perched motionless high in a dense tree often far from the nest site; Walkinshaw and Dryer (1961) found a singing male 145m from the nest. Huff (1929) found singing males remained in one tree for fifteen minutes to a half an hour and all observations in his 1929 publication were singing in tamarack even when the majority of the trees present were black spruce. It is difficult to find a nest of a Connecticut warbler. Their ground nests are concealed in areas with well-developed understories and the adults land approximately 30-40 feet from the nest (Callog 1994 In McPeck and Adams) and walk to the nest site (Callog 1994 In McPeck and Adams, Thorton 1999).

## **LIFE HISTORY**

### **Breeding Phenology**

The Connecticut warbler is among the latest of spring migrants, usually not arriving in the Lower Peninsula of Michigan until May and often still moving during the first week of June (Binford

1991). Courtship and mating begin soon after arrival to the breeding grounds in late May; continuing into late June (Walkinshaw and Dryer 1961).

### **Territories**

Male Connecticut warblers are highly territorial, defending its territory during the breeding season (Sadler and Myres 1976). Territory size ranges from 0.24 ha in open spruce to 0.48 ha in closed spruce forest in Minnesota ( Pitocchelli et al. 1997), territory was estimated to be ½ hectare per breeding bird pair ( USDA 2000a).

### **Nest**

Connecticut warblers nest on the ground (Callog 1994) in a small hollow, on moss mound in a bog, or in grasses or weeds, or at the base of a shrub ( Nature Serve 2001) sometimes forming loose “colonies” Cadman 1987, Walkinshaw and Dryer 1961, Binford 1991). The inside of a nest measured by Huff (1929) was an inch and a half in depth and two inches in width, the wall of the nest was approximately 1/2 inch in thickness. The structure and composition of the nest have been described as a cup nest, composed of fine, dry grasses, dry leaves, stalks of weeds, sedge stems, rootlets and other plant fibers (Kells 1889, Bent 1953, Harrison 1984, Peck and James 1987 In Pitocchelli et al. 1997), plant fibers resembling horsehair (Huff 1929), and horsehair ( Bent 1953, Harrison 1984, Peck and James 1987 ) or built of leaves in sphagnum moss or grass (Niemi et al. 2001d). In wet habitats they choose hummocks of sphagnum moss for nesting, similar to the Palm warbler (Walkinshaw and Dryer 1961). Nests in moss are small depressions, (Bent 1953, Huff 1929). Walkinshaw and Dryer (1961) described the nest they discovered as a bulky nest made of dead leaves and other debris piled in a mass. Bent (1953) described a nest found in 1923 as being concealed at the side of a bunch of dead grass with an inner lining of finer grass. The nest was in the open in rather short grass and weeds near the edge of poplar. Huff (1929) described a nest site “ Labrador tea and swamp laurel, low bog shrubs that formed a dense tangle throughout the little opening, overtopped the moss by a foot or more and offered ample protection for the otherwise open nest”. Most nesting accounts were reported in June with occasional records from July (Pitocchelli et al. 1997).

### **Number of broods**

The Connecticut warbler has one brood per year. It is unknown if renesting is attempted if nest is disturbed. Female has a single brood patch ; incubation is by the female only ( Pitocchelli et al. 1997).

### **Clutch size**

The clutch size is 3-5 eggs (Curson et al. 1994) or according to Harrison 1975 and Bent 1953, 4-5 eggs. There is no information on geographic variation in clutch size (Pitocchelli et al. 1997). Most egg dates throughout North America recorded mid-to late June (Bent 1953); early June-early July in Wisconsin ( Pitocchelli et al. 1997); first week of June through early July in Michigan (Walkinshaw and Dyer 1961). Eggs are oval, average 19.5 x 14.3 mm (Harrison 1975), creamy white background with speckled, spotted and blotched of auburn, bay, chestnut with underlying spots described in Pitocchelli et al. 1997 as brownish drab, light vinaceous drab and light Quaker drab. The egg has a slight gloss (Bent 1953) and is almost identical to that of the Mourning warbler ( Pitocchelli et al. 1997), however the Mourning warbler eggs may occasionally have black scrawls, are oval to short-oval in shape and are slightly smaller than the Connecticut warbler egg, average 18.2 x 13.8 mm (Harrison, 1975). The markings of the Connecticut warbler egg tend to be concentrated, but do not form a wreath as occurs in eggs of

many other warblers ( Bent 1953). As reported by Harris In Bent (1953) there were four extremes in measurement of the eggs: 21.3 by 14.3, 19.9 by 15.6, 17.3 by 14.0 and 18.8 by 13.2 millimeters. Eggs measured by Huff (1929) were uniform in width, .56 inches, the average size for the clutch was .81 x .56 inches. Eggs discovered by Seton in 1884 were .75 x .56 inches (Huff 1929).

### **Incubation and nestling period**

The incubation and nestling periods are still unknown ( Binford 1991). Connecticut warblers are altricial and nidicolous based on observations of 2-3 day olds by Parmelee and Oehlenschlager (1972). The age of fledging is not known (Pitocchelli et al. 1997).

### **Fledgling stage**

In Michigan, nestlings were observed departing the nest during the day (Walkinshaw and Dryer 1961). 1997). Both adults remain with the young soon after fledging (Peck and James 1987). Fledglings stay hidden and dependent on parents during the first week after fledging; becoming more independent during the second week out of the nest (Bent 1953). There is no information on how long families remain together; small migratory flocks of 20-25 birds have been seen in late August (Bent 1953).

### **Nesting success**

There is very little information on the annual and lifetime reproductive success of this species. In the only study reported, five young fledged from five eggs in a single nest, observation made by Walkinshaw and Dryer (1961).

### **Food habits**

Connecticut warblers glean spiders and insects from vegetation and will eat fruit in the summer (Pitocchelli J. et. al. 1997, Niemi et al. 2001d) and sometimes seeds (Bent 1953, Pitocchelli et al 1997, Niemi et al. 2001d). They are described as a foliage insectivore (Hobson and Schieck 1999). Warren (1890 In Bent 1953) reported Connecticut warblers consume beetles, larvae and snails in addition to the aforementioned items. Microhabitats for foraging are different depending on the time of year. During breeding season, Connecticut warblers feed on or just above the ground ( Pitocchelli, J. et. al. 1997), on fallen logs (Curson et. al. 1994), and in brushy sheltered areas around swamps and meadows ( Pitocchelli, J. et. al. 1997). Both sexes forage in dense undergrowth (Binford 1991). During migration, Connecticut warblers forage at all levels of vegetation. Observations of Connecticut warblers feeding at the tops of large willow trees 15-20 meters above the ground ( Pitocchelli, J. et. al. 1997) and at the base of mesquite brush piles in Puerto Rico (McKenzie and Noble 1989 ) have been made during migration. Very little is known about feeding habits on breeding and wintering grounds ( Pitocchelli et al 1997).

## **HABITAT**

Habitat the Connecticut warbler has been found occupying during the breeding season is varied; they have been found in association with fifteen different forest types on Forests in Michigan, Minnesota, Wisconsin and the provinces of Canada. The forest types, not listed in order of occurrence, are: jack pine, red pine, black spruce, mixed swamp conifer, northern white cedar, fir/aspens/paper birch, sugar maple/basswood, ash/elm/red maple, tamarack, paper birch, quaking aspen and a variety of openings, upland, wetland bog and wetland sedge meadow (see Table 1) ( Niemi et al. 2002a, 2002b, 2002c).

Habitat is separated into the following categories: breeding season habitat, habitat used during migration and winter habitat.

### **Breeding season habitat**

Breeding habitat consists of spruce-tamarack bogs, muskeg, poplar woodlands and moist deciduous forests (Pitocchelli, J. et. al. 1997), and jack pine (Robbins 1974) ranging from eastern British Columbia east across south-central Canada to Quebec and south to northern Minnesota, Wisconsin, and the Upper Peninsula and northern Lower Peninsula of Michigan (Binford 1991). Habitat types used during the breeding season vary across Minnesota, Wisconsin and Michigan and this phenomenon has also been reported in Canada where regional habitat associations in Ontario are different from those in Saskatchewan (Welsh 1993). Callog (1994) listed the existence of a well-developed understory as the most important habitat characteristic. The Connecticut warbler is secretive in behavior (Pitocchelli, J. et. al. 1997). In wet habitats they chose hummocks of sphagnum moss for nesting (Callog 1994 In McPeck and Adams 1994). The sizes of bogs where Connecticut warblers have been observed are described as relatively small bogs that are 100 acres in size or less (USDA 2000b). Connecticut warblers have been observed a large variety of habitats ranging from dry deciduous and conifer habitats, mesic mixed forest types and wet coniferous habitat (Binford 1991, Niemi et al. 2002a, 2002b, 2002c). Habitat for the Connecticut warbler was described as mature, short-needle conifers, usually single-aged, either lowland conifer or jack pine with the key feature appearing to be an ericaceous (a heath or in the heath family) shrub layer up to about 3 feet high. It does not appear to be an edge sensitive species in that it doesn't avoid edge habitat (USDA 2000a). Additional habitat information by State is located under the Section titled State Summaries.

Additional references to jack pine habitat have been made. Robbins (1974) described habitat in Wisconsin as arid jack pine regions where trees have reached heights of at least fifteen feet, with an understory of dead pine branches or of scrub oak and bracken fern. All jack pine stands were not found to contain Connecticut warblers, stands with trees under 15 feet did not have Connecticut warblers but trees 15-30 feet tall whose lower branches were present did. The presence or absence of a deciduous understory was not critical. Breeding habitat is described in greater detail in the State Summaries for Minnesota, Wisconsin, Michigan, and Canada on pages 17-20 in this document.

### **Habitat Used During Migration**

Connecticut warblers have been observed using brushy, weedy and fallow fields, swamp forest habitats (Bent 1953), and “tend to seek out thickety wet bottomlands” (Hilton 1992). Hilton (1992) caught Connecticut warblers in mist nets in South Carolina at the edge of a 1.1 ha pond bordered by an alder thicket, in mixed vegetation dominated by sweetgums, Eastern red cedar, and winged elms approximately 4-5 meters tall. A Connecticut warbler was observed in Galveston County, Texas, in late September, the habitat is described in “The Spoonbill” Volume XXVII, No. 6 October 1978 (Morgan and Eubanks 1979). Cohrs and Cohrs (1979) described habitat two Connecticut warblers were banded in Georgia during spring migration as “typical Chat habitat”. Dorsey and Ford (1978) observed a Connecticut warbler in mid-October in dense understory growth at the edge of a row of low thick trees bordering a sandy coastal strip.

**Winter habitat**

A few researchers have documented the occurrence of Connecticut warblers during winter in Panama (Hicks 1967), Ecuador ( Jahn et al. 1999), and Venezuela (Thomas 1993). Jahn et al. (1999) described the habitat as secondary vegetation near a natural backwater pond on the outskirts of Playa de Oro. The habitat description was not given for the Panama observation; in Venezuela three Connecticut warblers were observed; one in scrub on the ground near a dry water course; one in mesquite trees and another caught in a mist net set over shallow water in a lagoon (Thomas 1993).

**Habitat by National Forest**

Connecticut warblers have been recorded using 15 different forest types. The forest types Connecticut warblers have been observed during the breeding season were jack pine; red pine; white pine; fir/aspens/paper birch; wetland black spruce; wetland northern white cedar; tamarack; upland black spruce; mixed swamp conifer; ash/elm/red maple; sugar maple/basswood; mixed hardwoods; quaking aspen; bigtooth aspen; lowland brush and openings with the following vegetation types: upland undifferentiated, wetland bog, wetland sedge meadow. Surveys conducted on each of the National Forests were not completed with the same protocol, duration or during the same timeframes. The table below lists the habitats the Connecticut warbler have been found thus far on the National Forests this species is listed as Sensitive. Survey protocol by Forest is listed in the Survey Protocol section of this document.

**Table 1.** *Oporornis agilis* Habitat By National Forest

Forest	Habitat of Connecticut Warbler Occurrences (Forest Type is in parenthesis)
Chequamegon National Forest (Wisconsin)	Found almost solely in jack pine forest of some form, including savannah-like habitat (USDA 2000a). Specifically found in descending order of mean abundance: pole-sized jack pine, pole-sized ash/elm/red maple, regenerating red pine and pole-sized mixed swamp conifer. Observations have also been made in pole-sized sugar maple/basswood, pole-sized cedar, pole-sized black spruce, saw-sized fir/aspens/paper birch, saw-sized red pine and regenerating jack pine (Niemi et al. 2002). This data is based on point count surveys conducted over a period of ten years in 133 stands on the Chequamegon National Forest ( Lind et al 2001). No data was collected for the Nicolet National Forest through NRRI.
Chippewa National Forest ( Minnesota)	Open, mature lowland conifer including tamarack, sphagnum and jack pine (USDA 2000b). Specifically found in descending order of mean abundance in: pole-sized black spruce; pole- sized tamarack; saw – sized balsam fir/aspens/ paper birch; pole-sized mixed swamp conifer; saw- sized quaking aspen; and to lesser degrees saw-sized paper birch; pole-sized jack pine; pole-sized quaking aspen; pole-sized ash/elm/red maple; regenerating quaking aspen and saw-sized ash/elm/red maple (Niemi et al. 2002b). This data is based on point count surveys conducted over a period of ten years in 135 stands on the Chippewa National Forest ( Lind et al. 2001).

Forest	Habitat of Connecticut Warbler Occurrences (Forest Type is in parenthesis) cont.
Huron-Manistee National Forest (Michigan)	On two occasions Connecticut warblers have been heard singing in mature aspen stands. There are no confirmed nestings of Connecticut warblers on the Huron-Manistee, it is thought this species uses habitats during migration (C. Rachinni personal communication 2001). This data is based on project area surveys conducted in aspen stands in areas proposed for management since 2000.
Ottawa National Forest (Michigan)	The Connecticut warbler has been found in association with many different habitats on the Ottawa NF. The forest types are ordered: saw-sized mixed hardwood, regenerating and saw-sized quaking aspen, pole-sized black spruce, pole-sized big-toothed aspen, lowland brush, opening with vegetation types: upland undifferentiated, wetland sedge meadow and wetland bog. Connecticut warblers have also been reported in stands containing mature yellow birch and hemlock and on the border of northern white cedar and ash. This data is based on project area surveys conducted in stands proposed for harvest since 2000.
Superior National Forest (Minnesota)	Primarily boreal bogs and jack pine (which is a rare habitat there) (USDA 2000a). Specifically found in descending order of abundance in: pole-sized black spruce, saw-sized jack pine, regenerating quaking aspen, regenerating upland black spruce and to a lesser degree in pole-sized balsam fir/aspen/ paper birch, regenerating jack pine, saw-sized quaking aspen, pole-sized quaking aspen and pole-sized mixed conifer (Niemi et al. 2002c). This data is based on point count surveys conducted over a period of ten years in 168 stands on the Superior National Forest (Lind et al. 2001).

\*The habitat data for this table was not collected with the same methodology on each Forest. This data represents the best description of Connecticut warbler habitat on each Forest at present. Yearly updates of Forest types used by the Connecticut warbler (Mean Abundance, excluding flyovers and individuals outside 100m for the Superior, Chippewa and Chequamegon National Forests should be checked, available at <http://www.nrri.umn.edu/mnbirds>.

### Habitat In Canada

Connecticut warblers are strongly associated with wet, nutrient-poor vegetation types with black spruce and/or tamarack as the dominant tree component and with deep organic soils (Welsh and Venier 1996). In Ontario Cadman et al (1987) described habitat typically used by this species as being extensive, fairly open spruce bogs and tamarack fens with a well-developed understory. Other habitats frequented in some localities are young jack pine stands or open poplar woods. Cadman et al (1987) suggests this information points out that dry sites are sometime as suitable as boggy ones as long as the forest is not too dense.

Habitat in Canada is described as open boreal and wet woods. This species prefers dense shrub in boggy or wet boreal forest, but preferences differ in some parts of its range (Canadian Wildlife Service, 2001).

## Migration

The Connecticut warbler follows different migration routes in the spring and fall (Bent 1953). The spring and fall routes overlap to a limited extent in areas closest to its breeding range (Pitocchelli et al. 1997). Vagrants of the main migration route have been found (Pitocchelli et al. 1997). The Connecticut warbler is extremely secretive and shy during migration; the number of sightings is a poor estimate of actual numbers passing through (Pitocchelli et al. 1997). During migration Connecticut warblers have been found dead after colliding with towers (Caldwell and Cuthbert 1963, Caldwell and Wallace 1966).

## Spring Migration

The average first arrival date for the Connecticut warbler in southern Florida is 1 May and the average first arrival date on the breeding grounds in central Canada is 1 June (Potter 1989). The spring migration in Minnesota peaks in the spring in late May and from mid-August through late October in the fall (Niemi et al. 2001d). Spring migration in North America is chiefly west of the Appalachians. The spring route is through the West Indies and Florida, northwesterly across the southern Alleghenies and then northward through the Mississippi Valley. It is rarely seen in the spring east of the Allegheny Mountains as far as Pennsylvania and north of South Carolina and western North Carolina and is seen more commonly from Ohio westward (Bent 1953). Although very rare migrants in South Carolina, four Connecticut warblers were caught and banded in 1990 and 1991. An exceptionally stormy spring in the south central region of the United States in 1991 may have caused more Connecticut warblers to migrate north along an easterly route. The four bandings were between May 13 and May 24 (Hilton 1992). Two Connecticut warblers were mist netted in Georgia on May 21 (Cohrs and Cohrs 1979). Potter (1989) reported earliest date for Connecticut warblers in North Carolina as 26 April through 30 May. Connecticut warblers were observed after crossing Lake Huron at Point Pelee National Park in Canada between May 17 and May 21 (Wormington et al. 2001). See Figure 1 below for banding and count locations of Connecticut warblers during the 1993 spring migration.

**Figure 1.** Spring migration map Connecticut Warbler



Source: Droege and Wetherill, 1993 Migration Monitoring Workshop Available at: <http://www.im.nbs.gov/birds/migration/cowas.jpg>

## Fall Migration

During the fall migration, Connecticut warblers migrate almost due east to New England, largely avoiding the Mississippi valley south to Illinois and Ohio, then southward along the Atlantic coast through Florida and the West Indies to the wintering grounds in South America (Bent 1953). The first and last capture dates for birds banded in the fall in Maryland were the 25<sup>th</sup> of August and the 21<sup>st</sup> of October respectively with the median date being the 21<sup>st</sup> of September (Mehlman 1990). Connecticut warblers are thought to migrate in small flocks; groups of 20-25 birds have been seen on several occasions during fall migration (Bent 1953). Breeding grounds in Minnesota and Michigan are departed in late August-early October (Pitocchelli et al. 1997). There are numerous records from the interior of the United States and western states during fall migration (Pitocchelli et al. 1997). See Figure 2 for the banding and count locations for Connecticut warbler during fall migration 1993.

**Figure 2.** Fall Migration Map Connecticut Warbler



Source: Droege and Wetherill 1993 Migration Monitoring Workshop  
Available at: <http://www.im.nbs.gov/birds/migration/cowaf.jpg>

Figure 1 and 2 demonstrate pathways used by the Connecticut warbler during spring and fall migration. Locations marked with an “X” indicate the site used a counting technique rather than netting and an “O” represents areas with net captures (Droege and Wetherill 1993). These maps were compiled with one year of data taken from varying sources. Mostly the maps illustrate the difference in flyways used by Connecticut warblers in the spring verses the fall.

## DISTRIBUTION AND ABUNDANCE (RANGEWIDE/REGIONWIDE)

Distribution of this species is spotty, even in suitable habitat (Callog 1994 In McPeck et al. 1994). The entire distributional range is still not known (Piocchelli et al. 1997).

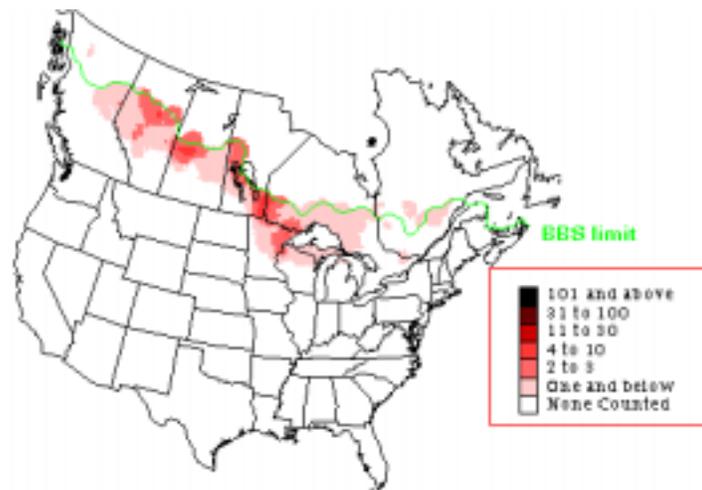
### Breeding Distribution

The breeding range of the Connecticut warbler is a narrow band extending from the Peace River eastward through central Saskatchewan, Manitoba and Ontario to the westernmost parts of Quebec ( Cadman et al 1987) and a small portion of north central British Columbia (Canadian Wildlife Service 2001). Eighty-five percent of the breeding range in North America occurs in Canada ( Canadian Wildlife Service 2001). In the United States breeding range of the Connecticut warblers is the western Great Lakes: northern Minnesota, northern Wisconsin and Michigan's Upper Peninsula and the northern tip of the Lower Peninsula (Bent 1953, NWRC 2000, Callog 1994 In McPeck and Adams ). See Figure 3.

### Winter Distribution

Various habitats in northern South America (Pitocchelli, J. et. al 1997, Binford 1991) are used. The Connecticut warbler is a rare autumn transient through the eastern West Indies (and most notably on Bermuda) and through northern to central Venezuela (Cumbre de Valencia and Carabobo undated) (Bent 1953), western Venezuela and northern and eastern Colombia, western and central Amazonian Brazil ( specifically Allianca and Rio San Lourenco Bent (1953) , and southeastern Peru (NatureServe 2001). Connecticut warblers are present in South America mostly October-April (NatureServe 2001). The first record of Connecticut warbler in Ecuador was made in 1996 (Olaf et al. 1999) and the first record of Connecticut warblers in Panama was made in 1963 and 1964 (Hicks 1967). Its distribution on the wintering grounds is poorly known (Pitocchelli, J. et. al. 1997). The Connecticut warbler may possibly be a rare migrant on the Caribbean Coast of Panama (Hicks 1967). Additional observation would answer the question whether they are casual wanderers from more eastern migration routes over the West Indies or Caribbean Sea (Hicks 1967). Males are solitary in winter (Curson et al. 1994 ).

**Figure 3.** North American Breeding Bird Survey, Summer Distribution of Connecticut Warbler, Breeding Bird Survey Routes 1966-1999.



Source: <http://www.mbr-pwrc.usgs.gov>

## STATUS

The North American Breeding Bird Survey began in 1966 with 600 survey routes and has now grown to 3,700 routes across the continental United States and Canada; nearly 2,900 routes are surveyed annually (Sauer et al. 1997). Each route is 24.5 miles in length with a total of 50 stops located at ½ mile intervals. The survey of these routes is designed to provide a continent-wide perspective of population change. A larger sample size with more routes is needed to reduce the effects of sampling error and to average local variations. Although a larger sample size is needed, the surveys produce an index of relative abundance that assume the fluctuations in indices are representative of the entire population (Sauer et al. 1997). Trend is an estimate summarized as a percent change/year. Because the trends are estimates, statistical tests are conducted to determine whether the trend is significantly different from zero, the null hypothesis. Trend estimates are summaries of population change; they do not provide information on population cycles or other patterns of population change. Trend estimates are calculated by region. The entire survey area includes the entire United States, excluding Alaska, and Canada. See the trend map in Figure 4.

North American Breeding Bird Survey Data indicate stable populations from 1966 to 1994 for Minnesota and Ontario; 1966-1991 for British Columbia, Manitoba, Ontario, Minnesota, and Michigan. Increases were detected in Alberta, Saskatchewan, and Wisconsin (Pitocchelli et al. 1997). For the time period 1966 to 2001 (Sauer et al. 2002) the United States Region shows a non-significant increasing trend, while the Eastern Breeding Bird Survey shows a significant decline and the Survey wide region shows a non-significant declining trend. These three Regions have been assigned the intermediate credibility measure. This data category reflects data with a deficiency and should be used with caution. In particular data in this category have either one or more of the following: a low abundance, small sample size (less than 14 routes) or the results would not detect a 3% per year change over the long-term. Although there are restrictions on the accuracy of this data, this is the very best source of trend data currently available and this data is utilized by Partner's In Flight and the National Audubon Society. The validity of trend data with too few observations should be questionable (Hamady 2002). In Canada in 1995 approximately 445 BBS routes were run (Sauer et al. 1997).

Declines have also been seen in Ontario and Alberta (NWRC, 2000). The Canadian Wildlife Service (2001) status summary lists Connecticut warbler population trend as a “significant large decline”. The North American Breeding Bird Survey is coordinated in Canada by the Canadian Wildlife Service and in the U.S. by the Patuxent Wildlife Research Center, United States Geological Survey (USGS). Population trends in the United States during the period 1966-1996 are displayed below in Figure 4. Canadian BBS data indicates severe decline in each of the past two decades (Canadian Wildlife Service (CWS 2001).

The annual indices of population change for the Connecticut warbler shows a trend of -6.7% from 1991-2000 and -8.9% over the full range (1967-2000). Trend is defined as the mean annual percent change in bird population (CWS 2002). This data should be used with some caution, the Breeding Bird Survey (BBS) covers little of the Canadian breeding range and BBS has low detection rates.

Numbers of Connecticut warblers captured at many Ontario banding stations are too low for analysis (CWS 2001).

Partner's In Flight (PIF) was created in 1990 with the goal to create a comprehensive planning effort to conserve nongame landbirds and their habitats in North America. PIF has a species prioritization database ranking species that are most vulnerable (Carter et al. 2000).

PIF has a species prioritization process that uses seven categories for evaluating vulnerability. The summation of the seven-parameter scores (total assessment scores) indicates the overall conservation priority. The parameters are Breeding distribution (BD), Nonbreeding distribution (ND), Relative Abundance (RA), Threats to breeding (TB), Threats to Nonbreeding (TN), and Population Trend (PT) scores for each factor range from 1 (low vulnerability) to 5 (high vulnerability). The seventh factor is Area Importance (AI) which reflects the relative importance of an area to a species and its conservation, based on the abundance of the species in that area relative to other areas and is scored on a similar scale 1 (reflects low abundance), 5 (reflects high abundance). The percent of total species population occurring in each area is included as another measure of stewardship responsibility. The number can range from 7 to 35 but needs to be considered in the context of its component parts rather than the total number. AI may be calculated for breeding or wintering populations. In general, scores for RA, PT and AI are taken from empirical data generated by the Breeding Bird Survey (Panjabi 2001). The overall score for the Connecticut warbler is 21 (AI calculated for breeding) with the following individual scores BD 3, ND 3, RA 4, TB 3, TN 2, PT 2 and AI 4 (Panjabi 2001).

The species prioritization process is a tool for conservation planning. PIF drafts Bird Conservation Plans for all of the physiographic areas of the continental United States. The physiographic areas used by PIF differ by name and boundary of those used by the USDA Forest Service-the Ecological Units of the Eastern United States 1995 (Keys et al. 1995). The Connecticut warbler is a species included in the PIF Bird Conservation Plan for the Boreal Hardwood Transition, this plan not yet completed. The trends seen for the Connecticut warbler (AI breeding) is listed as a moderate decline in the Boreal Hardwood Transition and stable in the Boreal Taiga Plains. The Bird Conservation Physiographic Regions are available at <http://rmb.wantjava.com/brcB.html>.

Partner's In Flight publishes a Watchlist developed to highlight those birds of the continental United States not already listed under the Endangered Species Act that most warrant conservation attention. The Connecticut warbler is not among the species on PIF's list.

The Audubon Society publishes a Watchlist of species for each State in the United States and National Watch Lists. The Watchlists are compiled for each state based on data from Partner's In Flight and the North American Breeding Bird Survey. The Connecticut warbler is on the Watchlist for Michigan, Minnesota and Wisconsin (National Audubon Society 1999 a-c) as a high priority species for the Boreal Hardwood Transition and Aspen Parklands Physiographic Areas. The Connecticut warbler is not on the National Audubon Watchlist.

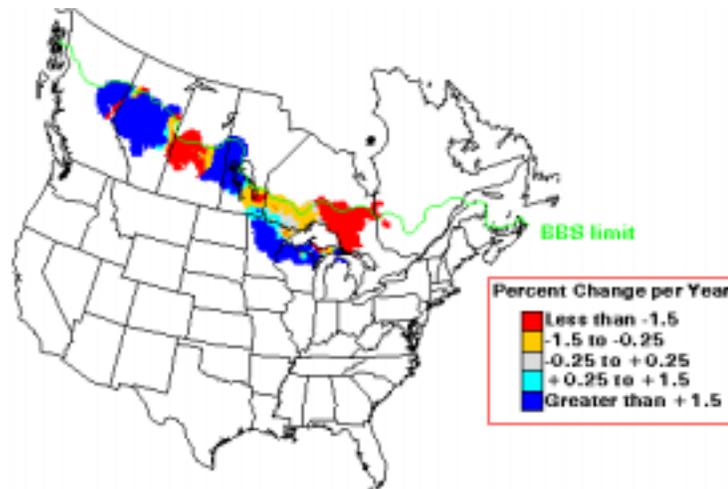
The Natural Resource Research Institute (NRRI) conducted point count surveys on the Chequamegon National Forest, Chippewa and Superior National Forests during a period of ten years beginning in 1991. A total of 1,268 survey points were established in 135 stands on the Chippewa, 168 stands on Superior National Forest and 133 stands on the Chequamegon National Forest (Lind et al 2001). Results show a significantly decreasing population for the Connecticut warbler on the Chippewa National Forest (Lind 2001). There is not enough data to show trends for the Superior and Chequamegon National Forests. Comparisons were made with BBS data

from four regions in the Great Lakes area: the Northern Spruce/Hardwoods, Great Lakes Transition and Driftless Area in addition to Minnesota statewide. In the Northern Spruce/Hardwoods region the Connecticut warbler is showing a significant declining trend.

The Connecticut warbler has a year 2000 Partners in Flight (PIF) status of 23 (Partners in Flight, 2001) and is a Tier 1 species (Butcher 2001). Tier 1 means that the Connecticut warbler is a very high conservation priority within the Bird Conservation Region #12 (bcr12) Boreal Hardwood Transition. The PIF status is the combined score that sums seven different indices: population trend, importance of the Bird Conservation Region for breeding of the species, global relative abundance, global breeding distribution, wintering distribution, global score threats during the nonbreeding season and threats to breeding success in the Bird Conservation Region.

The Natural Resource Research Institute assigned the Connecticut warbler a risk index of 36 due to a breeding range that is limited to the Northern Great Lakes area in the U.S. The highest score is 100 with the exception of the Kirtland's warbler ( JoAnn Hanowski personal communication 2002). NRRI ranked 229 breeding bird species in the Great Lakes Watershed based on potential risk of extinction using three quantifiable factors: 1) relative abundance 2) extent of breeding range in the Americas (distributional rarity) and 3) population trend over the past thirty years. A combination of high risk and high proportion of the species' range within the area suggests high priority for regional or local conservation efforts. Species with higher rankings by NRRI are: Northern goshawk (risk index 68) and piping plover ( risk index 48) ( NRRI 2001).

**Figure 4.** Connecticut warbler *Oporornis agilis* North American Breeding Bird Survey Trend Map 1966-1996



Source: <http://www.mbr-pwrc.usgs.gov/bbs/htm96/trn626/tr6780.html> (Sauer et. al 2001)

## Status in the Northern Great Lakes Region of the United States and Provinces of Canada

**Table 2.** State Ranks for *Oporornis agilis*

State/ Province	State Threatened/Endangered or Special Concern Listing	State/Province Heritage Status Ranks
Alberta	Not listed by COSEWIC as T/E or Special Concern	S4B
British Columbia	“ “ “	S2B, SZN
Manitoba	“ “ “	S4S5B, SZN
Michigan	Not listed as T/E or Special Concern	S2S3
Minnesota	Not listed as T/E or Special Concern	Not ranked
Quebec	Not listed by COSEWIC as T/E or Special Concern	S4
Saskatchewan	“ “ “	S2B, SZN
Wisconsin	Special Concern	S3B, SZN

S2= Imperiled: due to rarity or because of other factors making it very vulnerable to extirpation from the state. Typically 6 to 20 occurrences or few remaining individuals (1,000-3,000). S2B= same definition as S2 but during the breeding season. S2S3= rating falls between a S2 and S3. S3=Vulnerable; rare and uncommon, or found only in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extirpation. Typically 21 to 100 occurrences or between 3,000 to 10,000 individuals. S3B= same definition as S3 but during the breeding season. S4=Apparently secure in state, with many occurrences. S4B= same definition as S4 but during the breeding season. S4S5B= rating falls between S4 and S5 during the breeding season. S5 = Secure. SZN= Non-breeding migrants/vagrants.

The global rank G4 was assigned December 3, 1996. The current rounded global heritage status rank is also G4. G4= apparently secure globally, though it may be rare in parts of its range, especially at the periphery.

In Canada (includes the provinces of Quebec, Ontario, Manitoba, Saskatchewan, Alberta and British Columbia) the Connecticut warbler is not designated by COSEWIC (Committee on the Status of Endangered Wildlife in Canada).

**Table 3 :** *Oporornis agilis* Occurrence in the Northern Great Lake States by County, State and Year\*

<b>State</b>	<b>County of Occurrence</b>	<b>Source of Data/Breeding Bird Status of Occurrence</b>
Michigan	Alger County	ABB, 1 probable, 2 possible.
	Baraga County	ABB, 2 possible, Corace ( 2001), Doepker (2001).
	Cheboygan County	ABB, 2 confirmed.
	Chippewa County	ABB, 2 possible , Corace (2001); 2 in 2001 ( S. Sjogren personal communication 2001).
	Delta County	ABB, 2 confirmed, 1 possible.
	Dickinson County	ABB, 2 possible, Doepker ( 2001).
	Emmet County	ABB, 3 confirmed, 1 possible.
	Gogebic County	ABB, 2 possible.
	Houghton County	ABB, 1 probable, 1 possible.
	Iron County	ABB, 1 probable, 2 possible.
	Keweenaw County	ABB, 2 confirmed, 2 probable, 3 possible. ABB, 1 probable, 9 possible, early observation (Huff 1929).
	Luce County	ABB, 2 probable, Corace (2001).
	Mackinac County	ABB, 2 probable, 1 possible, historic collection (Huff 1929), Doepker (2001).
	Marquette County	ABB, 1 possible.
	Menominee County	ABB, 1 confirmed.
Montmorency County	ABB, 1 probable, 4 possible, Corace (2001), historic collection (Huff 1929).	
Ontonagon County	ABB, 1 confirmed, 1 possible.	
Otsego County	ABB, 1 probable, 3 possible.	
Schoolcraft County	ABB, 1 probable, 3 possible.	
Wisconsin	Ashland County	NHI listing, summer occurrence recorded 1957, 1958, 1968 (Robbins 1974)
	Bayfield County	NHI listing and WBBA, 1 confirmed, 2 probable, summer occurrence reported 1970, 1971 (Robbins 1974). WBBA, 1 probable. WBBA 1 probable.
	Burnett County	Summer occurrence reported in 1972 (Robbins 1974).
	Clark County	NHI listing and WBBA, 5 confirmed , 2 probable, summer
	Door County	occurrence reported 1941, 1956, 1963, 1966-1967, 1969-1973 (Robbins 1974). WBBA 1 confirmed, 1 probable,
Douglas County		

State	County of Occurrence	Source of Data/Breeding Bird Status of Occurrence
	Forest County	Summer occurrence reported 1962, 1964, 1965, 1968-1970 (Robbins 1974). WBBA 1 confirmed, 2 probable, Summer occurrence reported 1972 (Robbins 1974).
	Iron County	NHI listing, WBBA 1 confirmed. Summer occurrences reported in 1966 and 1970 (Robbins 1974). NHI listing, 1969 (Robbins 1974).
	Jackson County	Summer occurrence reported in 1963 (Robbins 1974)
	Langlade County	WBBA, 3 confirmed, 3 probable, summer occurrences reported in 1942, 1962, 1964, 1968, 1970, 1972-1973 by Robbins 1974.
	Lincoln County	WBBA, 1 probable. Documented Occurrence (S. Adams personal communication 2001), summer occurrences Reported in 1972 (Robbins 1974).
	Marinette County	WBBA, 1 probable, 1942, 1943 and 1945 occurrences documented in Robbins 1974.
	Oneida County	NHI listing, WBBA 2 confirmed, 4 probable, summer occurrence reported 1942, 1970 (Robbins 1974).
	Price County	
	Sawyer County	
	Vilas County	

\* Information from: Wisconsin Natural Heritage Program, Rare Species and Natural Communities, Natural Heritage Information (NHI) Working List by County, Michigan Breeding Bird Atlas, Robbins 1974, USGS undated, G. Corace, and R. Doepker personal communication 2001.

ABB = Michigan Breeding Bird Atlas (1991)      WBBA = Wisconsin Breeding Bird Atlas.

The Connecticut warbler is not tracked by the Michigan Natural Features Inventory, Minnesota Natural Heritage and Nongame Research Program, Ontario Natural Diversity Information Centre but is tracked by the Wisconsin Natural Heritage Program.

## STATE SUMMARIES

### Michigan

In Michigan, the Connecticut warbler breeds in a wide variety of habitats, including dry deciduous forests (aspen, often with white birch and bracken fern); dry coniferous (jack pine, with scattered aspen); mesic mixed (mature aspen, with spruce and some eastern white pine and

balsam fir); and wet coniferous (spruce and/or tamarack bogs, with sphagnum moss, Labrador tea, and some aspen). The forest is usually open, and there are dense shrubs and herb layers. Stands as open as park-like have been used. Aspen is often a conspicuous element and most breeding records are from wetland edges (Binford 1991).

The Connecticut warbler population in Michigan is small and local (Binford 1991). Collections of Connecticut warblers were made as early as 1894 in Marquette County (Huff 1929). Other early collections of this species were made in 1904 in Ontonagon County (Huff 1929), 1919 ( In Binford (1991) in Mackinac County and reports of mature birds seen 1922-1924 in Luce County (Huff 1929). Singing males were heard during the mid to late 1950's and 1960 but no nests were confirmed. The first Connecticut warbler nest was found in 1960 in Michigan in Ontonagon County (Walkinshaw and Dryer 1961, Callog 1994 In McPeck et al.). No Connecticut warbler nests were discovered during the 1983-1988 Breeding Bird Atlas survey period. However, Connecticut warblers were heard singing in all Upper Peninsula counties and four counties in the northern tip of the Lower Peninsula (Callog 1994 In McPeck et al 1994) with a concentration in Luce County (Binford 1991). In the 1970-1980's two adults attending young were noted, one in Ontonagon County (Belyea 1980 In Binford 1991) and the other in Luce County (Payne 1983 In Binford 1991). In the Lower Peninsula, Connecticut warblers have been observed in Oscoda ( Zimmerman 1955, Binford 1991) and Crawford counties ( Binford 1991). No birds were found in these two counties during the Breeding Bird Atlas survey (Binford 1991). The surveys conducted during 1983-1988 for the Breeding Bird atlas found Connecticut warblers (during the breeding season) in all Upper Peninsula counties plus four counties at the northern tip of the Lower Peninsula (Callog 1994 In McPeck et al 1994).

The Connecticut warbler is a late spring migrant in Michigan, arriving in the Lower Peninsula until mid May, beginning egg laying approximately June 5<sup>th</sup> (Binford 1991). Fall migration occurs in late August and the first three weeks of September, with some birds remaining until mid-October (Binford 1991).

The Connecticut warbler's tolerance of a variety of rather open habitats suggests that its Michigan population, although small and local, is in no immediate danger (Binford 1991). Most of Michigan's summer reports come from tamarack-spruce bogs, open poplar woods, and jack-pine barrens, all which provide thick undergrowth for its nesting and foraging requirements (Callog 1994 In McPeck et al. 1994).

The National Parks in Michigan reporting the occurrence of Connecticut warbler are Isle Royal National Park, Pictured Rocks National Park, and Sleeping Bear Dunes National Lakeshore (Information Center for the Environment, undated). The trend for the Connecticut warbler in Michigan from the North American Breeding Bird Atlas is -24.9% during the period of 1966-1999 (Sauer, et. al 2000). This data was suggested to be used with caution, marked with the least credible data by the North American Breeding Bird Survey, however is the best data available on trends of this species.

### **Minnesota**

Connecticut warblers are found at a higher incidence in boggy areas with black spruce (J. Lind personal communication 2001b); also using tamarack bogs, aspen and jack pine but to a much lesser degree (Niemi et al. 2001b and 2001c). Huff (1929) described habitat observing Connecticut warblers in a swamp with mixed and pure stands of both black spruce and tamarack with ground cover of pitcher plant, sundew, buckbean, wild calla, coral root, moccasin flower and dragon's mouth (*Arethusa bulbosa*).

The status of the Connecticut warbler in Minnesota is described as “regular”, “migrant” and “summer resident” in the Birds of Minnesota. It is a rare spring and fall migrant in eastern regions, casual to rare in most of the central and western regions. The spring migration period is early May to early June with the most records in late May (Janssen 1987). The earliest and latest dates of first arrival in the spring are, in the south May 5<sup>th</sup> and June 9-19<sup>th</sup> and in the north May 6<sup>th</sup> (no late date can be given in the north because of breeding birds). The fall migration is August through early October. The latest date Connecticut warblers have been observed in the fall is October 27 (Janssen 1987). According to MN Birdscape 1999, The Connecticut warbler has been observed in Minnesota as early as the 14 May and as late as 23 September.

In the early twentieth century, Connecticut warblers ranged as far south as the tamarack bogs of Isanti County, but there has not been a record reported there for 65 years, reported by Janssen in 1987. In north-central Minnesota, the Connecticut warbler is best represented as a “resident” from Koochiching, Aitkin, Hubbard and Beltrami Counties westward into eastern Marshall and Roseau Counties and in the northwest region in St. Louis, Lake and Cook Counties and as far south as northern Pine Counties (Janssen 1987). The historical range of this species in Minnesota includes areas as far south as Isanti County (Niemi et al. 2001d) There is one record from Clay County in late July, but this could have been a very early fall migrant (Janssen 1987).

The roadside count data for Minnesota has indicated no change in the population of Connecticut warbler between 1966 and 1990 (In Niemi et al. 2001 d). Few individuals of this species are observed along these routes, the sample size is relatively small for detecting a significant trend (Niemi et al. 2001d). The trend for the Connecticut warbler in Minnesota from the North American Breeding Bird Atlas is 1.0 during the period of 1966-1999 (a non-significant increasing trend) (Sauer, et. al 2000). It is suggested this data be used with caution and is marked with the intermediate rating of credibility by the North American Breeding Bird Survey.

Connecticut warblers have been sighted at the Voyageurs National Park. It is listed as non-reproducing resident status in this National Park, however the Connecticut is listed as non-reproducing in all the National Parks, (Information Center for the Environment, undated) as the data is lacking.

The Connecticut warbler is a high priority species for physiographic region 20 on Minnesota Audubon Watchlist (Russ et al. 1999).

### **Wisconsin**

The first confirmed nesting of Connecticut warbler in Wisconsin was made by Gromme in 1941 (Gromme 1942) in Douglas County. The site was described as an extensive spruce and sphagnum bog. The 1942 edition of Wisconsin Birds: A Preliminary Checklist With Migration Charts. The Connecticut warbler was listed as a “very rare” summer resident. In 1960 it was revised to “rare” (Robbins 1974).

The Solon Springs-Drummond region is an extensive pine barren area (extending from the northwest corner of Polk County northeast through Burnett and Washburn counties to north Bayfield County). There are pockets of jack pine in Marinette County with smaller pockets in western Oneida-northern Lincoln Counties and in southwestern Oconto-Menominee Counties. Farther south there are three areas: one blanketing substantial parts of Adams and Juneau

Counties; another in Monroe and Jackson Counties and the third in eastern Eau Claire County (Robbins 1974). In 1973 (Robbins 1974), Robbins counted 41 singing male Connecticut warblers in a two-hour interval in Solon Springs and Highland Townships in eastern Douglas County. Another thirty birds were detected in Barnes Township in western Bayfield County in June 1974 demonstrating a substantial colony of breeding Connecticut warblers in excess of 100 pairs between Solon Springs and Drummond. Habitat preference in this area was described as arid jack pine where trees have reached heights of at least fifteen feet with an understory either of dead pine branches or of scrub oak and bracken fern (Robbins 1974).

The Connecticut warbler has been observed in sixteen counties in Wisconsin (see Table 3). On June 25, 2001, a Connecticut warbler male was observed singing on Madeline Island north of Bayfield Wisconsin. The bird was singing in a tamarack bog, the trees were 5-20 feet tall with an understory described as typical bog vegetation (leatherleaf, bog laurel, and bog rosemary). The site was within 500 feet of open water (R. Evans personal communication, 2001). Connecticut warblers have been found to occur at Apostle Islands National Lakeshore and Saint Croix National Scenic River (Information Center for the Environment, undated). The trend for the Connecticut warbler in Wisconsin from the North American Breeding Bird Atlas is 0.4 % during the period of 1966-1999 (Sauer, et. al 2000). This data is suggested used with caution and marked as intermediate credibility by the North American Breeding Bird Survey. The trend does not show a significant nor non-significant increasing or declining trend. The North American Breeding Bird Survey database is the only trend data for this species in Wisconsin.

Few individuals are seen during migration, but data from banding records and tower kills indicate that the species is more abundant during migration than observation records alone suggest ( Niemi et al. 20001d).

## **Canada**

Eighty-five percent of the North American breeding range of the Connecticut warbler is in Canada (CWS, 2001). The breeding range of the Connecticut warbler in Canada is central-eastern British Columbia; north central and central Alberta; central Saskatchewan; central and southern Manitoba; north central to south-central Ontario and central-western Quebec (Godfrey 1986), see Figure 3. The Connecticut warbler is an uncommon migrant on southern Alberta, southern Saskatchewan, and southern Ontario. It is now thought to be breeding 300 km northeast of Sandy Lake, in the Severn River Basin which was previously known as the northern limit of it's range (Cadman et al. 1987). The Connecticut warbler is a rare spring and autumn visitor to Nova Scotia; with only sight records for New Brunswick (Godfrey 1986). The first confirmed nesting in Manitoba was recorded in 1883 (Bent 1953). Typically this species is found in extensive, fairly open, spruce bogs and tamarack fens (Helleiner 1987, Godfrey 1986), with well developed understory, jack pine stands and open poplar woods are also frequented in certain areas, suggesting that dry sites are sometimes as suitable as boggy sites as long as the forest is not too dense (Helleiner 1987). Connecticut warblers have been found especially in central Alberta, associated with dry ridges, knolls with open poplar woods and in the Amos, Quebec region, using open mature jack pine (Godfrey 1986). A study conducted by the Canadian Wildlife Service in 1989 found Connecticut warblers using black spruce habitats (Welsh 1993) but regional habitat associations of the Connecticut warbler in Ontario are different from those in Saskatchewan (Welsh 1993). Black spruce habitats were found to be the dominant habitat type in a study conducted by Welsh and Loughheed (1996) in mature habitats of the Great Clay Belt in

Ontario and Quebec. Connecticut warblers in Ontario were described as having a strong association with “wet, nutrient poor vegetation types with black spruce and /or tamarack as the dominant tree component and with deep organic soils (Welsh and Venier 1996). The warbler was found in eleven Forest Ecosystem Classification categories by Welsh and Lougheed (1996), ten of which had black spruce as the dominant tree species and the understory composition varying. The eleventh Forest Ecosystem type was trembling aspen-balsam fir-black spruce- *Diervilla* and *Clintonia*. The mean abundance was highest in black spruce/jack pine, feathermoss and *Cladina* spp. In descending order of mean abundance of Connecticut warblers occurrences were black spruce- *Ledum Chamaedaphne*- Sphagnum spp; black spruce-*Ledum-Sphagnum* spp.; black spruce- *Alnus*, *Ledum*, *Sphagnum*; black spruce (larch)- *Alnus*- *Aralis*, *Sphagnum*, *Hylocomium* and feathermoss; black spruce (jack pine)- feathermoss; black spruce (white cedar)- *Alnus*- *Cornus stolonifera*- herb rich-*Hylocomium*, *Rhytidiadelphus*-feathermoss, *Sphagnum* spp.; black spruce-jack pine-*Ptilium*-feathermoss; black spruce (white cedar)- *Alnus*- *Sphagnum* spp.- feathermoss and black spruce- *Ledum-Equisetum*-feathermoss-*Sphagnum* spp. In western Canada, Connecticut warblers were found in association with aspen or poplar stands (Kirk et al. 1996). Kirk et al (1996) felt their study, which found the majority of Connecticut warblers in “mature” (40-year-old stands) contradicted the findings of Schieck et al 1995 and Schieck and Nietfield 1995 of Connecticut warblers being most abundant in young forests.

The trend for the Connecticut warbler from breeding bird surveys in Canada between 1966-1996 is – 4.6% (NWRC 2000). The 1967-1998 trend for the Connecticut warbler in Canada is – 9.8% (N=65 routes) (Canadian Wildlife Service, 2001).

## **POPULATION BIOLOGY AND VIABILITY**

There is no information on age at first breeding or intervals between breeding and very little information on annual and lifetime reproductive success (Pitocchelli et al. 1997). In Michigan Walkinshaw and Dyer 1961 (In Pitocchelli et al. 1997) found 5 young fledged from five eggs. The estimated minimum age of a banded bird recovered in Pennsylvania is 4 years, 3 month (Klimkiewicz et al. 1983).

## **POTENTIAL THREATS AND MONITORING**

### **Present or Threatened Risks to Habitat or Range**

Without a great deal of information available on this species, the suspected threats may or may not be limiting factor (s) for the Connecticut warbler. The following lists threats as determined by a review of literature and discussions with wildlife and research wildlife biologists within the Great Lakes Region.

Threats may vary by region, as habitat use varies by locality.

The landscape needs (patch size, distribution, etc) for this species are unknown (USDA 2000a). The Connecticut warbler may be sensitive to habitat fragmentation due to increases in nest predation and parasitism that may accompany decreases in forest interior habitat (Niemi et al. 2001d, Matthiae 2001), however Connecticut warblers have been found in association with open forest habitats. Cowbird parasitism may be a threat (USDA 2000).

Effects of different land-uses on this species are unknown (Canadian Wildlife Service, 2001). Peat mining may pose a threat to Connecticut warbler habitat. Peat mining is a large industry in Canada and has started in the United States at Pine Island in Koochiching County Minnesota ( Hamady 2002).

Towers and structures have been reported as specific threats (USDA 2000b). Three hundred Connecticut warblers were killed in one season from collision with towers in Eau Claire Wisconsin (Hamady 2002). Two studies in Michigan's Lower Peninsula found Connecticut warblers to be among the warblers killed at a tower. Twenty-three of the 42 species were wood warblers (Caldwell & Cuthbert 1963). The Connecticut warbler was found as a fall migration fatality rather than a spring migration fatality at two towers studied from 1959-1964 near Cadillac, Michigan ( Caldwell and Wallace 1966). It is likely the fall fatalities are a result of the migration travel route being different in the fall than the spring route, rather than the age of the birds. There are over 77,000 communications towers in the United States and about 5,000 new towers are being built each year but the rate is expected to increase with developing technology in cellular telephones and digital television networks ( Shire et al. 2000). Loss and fragmentation of jack pine forests was identified as the biggest threat to Connecticut warbler (USDA 2000a).

The Connecticut warbler may be vulnerable to habitat loss on its wintering grounds (Rappole 1995).

It is felt jack pine was the critical habitat for maintaining viability on the Chequamegon-Nicolet National Forest although this warbler will use lowland conifer especially adjacent to wetlands (2000b). Threats to this species may include loss of jack pine due to budworm (USDA 2000c). The loss of pine barrens and fire suppression were listed as causes of fragmentation and loss of habitat on the Chequamegon-Nicolet National Forest (USDA 2000b).

**Table 4:** Threats or Risks to *Oporornis agilis* by Forest

<b>Forest</b>	<b>Risk or Threat</b>
Chequamegon-Nicolet	Loss of jack pine due to budworm (Adams 2000), and increased predation and parasitism due to forest fragmentation (Matthiae 2001). Maintenance of black spruce, tamarack bogs essential (Matthiae and Adams 2000)
Chippewa	There are no major threats to this species as they are using stands in boggy habitats that are not treated silviculturally (W. Russ, personal communication 2001).
Hiawatha	Uncertain of immediate threats, off forest wet site jack pine and black spruce management are providing habitat (K. Doran personal communication 2001). Not knowing all habitats this species is associated with may be a threat (S. Sjogren, personal communication 2001).
Huron-Manistee	The major threat is on private lands within the National Forest due to increased human development; forest clearing (C. Racchini 2001b).
Ottawa	The Forest does not have enough information on the type of habitat being used to know whether there are any threats or risks caused by management or lack of management (S. Babler personal communication 2001).
Superior	There are no threats to this species; the Connecticut warblers are using boggy habitats not managed by the Forest. (W. Russ, personal communication 2001).

#### **Commercial, Recreational, Scientific or Educational Overutilization**

Nothing recent reported, possible overcollection in the late 1800's and early 1900's along the east coast of Massachusetts (Pitocchelli et al. 1997).

#### **Disease or Predation**

Broods have been parasitized by brown-headed cowbirds (*Molothrus ater*). There is no information on the kinds of mammalian or avian predators, manner of predation, nor information on disease and parasites (Pitocchelli et al. 1997).

#### **Inadequacy of Existing Regulatory Mechanisms**

No inadequacies noted.

#### **Other Natural or Human Factors Affecting Continued Existence of Species**

A potential problem for this species may be the increase in the number of towers being constructed in flyways used for migration. During migration, there are some accounts of Connecticut warblers flying into towers as well as lighthouses, and other buildings. Connecticut warblers accounted for 2% of all warblers killed by towers in Eau Claire Wisconsin (Pitocchelli et al. 1997) while a study at a tower site on the Huron-Manistee found two Connecticut Warblers hit the tower during the four year study, both during fall migration (USDA 1997).

# **SUMMARY OF LAND OWNERSHIP AND EXISTING HABITAT PROTECTION**

## **Michigan**

### **Forest Service**

The Connecticut warbler breeds on the Hiawatha and Ottawa National Forests. Occurrences of this species have been recorded on Breeding Bird Surveys on the Ottawa Forest since 1991 and for the past five years on the Hiawatha National Forest (K. Doran personal communication 2001). On the Huron-Manistee this warbler is not known to breed and is thought to be only present during migration (C. Racchini personal communication 2001). There have been no records of Connecticut warblers breeding on the Huron-Manistee NF (C. Schumacher personal communication 2001, Binford 1991). On the Ottawa National Forest, thirteen Connecticut warbler have been found during the annual Breeding Bird Census 1991-2001 in seven locations. Wetland habitat on the Ottawa and Hiawatha Forests are protected by riparian guidelines and by implementing Best Management Practices. Currently no habitat improvement projects have been completed specifically to benefit this species. An opening with an occurrence of Connecticut warbler had past shrub planting and opening maintenance work completed. It is not known if the warbler was present in the stand due to past habitat improvement project, but is worth noting. Project areas are surveyed prior to project implementation on the Ottawa and aspen stands are surveyed on the Huron-Manistee National Forest. If a Connecticut warbler is found within a project area on any of the three National Forests, there is no standard mitigation currently developed for this species

### **Other Public (Department of Natural Resources, Park Service)**

The Department of Natural Resources does not conduct endangered, threatened or sensitive species surveys or deliberately manage habitat for this species (R. Aho personal communication 2001). In the Lower Peninsula, jack pine is managed for the benefit for the Kirtland's warbler. Although regenerating jack pine has been found to be among the types of habitat used by the Connecticut warbler (Niemi et al 2001a and 2001c), jack pine in the LP is unlikely to be occupied by Connecticut warblers as Connecticut warblers have not been found to breed in the LP (Binford 1991).

### **Private**

Little information on activities on private land is available. Private land provides habitat for this species. Private land along the edge of the Sturgeon River Wilderness on the Ottawa National Forest has records of Connecticut warblers, the observations being made during the annual Breeding Bird Census.

## **Minnesota**

### **Forest Service**

The Chippewa and Superior National Forest both provide breeding habitat for the Connecticut warbler. There were about 21 Connecticut warblers recorded on the Superior NF and about 23 recorded on the Chippewa during breeding bird surveys conducted between 1991 and 1999 (Niemi et al. 2001e). Connecticut warblers have been found in boggy areas and open/aspen types

with park-like settings (W. Russ, personal communication 2001). Numbers of Connecticut warblers recorded in roadside counts since 1966 have been steady (Matthiae and Adams 2000) but there are also reports of downward trends (Matthiae and Adams 2000). In northwestern Minnesota the Connecticut warbler does not occur on Forest Service land (USDA 2000b), Minnesota Birdscape 1999). Surveys conducted on the Superior and Chippewa National Forests by the Natural Resources Research Institute shows the most recent trend for the Connecticut warbler is having a significant decline (Adams 2000). Surveys are conducted by the Natural Resource Research Institute under contract. If a Connecticut warbler is found in project areas, currently there is no mitigation in place.

#### **Other Public Land (DNR, Park Service)**

Threats to the Connecticut warbler on state land are from past clearcutting and the loss of old growth conifer (M. Hamady personal communication 2001). The Minnesota Department of Natural Resources has management subsections that are managed with a landscape approach. One of the subsections that is in the Northeast corner of the state, the Border Lakes subsection, plans to increase conifers and lowland conifers. There is currently a lack of quantitative data (M. Hamady, personal communication 2001).

#### **Private**

The historical range reduction in Minnesota may be due to loss of suitable nesting habitat (Matthiae and Adams 2000). It is likely the range reductions in Minnesota from historical range has been due to the loss of suitable nesting habitat in more southerly portions of the Connecticut warblers range. Maintenance of mature black spruce-tamarack bogs is essential (Niemi et al. 2001d).

#### **Wisconsin**

##### **Forest Service**

The Connecticut warbler is found on both the Nicolet and Chequamegon sides of the Forest in low numbers. The Connecticut warbler has been observed at 12 sites on the Nicolet (surveys years 1987-1999), and approximately 17 sites on the Chequamegon survey years 1991-1999 (Niemi et al. 2001e). This warbler appears to be more common in the northwestern corner of the state in the jack pine belt. Mature jack pine is one of its preferred habitats. Elsewhere in the state it is found in localized populations in lowland conifer, especially black spruce and tamarack bogs with a good shrub layer. Overall it appears to be dependent on conifer with a well-developed understory (Matthiae and Adams 2000). Observations on the Chequamegon and Nicolet Forests are highest in the north with smaller numbers in the south. On the Forest, lowland conifer habitat is not heavily impacted by management, however jack pine habitat has and is being converted to red pine (primarily on the Washburn District) (Matthiae and Adams 2000). The Chequamegon-Nicolet National Forest has drafted proposed standards and guidelines for a possible increase or “no net loss” of jack pine habitat (jack pine needing to be replanted in these areas) (Adams 2000). Draft standards and guidelines attempt to keep all jack pine stands from being converted to red pine (see the section Summary of Existing Management Activities). These draft standards and guidelines were written for future inclusion in the Chequamegon-Nicolet Forest Plan.

### **Other Public Land (DNR, Park Service)**

The Connecticut warbler is on its southern range in Wisconsin and is described as common locally (E. Epstein personal communication 2001), the majority found in jack pine and a few on bog/forest edges. The biggest threat to this species is the conversion of jack pine to red pine (E. Epstein personal communication 2001). On state land there has been extensive harvest of jack pine due to budworm, which are being planted back to solely red pine especially in the Brule/Washburn area (Adams 2000). Currently the Connecticut warbler is a species of Special Concern in Wisconsin; its status may change in the future when the list is updated due to recent habitat loss. Currently there is no management or conservation for the Connecticut warbler on state land (E. Epstein personal communication 2001).

### **Private**

Large areas of adjacent state and county lands have been salvage harvested and converted to red pine (Matthiae and Adams 2000).

In addition to the three states listed above, Connecticut warblers are recorded as being present during part of the year in the following states as recorded by the National Parks and Lakeshores: Maryland (Assateague Island National Seashore and Catoctin Mountain Park), Florida (Canaveral National Seashore), Massachusetts (Cape Cod National Seashore), North Carolina (Cape Hatteras National Seashore), Georgia (Chattahoochee River National Recreation Area, Cumberland Island National Seashore and Fort Pulaski National Monument), Virginia (Colonial National Historic Park), Ohio (Cuyahoga Valley National Recreation Area), Iowa (Effigy Mounds National Monument), New York (Gateway National Recreation Area), Missouri (George Washington Carver National Monument), Indiana (Indiana Dunes National Lakeshore), New Jersey (Morristown National Historic Park), Colorado (Rocky Mountain National Park), and Pennsylvania (Valley Forge National Historic Park).

### **Canada**

#### **Canadian Wildlife Service**

The Status Summary for the Connecticut warbler written by the Canadian Wildlife Service (CWS) (2001) states the action needed for monitoring is to determine whether banding frequency is high enough at any U.S. banding stations to merit analysis and/or future tracking of trends. It's possible persistent decline and high Canadian stewardship responsibility merit research (CWS 2001).

#### **Other Public (National Park Service)**

Many of the parks do bird surveys. Data has not been compiled (J. Kennedy personal communication 2002).

#### **Private**

This data has not yet been compiled (J. Kennedy personal communication 2002).

## **MANAGEMENT ACTIVITIES FOUND IN LITERATURE**

There are no existing management activities being implemented on the Michigan, Minnesota and Wisconsin National Forests. Draft standards and guidelines have been written for potential future inclusion in the Chequamegon-Nicolet National Forest Plan (USDA 1999). There is no decision

yet on the guidelines for the new Forest Plan and they are subject to possible change. The potential standards and guidelines include:

- lowland conifer and black ash swamps should be treated only in experimental regeneration efforts, salvage, and other unique situations, which would benefit or not decrease Connecticut Warbler breeding habitat.
- Maintain or increase current amount of jack pine on the Forest in suitable soil types and historic jack pine areas through both reforestation planting and as a within-stand conifer component. Look for areas to do jack pine restoration.
- Harvesting of jack pine should be accomplished in blocks of 100+ acres wherever possible.

Other practices identified by the Chequamegon-Nicolet National Forest as being beneficial to Connecticut warbler habitat is replanting jack pine instead of red pine in areas treated, harvest jack pine in larger blocks, and maintaining within-stand jack pine components ( Adams 2000). Dr. Robert Howe at the University of Wisconsin Green Bay recommends maintaining mossy ground for this species as he feels this species keys in on this landscape feature as well as canopy cover ( USDA 2000c).

Low intensity prescribed fire to maintain jack pine and the shrub layer (USDA 2000b) may improve habitat for this species (W. Russ, personal communication 2001). Protecting areas with ericaceous understory, (USDA 2000b) would benefit this warbler.

## **PAST AND CURRENT CONSERVATION ACTIVITIES**

There are no conservation activities directed specifically at Connecticut warblers on the National Forests in Michigan and Minnesota. Surveys are conducted on the majority of the Forests in Michigan, Minnesota and Wisconsin for the Connecticut warbler; see the Existing Surveys, Monitoring and Research section. Data collection is the first step in developing conservation plans. It is thought forest management may be able to create conditions suitable for nesting but additional information on this species is needed (USDA, 2000b).

The Chequamegon-Nicolet National Forest has Draft Forestwide Standards and Guidelines for Connecticut warbler. The recommended guidelines 1) place harvest restrictions on lowland conifer and black ash swamps 2) recommends restoring, maintaining and increasing the amount of jack pine on the Forest in 100+ acre blocks (USDA 1999).

## **RESEARCH AND MONITORING**

### **Summary of Surveys and Monitoring by National Forest**

#### **Huron-Manistee National Forest**

All districts on the Huron-Manistee have surveyed for the Connecticut warbler (C. Schumacher personal communication 2001) in aspen types. An additional opportunity to pick up singing male Connecticut warblers is during the annual Kirtland's warbler surveys on the Huron side of the Forest. These stands are in the regenerating stage. No Connecticut warblers have been reported during the Kirtland's warbler surveys (P. Huber personal communication 2001).

### **Ottawa National Forest**

Surveys are being conducted on the Ottawa National Forest in project areas using a specific protocol (see Protocol section).

### **Hiawatha National Forest**

Surveys especially for the Connecticut warbler are not being conducted, however point count surveys are being conducted in the proposed project areas on the Forest and annual breeding bird surveys occur on established routes on the Westside of the Forest.

### **Chippewa and Superior National Forests**

In addition to pre-work surveys and breeding bird surveys being conducted on the Chippewa and Superior National Forest, the Natural Resource Research Institute also conducts Connecticut warbler surveys on these forests (S. Adam, personal communication 2001).

The National Resources Research Institute has conducted surveys on the Chippewa and Superior National Forests since 1990. The fixed plots are designed to test indicator species and gather information for the Breeding Bird Atlas. No site-specific project area surveys are being completed in proposed timber harvest areas on these two forests since Connecticut warblers are using habitats other than those suitable for timber harvest (W. Russ personal communication 2001).

Surveys conducted prior to the implementation of projects are part of the data collected in association with preparing the Biological Evaluation. These pre-project surveys are also being conducted on the Chequamegon-Nicolet, as of the 2001 breeding season, using a specific protocol which is listed in the protocol section.

There are 88 Breeding Bird Survey (BBS) routes in the State of Minnesota, 90 BBS routes in the State of Michigan and 72 BBS routes in the State of Wisconsin listed online in the North American Breeding Bird Survey database. Some of the routes are within proclamation boundaries of Forests but are not surveyed by the Forest Service. Not all of the survey routes are within habitats or in the range of the Connecticut warbler. A summary of the trend data from these surveys is listed under each State in the State Summary section of this document.

### **Current Published Research**

Various literature searches were conducted by North Central Experiment Station Library and at Northern Michigan University. Articles were found in the following categories:

Breeding Status of Connecticut and Mourning Warblers in Wisconsin (Auk 59:115-116)

Breeding habitat of the Connecticut warbler in the Rainy River District (Ont. Birds 9:84-86)

Nests and habitats in Minnesota (Auk 46: 455-465)

Migration timing in Montgomery County Maryland

Sighting as a migrant species:

In Ecuador (Wilson Bull. 111(2): 281-282 1999)

In Panama (Condor 69 (3): 319-320)

In Venezuela (J. Field Ornithol. 64 (4): 549-556)

In Puerto Rico (Florida Field Naturalist, 17 (3): 69-72 1989)

Records of occurrences in the eastern and southern United States:

Montgomery County Maryland (Maryland Birdlife 46 (3): 79-82 1990)

Wake County North Carolina (Chat 53 (2): 26-28 1989)  
Pennsylvania (Cassinia, No. 61 pp. 88 1986)  
DeKalb County Georgia (Oriole, 44 (1): 14 1979)  
Texas (Texas Ornithological Society Bulletin 12 (1): 21-22)  
Documentation of a nest:  
In Michigan (Walkinshaw and Dryer 1961)  
In Texas (Texas Ornithological Society, Bulletin 12 (1): 21-22 1979)  
Bandings of Connecticut warblers in South Carolina (Chat 56 (2): 32-34 1992)  
Breeding bird communities in boreal forest habitats ( Kuhnke editor) Birds in the Boreal Forest, Can. J. Zool. (1996) 74: 1749-1770)  
Relationships of community structure and species distributions (Ecography (1996) 19: 194-208).

Harvest and wildfire effects in boreal mixed forests were conducted. Connecticut warblers had a higher density in post-wildfire than post-harvest stands (Hobson and Schieck 1999); the highest densities were in 28-year old post-fire stands. Hobson and Schieck 1999 concluded Connecticut warblers may favor simpler shrub layers typical of earlier successional stages, or as a ground-nester have specific ground cover requirements. It was noted that habitat affinities for this species differ considerably throughout its range in northern boreal forests (Welsh 1993, Kirk et al. 1996 and Welsh and Loughheed 1996). In Bird Communities of Early-Successional Burned and Logged Forest (Schulkte, L and G. Niemi 1998 Journal of Wildlife Management 62 (4): 1418-1429, *Oporornis agilis* were presented in greater numbers in the logged areas, however the species this paper studied was the Mourning warbler and not the Connecticut warbler.

The Connecticut warbler and four other forest songbirds (ruby-crowned kinglet, blackburnian warbler, black-throated blue warbler and bay-breasted warblers) were modeled to determine if macroclimate variables determine breeding distribution in Venier et al. (1999). The conclusions were the mechanisms controlling breeding distribution cannot be determined by the modeling method chose for the study however they concluded that macro-climate is an important factor directly and/or indirectly determining distribution of breeding in these species and spatial breeding probabilities are accurate enough to be useful in predicting probability of breeding in unsampled areas.

In 1989 the Canadian Wildlife Service and Ontario Ministry of Natural Resources sampled breeding birds at 700 stations in northwestern Ontario (Welsh 1993). Some species were found to occur unevenly among forest types showing predictable preferences and changes in abundance depending on the forest habitat type. The Connecticut warbler was found to breed on organic soils with pure black spruce and regional habitat associations in Ontario are different than those in Saskatchewan.

The Connecticut warbler is included in the Birds of North America Species Accounts, completed by Pitocchelli et al. 1997. Soon to be available is The Partners in Flight Bird Conservation Plan for Boreal Hardwood Transition (Physiographic Area 20) by American Bird Conservancy, which the Connecticut warbler is included.

### **On-going Research – United States**

Greg Corace, a PhD candidate at Michigan Technical University, is studying two ecotypes, pine barren and the Clay Lake Plain. He has come across Connecticut warblers in four Michigan counties confirmed by singing males, but nesting is expected. In Ontonagon County over 70

stops in aspen/balsam/spruce Connecticut warblers had a maximum frequency of .014, while in Baraga County, the same number of stops in jack pine yielded a maximum frequency of .029 (G. Corace, personal communication 2001).

The Natural Resource Research Institute (NRRI) has conducted point count surveys since 1990 on the Minnesota National Forests to test indicator species and gather information for the Breeding Bird Atlas (W. Russ personal communication 2001). Understory data has been collected in a 100-meter circle where Connecticut warblers have been confirmed (J. Lind personal communication 2001); currently this data has not been analyzed (J. Hanowski personal communication 2001). NRRI is also conducting surveys on the Chequamegon side of the Chequamegon-Nicolet National Forest.

### **On-going Research – Canada**

There are various studies for monitoring landbirds in Canada. Information is being collected on the Connecticut warbler and many other species. Data is being compiled and stored in the following databases:

- A Jurisdictional Importance Database for Canadian Breeding Birds
- Avian Life History Information Database
- Breeding Bird Survey in Ontario
- Database of Northern Ontario Forest Succession and Songbird Studies
- Forest Bird and Monitoring Program
- Hudson Bay Lowland Songbird Surveys
- Northern Ontario Songbird Research database
- Ontario Breeding Bird Atlas database

### **Survey Protocol**

The use of road routes for determining presence of Connecticut warbler is not effective (E. Epstein personal communication 2001). The Connecticut warbler is not easily observable and it is found in areas that are not easily accessible to humans (Hamady 2002). Even in suitable habitat, the Connecticut warbler has a naturally spotty distribution (Callog 1994 In McPeck and Adams 1994). Nests are well concealed and are constructed on the ground. Discovery of nests are made even harder by the habit of the adult birds landing 30 to 40 feet from the nest and walking to it (Callog 1994 In McPeck and Adams 1994). Although the male's song is loud and distinctive, the male sings ventriloquially while perched motionless often far from the nest site (Binford 1991). In addition, this species is not tied to a single habitat type, it is found in a wide variety of habitats. Due to these factors, this species is likely to be under-recorded on surveys and confirming a breeding occurrence is difficult.

In Robbin's (1974) study, some surveys were conducted between 5:30 am and 7:30 am while other locations were surveyed as late as 9:45 AM in late June. Connecticut warblers were still being heard at 9:45 AM. Stops were made ¼ mile apart on the theory the song rarely carries 300 yards. Robbins felt in this study, at this distance, twice he was suspicious of hearing the same individuals at consecutive stops. Bent (1953) reported a singing male could be heard more than 300 yards away. Connecticut warblers are hard to detect presence because once mated they become silent (USDA 2000a). One day of observation made by Thorton (1999) three Connecticut warblers acknowledged the sound of the tape-recorded call by keeping their distance while one flew in within 15 feet of where the tape was being played.

## **National Forest Surveys**

### **Ottawa National Forest**

On the Ottawa National Forest, no specific habitat is targeted for surveys until more data is collected on which habitats Connecticut warblers are using on the Forest. Surveys are conducted pre-work for timber sales. Plots are set up using either systematic or random points. At least two plots per square mile (640 acres) are surveyed within the project area. Surveys are run starting in late May and running through June. Each plot is started with one minute of passive listening followed by a taped broadcast of the Connecticut warbler with a 30 second call and 30 second listening in each of the three directions 120 degrees from each other. A final minute of passive listening makes the total five minutes of survey time at each plot. Survey conditions should not be those that would interfere with listening (heavy wind or rain). Information to be recorded includes detailed description of the overstory and understory species and percent cover, split by height class for shrubs (Thurber 2000).

### **Huron-Manistee National Forest**

On the Huron-Manistee meandering walk-through surveys are being conducted in project areas during the early morning hours until 10am (C. Schumacher, personal communication 2001). Surveys could also be conducted during evening activity peaks. Surveys should occur in June. Using a tape recorder with the Connecticut warbler song is useful in eliciting a response (Schumacher 1999).

### **Chequamegon-Nicolet National Forest**

On the Chequamegon-Nicolet National Forest the same survey protocol is used for Connecticut warblers as Cerulean warblers. Surveys are conducted between May 21<sup>st</sup> and June 30<sup>th</sup>, from ½ hour before sunrise to 9:30 am. Survey method is a “walk-through” survey with 3-minute stops. Playback calls are utilized (USDA 2001). Potential project areas are surveyed prior to implementation, usually as part of the Biological Evaluation and National Environmental Policy Act (NEPA) process.

### **Chippewa National Forest**

See protocol under NRRI.

### **Superior National Forest**

See protocol under NRRI.

### **Natural Resource Research Institute (NRRI)**

NRRI surveys have been conducted on the Superior, Chippewa, Chequamegon National Forests under contract for a period of ten years (1991-2001). Surveys consist of ten-minute point counts conducted during June and July by trainer observers from approximately 0.5 hour before to 4 hours after sunrise on days with little wind (< 15km/hr) and with little or no precipitation. All birds heard or seen from the center point were recorded with estimates of their distance from that point. From 1991 to 1994, all birds seen or heard within 100 meter of the point center were recorded. The distance of 100 meters was changed in 1995 to include all birds seen or heard within 100m of the point center so the results could be compared with other monitoring programs. The number of individuals for each species is summed for 3, 5 and 10-minute periods (Lind J. et al. 2001). Each observer sampled a similar number of stands of each forest cover type.

All observers were required to pass an identification test of 75 bird songs made by Cornell University's Laboratory of Ornithology passing with 85% correct responses.

### **Research Priorities - Academia**

The Connecticut warbler has not been the primary subject of any biological research and a study on any aspect of its general biology would be valuable (Pitocchelli, et al. 1997). Specific research priorities listed in the species account for the Connecticut Warbler in *The Birds of North America* include:

- ◆ feeding habits on breeding and wintering grounds and during migration
- ◆ fledging development and age of departure
- ◆ extent of parental feeding and protection after young leave the nest
- ◆ development, growth rate, locomotion and temperature regulation
- ◆ brooding; extent of parasitism by brown-headed cowbird
- ◆ reproductive success
- ◆ breeding and wintering ranges and threats to these areas
- ◆ geographic variation, sexual dimorphism, age variation; vocal differences between sexes and birds of different ages; vocal behavior on wintering grounds and during migration
- ◆ micro- and macrogeographic variation among songs of the male Connecticut warblers
- ◆ effects of degradation of habitat, especially on wintering grounds.

Pitocchelli et al (1997) thought the study of the Connecticut warblers' general biology on the breeding ground is probably the highest priority and also deserving of immediate attention is a comprehensive description of its distribution on the wintering grounds. Through this assessment, the other research needs that have become apparent are the use of habitat by this species across the northern Great Lake States; age of first breeding or intervals between breeding; territory size; patch size; kinds of mammalian or avian predators; disease and parasites. The status of the Connecticut warbler needs to be studied and clarified (Pitocchelli et al. 1997). Other research priorities identified are the shrub densities where nests are found; better breeding and wintering surveys; and how current habitat compares with historic habitat (USDA 2000).

### **Research Priorities Specific to Developing Management Guidelines on the National Forests**

For developing management guidelines on the National Forests, the primary research priority is to determine understory composition and structure through analysis of plant communities rather than forest types (Hamady 2002). Describing plant species composition and structure of ground cover at different stages along successional pathways in different plant communities may assist in determining why these forest types are used (Hamaday 2002). Needing to be described are ground cover plant species composition and structure at different stages along successional pathways in different plant communities (Hamady 2002). Spruce budworm outbreaks and the effects to the Connecticut warbler population as well as to the relationship of it and other warbler species (Tennessee warbler, Cape May warbler, Blackburnian warbler and black-throated green warbler) (Hamady 2002).

In some ecosystems the forest cover types used by Connecticut warblers are stages along a successional pathway. It is important to understand bird species composition along successional pathways of different boreal plant communities (Hamady 2002). Factors other than forest type that should be given consideration are but not limited to 1) the presence of a population source 2)

availability of habitat at larger scales 3) types of ground cover used by species 4) competitors 5) distribution of food base (Hamady 2002).

Future surveys should include collecting detailed descriptions of the understory vegetation once a nest site is confirmed.

Where colonies of Connecticut warbler occur, patterns of population dynamics should be studied (Hamady 2002). The relationship between the Connecticut warbler and Tennessee warbler, Cape May warbler, blackburnian warbler and black-throated green warbler need to be clarified. Warbler species increase during outbreaks of spruce bud worm (Hamady 2002).

Effects to this species from logging and forest type conversion effects on ground cover is needed for developing management guidelines for this ground-nesting species (Hamady 2002). The effects of logging in different habitats used by Connecticut warbler should be investigated (Hamady 2002).

It is important to assess whether habitat types used by the Connecticut warbler are or will be lost due to peat mining (Hamady 2002).

Migration counts may prove useful in monitoring, but detection of this secretive bird requires banding, and numbers captured at many Ontario stations are too low for analysis. Need to determine whether banding frequency is high enough at any U.S. banding stations to merit analysis and/or future tracking of trends (Canadian Wildlife Service, 2001).

## REFERENCES

Adams, R. 2001a. Changes in Occurrence of Connecticut warbler since the last survey period (1998-2001).

\_\_\_\_\_. 2001b. Personal Communication Connecticut warblers in Michigan.

Adams, S. M. 2001. Personal communication Connecticut warblers, Medford RD, Chequamegon-Nicolet National Forest.

Aho, Robert. 2001. Personal communication, Connecticut warbler threats and management on Michigan state land.

**Audubon, J. J. ( date etc). Birds of America**

Babler, S. 2001. Personal communication, threats to Connecticut warbler on the Ottawa National Forest.

Bent, A. C. 1953. Connecticut warbler pp. 513-524 In Life Histories of North American Wood Warblers. U.S. National Museum Bulletin 203, 734 pp.

Bernstein, C. 2000. This is Not an Easy Bird. Bird Watcher's Digest. May-June 2000 pp. 58-61.

Binford, L. C. 1991. Connecticut warbler, *Oporornis agilis*, pages 440-441 In: The Atlas of Breeding Birds, Brewer, McPeck and Adams, Michigan University Press.

Butcher, G. 2001. Personal Communication. Partners In Flight Status for the Connecticut warbler.

Cadman, M. D., P. F. Eagles and F. M. Helleiner. 1987. Pp. 3 and pp. 412-413 in Atlas of Breeding Birds of Ontario. University of Waterloo Press.

Caldwell L. D. and G. J. Wallace. 1966. Collections of Migrating Birds at Michigan Television Towers. The Jack-Pine Warbler. Vol. 44, No. 3. pp. 117-123.

Caldwell, L. D. and N. L. Cuthbert. 1963. Bird Mortality at Television Towers near Cadillac, Michigan. The Jack-Pine Warbler, Vol. 41, No. 2. pp. 80-89.

Callog, C. 1994 In: The Birds of Michigan, McPeck, G. A. and R. J. Adams Jr. editors. Indiana Press. 358 pp.

Canadian Wildlife Service Landbird Committee. 2001a. Status summary Connecticut warbler. 2 pp.

Canadian Wildlife Service Center. 2001b. Trends for 233 Canadian Species 1991-2000 pp. 2-4 in Breeding Bird Survey Newsletter (A Newsletter for Cooperators in the Breeding Bird Survey of Canada). National Wildlife Research Centre.

Canadian Wildlife Service. 2002. Annual indices of population change for the Connecticut Warbler in Canada based on Breeding Bird Survey Data ( 1967-2000). 3 pp.

Carter, M. F. W. C. Hunter, D. N. Pashley and K. V. Rosenberg. 2000. Setting Conservation Priorities for Landbirds in the United States: The Partners in Flight Approach. The Auk 117 (2): 541-548.

Cohrs, D. and D. Cohrs. 1979. Connecticut Warbler in Dekalb County, Oriole, 44 (1):14.

Corace, G. 2001. Personal communication. Occurrence of Connecticut warbler in pine barren and Clay Lake Plain ecotypes.

Doepker, R. V. 2001. Letter to Phyllis Green in response to request to review the Connecticut warbler draft Conservation Assessment.

Doran, K. 2001. Personal communication Connecticut warbler on western Hiawatha NF.

Dorsey, G. A. and E. Ford. 1978. Connecticut warbler at Jekyll Island, Oriole 43 (2-3) 1978: 37.

Droege S. and C. Wetherill. 1993. Migration Maps for Some North American Neotropical Migrants.

3 pp. Available at: <http://www.im.nbs.gov/birds/migration/migrant.html>.

- Epstein, Eric. 2001. Personal communication, Connecticut warbler threats and management on Wisconsin state land.
- Evans, R. 2001. Personal communication. Habitat where singing male Connecticut warbler was observed in Wisconsin.
- Godfrey, W. E. 1986. The Birds of Canada, Revised Edition. Natural Museum of Natural Sciences. 595 pp.
- Gromme, O. J. 1942. Breeding status of Connecticut and Mourning Warblers in Wisconsin. *Auk* 59:115-116.
- Hamady, Maya. 2001. Personal communication, Connecticut warbler threats and management on Minnesota state land.
- Hamady, Maya. 2002. Review of Draft Connecticut Warbler Conservation Assessment. 2 pp.
- Hanowski, J. 2001. Personal communication Connecticut warbler understory data collection.
- Harrison, H. H. 1975. Connecticut warbler (*Oporornis agilis*) Page 195 in *Bird's Nests*, Peterson Field Guides. Houghton Mifflin Company.
- Holden, M. 2001. Personal communication breeding bird survey Sleeping Bear Dunes National Lakeshore.
- Hicks, David L, et al. 1967. Additions to the Avifauna of Panama: The Palm Warbler and The Connecticut Warbler, *Condor*, 69 (3): 319-320.
- Hilton, B. Jr. 1992. First bandings of Connecticut warblers (*Oporornis agilis*) in South Carolina. *The Chat* 56 (2): 32-34.
- Hobson K. A. and Jim Schieck. 1999. Changes in Bird Communities in Boreal Mixedwood Forest: Harvest and Wildfire Effects Over 30 Years. *Ecological Applications*, 9(3), pp. 849-863.
- Huber, P. 2001. Personal communication, Kirtland warbler surveys record no Connecticut warblers.
- Huff, N. L. 1929. The Nest and Habits of the Connecticut Warbler in Minnesota. *Auk* 46: 455-465.
- Humberto Elizondo, L. C. 2000. UBI's: Unidades basicas de informacion, *Oporornis agilis*. 1 pg. Available at <http://www>
- Information Center for the Environment, undated. National Parks where Connecticut warblers can be found. 1 pp. Available at <http://www.ice.ucdavis.edu/nps/speciesinparks.asp?taxa=Bird&cmastid=234701895>.

- Jahn, O. , M. E. J. Viteri and K. L. Schuchmann. 1999. Connecticut warbler, a North American Migrant New to Ecuador. *Wilson Bull.*, 111 (2); 281-282.
- Janssen, R. B. 1987. *Birds in Minnesota*, University of Minnesota Press, Minneapolis. 352 pp.
- Kennedy, Judith. 2002. Personal communication Connecticut warbler 1 pp.
- Keys, J. E. Jr., W. H. McNab and C. A. Carpenter. 1995. Northern Great Lakes Section page 10-13 *in* Map Unit Tables Subsections, ecological Units of the Eastern United States First Approximation.
- Kirk, D. A., A. W. Diamond, K. A. Hobson and A. R. Smith. 1996. Breeding bird communities of the western and northern Canadian boreal forest: relationship to forest type. *Can. J. Zool.* 74: 1749-1770.
- Lind, J., N. Danz, M. T. Jones, J. M. Hanowski and G. Niemi. 2001. Annual Update Report: Breeding Bird Monitoring in Great Lakes National Forests: 1991-2001 Report to: Chequamegon/Nicolet, Chippewa and Superior National Forests, Natural Resource Research Institute, Duluth, Minnesota, USA.
- Lind, J. 2001. Personal communication, Connecticut warbler.
- Matthiae T. M. 2001. Review of the draft Connecticut warbler Conservation Assessment.
- Matthiae T. M. and S. Adams. 2000. Regional Forester's Sensitive Species Evaluation for *Oporornis agilis* Chequamegon-Nicolet National Forest. 3 pp.
- Mehlman, D. W. 1990. Migration Timing of Four Uncommon Species in Montgomery County. *Maryland Birdlife* Vol. 46 No. 3: 79-82.
- Minnesota Birdscape. 1999. Birds Seen by MN Birdscape 1995-1998, viewed results 7/12/01.
- Minnesota Ornithologist's Union. <insert date>. On-line resources-distribution map of Connecticut warbler in Minnesota. 1 pp. Available at <http://www.cbs.umn.edu/~mou/birdref.html>.
- Morgan, J. G. and T. L. Eubanks, Jr. 1979. First documentation of Connecticut Warbler in Texas. *Texas Ornithological Society Bulletin* 12 (1): 21-22.
- National Audubon Society. 1999a. Audubon Watchlist-Wisconsin- 2<sup>nd</sup> Edition. 4 pp.
- \_\_\_\_\_. 1999b. Audubon Watchlist-Michigan- 2<sup>nd</sup> Edition. 4 pp.
- \_\_\_\_\_. 1999c. Audubon Watchlist-Michigan- 2<sup>nd</sup> Edition. 5 pp.

Natural Resource Research Institute. 2001. Extinction Risk and Shared Management Responsibility, Great Lakes Watershed, Twenty Representative Breeding Bird Species. 3 pp. Available at: <http://www.nrri.umn.edu/cwe/greatlakes/glpf/risk.htm>.

Nature Serve 2001. NatureServe: An online encyclopedia of life [web application]. 2000. Version 1.2. Arlington, Virginia USA: Association for Biodiversity Information. Available: <http://www.natureserve.org/>. (Accessed June 4, 2001).

Nearctica.com, Inc. 2001. Connecticut warbler (*Oporornis agilis*) from the Warblers of Eastern North America 3 pp. Available at <http://www.nearctica.com/birds/warbler/Oagilis.htm>.

Niemi G. et. al. 2002a. Mean Abundance, excluding flyovers and individuals outside 100m, Connecticut warbler, for the Chequamegon National Forest. 2 pp. Available at <http://www.nrri.umn.edu/mnbirds/Data/getrecords.asp>.

\_\_\_\_\_ 2002b. Mean Abundance, excluding flyovers and individuals outside 100m, Connecticut warbler, for the Chippewa National Forest. 2 pp. Available at <http://www.nrri.umn.edu/mnbirds/Data/getrecords.asp>.

\_\_\_\_\_ 2002c. Mean Abundance, excluding flyovers and individuals outside 100m, Connecticut warbler, for the Superior National Forest. 2 pp. Available at <http://www.nrri.umn.edu/mnbirds/Data/getrecords.asp>.

\_\_\_\_\_ 2002d. Connecticut warbler Species Account 2 pp. Available at <http://www.nrri.umn.edu/mnbirds/newaccounts/CONWa2.htm>.

\_\_\_\_\_ 2002e. Connecticut Warbler, Map of Breeding Bird Occurrences on the Superior, Chippewa, Chequamegon National Forests and St. Croix and South East areas 1991-1999. Available at <http://www.nrri.umn.edu/mnbirds/newaccounts/conwm2.htm>.

NWRC, Canadian Wildlife Service, 2000. Canadian Bird Trends Database: Connecticut Warbler . 3 pp. Available at <http://www.cws-scf.ec.gc.ca/trends/BirdInfo.cfm?id=6780>

Olaf, J. et al. 1999. Connecticut Warbler , A North American Migrant New to Ecuador. Wilson Bull., 111 (2), pp. 281-282.

Panjabi, A. 2001. The Partner's In Flight Handbook on Species Assessment and Prioritization Version 1.1. Rocky Mountain Bird Observatory. 25 pp.

Peck, G. K. and R. D. James. 1983. Breeding Birds of Ontario Nidology and Distribution pp. 283-284 Volume 1: Non-Passerines A Life Sciences Misc. Publication of the Royal Ontario Museum, Toronto, Canada.

Partners In Flight 2001. Year 2000 Scores for Boreal Hardwood Transition, Bird Conservation Region #12 Including Portions of MB, ON, PQ, MI, WI & MN, From Partners in Flight Species Prioritization Database, Rocky Mountain Bird Observatory, distributed by Greg Butcher, Midwest Coordinator for Partners in Flight. 6 pp.

Pitocchelli, J., J. Bouchie and D. Jones, 1997. Connecticut Warbler (*Oporornis agilis*). In *The Birds of North America*, No. 320 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D.C.

Potter, E. F. 1989. Connecticut Warbler: First Sightings from Wake County, N.C. and a Review of Migration Records Statewide. *The Chat* 53 (2): 36-38.

Robbins, S. D. 1974. New Light on the Connecticut Warbler. *Passenger Pigeon* 36 (3): 110-115.

Racchini, C. 2001a. Personal Communication, Connecticut warbler on the Huron-Manistee National Forest.

\_\_\_\_\_ 2001b. Risk Evaluation Supporting Narratives for Connecticut warbler 1 pp.

Robbins, S. D. 1974, New Light on the Connecticut warbler. *Passenger Pigeon* 36 (3): 110-115.

Russ, Wayne. 2001. Personal communication. Connecticut warbler on the Superior and Chippewa National Forests.

Sauer, R. J., J.E. Hines, G. Gough, I. Thomas, and B.G. Peterjohn. 1997. The North American Breeding Bird Survey Introduction *in* *The North American Breeding Bird Survey Results and Analysis*. Version 96.4. Patuxent Wildlife Research Center, Laurel. Maryland, USA.

Sauer, R. J., J. E. Hines, and J. Fallon 2002. *The North American Breeding Bird Survey, Results and Analysis 1966-2001*. Version 2002.1, USGS Patuxent Wildlife Research Center, Laurel, Maryland. Updated May 29, 2002, ran query 8/21/02.

\_\_\_\_\_ 2001. *The North American Breeding Bird Survey, Results and Analysis 1966-2000*. Version 2001.2, USGS Patuxent Wildlife Research Center, Laurel, Maryland. Updated June 24, 2001, ran query 8/24/01. (Connecticut warbler trend map)

Schumacher, C. M. 1999. Connecticut warbler protocol pp 2 *in* USDA 1999. Regional Forester Sensitive Species Survey Protocols, Huron-Manistee National Forest.

\_\_\_\_\_. 2001. Personal Communication. Connecticut warbler on the Huron-Manistee National Forest.

Shire G. G., K. Brown and G. Winegrad. 2000. Communication Towers: A Deadly Hazard to Birds. Report Documents a Report Compiled by American Bird Conservancy. 23 pp. Available at [www.abcbirds.org](http://www.abcbirds.org).

Sjogren, S. 2001. Personal Communication, Connecticut warbler on the eastern Hiawatha National Forest.

Tansy, M. 2001. Personal communication. Connecticut warbler at Seney National Wildlife Refuge.

- Thomas, Betsy Trent. 1993. North American Migrant Passerines at Two Non-Forested Sites in Venezuela. *J. Field Ornithol.*, 64 (4): 549-556.
- Thorton, B. 1999. *Chasing Warblers*. University of Texas Press, Austin. 148 pp.
- Thurber J. 2000 with update 5/25/01. Connecticut warbler survey protocol, Ottawa National Forest. 2 pp.
- USDA. 1996. Ottawa National Forest Monitor and Evaluation Report the First Decade and Beyond. 198 pp.  
plus appendices.
- \_\_\_\_\_. 1997. Dead bird Database, 1992-1996 Harrietta Tower 4 pp.
- \_\_\_\_\_ 1999. Draft Forestwide Standards and Guidelines for Connecticut Warbler Chequamegon-Nicolet National Forest 1 pp.
- \_\_\_\_\_2000a. Meeting notes from Interagency Population Viability Analysis Meeting January 2000,  
2 pp.
- \_\_\_\_\_ 2000b. Population Viability Assessment, U.S. Forest Service-National Forests in Minnesota and Wisconsin, January 19-21, 2000, notes from the Population Viability Assessment Panel Group 3 Non-forest Birds. 5 pp.
- \_\_\_\_\_2001. Sensitive Species Survey Needs, Meeting Notes May 1, 2001, Chequamegon-Nicolet National Forests. 5 pp.
- USGS. Undated. *Birds of the St. Croix River Valley: Minnesota and Wisconsin*. Northern Prairie Wildlife Research Center. 2 pp.
- Venier et al. 1999. Models of large-scale breeding bird distribution as a function of macroclimate in Ontario Canada, *Journal of Biogeography* 26: 315-328.
- Walkinshaw, L. H. and W. A. Dryer. 1961. The Connecticut Warbler In Michigan. *Auk*, Vol. 78: 379-388.
- Welsh, D. 1993 *Birds and Boreal Forests in Ontario* In: H. Kuhnke editor. *Birds in the boreal forest*. Forestry Canada Northwest Region. Northern Forestry Centre, Edmonton Alberta Canada.
- Welsh D. A. and S. C. Lougheed. 1996. Relationships of bird community structure and species distributions to two environmental gradients in the northern boreal forest. *Ecography* 19: 194-208.
- Welsh, D. A. and L. A. Venier. 1996. Binoculars and satellites: developing a conservation framework for boreal forest wildlife at varying scales. *Forest Ecology and Management* 85: 53-65.

Wisconsin Natural Heritage Program. Rare Species and Natural Communities, NHI Working List by County. <http://www.dnr.state.wi.us/org/land/er/workinglist/countylist/>.

Wormington, A., D. Martin, F. Urie, J. Haselmayer and P. Roberts. Point Pelee Bird Reports of Rarities and Uncommon Birds May 17-May 21, 2001. Available at <http://www.geocities.com/Heartland/Cottage/8090/RBR.html>.

## **LIST OF CONTACTS**

Mary Shedd, Wildlife Biologist, Kawishiwi Ranger District, Superior National Forest.

Susanne Adams, Wildlife Biologist, Medford Ranger District, Chequamegon-Nicolet National Forest.

Kevin Doran, Wildlife Biologist, Munising Ranger District, Hiawatha National Forest.

Steve Sjogren, Wildlife Biologist, St. Ignace Ranger District, Hiawatha National Forest. Carl

Racchini, Acting Forest Wildlife Biologist, Huron-Manistee National Forest.

Chris Schumacher, Wildlife Biologist, Manistee Ranger Station, Huron-Manistee National Forest.

Laura Hutchinson, Library Services Leader, North Central Research Station in St. Paul Minnesota.

Phil Huber, Wildlife Biologist, Mio Ranger District, Huron-Manistee National Forest.

Ray Adams, Ornithologist, Kalamazoo Nature Center and co-author of the Atlas of Breeding Birds in Michigan.

Eric Epstein, Endangered Resources, Wisconsin Department of Natural Resources.

Linda Parker, Forest Ecologist, Chequamegon-Nicolet National Forest.

Greg Corace, Michigan Technical College PhD student studying Clay Lake Plain and Pine Barrens.

Maya Hamady, Nongame Specialist, Region 2, Minnesota Department of Natural Resources.

Wayne Russ, Wildlife Biologist, Tofte Ranger District, Superior National Forest.

Mike Tansey, Wildlife Biologist, Seney National Wildlife Refuge.

Jim Lind, Field Technician, Natural Resource Research Institute, Duluth Minnesota.

Robert Aho, Wildlife Habitat Biologist, Michigan Department of Natural Resources, Baraga office.

JoAnn Hanowski, Natural Resources Research Institute, Duluth Minnesota.

Steve Babler, Wildlife Biologist, Kenton and Iron River Ranger Districts, Ottawa National Forest.

Robert Evans, Wildlife Biologist, Watersmeet Ranger District, Ottawa National Forest.

Judith Kennedy, Landbird Conservation Biologist, Canadian Wildlife Service, Hul, Quebec.

Max Holden, USDI- National Park Service, Sleeping Bear Dunes National Lakeshore, Michigan.

Andy Pils, Biological Science Technician, Bessmer Ranger District, Ottawa National Forest,

Michigan. Greg Butcher, Midwest Coordinator, Partners In Flight.

## **Information Requests**

Ray Adams for occurrences of Connecticut warbler since the Atlas of Breeding Birds in Michigan was published.

## **Review Requests**

Ray Adams, Kalamazoo Nature Center .

Susanne Adams, Medford-Park Falls Ranger District, Chequamegon-Nicolet NF.

Eric Epstein, Bureau of Endangered Resources, Wisconsin Department of Natural Resources.

Tom Doolittle, Bad River Indian Reservation.

Janet Green, Minnesota Ornithologist Union.

Maya Hamady, Nongame Specialist, Minnesota Department of Natural Resources.

Bob Howe, University of Wisconsin, Green Bay.

Ron McCormick, USDA, North Central Research .

Gerry Neimi, Natural Resource Research Institute.

Mary Shedd, Kawishiwi Ranger District, Superior National Forest .

Bob Doepker, Michigan Department of Natural Resources.

Carl Racchini, Huron-Manistee National Forests.

## **Others Responding to the review:**

Tom Matthiae, District Biologist, Great Divide Ranger District, Chequamegon-Nicolet National Forest.

Brian Bogaczyk, District Biologist, Bessemer Ranger District, Ottawa National Forest.

Nancy Berlin, R9 Threatened, Endangered and Sensitive Species Biologist.

Linda Parker, Forest Ecologist, Chequamegon-Nicolet National Forest.

Paul Makela, Forest Wildlife Biologist, Hiawatha National Forest.