

C-PIF-02. CONTRIBUTED PAPERS

BIOLOGY OF NEARCTIC-NEOTROPICAL MIGRATORY BIRDS

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C-PIF-02-01. IDENTIFICATION OF THE MIGRATORY CONNECTIVITY OF A THREATENED NEOTROPICAL MIGRANT, THE CANADA WARBLER (*CARDELLINA CANADENSIS*)

IDENTIFICACIÓN DE LA CONECTIVIDAD MIGRATORIA DE UN MIGRANTE NEOTRÓPICO AMENAZADO, *CARDELLINA CANADENSIS*

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Migratory connectivity is a measure of the strength of spatial connections between populations at different periods of the annual cycle, such as the breeding and overwintering periods of migratory birds. There is a general lack of studies focused on migratory connectivity for small songbirds of conservation concern, making conservation planning problematic. The challenge in determining migratory connectivity is in the identification of non-breeding and breeding areas for specific populations. Through the miniaturization of geolocators, it is now possible to track small songbirds of conservation concern year-round providing the data needed to determine migratory connectivity. The Canada Warbler (*Cardellina canadensis*) is a threatened Neotropical migrant. This species has declined by 2.3% per year from 1966 to 2012. The rate of decline is not consistent across its range; eastern population are declining more than western populations and southern populations are faring better than northern populations. The cause of overall population decline is unknown, as is the variation among the rates of decline across their range, but it is hypothesized to be linked to wintering ground factors. Most of the existing research on Canada Warblers is focused on breeding ground ecology. For the conservation of Canada Warblers to be successful, more information is required on wintering sites, as well as the potential drivers of the population decline. Our objective was to determine the migratory connectivity of the Canada Warbler to guide conservation priorities. We tracked individuals using geolocators from seven sites spatially stratified across the breeding range. Using these geocator data, we quantified migratory connectivity of seven breeding populations by using Mantel tests, and determined whether these geographically distinct breeding populations overwinter in overlapping areas. Understanding migratory connectivity is critical, as it is invaluable tool in drafting conservation plans for at-risk species.

C-PIF-02-02. EVIDENCE FOR DIFFUSE MIGRATORY CONNECTIVITY FOR PROTHONOTARY WARBLERS FROM GEOLOCATOR AND STABLE ISOTOPE DATA

EVIDENCIA PARA LA CONECTIVIDAD MIGRATORIA DIFUSA PARA PROTONOTARIA CITREA DE GEOLOCATOR Y DATOS ISOTOPICOS ESTABLES

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The Prothonotary Warbler (*Protonotaria citrea*) is a declining Neotropical migratory passerine which breeds in bottomland hardwood forests in southeastern North America and winters in tropical mangroves and other forested wetlands in Latin America. Habitat destruction on the wintering grounds has been suggested as the leading cause of population declines, with more than 35% of the world's mangroves lost since the 1970s. In order to determine habitat conservation priorities on the wintering grounds and to model full annual cycle population change, it is essential to understand migratory connectivity. Thirty-three individuals from five breeding sites were tracked to their wintering grounds using archival light-level geolocators between 2013-2016, and stable hydrogen isotope ratios were analyzed from 125 feather samples obtained from eight wintering ground locations. Wintering locations for geocator-tracked birds occurred in Central and South America and the Caribbean, and more than half of the individuals tracked wintered in an inland area in north-central Colombia. Feather samples collected from Costa Rica, Panama, Colombia, and the Caribbean were used to assign individuals to their location of feather growth the previous summer, and we found no evidence of strong segregation of breeding populations on the wintering grounds; rather, most wintering sites likely contained individuals from a broad catchment across the breeding grounds. Both tracking methods revealed a high degree of mixing between breeding and wintering populations, suggesting that Prothonotary Warblers exhibit diffuse migratory connectivity. One implication of this low level of connectivity is that the effects of habitat loss on the wintering grounds will be relative minor at any particular breeding site, but will be widespread across the breeding range.

C-PIF-02-03. PHYLOGEOGRAPHY OF A MIGRATORY SONGBIRD ACROSS ITS CANADIAN BREEDING RANGE: IMPLICATIONS FOR CONSERVATION UNITS

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Many different population concepts have been used to delineate conservation units for migratory songbirds (e.g., global, breeding, regional populations, and subpopulations) and clearer guidance based on genetic and demographic data is required to inform conservation efforts. The objectives of this study were to describe and evaluate potential drivers of genetic structure in Canadian breeding populations of the Ovenbird, *Seiurus aurocapilla*. We performed genetic analyses on feather samples of individuals from six study sites using nuclear microsatellites. We also assessed species identity and population genetic structure of quill mites (Acariformes, Syringophilidae). For male Ovenbirds breeding in three of these study sites, we collected light-level geocator data to document migratory paths and identify the wintering grounds. We also generated paleohindcast projections from bioclimatic models of Ovenbird distribution to identify potential refugia during the last

glacial maximum (LGM, 21,000 years before present) as a factor explaining population genetic structure. Birds breeding in the Cypress Hills (Alberta/Saskatchewan) may be considered a distinct genetic unit, but there was no evidence for genetic differentiation among any other populations. We found relatively strong migratory connectivity western and eastern populations, but some evidence of mixing among populations on the wintering grounds. There was also little genetic variation among syringophilid mites from the different Ovenbird populations. These results are consistent with paleohindcast distribution predictions derived from two different global climate models indicating a continuous single LGM refugium, with the possibility of two refugia. Our results suggest that Ovenbird populations breeding in boreal and hemiboreal regions are panmictic, whereas the population breeding in Cypress Hills should be considered a distinct management unit.

C-PIF-02-04. FOREST VS SHADE-GROWN COFFEE AS WINTER HABITAT FOR CANADA WARBLERS

BOSQUE VS CAFETALES CON SOMBRA COMO HABITAT DE INVIERNO PARA LA REINITA DEL CANADA (*CARDELLINA CANADENSIS*)

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The Northern Andes of South America are an exclusive wintering area for several Nearctic-Neotropical migratory species; however, over 90% of this region has been deforested. Population declines in the Canada Warbler (*Cardellina canadensis*) and other Nearctic-Neotropical migrants that spend the non-breeding season in South America are often associated with habitat loss and deterioration on the wintering grounds. Yet, our understanding about the suitability of habitats during the non-breeding season is limited. We assessed the quality of shade grown coffee plantations and forest as winter habitat for Canada Warblers overwintering in three sites in the western slope of the east Cordillera of the Colombian Andes during three winter periods (2013, 2014, 2015). We used daily and seasonal mass change, habitat selection, and departure date as indicator of habitat quality. Mass increased during the day at the individual (i.e., recapture data) and population level; the increase was higher for males than for females and lowest for both sexes during winter 2015 which corresponded to El Niño year. The effect of habitat on daily mass change was strong only for males during 2015 when the daily mass gain rate was higher in forest than coffee. Seasonal mass change at the individual and population level was affected by year, with birds having the lowest overwinter mass gain during winter 2015. Winter habitat occupancy was driven by site and sex; in each site males were more likely to occupy forest than coffee. Spring departure information from radio-telemetry suggests that birds in both habitats are making landscape movements in spring rather than “true” migratory flights. Our results suggest that the relative quality of coffee as winter habitat for Canada Warblers might decrease during El Niño year.

C-PIF-02-05. CONSERVATION STRATEGIES WOULD BENEFIT OF INITIATIVES THAT INCENTIVE THE MAINTENANCE OF SHADE-COFFEE PLANTATION OVER THE CANADA WARBLER WINTER RANGE

FROM PIXELS TO SHRUB-RICH CANOPY GAPS: FIELD VALIDATION OF HI-RESOLUTION SATELLITE IMAGERY FILTERED TO IDENTIFY HABITAT PATCHES FOR CANADA WARBLER

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When evaluating characteristics of forest stands using traditional forest inventory data, Canada Warbler breeding habitat varies considerably across Canada's boreal forest. Recently available imagery from the WorldView satellites provides resolution comparable to that of aerial photography traditionally used by the forest industry to derive polygons of forest stands. These satellite scenes can be filtered to highlight sub-stand patches dominated by Mountain Maple (*A. spicatum*), which may have a strong association with Canada Warbler occupancy. To test the applicability of this method in central Bird Conservation Region 8 (BCR 8; Boreal Softwood Shield), we selected several 10km x 10km squares of imagery from the WorldView 2 and WorldView 3 satellites, based on presence of pixels having spectral signature suggestive of *A. spicatum*. Field validation included ground-level photography of understorey habitat composition and structure, and point counts for breeding bird community. Results confirm presence of high density of *A. spicatum*, and point counts suggest high rate of occupancy by Canada Warbler. This satellite imagery filtering approach can serve as a foundation to derive a survey design for Canada Warbler that will estimate the distribution of suitable breeding habitat across a greater extent of BCR 8.

C-PIF-02-06. HABITAT SEGREGATION BETWEEN MALE AND FEMALE GOLDEN-WINGED WARBLERS AND BETWEEN GOLDEN-WINGED WARBLERS AND BLUE-WINGED WARBLERS, IN HONDURAS

SEGREGACIÓN DE HÁBITAT ENTRE MACHO Y HEMBRA REINITAS ALIDORADAS, Y ENTRE REINITAS ALIDORADAS Y REINITAS ALIAZULES, EN HONDURAS

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We undertook a study of male-biases in our habitat models and the existence of habitat segregation of Golden-winged and Blue-winged Warblers in Yoro, a coffee-producing region of Honduras. We conducted point count surveys at 54 points along habitat and elevational gradients with randomly ordered playback of Golden- and Blue-winged Warbler song and a mobbing track. We encountered male Golden-winged Warblers at 36 of the 54 surveys points, female Golden-winged Warblers at 10 points, and Blue-winged Warblers (all males) at 16 points. Golden-winged Warblers were present at all of the points where we encountered Blue-winged Warblers except one. Male Golden-winged Warblers were observed at 9 of the 10 points where female Golden-winged Warblers were seen. We found no difference in the frequency with which male Golden-winged and Blue-winged Warblers were encountered in shade coffee versus forest, although Golden-winged Warblers were more frequently encountered in humid forest compared to oak forest. Male Golden-winged Warblers were detected at higher elevations than female Golden-winged Warblers or Blue-winged Warblers, and landscapes in which only Golden-winged Warblers were detected had higher cover of humid forest and lower cover of agriculture than Blue-winged Warblers. We conclude based on these findings that male biases of surveys for Golden-winged Warblers using the standard male playback are slight at our sites. Golden-winged and Blue-winged Warblers appear to segregate by habitat and elevation, with Blue-winged Warblers occurring more frequently in oak forests, lower elevations and in less forested, more agricultural landscapes. Blue-winged Warblers respond to Golden-winged Warbler song more frequently than to Blue-winged Warbler song, indicating social interactions between these species that merit

further investigation. Finally, both Golden-winged and Blue-winged Warblers occur more frequently in coffee farms with adjacent forest, suggesting the need for forest conservation.

C-PIF-02-07. OCCUPANCY RATES OF YELLOW-BILLED CUCKOO ON SPRING STOPOVER IN NORTHERN COLOMBIA: THE UNKNOWN ROLE OF TROPICAL DRY FOREST

TASAS DE OCUPACIÓN DE *COCCYZUS AMERICANUS* EN LA MIGRACIÓN DE PRIMAVERA EN EL NORTE DE COLOMBIA: EL PAPEL DESCONOCIDO DEL BOSQUE SECO TROPICAL

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Coccyzus americanus es un ave migratoria Nearctico-Neotropical que se reproduce en Norteamérica y pasa el invierno en Sur América, donde sus movimientos de migración son poco conocidos. A nivel global, es considerada una especie en preocupación menor; sin embargo, existe evidencia de que la viabilidad de su población ha disminuido 54% en los últimos 40 años. Para entender sus movimientos en la costa Caribe de Colombia, entre marzo a mayo 2016, se realizaron recorridos en 243 transectos de 100 metros con 4.091 repeticiones. Los individuos fueron detectados auditiva y visualmente en 16 sitios distribuidos desde el Darién hasta la Guajira, cubriendo elevaciones entre los 5 a 1850 msnm. Se registró un total de 275 individuos en los transectos. Los primeros registros ocurrieron a finales de marzo pero la mayoría de individuos fueron observados entre la mitad de abril e inicios de mayo. Se detectó un mayor número de individuos entre los 0 a 200 msnm en Bosque Seco Tropical en la región central del Caribe. Se estimó la tasa de ocupación para los periodos de muestreo generando modelos con diferentes variables de clima y hábitat. Se encontró que la elevación, la precipitación anual y la cobertura de dosel influyen en la ocupación. Los modelos se proyectaron en mapas de distribución que muestran la variación de la tasa de ocupación en el tiempo y como la distribución de la especie se concentra en áreas definidas como bosque seco. La presencia de *C. americanus* durante tres semanas en los bosques secos del Caribe Colombiano, sugiere que esta región representa un sitio clave para la acumulación de la energía esencial para seguir migrando. En consecuencia, la pérdida actual de este tipo de cobertura (remanente de 8% en Colombia) puede afectar la supervivencia de esta y otras especies migratorias y residentes.

C-PIF-02-08. SPATIAL AND ANNUAL VARIABILITY IN WINTERING WOOD THRUSH CAPTURES IN BELIZE LINKED TO SOIL MOISTURE

VARIABILIDAD ESPACIAL Y ANUAL EN INVERNADA *HYLOCICHLA MUSTELINA* CAPTURA EN BELICE LIGADA A LA HUMEDAD DEL SUELO

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Conservationists are increasingly concerned about declines in Wood Thrush populations, which are attributed at least in part to habitat conditions and resource availability on the tropical wintering grounds. Prior research has indicated that wintering Wood Thrushes are more sedentary in higher quality habitat and relatively nomadic in lower quality habitat and that habitat quality was negatively associated with dryness. We conducted intensive constant-effort mistnetting in the Cockscomb Basin Wildlife Sanctuary during 2014,

2015 and 2016 in order to determine whether color-banded Wood Thrushes were stationary during the non-breeding season and whether their degree of nomadism, which we interpreted as an indication of habitat quality, varied along a gradient of soil moisture as indicated by NDVI. Netting took place at 26 sites, with 15 12-m nets deployed for two consecutive days twice each winter season. We captured 361 Wood Thrushes during the three years of the study. Captures varied greatly in time and space, with as many as 20 individuals captured within a single two-day netting period, often in just 1-2 nets. Capture rates also varied between years, with decline in captures of 20% - 100% between 2014 and 2015, with declines most pronounced at drier sites. Wood Thrush captures recovered in 2016, but numbers continued to be lowest at drier sites. Overall recapture rates were only 7.3%. High levels of variation coupled with low recapture and re-sighting rates suggest that either this population is experiencing high levels of mortality or that most individuals move during the non-breeding season. Despite the long-standing belief that most individuals are territorial on the wintering grounds, several recent studies suggest the contrary. The decreasing levels of abundance and recapture rates, associated with increasingly dry conditions at high elevation sites further strengthen the argument that Wood Thrushes move to exploit resources that shift from year to year and during the winter dry season.