WildResearch Nightjar Survey 2018 Annual Report

Report prepared by
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The WildResearch Nightjar Survey is a program under the non-profit organization, WildResearch.

WildResearch's mission is to build, train, and educate a community that contributes to conservation science.

In-kind support for the WildResearch Nightjar Survey in 2018 was provided by Bird Studies Canada, the Community Mapping Network, and many other naturalist organizations across Canada.

The WildResearch Nightjar Survey is made possible by the dedicated Citizen Scientists who generously donate their time to survey for and report on these cryptic birds.

Thank you to all WildResearch Nightjar Survey volunteers!

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Executive Summary

The WildResearch Nightjar Survey is a volunteer-run citizen science program that conducts nocturnal roadside surveys for three highly understudied species of conservation concern: the Common Nighthawk, the Common Poorwill, and the Eastern Whip-poor-will. All three species belong to the nightjar family, which is a group of cryptic migratory birds that forage for flying insects at night. These charismatic species are understudied because their nocturnal habits preclude their detection during other survey programs like the Breeding Bird Survey. The data available for nightjars indicate that their populations are in decline. The Common Nighthawk and Eastern Whip-poor-will is listed as Threatened under Canada's *Species at Risk Act* due to these perceived declines. The Common Nighthawk was recently reassessed as Special Concern by the Committee on the Status of Endangered Species in Canada (COSEWIC), also due to the perceived declines. The Common Poorwill has been assessed as Data Deficient by COSEWIC because sufficient surveys have not been completed. Citizen science surveys are an ideal way to study nightjars and contribute to their conservation because they can efficiently collect reliable data over a large geographic extent.

The WildResearch Nightjar survey program expanded once again in 2018! We launched a new chapter in Ontario and welcomed with it many new volunteers and a new regional coordinator. In addition, the New Brunswick region was transformed to the Maritimes Region with the introduction of available routes in both Nova Scotia and Prince Edward Island. Citizen science survey monitoring of nightjars had occurred previously in Nova Scotia in 2016 when the Canadian Wildlife Service (CWS) got the ball rolling but 2018 was the first year the surveys took place in Nova Scotia under the coordination of WildResearch. The surveys continued in the 6 previously established regions across Canada: Alberta, British Columbia, New Brunswick, Northwest Territories, Saskatchewan, and the Yukon. The program welcomed many returning and new volunteers. Behind the scenes, the Nightjar Atlas development team continued to implement the lessons learned in previous years and made further improvements to the data entry portal. Finally, we made progress towards satisfying our multi-species objective of determining best monitoring methods for nightjars and by comparing our protocols to other existing survey programs. We compared the WildResearch Nightjar Survey to the Breeding Bird Survey (BBS) for trend monitoring and habitat modelling and presented our results in the citizen science symposium at the 2018 International Ornithological Congress in Vancouver. Looking forward, we will continue our expansion in 2019 by welcoming a new coordinator and launching a new chapter in Manitoba.

1. BACKGROUND

1.1. Family Caprimulgidae: Nightjars

Nightjars are a family of cryptic birds that forage for flying insects at night. Due to their feeding habits, nightjars belong to a larger guild of birds called the aerial insectivores. Many of these species are highly migratory, spending their winters as far south as Argentina. These beautiful birds have long pointed wings for flight and are highly camouflaged because they roost during the day and nest on the ground. There are three species of nightjars that regularly occur in Canada: Common Nighthawk (*Chordeiles minor*), Common Poorwill (*Phalaenoptilus nuttallii*), and Eastern Whip-poor-will (*Antrostomus vociferus*).

A Common Nighthawk roosts on a rocky bluff. Photo: Dwayne Gaschermann

1.2. Why Survey Nightjars?

Relatively little is known about the population trends of nightjars due to their nocturnal habits and cryptic nature; however, steep population declines of other aerial insectivore species have been detected across North America. Although nightjar species are often missed by other bird survey programs, Breeding Bird Survey data indicate that many nightjar populations in Canada are also in decline. The Common Nighthawk and Eastern Whip-poor-will are federally listed as Threatened under Canada's *Species at Risk Act* due to these perceived declines, although the Common Nighthawk was reassessed in April 2018 as Special Concern by the Committee on the Status of Endangered Species in Canada (COSEWIC) and it's status under the *Species at Risk Act* will likely be updated to reflect that reassessment. The Common Poorwill has been assessed as Data Deficient by COSEWIC because sufficient surveys have not been completed.

1.3. How to Survey Nightjars?

Nocturnal roadside citizen science surveys are an ideal method to study nightjars in Canada and contribute to conservation. The nocturnal nature of these birds requires that survey stations must be easily accessible for surveyor safety. Travelling by car allows surveyors to travel quickly between stations that are far enough apart to ensure that birds are not counted twice. Citizen science surveyors allow for survey coverage of large geographic areas, which is important because nightjars are found across Canada. Data collected by citizen scientists during nocturnal roadside surveys will allow for analyses of habitat associations, long-term population monitoring, distribution and abundance mapping, and environmental assessment of these cryptic birds. Lastly, citizen scientists contribute invaluable local knowledge to the project including incidental nightjar reports and information about route accessibility and local habitat.

A Common Poorwill roosts at night. Photo: Alan Burger

1.4. Program Objectives

The goal of the WildResearch Nightjar survey is to contribute to the conservation and recovery of nightjars in Canada. To achieve this goal, the program has several multi-species objectives and one single-species objective per species.

1.4.1. Multi-species Objectives

- Collect baseline inventory data on nightjar populations in Canada.
- Determine best survey methods for nightjars in Canada and compare to other existing monitoring programs.

- Raise awareness on nightjar conservation and biology in Canada.

1.4.2. Single-species Objectives

- **Common Nighthawk:** investigate habitat associations in Canada.
- **Common Poorwill:** determine the extent of the species range in British Columbia, Alberta, and Saskatchewan.
- **Eastern Whip-poor-will:** determine the extent of the potential range contraction in Saskatchewan, Manitoba, Ontario and the Maritimes.

1.5. Program Background

The WildResearch Nightjar Survey began in south central British Columbia in 2010 and expanded to the rest of the province in 2014. The first four years of the program were conducted in the Okanagan region to target an area where Common Nighthawk and Common Poorwill are abundant. Surveys collected from 2010 to 2013 followed a standardized survey protocol designed by the Nightjar Survey Network in the United States. In 2014, the program was expanded to survey for the Common Nighthawk across their range in British Columbia. Also in 2014, the BC Nightjar Survey protocol was revised to create separate protocols reflecting the two species varying ranges and life histories. Surveys across British Columbia continued in 2015, with several trial surveys also conducted in Alberta and Saskatchewan. There was a major expansion of the WildResearch Nightjar Survey in 2016 as the survey officially launched in 5 new regions: Alberta, Saskatchewan, New Brunswick, the Yukon, and the Northwest Territories. The expansion was made possible by two major accomplishments. First, the Nightjar Atlas was introduced, hosted by the Community Mapping Network, and allowed for automated route sign-up to ease the workload of volunteer coordination. Second, a new standardized Canada Nightjar Survey Protocol ensured that all citizen science nightjar surveyors across the country would follow the same survey methods. In 2018, we continued to expand. We launched another region in Ontario at the heart of the Eastern Whip-poor-will range, and we renamed the New Brunswick region as the Maritimes region with the inclusion of Prince Edward Island and Nova Scotia.

2. WILDRESEARCH NIGHTJAR SURVEY METHODS

2.1. Survey Protocol

Roadside surveys, beginning at dusk, are used to survey Canada's three nightjar species. Each survey route is a series of 12 survey stations along a public road, which are spaced at least 1.6 km apart. At each survey station, a six-minute passive point count is conducted with an unlimited radius. In other words, the citizen scientist listens quietly for six minutes and records each nightjar detected. Information on wind speed, cloud cover, cars passing, and moon visibility is also collected at each survey station. Each route is sampled once a year between June 15 and July 15. In areas where Common Poorwills or Eastern Whip-poor-wills occur, volunteers are encouraged to survey within one week of the full moon when these birds call most frequently. Surveys start at 30 minutes before sunset and require approximately 2 hours to complete.

For further details, please visit the WildResearch website for copies of the Canadian Nightjar Survey Protocol (both English and French): http://wildresearch.ca/resources/nightjar-survey/

2.2.Survey Locations

Per the Canadian Nightjar Survey Protocol, the WildResearch Nightjar Survey uses Breeding Bird Survey (BBS) routes because these routes are randomly selected and will allow us to compare the Canadian Nightjar Survey Protocol to the BBS for long-term trend monitoring. The WildResearch Nightjar Survey also incorporates survey routes from other previous nightjar surveys, randomly selected routes in British Columbia that were established earlier in the program's history, some subjectively placed routes based on the occurrence of nightjars, and some routes in locations where Eastern Whip-poor-will have been historically detected.

3. SUMMARY OF 2018

The WildResearch Nightjar survey program expanded once again in 2018! We launched a new chapter in Ontario and welcomed with it many new volunteers and a new regional coordinator. In addition, the New Brunswick region was transformed to the Maritimes Region with the introduction of available routes in both Nova Scotia and Prince Edward Island. Citizen science survey monitoring of nightjars had occurred previously in Nova Scotia in 2016 when the Canadian Wildlife Service (CWS) got the ball rolling but 2018 was the first year the surveys took place in Nova Scotia under the coordination of WildResearch. The surveys continued in the 6 previously established regions across Canada: Alberta, British Columbia, New Brunswick, Northwest Territories, Saskatchewan, and the Yukon. The program welcomed many returning and new volunteers. Behind the scenes, the Nightjar Atlas development team continued to implement the lessons learned in previous years and made further improvements to the data entry portal. Lastly, we made progress towards satisfying our multi-species objective of determining best monitoring methods for nightjars and by comparing our protocols to other existing survey programs. We compared the WildResearch Nightjar Survey to the Breeding Bird Survey (BBS) for trend monitoring and habitat modelling and presented our results in the citizen science symposium at the 2018 International Ornithological Congress in Vancouver (see Section 4).

3.1.Volunteer Effort

In 2018, citizen scientists surveyed and submitted data for 150 routes (Table 1). Surveys were completed by 106 volunteers and 96 assistants, for a total of 202 volunteers in 2018! In total, volunteers contributed over 300 survey hours in addition to time required to reconnaissance routes and complete data entry for a total of over 800 volunteer hours.

Table 1. *Number of WildResearch Nightjar Survey routes, stations and observers per year since 2010.*

	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Routes surveyed	3	3	16	29	141	154	192	146	**150**	**834**
Stations surveyed	19	33	156	301	1,716	1,837	2,066	1,681	**1,692**	**9,501**
Observers	2	2	10	20	73	99	139	103	**106**	**554**

The number of routes surveyed in 2018 was similar to the year prior. Across Canada, there were 18 surveys conducted in Alberta, 73 in British Columbia, 8 in Saskatchewan, 15 in Ontario, 15 in the Yukon, 4 in the Northwest Territories, 11 in New Brunswick, 6 in Nova Scotia and 0 on Prince Edward Island. When compared to 2017, every province had a reduction in surveys conducted, except British Columbia and the new provincial regions (Ontario and Nova Scotia). The reduction in surveys in most regions may have been due to the removal of routes, particularly in regions with fewer route options due to limited road networks, and the absence of a paid intern to boost survey numbers and help with volunteer recruitment.

3.2. Common Nighthawk

Common Nighthawks were detected at 103 of the 150 routes surveyed (69%), and at 419 of the 1,692 stations surveyed (25%). In total, 803 Common Nighthawks were detected in 2018. The mean number of Common Nighthawks per station was 0.47 across all stations and 1.92 at stations where they were detected (Figure 1).

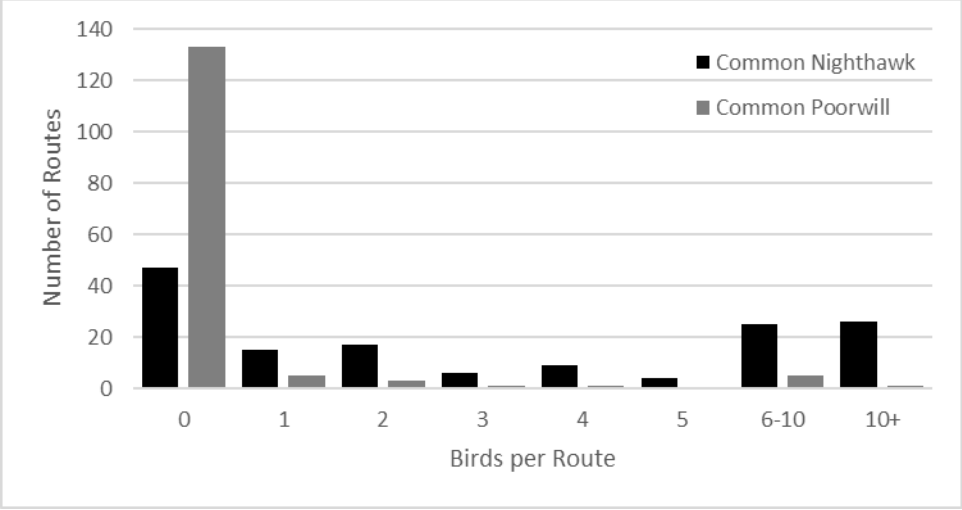

Figure 1. *Frequency of mean number of nightjars detected per survey route in 2018.*

Common Nighthawks were detected across all regions surveyed in 2018 (Figure 2). The highest number of nighthawks per station and route was 13 on southern Vancouver Island near Saanich. The highest number of nighthawks per route was 61 near McClelland Lake, AB. Relatively high abundances of Common Nighthawks continue to be detected along routes on

Vancouver Island, in southcentral British Columbia, in both the Yukon and the Northwest Territories, and in southwestern Saskatchewan. New in 2018 for the WildResearch Nightjar survey program was the moderate detections of Common Nighthawks in central Nova Scotia.

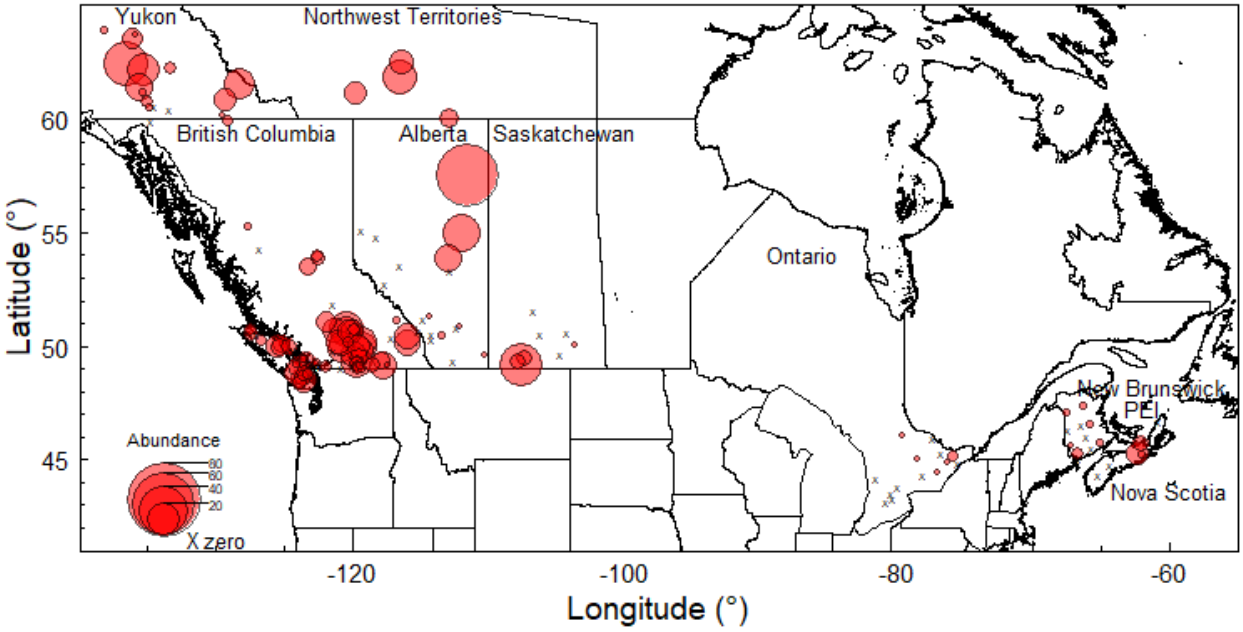

Figure 2. *Abundance of Common Nighthawks detected per route surveyed in 2018.*

A female Common Nighthawk incubates her eggs in northern Alberta. Photo: Elly Knight

3.3.Common Poorwill

In total, 70 Common Poorwills were detected in 2018. The mean number of Common Poorwills per station was 1.5 at stations where they were detected (Figure 1). The maximum number of Common Poorwills detected at a station was 4, in south central British Columbia near Oliver (Figure 4). True to their range, Common Poorwills were detected in central British Columbia, southeastern Alberta and southwestern Saskatchewan in 2018 (Figure 3). As in previous years, citizen scientists recorded particularly high abundances of Common Poorwills in the southernmost area of central British Columbia (Okanagan Valley). The Common Poorwill detected in Alberta, on the Thelma route, was a first for the province in the WildResearch Nightjar survey program.

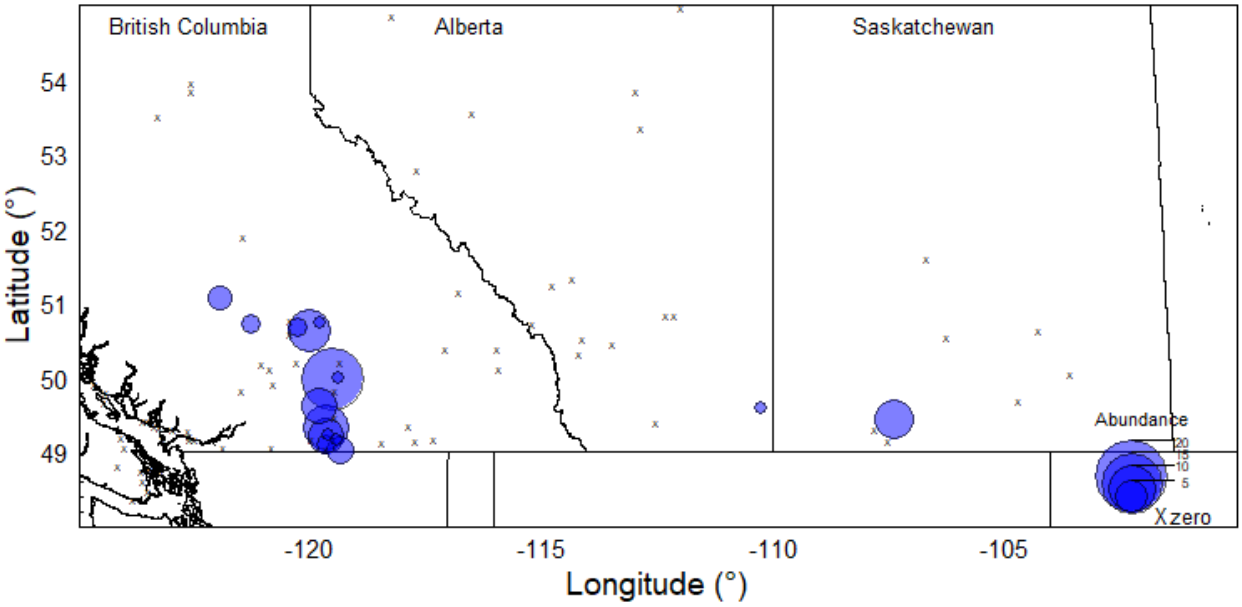

Figure 3. *Abundance of Common Poorwills detected per route surveyed in 2018.*

3.4.Eastern Whip-poor-will

Twenty-one Eastern Whip-poor-wills were detected during the 2018 WildResearch Nightjar Survey. The highest number of Eastern Whip-poor-wills per station was 3 near Kemptville, ON and Ashdad, ON. The highest number of Eastern Whip-poor-wills per route was 15 also near Ashdad, ON (Figure 4). Eastern Whip-poor-wills were primarily detected in Southeastern Ontario, approaching their known northern range at the Quebec border. There was also one Eastern Whip-poor-will detection in Nova Scotia, which is considered an uncommon detection.

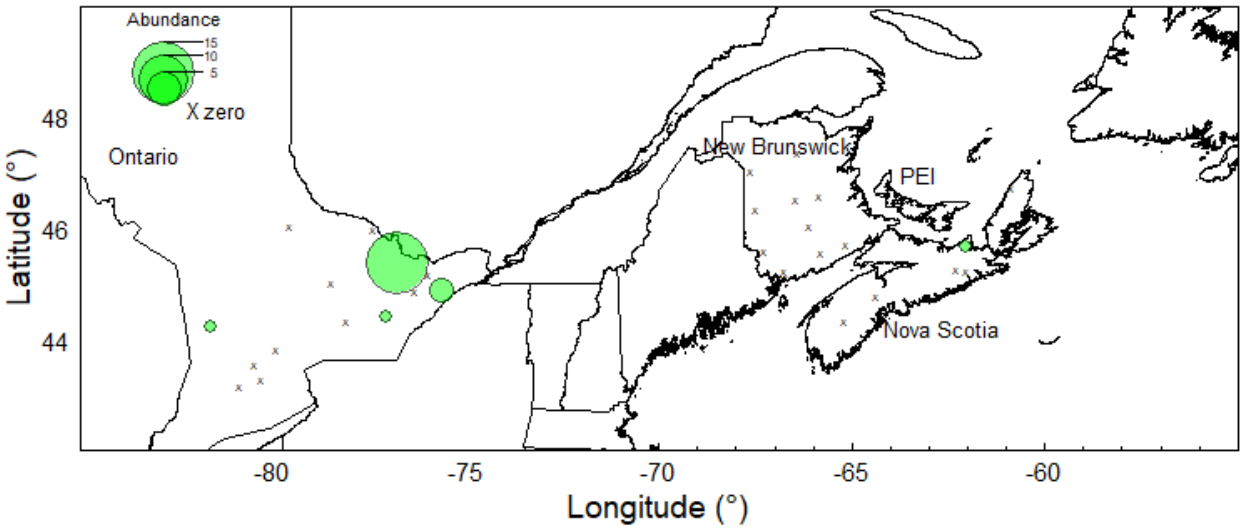

Figure 4. Abundance of Eastern Whip-poor-will detected per route surveyed in 2018.

3.5.Regional Updates

3.5.1. British Columbia

By Paul Preston, British Columbia Regional Coordinator

This year, the WildResearch Nightjar Survey in British Columbia covered 74 routes, a few more than last year. As per usual, we had many volunteers in the Southwest of the province as well as in the Okanagan and Thompson regions however this year we had a few more in central and northern BC than in previous years which is excellent! Of those 74 routes that were surveyed this year, 60 of them picked up Common Nighthawks and 14 of them also detected Common Poorwills. Both of these numbers are higher than last year! We communicated with many amazing volunteers who were all very excited about the surveys this year. We did not run any orientations in this season in BC. However, this year I did a presentation about Nightjars at the Museum of Vancouver for their Wild Things exhibit which lead to some very interesting discussions with local nightjar enthusiasts which was great! Thank you to all the very enthusiastic and patient volunteers this year. I look forward to next summer and in the meantime, happy birding!

3.5.2.Alberta

By Elly Knight, Alberta Regional Coordinator

Huge thanks to all the nightjar surveyors in Alberta this year! We surveyed 18 routes across the province this year, from north of Ft. McMurray and Peace River to south of Lethbridge. Common Nighthawks were detected at 10 of those routes. Alberta continues to hold the record for highest number of Common Nighthawks detected – 61 individuals were detected on a single route north of Fort McMurray! Surveys in other areas of northeastern Alberta suggest that Common Nighthawk populations are particularly abundant in boreal areas that have sandy soils and jack pine forest. Common Nighthawks were also detected in the southern areas of the province, but always as single birds. As for our other nightjar species,

this was the first year a Common Poorwill was detected in Alberta! One individual was heard calling in the south eastern corner of the province in the Cypress Hills, where Common Poorwills are known to breed.

3.5.3. Saskatchewan

By Gabriel Foley, Saskatchewan Regional Coordinator

In 2018, eight volunteers surveyed eight routes in Saskatchewan. Of the routes surveyed, half had nightjars detected on them with a total of 44 nighthawks and 7 poorwills. Routes had an average of 6.4 nightjars detected per survey. Grasslands West had the most detections with 31 nighthawks, Mankota and Newton Lake each had 6, and Tyvan had one nighthawk. A huge thanks to all of the hard-working volunteers who collected these data – this project would be impossible without you. Thanks as well to Shayna Hamilton for coordinating the Saskatchewan region for the last two years! Shayna did a fantastic job and is moving on to graduate school, and so I (Gabriel) have returned to the Coordinator position. I look forward to working with the Saskatchewan volunteers again!

The sun sets in Saskatchewan's Cypress Hills, where Common Nighthawks and Common Poorwills can both be found. Photo: Elly Knight

3.5.4. Yukon

By Andrea Sidler, Yukon Regional Coordinator

We had a successful third year of surveying for Common Nighthawks in the Yukon. A big thank you goes out to all the dedicated volunteers who ran, and re-ran routes, during this blustery summer to collect data and make this survey season happen.

This year, 8 people surveyed 16 routes and detected a total of 119 Common Nighthawks – 31 more than in 2017!! Nighthawks were detected on 13 of the 16 routes throughout the territory, suggesting that Nighthawks are using a variety of different kinds of habitat. Overall, 52 birds were detected performing repeat wing booms indicating that there is considerable breeding activity occurring in the Yukon's boreal forest. The McGregor Creek route had the highest number of total detections with 32 birds, and the Little Salmon River route had the highest percentage of repeat wing-booming males (79%). This year, there were also four 'urban' Nighthawks detected on the survey route running through Whitehorse (Miles Canyon to Porter Creek). Two individuals were observed above the Yukon River, weaving in and out, through a flock of 60 gulls.

Alongside the peents and booms, surveyors enjoyed spectacular sunsets, and this year in particular, were captivated by the beautifully haunting notes of singing Hermit Thrush. Thank you again to all of our fantastic volunteers. We appreciate all you do - we really couldn't run this program without all of your efforts! As well, thanks to the Whitehorse Canadian Wildlife Service office for contributing their data to this project. Looking forward to another great season in 2019!

3.5.5. Maritimes

By Virginia & Alex Noble-Dalton, Maritimes Regional Coordinators

The 2018 WildResearch Nightjar Survey season was an exciting transition year for the Maritimes Region. This year, the WildResearch Nightjar survey expanded to have routes available in all three of the Canadian Maritimes provinces: New Brunswick, Nova Scotia and Prince Edward Island. The survey protocol also removed some available routes in New Brunswick which had no nightjars detected for two consecutive years. It was fantastic to undertake the third season of the WildResearch Nightjar Survey in New Brunswick, and to continue to see the support and enthusiasm for this survey program growing in the province. 2018, was the first year the surveys took place in Nova Scotia under the coordination of WildResearch; but was the second season for citizen science survey monitoring of nightjars as the Canadian Wildlife Service (CWS) got the ball rolling in 2016. It was amazing to have a mix of returning and new surveyors in Nova Scotia. This past year was truly the inaugural survey season for Prince Edward Island and we can't wait to see what data comes from the Island!

Overall, a total of 17 survey routes were surveyed in the Maritimes in 2018 (with interest in an additional 6 routes). 13 of these survey routes were also surveyed during a previous survey season (9 in New Brunswick and 4 in Nova Scotia), and thus it is exciting to see the time series for these routes beginning. In 2018, 5 routes in New Brunswick were removed from the pool of available routes after having no nightjars detected during the previous two consecutive years. Excitingly, survey coverage occurred throughout the entirety of Nova

Scotia and almost the entirety of New Brunswick. During the surveys, a total of 36 Common Nighthawks were observed, 8 of which was recorded to be wing booming. One Eastern Whip-poor-will was also detected; this was the first observation submitted for the species in Nova Scotia (near Antigonish) during the WildResearch Nightjar Survey. The highest occurrences of Common Nighthawks was on the Trafalgar, NS route, with fourteen individuals. The surveys also recorded two occurrences of Barred Owls and one Great Horned Owl juvenile begging. We look forward to continuing to build on the success of the survey season for next year's WildResearch Nightjar Survey. We are excited that the survey protocol was translated to French, which will aid in getting further involvement of the largely francophone population of Northern New Brunswick. A big thank you goes out to the Maritimes Naturalist clubs and all who helped us advertise the program.

Thank you again to all who volunteered your time to participate in this survey program, without you this valuable data wouldn't be collected and there wouldn't be a survey program at all.

3.5.6. Northwest Territories

By Rhiannon Pankratz, Northwest Territories Regional Coordinator

The 2018 Nightjar Survey was a great success in the Northwest Territories! First off, thank you to three surveyors who counted a total of 52 individual Common Nighthawks across four routes. Approximately 72% of sites had at least one Common Nighthawk. Thirteen sites had more than one Common Nighthawk with one site having a total of four birds! Detections ranged from eight to 22 birds across the four routes, meaning all routes surveyed had Common Nighthawk.

3.5.7. Ontario

By Elora Grahame, Ontario Regional Coordinator

It was the first year of WildResearch Nightjar Surveys in Ontario, and I'm incredibly grateful to the volunteers who helped get the chapter off to such a strong start. Fifteen routes were surveyed in 2018, and nightjars were detected at nine of those routes. Ontario volunteers counted 7 Common Nighthawks and 20 Eastern Whip-poor-wills, providing invaluable data for birds that are all too often missing from Breeding Bird Surveys and eBird checklists. Though several of the adopted routes yielded no nightjar detections, the absence of nightjars from these locations provided us with important data, and I'm especially thankful to the volunteers who surveyed these routes despite knowing that the chances of a nightjar detection were slim. This year, the Ontario chapter hopes to recruit more volunteers and expand the number of routes covered. Will 2019 be the year an Ontario volunteer becomes the first to record a Chuck-will's-widow (*Antrostomus carolinensis*) for the WildResearch Nightjar Survey database? I can't wait to find out!

3.6. Citizen Science Spotlight

By Dr. Nora Fortune, 2018 Ontario WildResearch Nightjar Survey Citizen Scientist

Sunset during WildResearch Nightjar Survey in Haliburton County, ON. Photo Credit: Dr. Nora Fortune

The mesmerizing call of the Whip-poor-will transports me to the warm summer nights of childhood spent at our family cottage near Bancroft, ON. For my husband, Brian, it's the recollection of the persistent and annoyingly repetitive calls from the roof of his cottage in the Kawarthas while he tried to sleep.

As the years have gone by, each of us has noticed that we no longer hear these amazing birds in their old habitats. We have been saddened by this loss, but the opportunity to do something about it has brought some comfort. Our daughter and son in-law suggested that we get involved with the WildResearch Nightjar Survey in our area. This allowed us to use our love of science and nature to fulfill our Veterinary Oath to protect the environment.
We volunteered to spend a couple of summer evenings listening for the calls of Nighthawks and Whip-poor-wills along a route in Haliburton County, ON. Starting in an urban setting we heard the sounds of voices, cars, music and the din of a busy Saturday night. As the evening progressed and the stops became more remote, the sounds were clearer. The noise from multitudes of bird calls, insects, frogs and the occasional passing car faded with the light. Each stop was a six minute meditation of listening and observing; an opportunity just to be still and quiet.

We saw other wildlife as we stood silently on the side of the road. A white tailed deer approached us out of the twilight and a black bear crossed the road in front of our car. The two nights spent on the side of the road were more rewarding than we had imagined they would be. We both experienced the summer evening in a new way and we did hear one Common Nighthawk. We are looking forward to participating in the WildResearch Nightjar Survey next year and we will be listening for the elusive Eastern Whip-poor-will again.

4. BETTER TOGETHER: NIGHTJAR SURVEYS HELP IMPROVE TREND ESTIMATES & HABITAT MODELS

By Elly Knight, Program Manager

4.1. Background

One of the multi-species objectives for the WildResearch Nightjar Survey is to "determine best survey methods for nightjars in Canada and compare to other existing monitoring programs." In other words, we know that surveying for nightjars is probably best done at night (it's in their name after all), but *how* much better is it? And is it really necessary?

Well this year, we set out to answer those questions by partnering with Adam Smith at Environment and Climate Change Canada to compare how the WildResearch Nightjar Survey and the Breeding Bird Survey (BBS) stack up. The BBS is North America's primary source of population monitoring data for most bird species. The BBS and the WildResearch Nightjar Survey are very similar–they use the same route network and have similar survey methods. The main difference is timing! The BBS starts at a half hour before sunrise, while the WildResearch Nightjar Survey starts at a half hour before sunset.

Why might timing be everything? Because nightjars aren't detectable at all times of day! When we survey for birds and analyze the data, we have to keep in mind availability for detection. In other words, a species might be present during a survey, but aren't reported because they aren't seen or heard. These false negative detections can have substantial implications for the results of trend and habitat analyses. There are a variety of statistical approaches that can be used to account for imperfect detection, but not if detectability is extremely low.

We thus set out to investigate the suitability of the WildResearch Nightjar Survey and the BBS for conservation management of nightjars. First, we investigated the probability of observation relative to the survey timing of both programs. Next, we simulated population declines and used BBS-style trend analyses to determine the probability of detecting a negative population decline for each survey program. We then used data from both programs to determine suitability for habitat modelling by constructing probability of occurrence maps and assessing their predictive ability. Finally, we explored the potential for the survey programs to complement each other by simulating trend estimation and predicting probability of occurrence using the two datasets combined.

4.2.Methods

4.2.1.Data Availability

We used all data available for both programs from 1997-2018. First, we tallied the number of detections within the two programs for Canada's three nightjar species. For each species, we used only routes within the breeding range and totaled the number of survey stops and routes that the species was detected on. Based on these totals, we decided to use the Common Nighthawk for subsequent analyses because it was the only nightjar species for which there were sufficient detections in both datasets. We subsequently defined the study area for all subsequent analyses as the provinces and territories of western Canada where we had spatially continuous data for both programs (Figure 5).

4.2.2.Survey Timing

Next, we analyzed survey timing. We used mixed effects logistic regression to model the probability that a nightjar was detected on any given survey, with route number as a random effect of intercept. We included time relative to sunrise as a third order polynomial as a predictor in the analysis and time relative to sunset as a second order polynomial in the targeted analysis. We similarly included day of year as a second order polynomial in both analyses. We selected the most parsimonious model using Akaike's information criterion for small sample sizes (AICc).

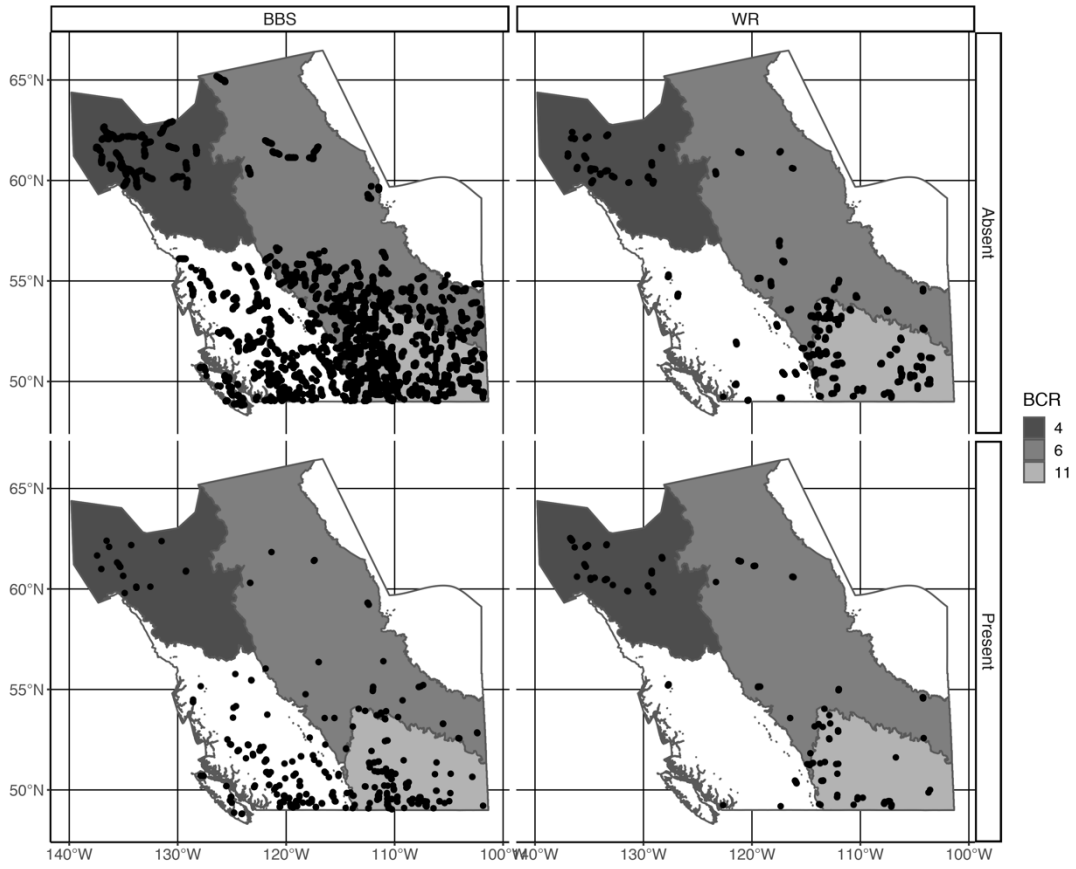

Figure 5. *Study area and data used for comparison of the Breeding Bird Survey (BBS) and the WildResearch Nightjar Survey (WR). Bottom panels show survey stops where Common Nighthawks were detected (Present) and top panels show survey stops where Common Nighthawks were not detected (Absent). White areas indicate areas outside the Bird Conservation Areas (BCRs) included in the habitat analyses.*

4.2.3. Trend Detection

We then investigated program suitability for trend monitoring. We used simulation to estimate the probability of detecting a 30% Common Nighthawk population decline over a period of 10 years. We parameterized the simulation using the real data from both programs, and generated 1000 stochastic simulated survey data sets for each program. We then used BBS-style models to estimate the population trend of each data set, resulting in 1000 population trend estimates for each program. We also investigated whether the two programs combined could improve trend estimates by simulating 1000 population trend estimates for both programs combined.

4.2.4. Habitat Modelling

Finally, we used data from both programs, as well as the two programs combined to create Common Nighthawk habitat models. We created probability of occurrence maps for three bird conservation regions (BCRs) within the study area (BCR 4, 6, 11) at varying latitudes.

We used mixed effects logistic regression to model probability of occurrence with route number as an intercept random effect. We included the results of the survey timing analysis as an offset to account for differences in probability of detection. We used a variety of vegetation, climate, and geographic variables as predictor variables. We trained models including all *a priori* predictors with 70% of the data, and then tested the predictive ability of the model with the withheld 30% data. We then repeated the model training and testing process 100 times for each BCR model to estimate predictive ability and variation in the predictive maps.

4.3.Results

4.3.1.Data Availability

Nightjars were detected 44 (Eastern Whip-poor-will) to 280 (Common Poorwill) times more often at targeted survey stops than at breeding bird survey stops (Table 2). At the route level, nightjars were detected 2.7 (Eastern Whip-poor-will) to 270 (Common Poorwill) times more often on the targeted than on the breeding bird survey; however, the breeding bird survey had more survey stops per route (50) than the targeted survey (12).

Table 2. *Number of stops and routes surveyed by the Breeding Bird Survey (BBS), and the WildResearch Nightjar Survey (WR) and the number of stops and routes at which each species was detected.*

Species	BBS Stops Surveyed	BBS Stops Detected	BBS Routes Surveyed	BBS Routes Detected	WR Stops Surveyed	WR Stops Detected	WR Routes Surveyed	WR Routes Detected
CONI	423,559	953	4,583	607	2,925	402	259	125
COPO	13,618	3	313	3	124	7	11	3
EWPW	178,191	114	2,661	89	541	13	49	5

4.3.2.Survey Timing

The probability of observing a Common Nighthawk on the BBS was strongly related to time relative to sunrise, with probability dropping to zero at approximately the start of the survey at sunrise (Figure 6). BBS surveys that were conducted further south had a high probability of observing a Common Nighthawk during the survey period. The probability of observing a Common Nighthawk on the WildResearch Nightjar Survey was also strongly related to time relative to sunset; however, the probability of observation was highest during the standard survey period, suggesting that the program does maximize detectability for this species. The probability of observing a Common Nighthawk was related to day of year on the BBS, but not on the WildResearch Nightjar Survey.

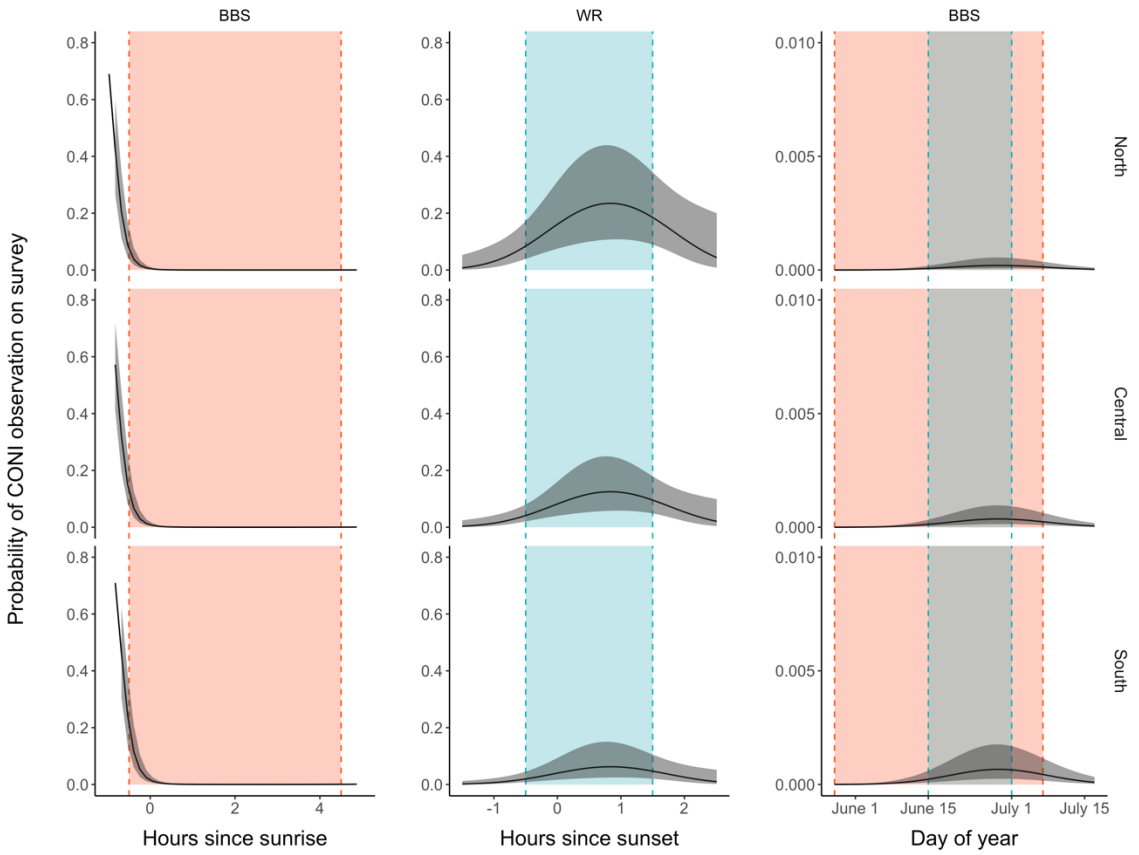

Figure 6. *Temporal predictors of the probability of Common Nighthawk observation on the Breeding Bird Survey (BBS) and WildResearch Nightjar Survey (WR) at varying latitudes (south = 50 °N, central = 55 °N, north = 60 °N). Shaded portion of each figure indicates the typical survey period for that survey program.*

4.3.3. Trend Detection

The population trend estimates from the BBS, WildResearch Nightjar Survey, and the two programs combined had similar bias; however, the variation (standard error) of the population estimates was almost twice as large for the BBS (Figure 7). The number of trend estimates that significantly detected the simulated 30% population decline was approximately 5% for the BBS, but was greater than 40% for the WildResearch Nightjar Survey. The probability of significantly detecting the simulated decline was highest when the two programs were combined (~45%).

4.3.1. Habitat Modelling

The probability of occurrence predictions were higher from WildResearch Nightjar Survey data were higher than from BBS data in all three BCRs (Figure 8). The average predictions were similar between the three model sets for BCR 6 and 11. The predictive capacity (measured as the area under the curve of a receiver operating characteristic, or ROC AUC), was also similar between all three model sets for BCRs 6 and 11 (Figure 9). The predictions for BCR 4 from the WildResearch Nightjar Survey and the combined model were more northerly than the predictions from the BBS. As a result, the predictive capacity was higher

for the WildResearch Nightjar Survey and the combined model than for the BBS model. In general, the combined models performed best across the three BCRs.

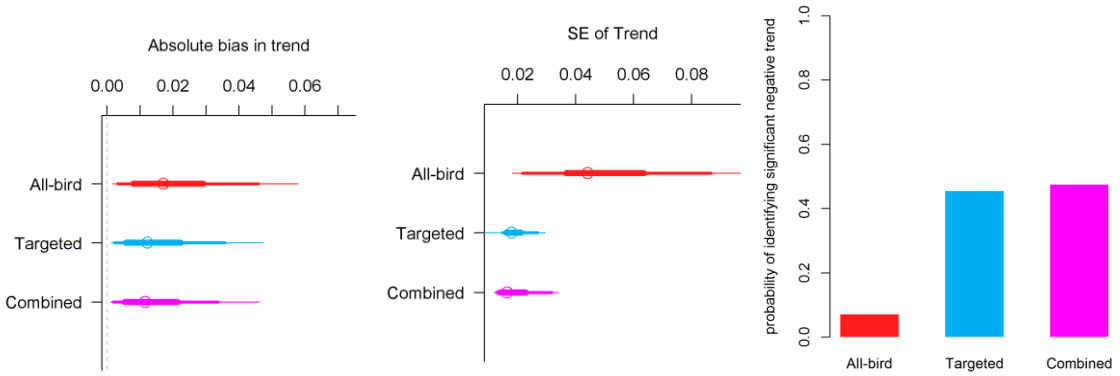

Figure 7. *Bias, standard error, and probability of detecting a significant decline from 1000 Common Nighthawk population trend estimates relative to the simulated population trend of 30% population decline over 10 years.*

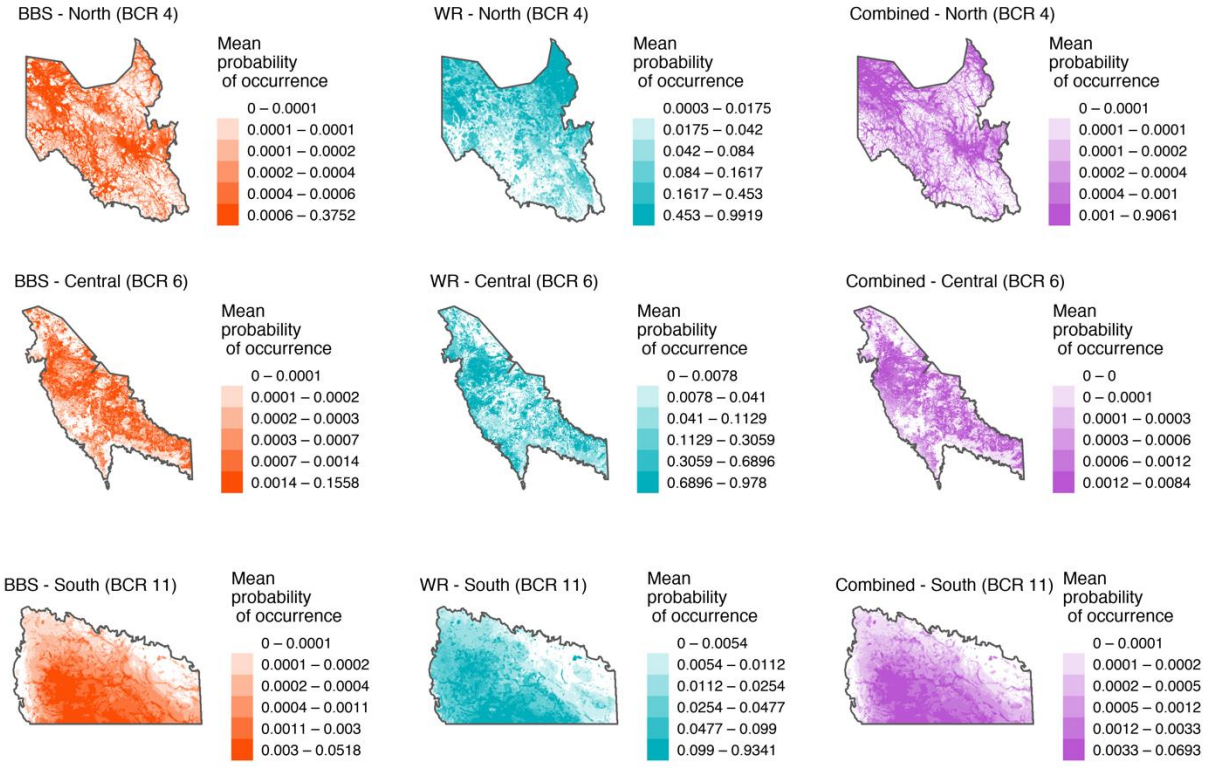

Figure 8. *Common Nighthawk probability of occurrence from habitat models built for three bird conservation regions (BCRs) from Breeding Bird Survey (WR) data, WildResearch Nightjar Survey (WR), and the two datasets combined. Probability of occurrence was calculated as the mean of models built from 100 bootstraps of training and testing data.*

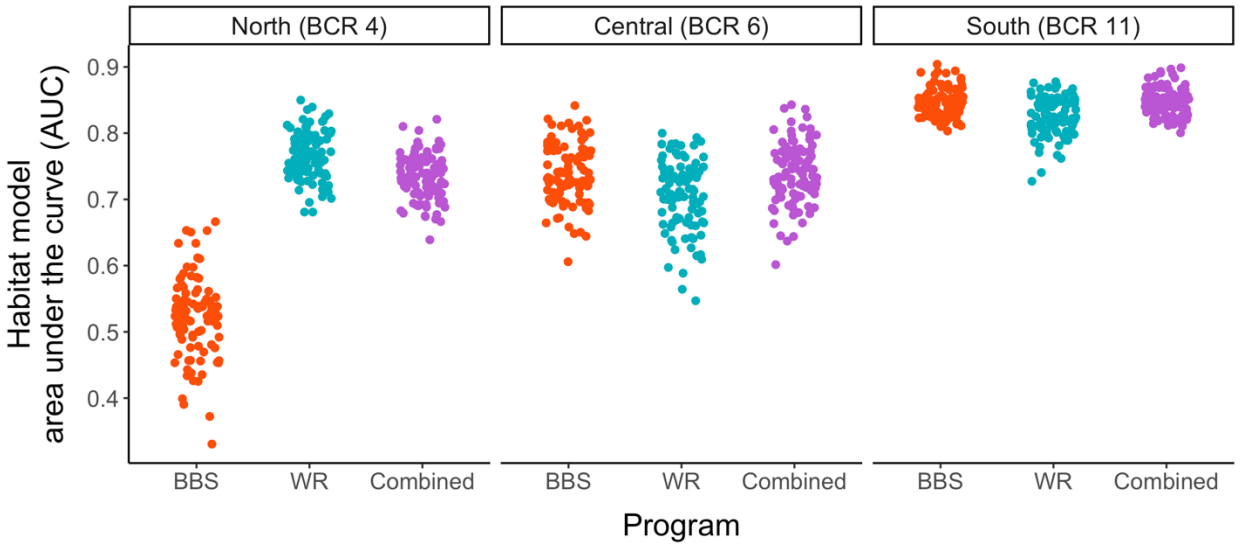

Figure 9. *Area under the curve of the receiver operating characteristic for 100 probability of occurrence models built for three bird conservation regions (BCRs) from Breeding Bird Survey (WR) data, WildResearch Nightjar Survey (WR), and the two datasets combined*

4.4.Discussion

The Breeding Bird Survey (BBS) dataset performed the worst, with a very low probability (5%) of detecting a significant population decline of 30%, and a lower predictive capacity for habitat models in BCR 4. The BBS likely performed poorly because probability of observing a Common Nighthawk on a BBS survey drops to nearly zero at approximately the start of the survey. The probability of observation dropped to zero earlier the further north the survey is conducted, which explains the poor predictive performance of BBS data for BCR 4 in the Yukon. What the BBS lacks in probability of observation, it makes up for in sheer dataset size, which resulted in reasonably predictive models for BCR 6 and 11. In contrast, the WildResearch Nightjar Survey dataset was reasonably small, but the survey period was approximately centered over the time of day when probability of observation was highest. The combined models had the highest probability (45%) of detecting a significant 30% population decline over 10 years. The combined dataset also resulted in habitat models that had higher predictive capacity across the three bird conservation regions (BCRs) that we habitat modelled. We conclude that overall, the models that combined BBS and WildResearch Nightjar Survey data performed best, and that the two programs are best together.

5. OTHER ACCOMPLISHMENTS IN 2018

5.1.Route Assessment

Following the Canadian Nightjar Survey Protocol, survey routes are reassessed every year to transition the program from habitat objectives to long-term monitoring objectives. Routes that have been surveyed for two years without a nightjar detection are removed from the

regular list of available routes to a "zero" route list. These zero routes will be made available again every five years to ensure monitoring is capable of documenting range expansions. 2017 was the first year of survey route assessment. Prior to the 2018 season, a total of 17 routes were removed from the pool of available routes with highest number occurring in Alberta (6) but affecting 4 different regions (Table 3). Survey route assessment took place again following the 2018 season and another 10 routes will be removed from the pool of available routes for 2019 with highest number occurring again in Alberta (5).

Table 3. *Number of WildResearch Nightjar Survey routes removed from the pool of available routes.*

	AB	BC	MB	NB	NS	NWT	PE	SK	YT	Total
2017	6	0	NA	5	NA	0	NA	3	**3**	**17**
2018	5	2	NA	0	2	0	NA	1	**0**	**10**

5.2.Appreciation Project

We always send our volunteers a little token of appreciation, and the 2018 survey season will be no exception! But we've got something special up our sleeves this year, courtesy of our Ontario coordinator and artist extraordinaire, Elora Grahame. Make sure to watch your mailbox for this special surprise!

6. FUTURE PLANS

In the long-term, we will continue working towards our multi-species and single-species objectives. We will continue to encourage the use of our data by students and researchers across Canada and continue to communicate our findings with stakeholders and the public.

6.1. New Manitoba Chapter

We are super excited to announce the expansion of the WildResearch Nightjar Program with the introduction of a Manitoba chapter for 2019! The COSEWIC assessment of the Common Nighthawk noted that "the species is still relatively abundant and widely distributed throughout the province". However, visual counts occurring in the Pinawa area suggested that between 1976-1981 and 1992-1997 the species decreased by 75% but did see an increase in during the 2000-2005 period (COSEWIC 2007).

The launch of the Manitoba chapter is made possible thanks to our new Regional Coordinator, Alicia Korpach! Alicia is a graduate student in the Avian Behaviour and Conservation (Fraser) Lab at the University of Manitoba, studying the influence of artificial light on the spatiotemporal patterns of migrating Eastern Whip-

poor-wills. With a background in avian field research, conservation planning, and geographic information science, Alicia is combining her interests and skills to track the movements of these elusive and understudied birds. She also feels lucky that many of her whip-poor-will field sites in Manitoba are located near productive Saskatoon berry-picking spots! Originally from Saskatchewan, Alicia has lived and worked in the Northwest Territories and BC. Alicia is looking forward to helping to build the Nightjar Survey Program in her new home province of Manitoba.