Status of the Cape May Warbler (Dendroica tigrina) in Alberta

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PREFACE

Every five years, the Fisheries and Wildlife Management Division of Alberta Natural Resources Service reviews the status of wildlife species in Alberta. These overviews, which have been conducted in 1991 and 1996, assign individual species to 'colour' lists that reflect the perceived level of risk to populations that occur in the province. Such designations are determined from extensive consultations with professional and amateur biologists, and from a variety of readily available sources of population data. A primary objective of these reviews is to identify species that may be considered for more detailed status determinations.

The Alberta Wildlife Status Report Series is an extension of the 1996 *Status of Alberta Wildlife* review process, and provides comprehensive current summaries of the biological status of selected wildlife species in Alberta. Priority is given to species that are potentially at risk in the province (Red or Blue listed), that are of uncertain status (Status Undetermined), or which are considered to be at risk at a national level by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

Reports in this series are published and distributed by the Alberta Conservation Association and the Fisheries and Wildlife Management Division of Alberta Environmental Protection, and are intended to provide detailed and up-to-date information which will be useful to resource professionals for managing populations of species and their habitats in the province. The reports are also designed to provide current information which will assist the Alberta Endangered Species Conservation Committee to identify species that may be formally designated as endangered or threatened under the Alberta Wildlife Act. To achieve these goals, the reports have been authored and/or reviewed by individuals with unique local expertise in the biology and management of each species.

EXECUTIVE SUMMARY

The Cape May Warbler (Dendroica tigrina) is currently included on the 'Blue List' of species that may be at risk in Alberta, due to concerns over habitat loss and declines in populations in some areas. This review summarizes available information on the Cape May Warbler, as a step towards updating the status of this species in the province.

Cape May Warblers are neotropical migrants that breed in the boreal and foothills regions of Alberta. They require mature to old forest stands with a predominantly coniferous (usually spruce) canopy. They may also require very large spruce spires standing above the main canopy. Cape May Warbler populations are known to respond dramatically to spruce budworm outbreaks.

The principal concern over the status of the Cape May Warbler relates to loss and degradation of its breeding habitat. Activities of the forestry and energy sectors are causing habitat loss and fragmentation. Exploration and development for oil and gas further contribute to habitat loss and dissects large areas of forest with extensive linear disturbances. Projections are for rates of resource extraction activities to increase. Canadian populations of this species may have declined over the past 30 years. Habitat loss in wintering areas in Mexico, central America, and the Carribean, and along migration routes, will likely exacerbate this situation.

The Cape May Warbler is a relatively uncommon songbird across much of Alberta's 'Green Zone', and little detailed information exists as to its overall distribution, abundance, or habitat requirements. Available evidence suggests resource extraction activities threaten this species' habitat. However, robust, longer-term data sets and a better understanding of the habitat requirements of this species will be needed to more adequately assess the status of the species in Alberta and to monitor effects of resource extraction.

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INTRODUCTION

The Cape May Warbler (Dendroica tigrina) is a neotropical migrant songbird in the family Parulidae (the wood warblers). This species breeds across the boreal forests of Canada, and in the northeastern United States, and winters in the West Indies and the east coast of Central America. The Cape May Warbler is uncommon in most areas of Alberta, and consequently, little is known about its ecology. Recently, concerns over the degradation and loss of its breeding habitat have led to the species' inclusion on the 'Blue List*' of species that may be at risk in Alberta (Alberta Wildlife Management Division 1996).

This report summarizes available information on the Cape May Warbler, with an emphasis on breeding populations in Alberta in an effort to update its status in the province.

HABITAT

The available information on habitat preferences of the Cape May Warbler emphasizes an association with coniferous tree species in mature or old forests (Salt and Salt 1976, Erskine 1977, Godfrey 1986, Baltz and Latta 1998). However, unpublished data from Alberta suggest the species may also use deciduous-dominated forests (see below). In Alberta it is known from the Boreal Forest and Foothills Natural Regions (Subarctic, Peace River Lowlands, Central, Wetland, and Dry Mixedwood and Lower Foothills Subregions; (Achuff 1994).

There are very few published studies which have provided detailed descriptions of habitats occupied by the Cape May Warbler. The few available reports from western Canada consistently identify a strong association with coniferous tree species, usually spruce (Picea spp.) or fir (Abies spp.), and usually in mature or old forest stands (Erskine 1977, Morse 1978, Titterington et al. 1979, Enns and Siddle 1996, Bennett et al. 1999). There is general consensus that Cape May Warblers also require scattered very tall conifers extending well above the main canopy, possibly as singing posts (Salt and Salt 1976, Francis and Lumbis 1979, Welsh 1987, Cooper et al. 1997, Bennett et al. 1999), although this has not been scientifically quantified. Habitat of the Cape May Warbler appears to be fairly consistent across its range, generally comprised of mature to old growth spruce-dominated stands with a relatively open understorey (Erskine 1977, Titterington et al. 1979, Erskine 1992, Parker et al. 1994). During the breeding season, Cape May Warblers are almost never reported from recently disturbed sites, and this species is usually classified as a forest specialist. Cape May Warblers may only find suitable habitat within roughly 873 000 ha of Alberta's forests, or approximately 4.7% of the total forest area[1]. Thus, suitable habitat is much more limited than is suggested by simple descriptions of this species' range in the province.

In Alberta, the highest numbers of Cape May Warblers have been associated with mature to old stands dominated by white spruce (Picea glauca), sometimes mixed with trembling aspen (Populus tremuloides), balsam poplar (Populus balsamifera) or white birch (Betula papyrifera). Aspen-dominated stands are also used, but apparently to a much lesser extent. A large study near Calling Lake has detected too few Cape May Warblers to statistically model habitat relationships, but 18 of 28 records of the species were from stands of

* See Appendix 1 for definitions of selected status designations

[1] These figures based on Phase 3 Forest Inventory data for all productive forested land, all age classes, north of township 47. Cape May Warbler habitat defined as origin 1900, > 80% conifer stands dominated by white spruce or balsam fir. Analysis performed by N. Peterson.

>60% white spruce, and most (15) sites were >80% spruce (F. Schmiegelow, pers. comm.). In northeastern British Columbia, Cape May Warbler habitat has been summarized as tall, dense stands of white spruce with an open, mossy understorey (Enns and Siddle 1996), a pattern that appears to hold in adjacent southwestern Northwest Territories (C. Machtans, pers. comm.). An association with ecosite phases d2 (aspen – white spruce – low bush cranberry) and d3 (white spruce – low bush cranberry) is common in the boreal mixedwood (P. Balagus, pers. comm., see Beckingham and Archibald 1996). However, in Alberta Cape May Warblers have occasionally been found using mixed coniferous-deciduous stands, deciduous-dominated stands, black spruce (Picea mariana) stands, and treed fens (P. Balagus, S. Hannon, B. Harrison, F. Schmiegelow, M. Wheatley, pers. comm.). Occupied stands have ranged in age from 60 to >130 years, with many additional reports from unquantified "old growth" stands. The low frequency at which this species is encountered in most areas of its range has prevented researchers from performing detailed habitat analyses.

CONSERVATION BIOLOGY

The Cape May Warbler is a medium-sized wood warbler that is highly secretive on its breeding grounds. Males and females of this species are comparable to many other members of the genus Dendroica: roughly 13 cm long and weighing about 10 g (Baltz and Latta 1998); males are more brightly coloured. Very few data exist on longevity, but the oldest bird on record was a minimum of 4 yr, 3 mo based on a band return (Klimkiewicz et al. 1983). No subspecies or hybrids have been described, but hybrids with Bay-breasted Warbler (Dendroica castanea) or Blackpoll Warbler (Dendroica striata) are thought possible (Baltz and Latta 1998).

The species is almost entirely insectivorous during the breeding season, but may add fruit and nectar to its diet on its winter range. Diet items in the summer are primarily lepidopteran (butterfly and moth) larvae and a variety of other small insects including beetles, flies, and ants (Kendeigh 1947, Bent 1953). The Cape May Warbler is known to be a major predator of spruce budworm (Choristoneura fumiferana) and forest tent caterpillar (Malacosoma disstria) during outbreaks of these insects (Morse 1978, Baltz and Latta 1998). On its winter range, the diet of the Cape May Warbler may include up to 50% fruit, seeds, and nectar (Baltz and Latta 1998). Most foraging is diurnal, primarily by gleaning insects off leaves or needles near branch tips of trees, and is consistently focussed in the uppermost branches (MacArthur 1958).

The first Cape May Warblers arrive in Alberta from mid to late May (Pinel et al. 1993). Virtually no information exists on territory size or breeding phenology, but these characteristics are likely similar to those of other wood warblers. Pair formation presumably occurs shortly after arrival on the breeding grounds, and males aggressively attack and chase each other in territorial defense (Morse 1978). Territory size is likely roughly 0.25 ha to 1.0 ha. Nests are most often built in coniferous trees, concealed near the trunk high in the tree; average nest heights range from 10 m to 18 m (Bent 1953, MacArthur 1958, Peck and James 1987). Only a single nest has been documented in Alberta: an extralimital record in the town of Brooks (Salt 1973). Five or six eggs are laid, and are incubated by the female alone for 12 to 13 days (Bent 1953, Harrison 1975). Larger clutches may be laid during periods of high food supply (MacArthur 1958). Fledglings probably depart the nest after 10 or 11 days.

Fall migration in Alberta commences in late

August and runs through late September or later; early and late dates are reported as 25 August and 14 October (Pinel et al. 1993). Cape May Warblers, particularly young birds, are regular but sparse in central and southern Alberta during migration (Salt 1973), but little is known about the patterns or routes followed. Annual survivorship is not known.

DISTRIBUTION

The high pitched, weak song of the Cape May Warbler is difficult for some observers to hear, and is easily confused with several other songbird species. This, combined with its habit of remaining in upper levels of the forest canopy, make this species difficult to census. Records from some areas of its range, including Alberta, are therefore sparse.

1. Alberta. - The Cape May Warbler breeds in the northern forested portion of Alberta (the 'Green' zone), outside of the Rocky Mountains (Figure 1). Most published range maps show a distribution covering the entire province north of a line from roughly Grande Prairie to Cold Lake (Salt 1973, Salt and Salt 1976, Semenchuk 1992, McGillivray and Semenchuk 1998). The most recent extensive survey effort (Semenchuk 1992) detected the species too rarely to provide any further details.

The Cape May Warbler is known from the northern-most portions of Alberta including Bistcho Lake and several localities in Wood Buffalo National Park (Preble 1908, Soper 1942, Semenchuk 1992, M. Bradley, pers. comm.). The species is also known from areas across the Boreal Forest Natural Region, with documented records around Fort Vermilion, Manning, Sturgeon Lake, Peerless Lake, and Fort McMurray. The southeastern limit of the species' breeding range is probably roughly coincident with the limits of the Boreal Forest Natural Region, with records at Calling Lake, Skeleton Lake, Lac La Biche and Cold Lake. At the southwestern limit of the breeding range, June records of singing males exist from Hinton, and south to Caroline and Sundre. This suggests that the species may breed in the Foothills Natural Region, but additional breeding evidence should be sought. Cape May Warblers are considered very rare visitors to Banff and Jasper National Parks (Holroyd and Van Tighem 1983). There are no records from the Canadian Shield Natural Region in northeastern Alberta (e.g., Wallis and Wershler 1984, Erickson and McGillivray 1990).

2. Other areas. - Cape May Warblers are close to their northern and western range limits in Alberta, but the species is well documented in both the Northwest Territories (Sirois and McRae 1996) and British Columbia (Cooper et al. 1997). They are found regularly but in low numbers in the Slave River valley (M. Bradley, pers. comm.) and around Fort Liard (C. Machtans, pers. comm.), both in the Northwest Territories. The species is also known from Dawson Creek and Fort Nelson areas of northeastern British Columbia (Cooper et al. 1997). From this northwestern limit of their range, Cape May Warblers breed across Canada east to the Maritime provinces, and south into the U.S.A. to northern Wisconsin, Michigan, and northern New York and Maine (Godfrey 1986, Baltz and Latta 1998; Figure 2). Local distributions can be strongly influenced by outbreaks of spruce budworm (MacArthur 1958, Morse 1978).

The Cape May Warbler winters primarily in the West Indies (especially the Bahamas and the Greater Antilles) and southeastern Mexico, Belize, and Honduras, with casual records from many areas of the United States (American Ornithologists' Union 1998). Higher numbers of vagrant individuals have been recorded in years with high budworm populations on breeding grounds (Patten and Burger 1998).

Figure 1. Cape May Warbler observations in Alberta from 1894 - 1999. Breeding records are observations of confirmed breeding activity, or records of singing males from late May or June. Non-breeding records are observations of migrating birds, or other records for which no breeding information was available. Details of these records can be found within the Biodiversity/Species Observation Database maintained by Alberta Environment.

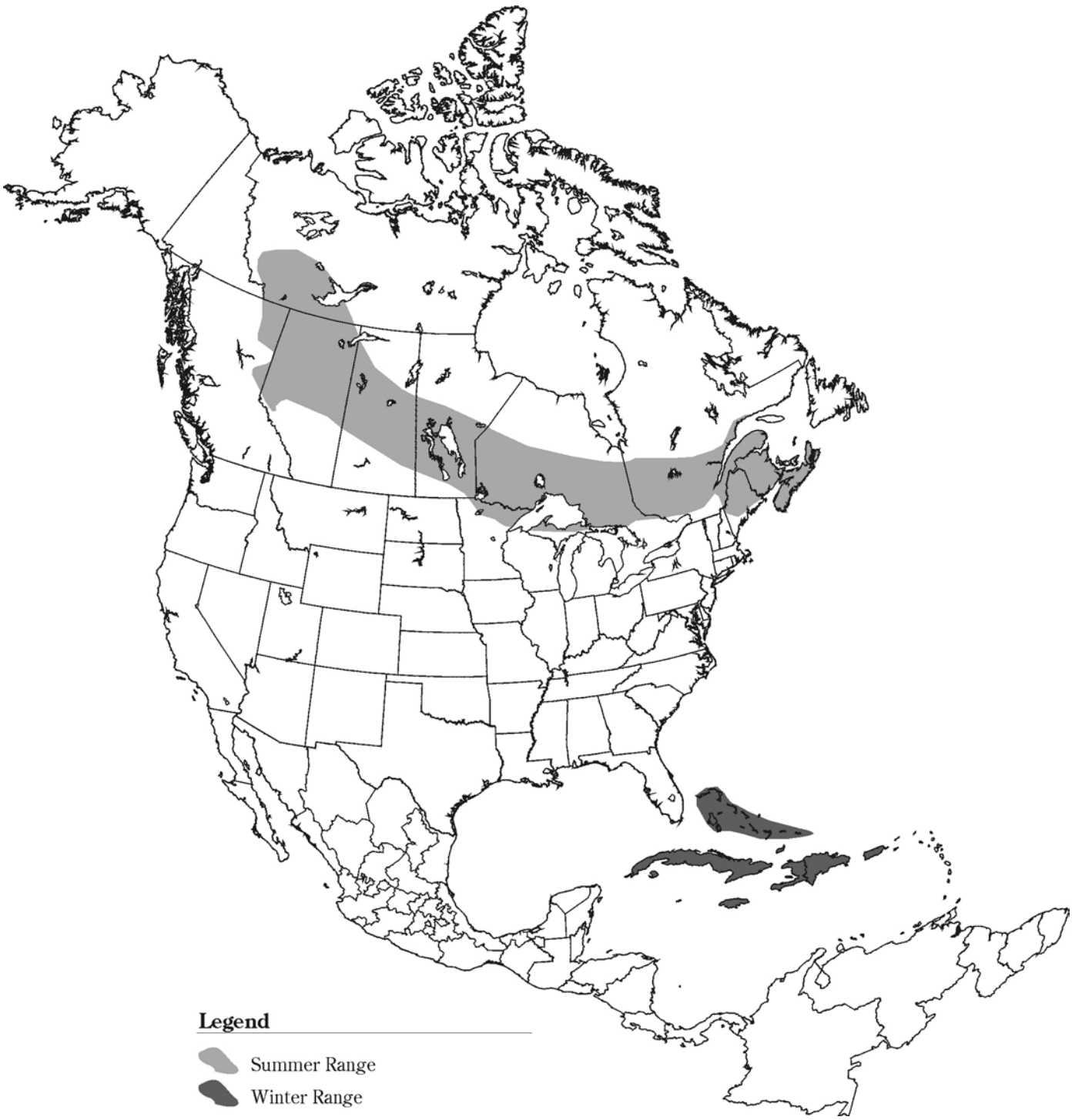

Figure 2. Summer and winter range of the Cape May Warbler.

POPULATION SIZE AND TRENDS

Difficulties in censusing Cape May Warblers affect estimations of population size and trends (see 'Distribution' section, above). Further, any estimation of population size or trends in the future will be complicated by the species' strong numerical response to outbreaks of forest insects, such as the spruce budworm. In Ontario, Cape May Warbler density doubled over a period of only four years in response to a budworm outbreak (Welsh 1985).

1. Alberta. - There are no estimates of the population size of Cape May Warblers in Alberta. The species is usually described as uncommon and locally distributed. In most areas it is only rarely encountered, with most observers reporting very few records. The Atlas of Breeding Birds of Alberta project (Semenchuk 1992) detected Cape May Warblers in only 2% of squares (100 km^2 each) in the Boreal Forest Natural Region. There are no areas where the species is known to be abundant.

It is difficult to assess the overall abundance of Cape May Warblers, or population trends, in Alberta. Systematic surveys have only been conducted in the southeastern portion of the boreal forest in Alberta, and at two other sites near Peace River and Fort Vermilion. Little or no survey work has been conducted in other areas, particularly areas north and west of the Peace River.

Although Cape May Warblers are usually reported to be quite rare, they occasionally achieve a higher abundance rank relative to other wood warblers in certain old white spruce habitats. They were the eighth most abundant of 19 warbler species detected in coniferous habitats in a long term study near Calling Lake (F. Schmiegelow, pers.comm.), and were the third most abundant of nine warblers in coniferous sites near Peace River (B. Harrison, pers. comm.). The highest abundances reported in Alberta are from the Fort Vermilion area, the only location in the province where singing males have been reported close enough together to be audible simultaneously (L. Takats, pers. comm.). More often, however, the species is detected only in very low numbers (e.g., total of seven detections at 403 census stations north of Lac La Biche; S. Hannon, pers. comm.). East of Lac La Biche, Cape May Warblers were the 16th most abundant of 18 warbler species (Wallis et al. 1994). However, it is difficult to determine if the low reported numbers are an artifact of the habitats being sampled. Many of the large studies in Alberta have or are focussed on deciduous-dominated forests, and may therefore be under representing the abundance of Cape May Warblers.

There are no data that allow estimation of a population trend for Cape May Warblers in Alberta. This species has only been reported from five Breeding Bird Survey routes in the province, and no research studies have sufficient temporal data for trend estimation over smaller areas.

2. Other areas. - There are no estimates of the population size of Cape May Warblers from other areas of its breeding range. Reported population densities from eastern North America range from 0.01 pairs/ha in areas with no spruce budworm (Erskine 1977), to 0.3 to 1.48 pairs/ha in local areas with severe budworm infestations (Erskine 1977, Morse 1978, Welsh 1987). In northeastern British Columbia, Cape May Warblers were the fourth to seventh most abundant songbird in some old coniferous forests, at densities of roughly 0.06 to 0.51 pairs/ha with low budworm populations (Bennett et al. 1999). In Saskatchewan and Manitoba, densities of 0.09 to 0.17 pairs/ha and 0.01 to 0.09 pairs/ha, respectively, have been

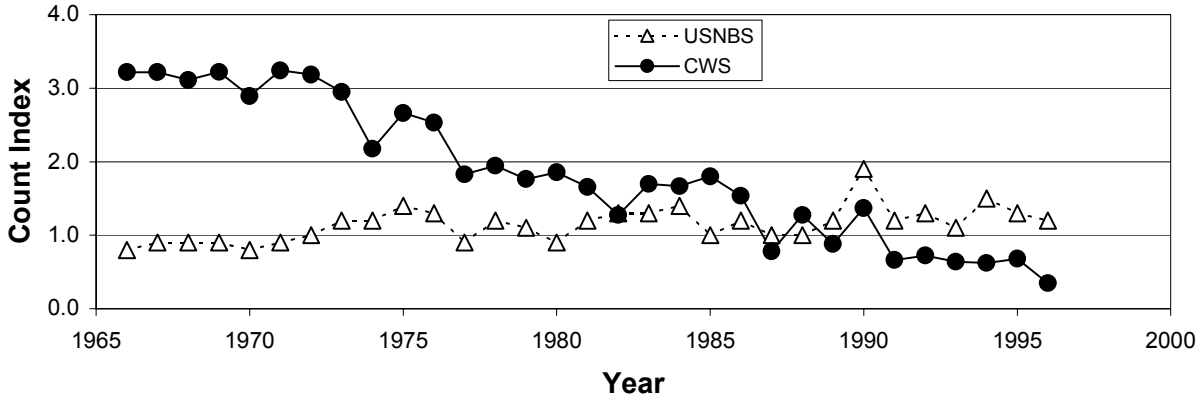

Figure 3. Annual indices for Cape May Warbler for Canada derived from BBS data. Indices calculated by both Canadian Wildlife Service (CWS) and by the US National Biological Survey (USNBS) are shown as analytic methods differ.

reported (Kirk et al. 1997). Although the numbers are difficult to compare directly, densities of Cape May Warblers in Alberta are likely comparable to the lower end of the range of densities in these other areas (BC, SK, MB).

Population trend estimates for Cape May Warblers may be derived from Breeding Bird Survey (BBS) data. The survey-wide and Canada-wide analyses show nonsignificant declines from 1980 and 1998 at –2.9 % and –2.3% per year (Sauer et al. 1999). Longer-term analyses suggest trends between +1.5 % per year (survey-wide 1966-1998, (Sauer et al. 1999) and +3.4 % per year (Canada-wide 1967 and 1998; Downes et al. 1999). These long-term trends are not statistically significant and the results should be viewed with caution due to the low numbers of birds detected on most routes and the small number of routes located within the breeding range of the Cape May Warbler. The trends are represented in the annual indices for the Cape May Warbler (Figure 3). Note that different analytical methods are used by the Canadian and American partners in the BBS program; neither method is clearly better than the other so results from both are presented here.

LIMITING FACTORS

There is considerable debate in the scientific literature as to the relative significance of events occurring on breeding, wintering, and migratory stopover habitats, in terms of their effects on songbird populations (e.g., (Böhning-Gaese et al. 1993, Rappole and McDonald 1994). For the purposes of this report, this section will mainly deal with events occurring in Alberta, within the breeding range of the Cape May Warbler.

1. Habitat Loss and Fragmentation. - The loss and fragmentation of forest habitat are closely allied processes. 'Habitat loss' refers to the conversion of suitable habitat into unsuitable habitat, while 'fragmentation' is the increasing isolation and division of remaining habitat. Habitat fragmentation has been implicated in the declines of neotropical migratory songbird populations across North America (Robbins et al. 1989, Terborgh 1989). As the area of patches of suitable habitat declines, and the distances between those patches increases, the likelihood of individual patches supporting a subpopulation of birds declines (Saunders et al. 1991, Villard et al.

1995). Some species of songbirds have also been shown to be reluctant to cross habitat openings (Desrochers and Hannon 1997). Much of our understanding of the effects of forest fragmentation on birds developed from studies in agricultural landscapes in eastern North America, but recent research in Alberta is showing less severe results (e.g., Schmiegelow et al. 1997). No researchers studying the effects of forest fragmentation in Alberta or elsewhere have found sufficient numbers of Cape May Warblers to draw any specific conclusions regarding this species, although it may be reasonable to assume that Cape May Warblers will respond to habitat fragmentation in a similar fashion as other neotropical migrants.

These factors together (habitat loss, fragmentation, and edge avoidance) may lower bird reproductive success in fragmented forests by influencing pairing success (Gibbs and Faaborg 1990, Villard et al. 1993) or other factors (see 'Nest Predation and Parasitism', below). However, no specific studies have been conducted on Cape May Warblers in relation to these factors. Habitat corridors may facilitate bird dispersal in a fragmented landscape, but there is likely to be a critical threshold in the degree of landscape fragmentation beyond which populations may decline more rapidly (With and Crist 1995). Overall, it is thought that the effects of habitat loss outweigh the effects of habitat fragmentation (Fahrig 1997). Thus, although the two processes are clearly linked, conservation efforts are probably best directed at slowing the rate of direct habitat loss.

2. Agriculture. - Agricultural expansion may be implicated as one possible cause of habitat loss and fragmentation. In the Alberta portion of the breeding range of the Cape May Warbler, agriculture is largely limited to parts of the Peace River drainage (Northern Dry Mixedwood) and Athabasca River drainage (Southern Dry Mixedwood). In the Peace Country, 20 852 km^2 (~46%) of the land was in agricultural production in 1986, an increase of nearly 9000 km^2 since 1961 (Government of Canada 1991). A similar trend occurred in the Southern Dry Mixedwood between 1949 and 1950 and 1994 and 1995, when roughly 9000 km^2 of land were modified, for a total of 26 300 km^2 (~58%) of anthropogenically modified lands in the region (Alberta Environmental Protection 1998). It has been suggested, however, that agricultural expansion in the Peace River drainage is nearing its limits, as all economically viable land is already in use (MacLock et al. 1996).

3. Forest Management. - Timber harvesting has increased significantly in Alberta in recent years. Coniferous forests have long been the most desired forests for harvesting because of their high fibre value. Large forested areas have been allocated to forest companies under Forest Management Agreements (FMAs). As of December 1995, there were 11 FMA holders in Alberta covering more than 13.6 million ha of the province's forested area (Alberta Environmental Protection 1996); by November 1998 this had increased to 17 FMA holders covering roughly 19.6 million ha (D. Price, pers. comm.). These figures represent 60% and 87% allocation of the province's forested landbase, respectively. The proportion of the Annual Allowable Cut (AAC) allocated has also steadily increased. As of January 1995, roughly 85% of the province's AAC of timber had been allocated (94% coniferous, 73% deciduous), and the provincial government anticipates further increases in allocation and harvesting (Alberta Environmental Protection 1996). Between 1990 and 1995, approximately 41 000 ha of coniferous forest were harvested annually (Alberta Environmental Protection 1996), representing 0.2% of the commercially productive landbase. Computer models have recently been used to examine the long-term

effects of timber harvest policies in Alberta, using the Alberta Pacific FMA area as an example. Shortfalls in conifer harvest are seen over the next 50 years, suggesting that current levels of white spruce harvest are unsustainable (Cumming 1999). The situation is further exacerbated when wildfire is accounted for in the model, with significant shortfalls in coniferous timber availability occurring by 2045 (S. Cumming, pers. comm.).

Cape May Warbler habitat will likely be reduced in quantity and quality under the current forest harvesting strategies. Current operating ground rules for forestry in the province dictate a two- or three-pass clearcutting system, with the oldest stands prioritized for harvest (Alberta Environmental Protection 1994). Furthermore, with rotation lengths of 60 and 80 years, stands will be harvested just as they are becoming potentially suitable for Cape May Warblers (see 'Habitat' section, above). There are very few data available on the use of different aged post-harvest forest stands by Cape May Warblers, but Titterington et al. (1979) found that in Maine they did not use early and mid-successional forests following clearcutting. Even-aged forest management practices will also lead to stands lacking the towering spruce spires which Cape May Warblers may require. Overall, current forest harvesting strategies will lead to a reduction in the proportion of old stands in the landscape, and will fragment previously contiguous forest; both these factors will reduce habitat quantity and quality for Cape May Warblers.

Increasingly, consideration is being given to modified harvest strategies, involving the retention of vegetation structure for wildlife habitat as an alternative to clearcutting. Trials involving appropriate Cape May Warbler habitat, i.e. coniferous-dominated forest, have not been conducted. However, other forest specialist species were largely excluded from sites with vegetation retention rates up to roughly 40% (Norton and Hannon 1997, Schieck et al. 2000).

4. Energy Sector Activities. **-** Oil and gas development in the forested region of Alberta impacts the landscape through the clearing of forest for seismic exploration lines, pipelines, wellheads, and roads. Accurate statistics on energy sector activities are difficult to obtain. A crude estimate of the impact to date is roughly 9080 km^2 (3%) of cleared land in the Boreal Forest Natural Region (not including Wood Buffalo National Park; Alberta Environmental Protection 1998). Currently, roughly 14 000 km of new seismic lines are cut each year, and an additional 20 000 km of existing lines are re-cleared annually (R. Jamieson, pers. comm.). At an average width of 6 m, this translates to approximately 8400 ha of new forest cutting annually, and 12 000 ha of forest being re-opened. One estimate of linear disturbance density is 2 km/km^2 on the forest landbase in north-central Alberta (B. Stelfox, pers. comm.). The total area directly affected annually by energy sector activities may be comparable to that affected by the forest industry; on the Alberta Pacific FMA area roughly 10 000 ha to 13 000 ha are affected by the energy sector compared to rougly 16 000 ha by forestry (B. Stelfox, pers. comm.). However, due to the linear nature of many of these disturbances, the total area of forest that may be influenced by these disturbances may be significantly higher. This adds to the impacts of forestry in causing habitat loss, and further reduces the availability of forest undisturbed by human activities, as well as creating semi-permanent open corridors into forested landscapes (see below).

5. Spruce Budworm. **-** The distribution, frequency, and severity of spruce budworm outbreaks may influence Cape May Warbler

distribution and abundance. In 1998, 114 668 ha of forest, (excluding the area north of Fort Chipewyan for which data were not available), were defoliated by budworm in Alberta, a large increase over the 50 056 ha defoliated in 1997 (Ranasinghe et al. 1998). Spraying of biological insecticides for spruce budworm began in Alberta in 1989 and has been effective in reducing budworm populations from epidemic to endemic levels (S. Ranasinghe, pers. comm.). In 1997 and 1998, spraying of a biological control agent was undertaken over 20 068 ha and 8801 ha, respectively, in areas north and west of High Level. In 2000, Alberta Environment did not conduct any aerial spraying to control spruce budworm infestations in the 'Green Area' (S. Ranasinghe, pers. comm.). This is because survey data in 1999 indicated low levels of budworm populations in previously infested areas of the province (S. Ranasinghe, pers. comm.). Alberta Environment is currently assessing the spruce budworm population levels expected in 2001 to determine whether spraying will be required (Ranasinghe, pers. comm.). If spraying is effective at controlling budworm outbreaks, it is possible that the increase in warbler numbers that might be expected in response to the outbreak could be reduced (i.e. a smaller increase). Given the relatively few areas of the province that appear to have a problem with budworm, and a lack of information about the warblers in those areas (with or withouta budworm outbreak), there is no conclusion to be made other than there being no cause for concern currently. The situation might be very different in the east where budworm outbreaks are more widespread, and warbler densities are higher to start with.

Alberta's current spraying policy includes the following guidelines: (1) Alberta Environment will only use federally registered biological insecticides for aerial spraying; (2) Aerial spraying of insecticides will be used, in conjunction with prioritized harvesting, as a part of an integrated approach to control spruce budworm infestations in theprovince; (3) Need for aerial spraying will be decided depending on the management objectives for a given Forest Management Unit (FMU) infested with spruce budworm and the level of spruce budworm control achievable by prioritized harvesting in that FMU; (4) Forest stands for aerial spraying within a given FMU will be selected based on the guidelines given in the "Spruce Budworm Management Guide" (S. Ranasinghe, pers. comm.).

6. Nest Predation and Parasitism. - In the heavily fragmented landscapes of eastern North America, where agriculture is the dominant land use, predation and parasitism of nests is thought to be a significant limiting factor of songbird populations (Andrén 1992, Donovan et al. 1995, Robinson et al. 1995). The Brown-headed Cowbird (Molthrus ater) regularly parasitizes nests of neotropical migrant songbirds, and predation of eggs by corvids can be significant. Cape May Warblers are thought to be only rare hosts for cowbirds, because the two species' ranges rarely overlap (Baltz and Latta 1998). However, species such as the Brown-headed Cowbird and jays, crows and magpies may gain access to forested landscapes via linear corridors, such as resource extraction roads, pipeline corridors, and seismic lines (Askins 1994). Edge habitats, which may facilitate predation or parasitism, are short lived adjacent to cutblocks, but are longer-term features associated with linear disturbances and agricultural land clearing. Rates of nest predation and cowbird parasitsm may be higher in areas of agricultural clearing than forestry (Bayne and Hobson 1997).

7. Winter and Migration Stopover Habitat. - Winter habitat degradation is likely a significant factor affecting songbird populations (Sherry and Holmes 1993) and

may, in fact, be more significant than factors on the breeding grounds (Rappole and McDonald 1994). Forest habitats in the wintering range of most North American songbirds are being depleted at an alarming rate: forest loss in Central America has been estimated at 2% annually (Hartshorn 1992). Cape May Warblers are thus being affected by habitat alterations on both their summer and winter ranges.

STATUS DESIGNATIONS

1. Alberta. - The Cape May Warbler is included on the 'Blue List' of species that may be at risk in the province (Alberta Wildlife Management Division 1996). This designation was made based on concerns over anticipated population declines in some areas coupled with expected loss of old-growth habitats. The Alberta Natural Heritage Information Centre has assigned a provincial rank of S2, indicating imperilment due to rarity (ANHIC 2001, see Appendix 1 for explanation of ranks).

In a federal conservation and management priority-setting exercise, the Cape May Warbler was ranked second out of 232 landbird species in Alberta in terms of 'provincial supervisory responsibility' (Dunn 1997). This ranking reflects both the species' extensive geographic range in the province, and potential threats to its persistence.

2. Other Areas. - The Cape May Warbler has not been considered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The Global Heritage Status Rank for the Cape May Warbler is G5 or 'demonstrably secure' throughout its range (Nature Serve 2000). In the United States, its National Heritage Status Rank is N5 (Nature Serve 2000). In British Columbia, the Cape May Warbler is ranked S2 or 'imperiled' and is on the 'Red List' of vulnerable or sensitive species (Cooper et al. 1997, British Columbia Conservation Data Centre 2001). Its restricted distribution and threats to habitat (similar to those in Alberta) were cited as reasons for the recommended status. In Saskatchewan, it is ranked S4, or 'apparently secure' (Saskatchewan Conservation Data Centre 2001), S2 in Newfoundland and S1 in Labrador (Nature Serve 2000). The Cape May Warbler is ranked S4 or S5 ('secure') in other jurisdictions in Canada and the state of Maine. It is ranked S2 or S3 ('very rare or localized') in Vermont, New York, New Hampshire, Michigan, and Wisconsin.

RECENT MANAGEMENT IN ALBERTA

No specific management activities have been reported for this species in Alberta. However, several major research initiatives on forest management are underway in the province that include a songbird component (see Norton 1999 for a review). Most of these projects have been and continue to be focussed on deciduous-dominated habitats and therefore may not reveal much new insight into the Cape May Warbler.

SYNTHESIS

Very little is known about the population size or trends of the Cape May Warbler in Alberta. Data collected through Breeding Bird Surveys suggest a declining population trend across Canada and the species' whole range; small sample sizes weaken the application of these analytic methods. Available habitat descriptions suggest the species is dependent on older, conifer-dominated forest stands that will decline in abundance and quality as a result of resource extraction. Larger scale surveys across the poorly known northern boreal zone, while expensive and logistically difficult, would generate valuable basic information on

the distribution and abundance of this and other songbird species. Additional censuses in areas of high spruce budworm populations would be useful to determine if western populations of Cape May Warblers respond to outbreaks of this insect as in eastern North America. Long-term, standardized studies will be crucial in determining the provincial trend of the Cape May Warbler, although low population densities will render this very difficult (e.g., BBS and atlas-style sampling would be insufficient). A detailed characterization of the Cape May Warbler's habitat use across all forest types used by the species could quantify features it requires (e.g., stand ages, tree species density and distribution). Efforts should be made to confirm or refute comments that the species requires spruce spires reaching above the main forest canopy, as this feature will not likely be retained in managed forests under current practices. Since a reduction in the rate of forest harvest and clearing is unlikely in the near future, modifications to harvest practices forest and management policy to guarantee the continued availability of suitable habitat should be pursued.

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APPENDIX 1. Definitions of selected legal and protective designations.

A. Status of Alberta Wildlife colour lists (after Alberta Wildlife Management Division 1996)

Red	Current knowledge suggests that these species are at risk. These species have declined, or are in immediate danger of declining, to a nonviable population size.
Blue	Current knowledge suggests that these species may be at risk. These species have undergone non-cyclical declines in population or habitat, or reductions in provincial distribution.
Yellow	Species that are not currently at risk, but may require special management to address concerns related to naturally low populations, limited provincial distributions, or demographic/life history features that make them vulnerable to human-related changes in the environment.
Green	Species not considered to be at risk. Populations are stable and key habitats are generally secure.
Undetermined	Species not known to be at risk, but insufficient information is available to determine status.

B. Alberta Wildlife Act

Species designated as 'endangered' under the Alberta Wildlife Act include those defined as 'endangered' or 'threatened' by *A Policy for the Management of Threatened Wildlife in Alberta* (Alberta Fish and Wildlife 1985):

Endangered	A species whose present existence in Alberta is in danger of extinction within the next decade.
Threatened	A species that is likely to become endangered if the factors causing its vulnerability are not reversed.

C. Committee on the Status of Endangered Wildlife in Canada (after COSEWIC 2001)

Extinct	A wildlife species that no longer exists.
Extirpated	A wildlife species that no longer exists in the wild in Canada, but exists elsewhere in the wild.
Endangered	A wildlife species that is facing imminent extirpation or extinction.
Threatened	A wildlife species that is likely to become an endangered species if nothing is done to reverse the factors leading to its extirpation or extinction.
Special Concern (Vulnerable)	A wildlife species of special concern because it is particularly sensitive to human activities or natural events, but does not include an extirpated, endangered or threatened species.
Not at Risk	A wildlife species that has been evaluated and found to be not at risk.
Indeterminate	A species for which there is insufficient scientific information to support status designations.

D. United States Endangered Species Act (after National Research Council 1995)

Endangered	Any species which is in danger of extinction throughout all or a significant portion of its range.
Threatened	Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

E. Heritage Status Ranks (after Nature Serve 2000)

G1/S1	**Critically Imperiled**: Critically imperiled globally because of extreme rarity or because of some factor(s) making it especially vulnerable to extinction. Typically 5 or fewer occurrences or very few remaining individuals (<1,000) or acres (<2,000) or linear miles (<10).
G2/S2	**Imperiled**: Imperiled globally because of rarity or because of some factor(s) making it very vulnerable to extinction or elimination. Typically 6 to 20 occurrences or few remaining individuals (1,000 to 3,000) or acres (2,000 to 10,000) or linear miles (10 to 50).
G3/S3	**Vulnerable**: Vulnerable globally either because very rare and local throughout its range, found only in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extinction or elimination. Typically 21 to 100 occurrences or between 3,000 and 10,000 individuals.
G4/S4	**Apparently Secure**: Uncommon but not rare (although it may be rare in parts of its range, particularly on the periphery), and usually widespread. Apparently not vulnerable in most of its range, but possibly cause for long-term concern. Typically more than 100 occurrences and more than 10,000 individuals.
G5/S5	**Secure**: Common, widespread, and abundant (although it may be rare in parts of its range, particularly on the periphery). Not vulnerable in most of its range. Typically with considerably more than 100 occurrences and more than 10,000 individuals.
GX/SX	**Presumed Extirpated**—Element is believed to be extirpated from the nation or subnation*. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.
GH/SH	**Possibly Extirpated** (Historical)—Element occurred historically in the nation or subnation*, and there is some expectation that it may be rediscovered. Its presence may not have been verified in the past 20 years. An element would become NH or SH without such a 20-year delay if the only known occurrences in a nation or subnation were destroyed or if it had been extensively and unsuccessfully looked for. Upon verification of an extant occurrence, NH or SH-ranked elements would typically receive an N1 or S1 rank. The NH or SH rank should be reserved for elements for which some effort has been made to relocate occurrences, rather than simply using this rank for all elements not known from verified extant occurrences.

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