USING CANADIAN MIGRATION MONITORING NETWORK DATA TO ASSESS POPULATION CHANGES IN CANADA WARBLER (*Cardellina canadensis*)

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Major Advisor	Second Reader

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ABSTRACT

Nesbitt, 2023. Using Canadian Migration Monitoring Network data to assess population changes in Canada Warbler (*Cardellina canadensis*). 28 pages.

The Canada Warbler (*Cardellina canadensis*) has been listed since 2010 as *Threatened* according to the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) due to significant and long-term declines in the global population. The cause of the decline over the past years cannot be narrowed down to one threat, but loss and degradation of habitat on the breeding and wintering grounds are one of the major threats. Tracking this species is extremely important and a role for bird banding at observatories occurs during migration, for example at the Long Point Bird Observatory in Ontario. Data from this bird observatory was chosen to analyze spring and fall population trends for the Canada warbler using the database in NatureCounts, along with using the two COSEWIC documents, to explore whether threats to this species have changed or have stayed the same since 2010. The COSEWIC reports list the same threats, including habitat loss, vulnerability to highways, forestry practices and pollutants. However, climate change is discussed more in the most recent report. Combined with the fact that since listing, the Canada Warbler population is continuing to decline, I conclude that threats are increasing because of increasing effects of climate change.

Keywords: climate change, fall migration, Long Point Bird Observatory, Ontario, spring migration

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I would like to thank my principal advisor, Dr. Brian McLaren, for assisting me through the development of this undergraduate thesis and for being patient throughout my learning curve of how to write a well-developed thesis. Thank you to Kyle Cameron, the Ontario Project Biologist at Birds Canada, for allowing me access to the data needed to develop this thesis and for understanding and guiding me through the bird banding process at Long Point Bird Observatory. Thank you to my mother and father, Debbie and Larry Nesbitt, and my sisters, Mandy and Kelly Nesbitt, for putting up with me throughout my undergraduate education. You have all been a great help, and I value your patience. Finally, thank you to everyone who has supported me in finishing my thesis.

INTRODUCTION AND OBJECTIVES

The Canada Warbler (*Cardellina canadensis* L. 1766) is a well-researched, small woodland songbird. It has a diverse migratory range because of its unique migration patterns. It has a limited winter range in South America and an extensive distribution across its breeding grounds in Canada. This New World warbler or "wood-warbler" (Family Parulidae) migrates through parts of Mexico and Central America during the spring, and 80% of the population breeds in Canada, within a range from northeastern British Columbia across the southern Boreal Forest Region to Southern Ontario. This species declined by 62% between 1970 to 2014. Therefore, the Canada Warbler has been on the Committee for the Status of Endangered Wildlife in Canada (COSEWIC) list of threatened species since 2010. The Government of Canada is bound by its Species at Risk Act (2003) to prevent wildlife from becoming extinct. This act provides the legal protection of species that include the Canada Warbler. Since 2010 when its status was determined, there have been multiple conservation actions and research programs that follow the Canada Warbler Recovery Strategy. For example, breeding grounds are increasingly protected in forest management plans.

The evolution of bird migration has been of general interest, and researchers have questioned for decades why some birds make long migrations, while others do not migrate. Theoretical consideration includes population ecology and migratory patterns (Alerstam and Hedenstrom, 1998). The overall purpose of migration in birds is to find specific ecological conditions and habitats for feeding, breeding, and raising their

young. Bird banding is one of the most valuable tools in studying wild birds and their migratory patterns. Wild birds are captured and marked with a small metal and a band placed on the leg, then released. A number on the bar is set in the Motus Wildlife Tracking System and NatureCounts. The Motus Wildlife Tracking System is an international collegiate network of researchers that use automated radio telemetry to simultaneously track hundreds of individuals of number of species of birds.

Bird banding began in North America in the early 1900s. The first bird observatory in the Western Hemisphere, near Port Rowan, Ontario, on Lake Erie, is the Long Point Bird Observatory (LPBO), created in 1960 with a mission to advance the understanding, appreciation, and conservation of wild birds, to protect their habitats and to conduct research on the migration of numerous birds (Buckley et al., 1998). Migratory bird banding stations help elucidate regional migration patterns, and observatories allow changes over a long period, but it is hard to determine the population status from banding information. Total population numbers are estimated from observations, citizen science, breeding bird atlas and many other factors (Sauer, J.R. & Link, W.A. 2004). LPBO houses a few of the longest continuous datasets on migration in North America. The outreach from this observatory quickly grew beyond Long Point with the implementation of regional and provincial research, which led in 1998 to multiple conservatories throughout Canada and the beginning of Birds Canada (originally Bird Studies Canada). Birds Canada is now the leading science-based bird conservation organization in Canada, intending to conserve the wild birds of Canada through science, ground research, and innovative partnership. Their data is from various volunteer monitoring programs, and they conduct targeted research towards

conservation planning, including for endangered and threatened species. (State of Canada's Birds. 2019) In addition, Birds Canada offers public outreach and diverse public education programs to inform what the organization is doing and how the public can volunteer for these initiatives. (McDonald, M.V. 2013)

RESEARCH OBJECTIVES

The general objective of this thesis is to use LPBO Migration Monitoring data to assess changes in the Canada Warbler population before and after protection under the Species at Risk Act. I will analyze threats to the Canada Warbler in 2021 and compare these with threats identified before 2010. I will also compare migratory data, including spring and fall observation trends from the Long Point Bird Observatory. I predict that the Canada Warbler population will continue to decline and face multiple threats in the future.

LITERATURE REVIEW

CANADA WARBLER ECOLOGY

Description / Appearance

The Canada Warbler is also known as the Necklace Warbler, referring to the necklace collar appearance formed by the black stripes on their upper chests (Reitsma et al., 2009). This species has an approximate wingspan of 20-22 cm, a body length of 12-15 cm, and a weight between 9.0-9.5 g; it is a brightly coloured passerine. Females and immature birds are typically less bright than the males; the male's necklace stripes also extend to the forehead and cheeks; another difference in mature males is a well-defined white eye ring. In addition, females have an upper-tail covert that is a dull gray, and their breasts and throats are yellow. The Canada Warbler's lifespan is unknown; however, the maximum recorded age was eight years. This warbler is a small forest songbird part of the Parulidae family and belongs to the subfamily Sylviidae; the Parulidae family has around 126 species that live in various habitats, including heavily wooded deciduous and coniferous forests, marshes, and swamps.

Habitat

The Canada Warbler adapts to various forest habitats, including mixed deciduous-coniferous forest types with a shrub layer that is usually the result of canopy gaps (Government of Canada, 2019). It usually occurs in habitats with suitable drainage

but is also associated with moist soil areas and can occur around sloped riverbanks and in shrub forests on slopes. The Canada Warbler can also adapt to clearcuts, human disturbances including pollution, natural disturbances including burned areas, and an old-growth forest in the summer, spring, and fall seasons (Reitsma et al., 2009). In the winter, their range is primarily mature rainforests, second-growth forests, coffee plantations and agricultural field edges at an altitude of 1000 to 2500 m (Government of Canada, 2019). During migration, the Canada Warbler favors areas with a well-developed shrub layer, such as forest edges and second-growth forests, and forages close to the ground in herbaceous and low woody vegetation (Reistma et al., 2009). When the Canada Warbler is in Mexico and northern Central America, it occurs in the shrub layer and upper layers of humid to semi-humid forests and forest edges from sea level to 2500 m above sea level. (Conboy, M. Mackenzie, S. 2020)

Breeding Grounds

Migratory birds select their breeding habitat according to land distribution, abundance, past reproductive success, and proximate cues that include forest structural components (Reitsma et al., 2009). For example, the Canada Warbler seeks structure associated with forested areas; forest edge is therefore among the proximate cues, as are social and demographic cues. (Alerstam, T. & Hedenstrom, A. 1998) The Canada Warbler breeds in every province of Canada, excluding Newfoundland and Labrador, and they also breed in the Northern States and the southern Appalachian Mountains (Figure 1).

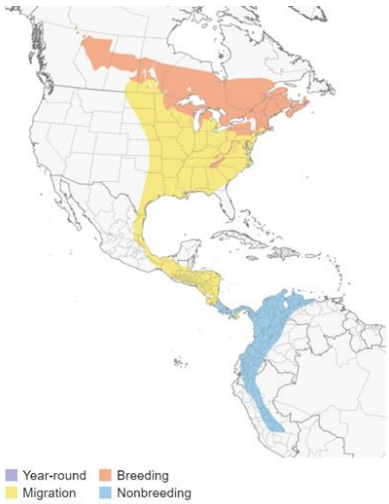

Figure 1. The range of Canada Warbler inbreeding, migration, and non-breeding seasons (McDonald, 2013).

The Canada Warbler nests on or very close to the ground, often in fens or fallen logs, and nest sites are only used once. They lay around four to five eggs annually, and the incubation lasts 12 days. Nest success is higher when nests are placed in areas with coarse woody debris, high shelter, and dense stems from woody plants and ferns (Hallworth, M., P. M. Benham & Reitsma, L. 2008) The chicks stay in the nest for ten days before fledging, which lasts about two weeks, the same as most New World warblers. The prime nesting region is where insects are abundant, which is why breeding is significantly higher in Canada (McDonald, 2013).

Songbird Migration

Migration has classically been defined as the seasonal movement of individuals between breeding grounds and wintering grounds, specifically spring and fall migration (Colwell, 2010). The Canada Warbler is a long-distance, nocturnal migrant (Reitsma et al., 2009). It lands in the morning and feeds for several days before resuming its migration. Approximately 1.4 million Canada Warblers migrate to Canada to breed; many studies have shown that they seek specific habitat features in selecting territory locations (Hallworth, M., P. M. Benham & Reitsma, L. 2008) Spring arrival to the breeding grounds for the Canada Warbler occurs between mid-May and early June. Fall migration begins mid-July and lasts through early September (NatureCounts, 2020).

The Canada Warbler, as for other warblers, migrates along flyways or defined routes between breeding and wintering grounds. However, researchers are witnessing rapid environmental changes that are causing changes in the migratory behaviors of birds; this is the result of climate change (Lisovski and Liedvogel, 2021). These changes are affecting birds' behaviors, ranges, and population dynamics. As a result, many bird species are experiencing negative impacts. These impacts include population decline resulting from habitat loss, habitat fragmentation, and deterioration (Dunn, E.H. 2005); long-distance migration has decreased among breeding species within North America (Nature Canada, 2021). The outcome is increased competition between short-distance migrants and resident birds on the breeding grounds of migrants. The adaptability of long-distance migrants to changes to their routes is one of the essential factors to their surviving climate change (Dunn, E.H. 2005). Currently, warming temperatures have been directly linked to earlier spring arrival and delayed fall departure in warblers. In

addition, the changing of temperatures has been linked indirectly to changes in migration matters of migratory birds because of the decline of insects forcing more northern migrations (Hallworth, M., P. M. Benham & Reitsma, L. 2008) Birds in small populations with restricted ranges, as well as birds that rely on multiple forested habitats sites are most vulnerable to change.

MATERIALS AND METHODS

Trends in Canada Warblers over seven seasons were calculated daily, combining a morning census with general observations throughout a day. Most data were received from the Long Point Bird Observatory (LPBO), part of the Canada Migration Monitoring Network (CMMN). LPBO is situated on the world's largest freshwater sand spit, extending 40 km into Lake Erie, and the point is surrounded by wetlands protected as a National Wildlife Area. The observatory has three permanent research stations, including the Tip, Breakwater, and Old Cut (Figure 2). The LPBO's longest-running research station is the tip portion, established in 1960. LPBO data were used because of its geographic position in Canada, as the Canada Warbler migrates through Long Point to arrive in much of the eastern portion of its breeding range (Figure 3). (Long Point Bird Observatory. 2019)

Figure 2. LPBO Operates three permanent research stations on Long Point: The Tip, Breakwater, and the main office of Long Point Bird Observation called Old Cut (Birds Canada, 2021).

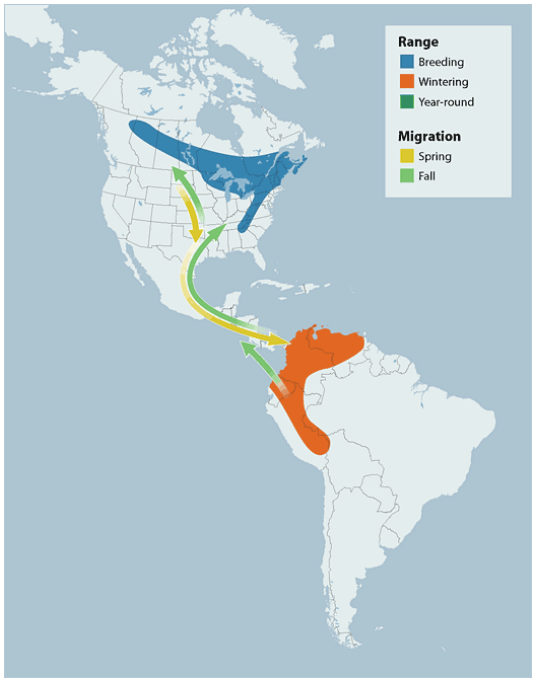

Figure 3. Canada Warbler migration map (Birds Canada, 2021).

The data were received from Nature Counts, one of the world's largest biodiversity data repositories that contains data on the distribution on abundance of Canada's wildlife gathered by a network of volunteers and scientists with partnership programs. (NatureCount.2022) The data analyzed for this project includes a combination of what was received from LPBO, including observation data for the spring and fall, presented as trends incorporating the Credible Interval. Changes to threats were analyzed using the 2008 COSEWIC reports and the recently released 2021 Canada Warbler Action Plan. (COSEWIC. 2008) The second report is the Canada Warbler Full Life Cycle Conservation Action Plan. (Nature Canada, 2021)

RESULTS AND DISCUSSION

The Canada Warbler has been facing new threats in the last ten years, and factors listed in its decline in the initial COSEWIC report in 2008 are still threatening the population. Threats included in the COSEWIC assessment and status report are:

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- Habitat loss from land conversion
- Vulnerability to highways
- Habitat loss from forestry practices
- Pollutants

In the breeding range, draining swamp forests for agriculture and urban development has decreased the forested area available to the Canada Warbler. (Nature

Canada, 2021). Other factors associated with forest habitat loss include road construction, housing and pipeline development. The mixed boreal forest has also been cleared for agriculture and petroleum development in Western Canada, contributing to breeding grounds and habitat (Government of Canada, 2019). In much of Canada, budworm and beetle outbreaks have disturbed the forest, but there is little evidence that budworm outbreaks contribute to the population decline. (Nature Canada, 2021)

The first COSEWIC report discussed climate change as a possible factor in Canada Warbler decline, but it was unknown how the population would be affected. Climate change has influenced plant phenological patterns, insect abundance, temperature warming, frequency and timing of tropical storms, hurricanes, and increases in wildfire (COSEWIC. 2008). Extreme events can affect the Canada Warbler because the species is vulnerable in response to:

- Changes in precipitation
- Sensitivity to changes in the seasons
- Other environmental cues

Climate change is a new threat to the Canada Warbler population since it was protected in 2010 (Government of Canada, 2019).

The Canada Warbler's spring population average trend of –7.13% is equivalent to an estimated population loss of 7.13% every year between 2010 and 2017 (Figure 4). Notable increases in 2009 and 2010 are not unexpected because the survival of the Canada Warbler during migration can be positively impacted by favorable weather patterns. (NatureCount.2022) According to the historical record from the Global Climate

Change Reports, the average weather through the spring of 2009 was warmer than in other years, and less precipitation occurred. The two situations of less precipitation and warmer weather are favorable for migrating birds because they face multiple threats travelling from South America; these also include limited habitat. Thus, the population stabilizes into a positive population index from 2009 to 2010 but decreases into the negative and slowly decreases over time. The historical report also shows that natural disasters have increased in the past 10 years due to climate change, which can affect Canada Warbler's efficiency in making it to their breeding zones. (Conboy, M. Mackenzie, S. 2020)

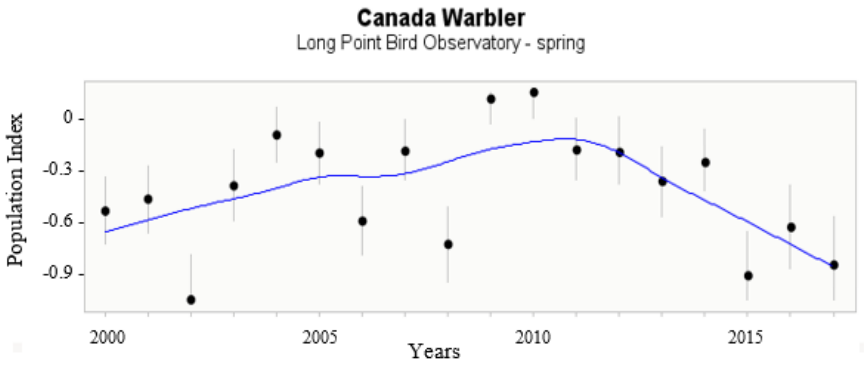

Figure 4. Canada Warbler population trends based on spring counts at LPBO from 2000 to 2017 (NatureCounts 2022).

Fall observations at LPBO show a negative population index except in 2015, equivalent to an average population growth of –8.15% per year (Figure 5). The decline can result from threats including forestry, pollutants, and low insect abundance. (NatureCount.2022)

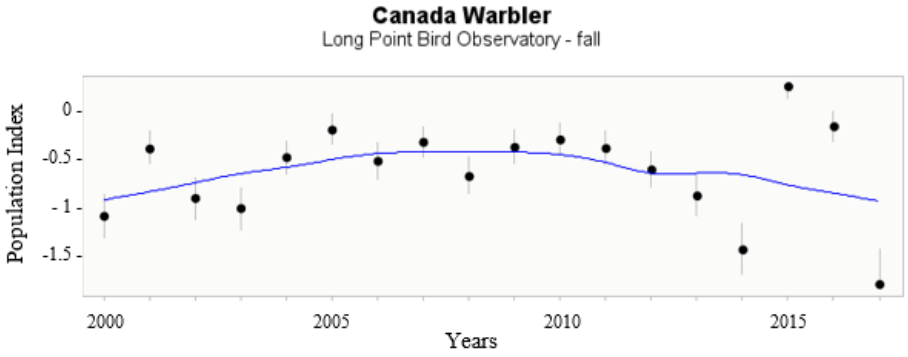

Figure 5. Canada Warbler population trends based on spring counts at LPBO from 2000 to 2017 (NatureCounts 2022).

CONCLUSION

Looking at the trends of spring and fall migration at LPBO suggests that migration patterns are shifting in the Canada Warbler. Reviewing the COSEWIC documents helps us understand the threats that affect the Canada Warbler on its migration journey. Banding migratory birds allows for analysis, including life spans and population rates, to support trends. There is no doubt that many migratory bird species fall victim to the effects of climate change; however, it is also important to note that others may be adaptable and resilient to these changes.

LITERATURE CITED

Alerstam, T. & Hedenstrom, A. 1998. The development of bird migration theory. Journal of Avian Biology 29 (4), 343-369.

Buckley, P. Francis, G. Blancher, P. DeSante. Robbins, C. Smith, G. 1998. The North American Bird Banding Program: Into the 21st Century. Journal of Field Ornithology. 69 (4), 511-529.

Birds Canada. 2021. Long Point Bird Observatory. Birds Life International. https://www.birdscanada.org/bird-science/long-point-bird-observatory-sightings-board/.

Conboy, M. Mackenzie, S. 2020. Annual Report. Long Point Bird Observatory. Ontario Birds 39-1.qxp (ofo.ca).

COSEWIC. 2008. COSEWIC Assessment and Status Report on the Canada Warbler. Committee on the Status of Endangered Wildlife in Canada.

Colwell, M. 2010. Shorebird Ecology, Conservation, and Management. University of California Press.

Dunn, E.H. 2005. Counting migrants to monitor bird populations: State of the art. General Technical Report (GTR). In: Ralph, C. J., & Rich, T.D., editors. Bird Conservation Implementation and Integration in the Americas: Proceedings of the Third International Partners in Flight Conference. 2002 March 20-24; Asilomar, California, Volume 2 Gen. Tech. Rep. PSW-GTR-191. Albany, CA: U.S. Dept. of Agriculture, Forest Service, Pacific Southwest Research Station. Pages 712-717.

Government of Canada. 2019. Canada Warbler COSEWIC Assessment and Status Report. https://www.canada.ca/en/environment-climate-change/services/species-risk-act-accord-funding/act-description.html.

Hallworth, M., P. M. Benham & Reitsma, L. 2008. Canada Warbler breeding ecology in young forest stands. Forest Ecology and Management 255 (3). 1353-1358.

Lisovski, S. & Liedvogel, M. 2021. A bird's migration decoded. Nature 591(7849), 203-204.

Long Point Bird Observatory. 2019. Migration Monitoring Protocol. Birds Canada. https://birdscanada.org/download/LPBOMigrationProtocol.pdf.

McDonald, M.V. 2013. Canada Warbler. Cornell Lab of Ornithology. http://bna.birds.cornell.edu/bna/species/324.

Nature Canada. 2021. Canada Warbler Conservation Featured at Conservation. https://naturecanada.ca/news/blog/canada-warbler-conservation-featured-at-conservation-workshop-in-edmonton.

NatureCount.2022. Birds Canada Oiseaux Canada. Birdlife International.

NatureCounts - NatureCounts.

Reitsma, L. Goodnow, T. Hallworth, and C, Conway. 2009. Canada Warbler: Recovery Strategy Series. Environment Canada.

Sauer, J.R. & Link, W.A. 2004. Some consequences of using counts of birds banded as indices of populations. Studies in Biology 29(168), 172.

State of Canada's Birds. 2019. NABCI Canada. http://nabci.net/wp-content/uploads/2019-State-of-Canadas-Birds-1.pdf.