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Natural Resource Stewardship and Science

North Coast and Cascades Network Landbird Monitoring

Report for the 2020 Field Season

Natural Resource Data Series NPS/NCCN/NRDS—20211337

ON THIS PAGE
2020 crew members Fanter Lane and Kelsey Bellavance at Olympic National Park
Photograph taken by: Mandy Holmgren, The Institute for Bird Populations

ON THE COVER
Common Raven (*Corvus Corax)*, North Cascades National Park
Photograph taken by: Kelsey Bellavance, The Institute for Bird Populations

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Natural Resource Data Series NPS/NCCN/NRDS—2021/1337

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November 2021

U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science
Fort Collins, Colorado

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Please cite this publication as:

Holmgren, A. L., R. L. Wilkerson, R. B. Siegel, and J. I. Ransom. 2021. North Coast and Cascades Network landbird monitoring: Report for the 2020 field season. Natural Resource Data Series NPS/NCCN/NRDS—2021/1337. National Park Service, Fort Collins, Colorado. https://doi.org/10.36967/nrr-2288211.

NPS 105/177824, 149/177824, 168/177824, November 2021

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Executive Summary

In 2020 the North Coast and Cascades Network (NCCN) continued to implement the Network's Landbird Monitoring Protocol, in partnership with The Institute for Bird Populations. The protocol was initially field-tested with data collected from the annual panel only, as part of protocol development during 2005–2006, and has subsequently been implemented fully (including data collection on the annual panel as well as all of the five alternating panels) for the past 13 years (2007–2020), except for 2017 when data collection was temporarily suspended to reallocate resources for a 5-year data synthesis. In 2020 we conducted 1,180 point counts at point count survey stations along 68 transects in the large wilderness parks of the NCCN, including Mount Rainier National Park (MORA), North Cascades National Park Complex (NOCA), and Olympic National Park (OLYM).

Across the three large parks, we documented the presence of 130 species and two hybrids, 96 of which were detected during point counts. For 57 species (all species for which we amassed at least 84 point count detections over the period 2005–2020), we present the total number of detections of each species on each park's annual panel transects during the 2005–2020 field seasons. We caution, however, that these detection totals have not been adjusted for differences in survey effort, observer effects, or potential differences in detectability of birds between years; such adjustments will be made in conjunction with trend analyses in a future multi-year report.

In the summer of 2020, we were scheduled to survey the grid at SAJH. However, we decided to drop the surveys there because of the COVID-19-related safety risks of traveling to an island when there were still stringent statewide rules about traveling during that phase of the pandemic.

The number of bird detections on annual-panel transects across all three large parks decreased by 401 between 2019 and 2020, though the magnitude of the change in detections varied substantially among the parks. At NOCA there was an increase of 225 detections on annual-panel transects, though when factoring in the increase in point counts conducted in 2020, the average number of birds per count actually decreased slightly (5%) from 2019. At both MORA and OLYM, detections decreased between 2019 and 2020. When factoring in the number of point counts conducted each year, both parks saw a substantial decrease in the average number of birds per count (a decline of 24% at MORA and 19% at OLYM).

Many species were nonetheless detected in slightly or moderately greater numbers in the three large parks in 2020 than in previous years. A few of these species include yellow-rumped warbler, Nashville warbler, black-throated gray warbler, warbling vireo, and song sparrow. Each of these species had more detections in 2020 than in any of the previous 14 years. Interpretation of these results will be completed as part of the next multi-year trend analysis, which will account for annual variation in survey effort, observer effects, and detection probability.

Acknowledgments

We thank the 2020 crew members for their hard work and dedication to the project: K. Bellavance, M. Kropp, F. Lane, Q. McMahon, and K. Ray. We thank K. Jenkins (FRESC Olympic Field Station) and the entire NCCN Landbird Monitoring Group for their contributions toward developing the NCCN Landbird Monitoring Protocol and guiding its implementation. We thank T. Chestnut and P. Happe for providing program oversight at the respective parks; S. Gremel and V. Gempko for help with logistics during the season; and R. Christophersen for boat rides on Ross Lake. We thank K. Braun and N. Antonova for GIS training and support and K. Braun for providing maps for this report; J. Boetsch and K. Bonebrake for extensive help with data management; L. Grace for help with formatting this report to National Park Service standards; R. Mazur, NCCN Inventory and Monitoring Program Manager, for her support of the project; and the ESRI Nonprofit Organization Program for software support provided to The Institute for Bird Populations. This is Contribution No. 710 of The Institute for Bird Populations.

Introduction

Reported declines of many Neotropical migratory bird species and other bird species breeding in North America during the 1990s stimulated interest in avian population trends and mechanisms driving those trends (Robbins et al. 1989, DeSante and George 1994, Peterjohn et al. 1995). Data from the North American Breeding Bird Survey indicate that many landbird populations in Pacific Northwest coniferous forests have been declining during the past several decades (Andelman and Stock 1994a, 1994b, Sharp 1996, Saab and Rich 1997, Altman 1999, 2000, North American Bird Conservation Initiative, U.S. Committee 2009, Sauer et al. 2017).

Threats to bird populations breeding in Pacific Northwest conifer forests include outright habitat loss as well as forest management practices that discourage the development of old-growth conditions (Bolsinger and Waddell 1993). Since European settlement, large tracts of low-elevation coniferous forest have been lost to residential and agricultural development, with the overall extent of old-growth forest reduced by more than half since World War II (Bolsinger and Waddell 1993). Landscapes that have been managed for timber production are now dominated by early- and mid-successional forests (Bunnell et al. 1997), and exhibit increased fragmentation as well as a variety of altered structural characteristics that likely affect bird community composition (Meslow and Wight 1975, Hagar et al. 1995, Bunnell et al. 1997, Altman 1999).

Pacific Northwest landbirds breeding in habitats other than conifer forests face substantial threats as well. Species that breed in the subalpine and alpine zones may be exposed to visitor impacts, ecological changes resulting from alterations of the natural fire regime, and perhaps most importantly, may be among the birds most strongly affected by climate change during the coming decades. Indeed, Oregon-Washington Partners in Flight has explicitly called on the National Park Service to take responsibility for monitoring birds in high-elevation areas throughout the Pacific Northwest (Altman and Bart 2001). Pacific Northwest migratory landbirds also face additional threats on their wintering grounds and along migration routes, including loss or alteration of stopover habitat.

The three large parks in the North Coast and Cascades Network (NCCN)—Olympic National Park (OLYM), North Cascades National Park Service Complex (NOCA), and Mount Rainier National Park (MORA)—range from sea level to nearly 4,400 m and contain huge tracts of late-successional conifer forest on the Olympic Peninsula and the west slope of the Cascades, as well as large areas dominated by subalpine and alpine plant communities. NOCA also contains substantial tracts of more arid conifer forest typical of the east side of the Cascades, which hosts a somewhat distinct avifauna (Altman 2000) compared to other areas in the three large parks. San Juan Island National Historical Park (SAJH), in the rain shadow of the Olympic Mountains, contains small but important examples of coastal prairie and Garry Oak (*Quercus garryana*) woodlands, plant communities that are fairly rare in western Washington (Atkinson and Sharpe 1985) and host unusual bird communities (Lewis and Sharpe 1987, Siegel et al. 2009e). Lewis and Clark National Historical Park (LEWI) contains lowland wetlands as well as coastal and upland forests, and extends our program's area of inference substantially southward. Avian inventory projects assessing park- and/or habitat-

specific abundance of all commonly occurring bird species at all five parks (Siegel et al. 2009e, Siegel et al. 2009a, Siegel et al. 2009d, Wilkerson et al. 2009a, Siegel et al. 2009c), have provided baseline information for assessing changes in bird abundance and distribution over time due to climate change or other factors, as well as reference information for assessing recent trends within the parks and the effects of more intensive land management practices elsewhere in the region (Siegel et al. 2012, Ray et al. 2017a, Ray et al. 2019).

National parks in the NCCN and elsewhere fulfill vital roles as both refuges for bird species dependent on late-successional forest conditions (American Bird Conservation Initiative, U.S. Committee 2011), and as reference sites for assessing the effects of climate change, land use, and land cover changes on bird populations throughout the larger Pacific Northwest region (Silsbee and Peterson 1991, Siegel et al. 2012). Monitoring population trends at reference sites in national parks is especially important because parks are among the sites in the United States where population trends due to large-scale regional or global change patterns are likely least confounded with local changes in land-use (Simons et al. 1999). Additionally, long-term monitoring of landbirds throughout the NCCN provides information valuable for decision-making about important management issues in the parks, including visitor impacts, fire management, and the effects of introduced species.

The specific objectives of the NCCN Landbird Monitoring Project are:

1. To detect trends in the density of as many landbird species (including passerines, near passerines, and galliformes) as possible throughout accessible areas of five NCCN parks during the breeding season.

2. To track changes in the breeding season distribution of landbird species throughout accessible areas of the three large wilderness parks.

In this report we make comparisons between data collected in 2020 and the previous 13 years of data collection (Siegel et al. 2008, Wilkerson et al. 2009b, 2010, Holmgren et al. 2011–2020). This report and subsequent annual reports for the Landbird Monitoring Project are intended primarily as administrative reports. More comprehensive analyses of these data, including trend analysis that accounts for the potentially confounding effects of variation in detectability and sampling effort, are conducted in conjunction with periodic detailed trend analyses. The first trend analysis report summarizes data from 2005–2012 (Saracco et al. 2014). More recently, an analytical framework has been developed for this project that integrates several recent developments in Bayesian N-mixture modeling to assess landbird trends and evaluate the role of climatic and other spatiotemporal variables in driving those trends, yielding a technical report and two published papers (Ray et al. 2017a, 2017b, 2019).

Study Area

The study area for the NCCN Landbird Monitoring Project (Figure 1) includes areas of MORA, NOCA and OLYM that are accessible by foot and lie within one km of a road or trail, as well as all of SAJH (including both American Camp and English Camp) and portions of LEWI.

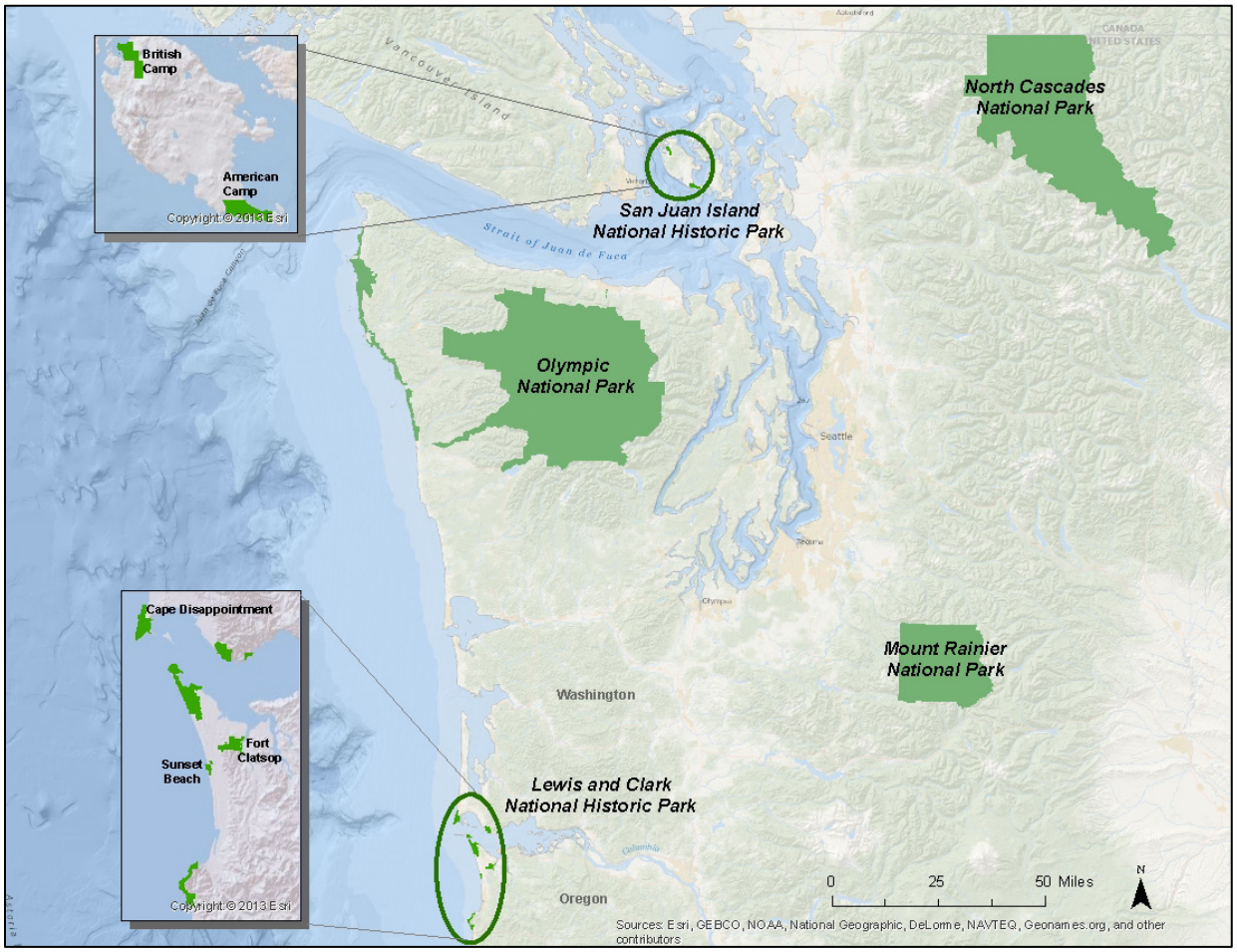

Figure 1. National Park Service units participating in the North Coast and Cascades Network Landbird Monitoring Project.

Methods

Sample Design

A detailed description of the sample design for the NCCN Landbird Monitoring Project is provided in the NCCN Landbird Monitoring Protocol (Siegel et al. 2007). In brief, the sample design for the three large parks utilizes six panels of transects in each park. At NOCA and at OLYM each panel includes four low-elevation transects (transect starting points <650 m), four mid-elevation transects (transect starting points between 650 m and 1,350 m) and four high-elevation transects (transect starting points >1,350 m). At MORA the sample design is the same as at the other two large parks, except there are only two low-elevation transects in each panel, and the cutoff between low-elevation transects and mid-elevation transects is 800 m rather than 650 m. All transect starting points are on park roads or trails, and the transects consist of a line of approximately 10–20 points, extending perpendicularly (or as close to perpendicularly as topographic and physiographic features allow) in both directions away from the trail.

In 2020 we implemented the full study design in the three large parks for the thirteenth year, including surveys of the annual panel ('Ann1') as well as the third alternating panel ('Alt4') (Figures 2–4). The protocol was initially field-tested with data collected from the annual panel only as part of protocol development during 2005–2006, and has subsequently been implemented fully (including data collection on the annual panel as well as all of the five alternating panels) for the past 13 years (2007–2020), except for 2017 when data collection was temporarily suspended to reallocate resources for a 5-year data synthesis (Ray et al. 2018). Results from each of the first 13 years of full implementation are presented in Siegel et al. (2008), Wilkerson et al. (2009b, 2010), and Holmgren et al. (2011–2020). Multi-year trend analyses are provided in Saracco et al. (2014) and Ray et al. (2017a).

At the two smaller parks (LEWI and SAJH), the sample design consists of a systematic grid of point count survey stations, with the two parks scheduled to be surveyed in alternating years. In the summer of 2020 we were scheduled to survey the grid at SAJH. However, we decided to drop the surveys there because of the COVID-19-related safety risks of traveling to an island when there were still stringent statewide rules about traveling during that phase of the pandemic. In addition to crew safety, we were also concerned about exposing residents of the island and SAJH employees to our crew.

Crew Training and Certification

Mandy Holmgren, a Staff Biologist with The Institute for Bird Populations, served as the 2020 Field Lead. All five of the crew members were returning from previous years, so we were able to reduce our training down from about three weeks to only five days, two of which were done virtually over Zoom. This shortened training session started on May 26 and ended on May 30, at which point everyone on the crew was ready to begin collecting data. All individuals who collected data during the 2020 field season (Table 1) were employees of The Institute for Bird Populations.

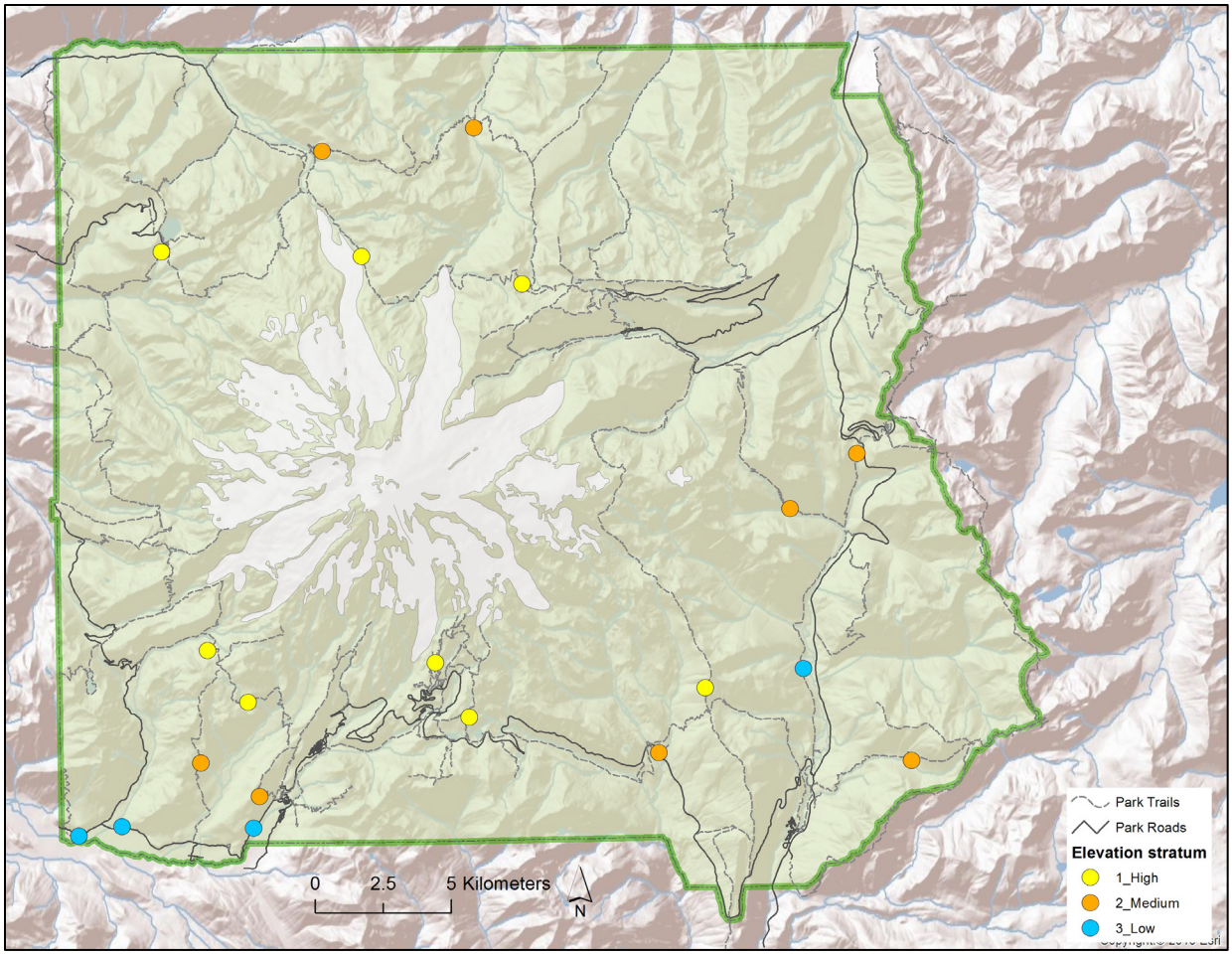

Figure 2. Approximate locations of transects conducted at Mount Rainier National Park in 2020.

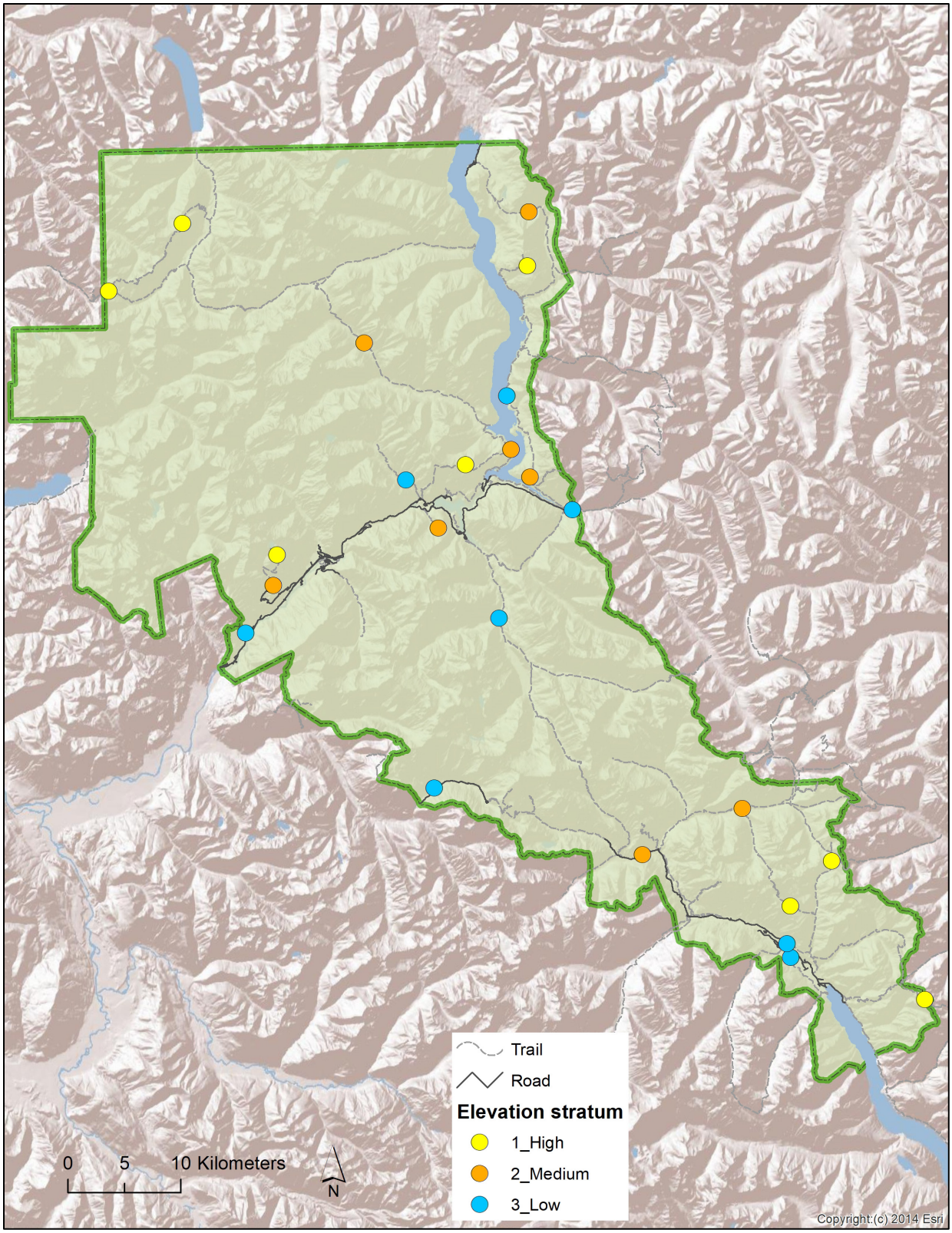

Figure 3. Approximate locations of transects conducted at North Cascades National Park Complex in 2020.

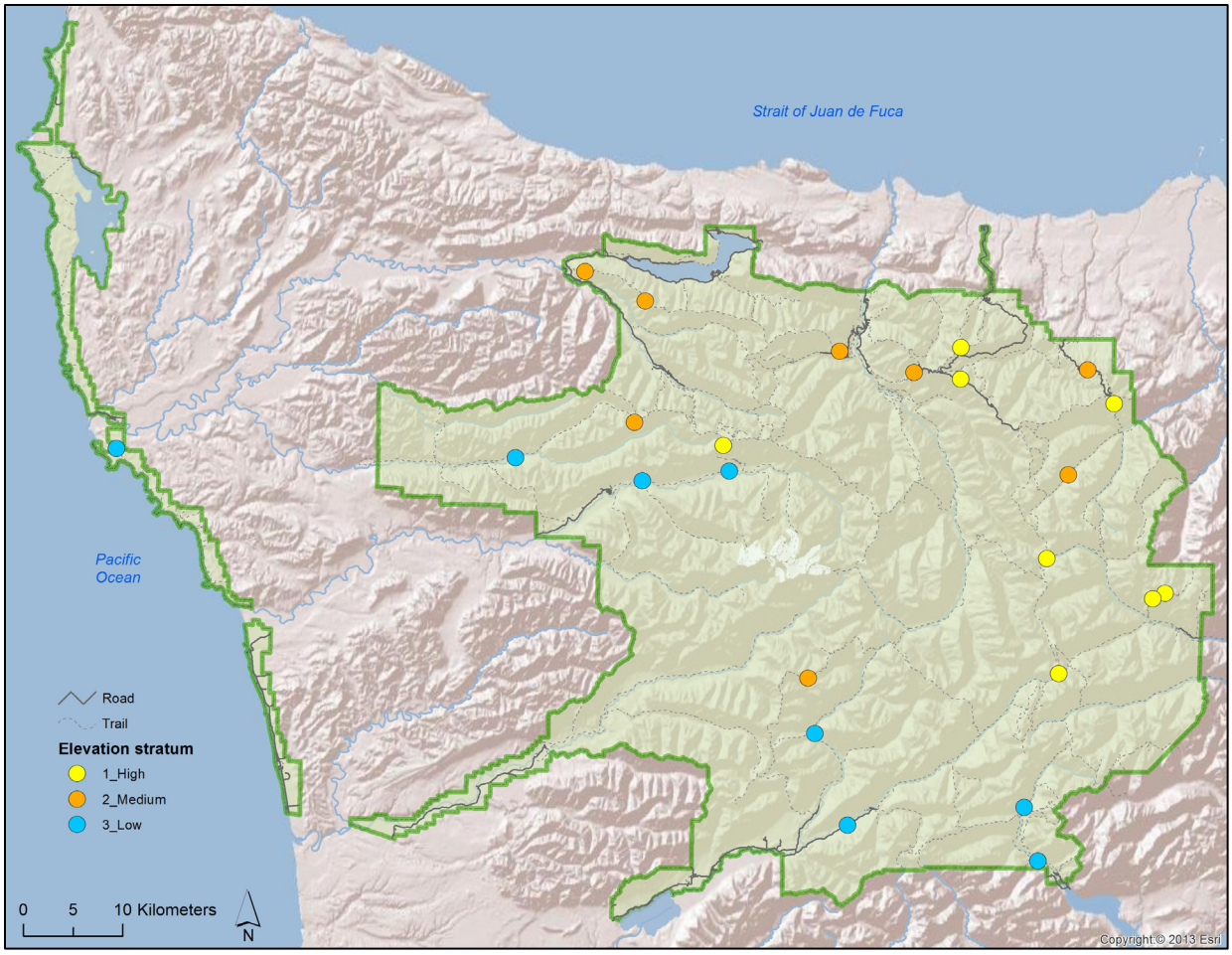

Figure 4. Approximate locations of transects conducted at Olympic National Park in 2020.

Table 1. Observers who conducted point counts in the North Coast and Cascades Network in 2020.

Observer	Role
Kelsey Bellavance	Technician
Mandy Holmgren	Field Lead
Mikaela Kropp	Technician
Fanter Lane	Technician
Quinn McMahon	Technician
Katelyn Ray	Technician

Data Collection

All point count data were collected between June 2 and July 26 at MORA, between June 2 and July 28 at NOCA, and between June 2 and July 30 at OLYM. At the three large parks, low-elevation transects were generally surveyed first, followed by the mid-elevation transects, and finally the high-elevation transects.

Data collection followed the detailed procedures explained in the NCCN Landbird Monitoring Protocol (Siegel et al. 2007). Crew members generally worked in pairs to survey a single transect each morning. Crew members were provided maps and coordinates of all point count station locations on the transects, as well as narrative descriptions of point count stations and the travel routes between successive stations. These were used to locate the same point count stations that were previously established and surveyed. Beginning within 10 minutes of official sunrise, each observer conducted a point count, and then continued along the transect route, conducting another point count every 200 m until 3.5 hours after official local sunrise.

At each point count station, observers recorded the starting time, scored the degree of noise interference caused by such factors as flowing water or wind, recorded the weather conditions, and then began the seven-minute point count. The point count was partitioned into three time intervals (0–3:00, 3:01–5:00, and 5:01–7:00). Observers noted each time interval in which they detected each individual bird. Birds observed in the first three minutes allow comparison with Breeding Bird Survey data (Sauer et al. 2008), which are based on three-minute counts. Observers estimated the horizontal distance, to the nearest meter, to each bird detected. The observers also recorded whether the distance estimates were based on an aural or visual detection, and whether the bird ever sang during the point count. Prior to 2011 we used point counts with durations of only five minutes broken into two time intervals (0–3:00, 3:01–5:00), but in 2011 we added the third time interval to make the data more useful for analysis within an occupancy modeling framework that relies on detection or non-detection of individual birds within multiple time intervals to estimate detection probability.

After completing their last point count each morning, observers retraced their steps back to the starting point. Along the way, they conducted a brief habitat assessment at each of the survey points. The brief habitat assessment consisted of characterizing habitat within a 50-m radius of the survey point, noting the primary (and secondary, if appropriate) plant community type, canopy cover class, and tree size class, according to the categories developed by Pacific Meridian Resources (1996). While conducting the habitat assessments, observers also used Global Positioning System (GPS) units to collect location data files. Where necessary, observers amended narrative descriptions of the point locations.

Whenever crew members detected species thought to be rare in the park or difficult to detect during diurnal point count surveys, they completed “Rare Bird Report Forms”, including descriptions of the birds’ appearance, behavior, and precise location. These reports covered not only birds detected during point counts, but also birds detected while sampling vegetation, hiking between transects, relaxing at camp in the evening, or at any other time during the field season, including the pre-season training session. Additionally, crew members recorded a complete list of all incidental bird species

detected in the park throughout the field season, including common species that might not have been recorded during point counts or were not rare enough to warrant a rare bird report.

After completing their fieldwork each day, partners reviewed each other's data forms for missing or incorrectly recorded data, discussed any interesting or surprising bird detections, and completed a Transect Visit Log summarizing the day's efforts.

Data Management

The Landbird monitoring protocol for national parks in the North Coast and Cascades Network (Siegel et al. 2007) requires crews working at each large park to enter as much of their own data into the NCCN Landbird Monitoring Project's Microsoft Access database throughout the field season as they can. The crew worked three additional days at the end of the field season to continue entering and verifying data. The Field Lead finished verifying the remaining data after the field season. Data entry procedures followed the guidelines in Siegel et al. (2007).

The project database includes built-in quality assurance components such as pick-lists and validation rules to test for missing data or illogical combinations. After entering the data, the Field Lead verified the database records for complete and accurate transcription by retrieving and visually comparing the data associated with each sampling event against the original forms.

Once all data for the season were entered and verified, the Field Lead conducted a rigorous quality review on the data set by running a set of pre-built validation queries to check for completeness, missing or out-of-range values, logical consistency, and structural integrity. Errors identified during this review were corrected where possible, and annotations related to specific issues raised by each query were stored within the project database as needed and appropriate. The data set was then certified as complete and ready for use. Output for this report was generated using standard summary queries in the project database.

After the field season, field forms were scanned and stored with digital records. Photographic images were processed to remove poor quality or duplicative files, given names according to convention, and organized according to project requirements. GPS data associated with sampling events were downloaded and processed, and the resulting coordinate data were then uploaded into the project database.

Data Analysis

We summarized and tabulated data according to the template in Siegel et al. (2007). Climate data for the 2020 season were sourced from the Office of the Washington State Climatologist (2020). We present survey results without making any adjustments for detectability, which may vary substantially by species, habitat, observer, or other factors. In conjunction with periodic trend analyses for this monitoring project, factors affecting detectability of birds during point counts are assessed quantitatively, allowing for annual results to be adjusted to account for variable detectability (Buckland et al. 2001, Nichols et al. 2009, Ray et al. 2017b). Results in this report that have not yet been adjusted to account for detectability should be viewed as provisional only.

Results

2020 Field Season

We completed our thirteenth year of full implementation of the NCCN Landbird Monitoring Project with the experience gained from two pilot field seasons (2005 and 2006) and 12 previous years of full protocol implementation. Our procedures for season preparation, data collection, data management, data analysis, and reporting have all been well vetted, and required no substantial changes this year.

The season started off with a near-average snowpack across all three parks, ranging from about 72-114% of normal on May 1. Warm May temperatures melted the snowpack quickly, bringing the snowpack to slightly below normal by June 1 (Office of Washington State Climatologist Data). Snow-related access was occasionally an issue this season, but that was primarily because of the efficiency of the crew this year; we were ahead of schedule and particularly at MORA, were attempting to get into areas well before we typically travel to them. Large-scale low pressure dominated parts of June and July, which made for showery weather and unfavorable survey conditions at times. Even mornings without steady rain were often misty with low clouds and very low visibility, also making for poor survey conditions. As a result, some sites were surveyed slightly later than normal.

2020 Bird Counts

In 2020 we surveyed all of the 68 intended transects in the large parks, including 34 transects from the annual-panel, and 34 transects from the third alternating panel (Table 2 and 3).

Appendix A provides a detailed multi-year survey history of all transects sampled in the large parks to date. In 2020 we conducted 352 individual point counts at MORA, 452 point counts at NOCA and 376 point counts at OLYM (Table 2). During the 1,180 point counts in the three large parks, we counted 10,083 individual birds. Across the three large parks, we documented the presence of 130 species and two hybrids (Table 4), 96 of which were detected during point counts. The remaining 36 species were recorded only as incidental detections or on "Rare Bird Report Forms."

For the annual-panel transects only, the number of individuals of each species detected during point counts (unlimited radius) and the number of transects on which each species was detected are provided in Table 5. On the annual-panel transects we detected 44 bird species during point counts at MORA, 69 species and one hybrid during point counts at NOCA, and 58 species during point counts at OLYM (Table 5). Pooling detections on annual-panel transects across all species, we amassed 852 individual bird detections (average of 4.90 detections/point) at MORA, 2,629 detections (average of 11.48 detections/point) at NOCA, and 1,791 detections (average of 9.23 detections per point) at OLYM (Table 5). The five most frequently detected species on the annual-panel transects in 2020 were: dark-eyed junco (439 detections), Pacific wren (349 detections), varied thrush (304 detections), pine siskin (298 detections), and Pacific-slope flycatcher (273 detections).

Pooling data across the annual-panel transects as well as the transects in the third alternating panel ("Alt4"), the number of individuals of each species detected during point counts (unlimited radius)

and the number of transects on which each species was detected are provided in Table 6. Using data pooled across all transects, we detected 60 bird species during point counts at MORA, 78 species and one hybrid during point counts at NOCA, and 65 species during point counts at OLYM (Table 6). Considering data from both panels, the five most frequently detected species were: dark-eyed junco (949 detections), Pacific wren (650 detections), varied thrush (611 detections), Hermit/Townsend's warbler (518 detections), and pine siskin (516 detections).

We combined detections of Townsend's warbler, hermit warbler, Townsend's/hermit warbler hybrids, and unidentified Townsend's/hermit warblers in Tables 5 and 6, and Figures 6a–6j. These two species hybridize extensively at MORA and OLYM, and are very difficult to tell apart within these hybrid zones. All detections in this report listed as Townsend's/hermit warblers at NOCA are likely Townsend's warblers.

Marbled murrelet, one of two bird species occurring in these parks that is listed under the Endangered Species Act (the other being northern spotted owl), was detected at times other than a point count this year and was documented on "Rare Bird Report Forms." This species was also detected during point counts at OLYM. Detections of these species at times other than point counts are summarized in Table 7.

For 57 species (all species for which we amassed at least 84 point count detections over the period 2005–2020), we present the total number of detections of each species on each park's annual panel transects during the 2005–2020 field seasons (Figures 5a–5j). We caution, however, that these detection totals have not been adjusted for differences in survey effort, observer effects, or potential differences in detectability of birds between years; such adjustments will be made in conjunction with trend analyses in a future multi-year report.

2020 Bird Counts Compared to Previous Years

The number of bird detections on annual-panel transects across all three large parks decreased by 401 between 2019 and 2020, though the magnitude of the change in detections varied among the parks. At NOCA there was an increase of 225 detections on annual-panel transects, though when factoring in the increase in point counts conducted in 2020, the average number of birds detected per point actually decreased slightly (5%) from 2019. At both MORA and OLYM detections decreased between 2019 and 2020. When factoring in the number of point counts conducted each year, both parks saw a substantial decrease in the average number of birds per count (a decline of 24% at MORA and 19% at OLYM).

Many species were nonetheless detected in slightly or moderately greater numbers in the three large parks in 2020 than in previous years. A few of these species include yellow-rumped warbler, Nashville warbler, black-throated gray warbler, warbling vireo, and song sparrow. Each of these species had more detections in 2020 than in any of the previous 14 years.

In contrast, the number of red crossbill, pine siskin, and evening grosbeak detections remained low in 2020. Pine siskin detections were also at the lowest they have been since 2011. We had no Clark's

nutcracker detections in 2020, the first time since the start of the monitoring program. We usually do not detect this species in high numbers, but its absence from our 2020 point counts is notable.

Table 2. North Coast and Cascades Network landbird monitoring transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks that were surveyed in 2020.

Park	Panel	Elevation	Transect	No. of points surveyed
MORA	Ann1	Low	4001	18
MORA	Ann1	Low	4005	14
MORA	Ann1	Medium	4002	16
MORA	Ann1	Medium	4004	15
MORA	Ann1	Medium	4009	17
MORA	Ann1	Medium	4012	21
MORA	Ann1	High	4003	14
MORA	Ann1	High	4007	22
MORA	Ann1	High	4011	17
MORA	Ann1	High	4014	20
MORA	Alt4	Low	4021	16
MORA	Alt4	Low	4022	18
MORA	Alt4	Medium	4057	16
MORA	Alt4	Medium	4060	25
MORA	Alt4	Medium	4061	19
MORA	Alt4	Medium	4065	16
MORA	Alt4	High	4035	15
MORA	Alt4	High	4036	17
MORA	Alt4	High	4039	15
MORA	Alt4	High	4043	21
NOCA	Ann1	Low	1013	17
NOCA	Ann1	Low	1017	15
NOCA	Ann1	Low	1020	18
NOCA	Ann1	Low	1023	22
NOCA	Ann1	Medium	1015	19
NOCA	Ann1	Medium	1018	23

Table 2 (continued). North Coast and Cascades Network landbird monitoring transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks that were surveyed in 2020.

Park	Panel	Elevation	Transect	No. of points surveyed
NOCA	Ann1	Medium	1022	19
NOCA	Ann1	Medium	1024	15
NOCA	Ann1	High	1014	23
NOCA	Ann1	High	1016	18
NOCA	Ann1	High	1019	15
NOCA	Ann1	High	1021	25
NOCA	Alt4	Low	1036	21
NOCA	Alt4	Low	1054	17
NOCA	Alt4	Low	1061	16
NOCA	Alt4	Low	1122	22
NOCA	Alt4	Medium	1033	23
NOCA	Alt4	Medium	1035	18
NOCA	Alt4	Medium	1038	18
NOCA	Alt4	Medium	1041	18
NOCA	Alt4	High	1048	17
NOCA	Alt4	High	1049	18
NOCA	Alt4	High	1050	17
NOCA	Alt4	High	1052	18
OLYM	Ann1	Low	3001	14
OLYM	Ann1	Low	3121	18
OLYM	Ann1	Low	3126	17
OLYM	Ann1	Low	3134	20
OLYM	Ann1	Medium	3122	18
OLYM	Ann1	Medium	3123	17
OLYM	Ann1	Medium	3130	11
OLYM	Ann1	Medium	3200	23
OLYM	Ann1	High	3124	14
OLYM	Ann1	High	3125	16

Table 2 (continued). North Coast and Cascades Network landbird monitoring transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks that were surveyed in 2020.

Park	Panel	Elevation	Transect	No. of points surveyed
OLYM	Ann1	High	3127	16
OLYM	Ann1	High	3128	10
OLYM	Alt4	Low	3155	15
OLYM	Alt4	Low	3159	15
OLYM	Alt4	Low	3161	13
OLYM	Alt4	Low	3163	17
OLYM	Alt4	Medium	3160	12
OLYM	Alt4	Medium	3167	13
OLYM	Alt4	Medium	3168	16
OLYM	Alt4	Medium	3174	15
OLYM	Alt4	High	3158	19
OLYM	Alt4	High	3164	18
OLYM	Alt4	High	3171	16
OLYM	Alt4	High	3173	13

Table 3. Summary history of North Coast and Cascades Network landbird monitoring transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks completed through 2020.

Park	Elevation Stratum	Number of transects completed														
		2005[a]	2006[a]	2007[b]	2008[c]	2009[d]	2010[e]	2011[f]	2012[b]	2013[c]	2014[d]	2015[e]	2016[f]	2018[b]	2019[c]	2020[d]
MORA	Low	2	2	4	4	4	4	4	4	4	4	4	4	4	4	4
MORA	Medium	4	4	8	8	8	8	6	8	8	8	8	8	8	8	8
MORA	High	4	4	8	8	8	7	3	8	8	8	8	8	8	8	8
ALL	All	10	10	20	20	20	19	13	20	20	20	20	20	20	20	20
NOCA	Low	4	4	8	8	7	8	8	8	8	8	7	8	8	8	8
NOCA	Medium	4	4	7	7	8	8	8	8	7	8	8	8	8	8	8
NOCA	High	4	4	7	5	8	6	5	8	8	8	8	7	8	7	8
ALL	All	12	12	22	20	23	22	21	24	23	24	23	23	24	23	24
OLYM	Low	4	4	8	8	8	8	8	8	8	8	8	8	8	8	8
OLYM	Medium	4	3	8	7	8	8	7	8	8	8	8	7	8	8	8
OLYM	High	4	4	7	8	8	8	8	8	8	8	8	8	8	8	8
ALL	All	12	11	23	23	24	24	23	24	24	24	24	23	24	24	24

[a]Only the annual panel transects were surveyed in 2005 and 2006, during the protocol development phase of the project.

[b]The annual panel along with the first alternating panel were surveyed in 2007, 2012, and 2018.

[c]The annual panel along with the second alternating panel were surveyed in 2008, 2013, and 2019.

[d]The annual panel along with the third alternating panel were surveyed in 2009, 2014, and 2020.

[e]The annual panel along with the fourth alternating panel were surveyed in 2010 and 2015.

[f]The annual panel along with the fifth alternating panel were surveyed in 2011 and 2016

Table 4. All species recorded in the three large North Coast and Cascades Network parks during the 2020 field season, including the pre-season training session.

Species	Scientific Name
Canada Goose *	*Branta canadensis*
Wood Duck *	*Aix sponsa*
Northern Shoveler *	*Anas clypeata*
Mallard *	*Anas platyrhynchos*
Harlequin Duck *	*Histrionicus histrionicus*
Barrow's Goldeneye *	*Bucephala islandica*
Hooded Merganser *	*Lophodytes cucullatus*
Common Merganser	*Mergus merganser*
Ruffed Grouse *	*Bonasa umbellus*
Sooty Grouse	*Dendragapus fuliginosus*
Red-necked Grebe *	*Podiceps grisegena*
Band-tailed Pigeon	*Patagioenas fasciata*
Common Nighthawk	*Chordeiles minor*
Black Swift	*Cypseloides niger*
Vaux's Swift	*Chaetura vauxi*
Anna's Hummingbird	*Calypte anna*
Rufous Hummingbird	*Selasphorus rufus*
Calliope Hummingbird	*Selasphorus calliope*
Sora *	*Porzana carolina*
Spotted Sandpiper	*Actitis macularius*
Marbled Murrelet	*Brachyramphus marmoratus*
Ring-billed Gull *	*Larus delawarensis*
Pacific Loon *	*Gavia pacifica*
Common Loon	*Gavia immer*
Double-crested Cormorant *	*Nannopterum auritus*
Pelagic Cormorant *	*Urile pelagicus*
Great Blue Heron *	*Ardea herodias*

* Species that were detected only at times other than during point counts.

Table 4 (continued). All species recorded in the three large North Coast and Cascades Network parks during the 2020 field season, including the pre-season training session.

Species	Scientific Name
Turkey Vulture	*Cathartes aura*
Osprey	*Pandion haliaetus*
Golden Eagle *	*Aquila chrysaetos*
Northern Harrier *	*Circus cyaneus*
Sharp-shinned Hawk *	*Accipiter striatus*
Cooper's Hawk *	*Accipiter cooperii*
Northern Goshawk	*Accipiter gentilis*
Bald Eagle *	*Haliaeetus leucocephalus*
Red-tailed Hawk	*Buteo jamaicensis*
Great Horned Owl *	*Bubo virginianus*
Northern Pygmy-Owl	*Glaucidium gnoma*
Barred Owl	*Strix varia*
Belted Kingfisher	*Megaceryle alcyon*
Red-breasted Sapsucker	*Sphyrapicus ruber*
American Three-toed Woodpecker	*Picoides dorsalis*
Black-backed Woodpecker *	*Picoides arcticus*
Downy Woodpecker *	*Picoides pubescens*
Hairy Woodpecker	*Picoides villosus*
Northern Flicker	*Colaptes auratus*
Pileated Woodpecker	*Dryocopus pileatus*
American Kestrel	*Falco sparverius*
Peregrine Falcon *	*Falco peregrinus*
Red-naped x Red-breasted Sapsucker Hybrid	*Sphyrapicus nuchalis x ruber*
Olive-sided Flycatcher	*Contopus cooperi*
Western Wood-Pewee	*Contopus sordidulus*
Willow Flycatcher	*Empidonax traillii*
Hammond's Flycatcher	*Empidonax hammondii*

* Species that were detected only at times other than during point counts.

Table 4 (continued). All species recorded in the three large North Coast and Cascades Network parks during the 2020 field season, including the pre-season training session.

Species	Scientific Name
Dusky Flycatcher	*Empidonax oberholseri*
Pacific-slope Flycatcher	*Empidonax difficilis*
Say's Phoebe	*Sayornis saya*
Hutton's Vireo	*Vireo huttoni*
Cassin's Vireo	*Vireo cassinii*
Warbling Vireo	*Vireo gilvus*
Red-eyed Vireo	*Vireo olivaceus*
Canada Jay	*Perisoreus canadensis*
Steller's Jay	*Cyanocitta stelleri*
Clark's Nutcracker	*Nucifraga columbiana*
American Crow	*Corvus brachyrhynchos*
Common Raven	*Corvus corax*
Horned Lark	*Eremophila alpestris*
Tree Swallow	*Tachycineta bicolor*
Violet-green Swallow	*Tachycineta thalassina*
Northern Rough-winged Swallow *	*Stelgidopteryx serripennis*
Barn Swallow	*Hirundo rustica*
Cliff Swallow *	*Petrochelidon pyrrhonota*
Black-capped Chickadee	*Poecile atricapillus*
Mountain Chickadee	*Poecile gambeli*
Chestnut-backed Chickadee	*Poecile rufescens*
Bushtit *	*Psaltriparus minimus*
Red-breasted Nuthatch	*Sitta canadensis*
White-breasted Nuthatch	*Sitta carolinensis*
Brown Creeper	*Certhia americana*
Rock Wren *	*Salpinctes obsoletus*
Canyon Wren *	*Catherpes mexicanus*

* Species that were detected only at times other than during point counts.

Table 4 (continued). All species recorded in the three large North Coast and Cascades Network parks during the 2020 field season, including the pre-season training session.

Species	Scientific Name
House Wren	*Troglodytes aedon*
Pacific Wren	*Troglodytes pacificus*
American Dipper	*Cinclus mexicanus*
Golden-crowned Kinglet	*Regulus satrapa*
Ruby-crowned Kinglet	*Corthylio calendula*
Western Bluebird	*Sialia mexicana*
Mountain Bluebird	*Sialia currucoides*
Townsend's Solitaire	*Myadestes townsendi*
Veery	*Catharus fuscescens*
Swainson's Thrush	*Catharus ustulatus*
Hermit Thrush	*Catharus guttatus*
American Robin	*Turdus migratorius*
Varied Thrush	*Ixoreus naevius*
Gray Catbird *	*Dumetella carolinensis*
European Starling *	*Sturnus vulgaris*
Cedar Waxwing	*Bombycilla cedrorum*
American Pipit	*Anthus rubescens*
Evening Grosbeak	*Coccothraustes vespertinus*
Pine Grosbeak	*Pinicola enucleator*
Gray-crowned Rosy-Finch	*Leucosticte tephrocotis*
House Finch *	*Haemorhous mexicanus*
Purple Finch	*Haemorhous purpureus*
Cassin's Finch	*Haemorhous cassinii*
Red Crossbill	*Loxia curvirostra*
Pine Siskin	*Spinus pinus*
American Goldfinch *	*Spinus tristis*
Chipping Sparrow	*Spizella passerina*

* Species that were detected only at times other than during point counts.

Table 4 (continued). All species recorded in the three large North Coast and Cascades Network parks during the 2020 field season, including the pre-season training session.

Species	Scientific Name
Fox Sparrow	*Passerella iliaca*
Dark-eyed Junco	*Junco hyemalis*
White-crowned Sparrow	*Zonotrichia leucophrys*
Savannah Sparrow	*Passerculus sandwichensis*
Song Sparrow	*Melospiza melodia*
Spotted Towhee	*Pipilo maculatus*
Bullock's Oriole *	*Icterus bullockii*
Red-winged Blackbird	*Agelaius phoeniceus*
Brown-headed Cowbird	*Molothrus ater*
Orange-crowned Warbler	*Oreothlypis celata*
Nashville Warbler	*Oreothlypis ruficapilla*
MacGillivray's Warbler	*Geothlypis tolmiei*
Common Yellowthroat	*Geothlypis trichas*
American Redstart	*Setophaga ruticilla*
Yellow Warbler	*Setophaga petechia*
Yellow-rumped Warbler	*Setophaga coronata*
Black-throated Gray Warbler	*Setophaga nigrescens*
Townsend's Warbler	*Setophaga townsendi*
Townsend's x Hermit Warbler hybrid	*Setophaga townsendi x occidentalis*
Hermit Warbler	*Setophaga occidentalis*
Wilson's Warbler	*Cardellina pusilla*
Western Tanager	*Piranga ludoviciana*
Black-headed Grosbeak	*Pheucticus melanocephalus*
Lazuli Bunting	*Passerina amoena*

* Species that were detected only at times other than during point counts.

Table 5. Number of transects with detections and number of individual detections for each species detected during point counts on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks in 2020.

	Number of transects with detections				Number of individual detections			
Species	**MORA**	**NOCA**	**OLYM**	**ALL**	**MORA**	**NOCA**	**OLYM**	**ALL**
Common Merganser	–	–	1	1	–	–	1	1
Sooty Grouse	3	4	7	14	3	7	16	26
Band-tailed Pigeon	1	–	6	7	3	–	10	13
Common Nighthawk	–	1	1	2	–	3	1	4
Black Swift	–	1	–	1	–	1	–	1
Vaux's Swift	3	5	1	9	10	12	2	24
Rufous Hummingbird	2	9	6	17	3	17	10	30
Calliope Hummingbird	–	2	–	2	–	3	–	3
Spotted Sandpiper	1	1	1	3	5	1	1	7
Turkey Vulture	–	1	–	1	–	1	–	1
Northern Goshawk	1	1	–	2	1	1	–	2
Red-tailed Hawk	–	–	1	1	–	–	1	1
Northern Pygmy-Owl	3	–	–	3	3	–	–	3
Barred Owl	–	–	1	1	–	–	2	2
Belted Kingfisher	–	–	2	2	–	–	4	4
Red-breasted Sapsucker	1	5	–	6	1	28	–	29
American Three-toed Woodpecker	–	–	1	1	–	–	1	1
Hairy Woodpecker	3	11	6	20	6	31	12	49
Northern Flicker	5	7	9	21	5	10	19	34

Table 5 (continued). Number of transects with detections and number of individual detections for each species detected during point counts on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks in 2020.

	Number of transects with detections				Number of individual detections			
Species	**MORA**	**NOCA**	**OLYM**	**ALL**	**MORA**	**NOCA**	**OLYM**	**ALL**
Pileated Woodpecker	–	3	3	6	–	3	7	10
American Kestrel	–	–	1	1	–	–	1	1
Red-naped x Red-breasted Sapsucker Hybrid	–	2	–	2	–	2	–	2
Olive-sided Flycatcher	1	8	6	15	1	39	10	50
Western Wood-Pewee	–	4	–	4	–	22	–	22
Willow Flycatcher	–	1	–	1	–	1	–	1
Hammond's Flycatcher	4	9	10	23	24	170	54	248
Dusky Flycatcher	–	3	–	3	–	15	–	15
Pacific-slope Flycatcher	6	5	11	22	49	26	198	273
Say's Phoebe	–	1	–	1	–	1	–	1
Hutton’s Vireo	–	–	1	1	–	–	1	1
Cassin's Vireo	–	6	–	6	–	34	–	34
Warbling Vireo	3	8	6	17	9	85	25	119
Red-eyed Vireo	–	2	–	2	–	14	–	14
Canada Jay	5	4	3	12	14	10	16	40
Steller’s Jay	5	8	7	20	10	13	29	52
American Crow	–	–	3	3	–	–	8	8
Common Raven	4	3	3	10	8	5	6	19
Tree Swallow	–	1	–	1	–	2	–	2

Table 5 (continued). Number of transects with detections and number of individual detections for each species detected during point counts on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks in 2020.

	Number of transects with detections				Number of individual detections			
Species	**MORA**	**NOCA**	**OLYM**	**ALL**	**MORA**	**NOCA**	**OLYM**	**ALL**
Violet-green Swallow	–	2	–	2	–	6	–	6
Barn Swallow	1	–	–	1	9	–	–	9
Black-capped Chickadee	–	–	1	1	–	–	1	1
Mountain Chickadee	–	3	–	3	–	11	–	11
Chestnut-backed Chickadee	8	10	11	29	17	101	58	176
Red-breasted Nuthatch	9	11	10	30	43	68	34	145
Brown Creeper	7	8	7	22	19	26	16	61
House Wren	–	1	1	2	–	2	1	3
Pacific Wren	10	10	12	32	76	112	161	349
American Dipper	–	–	2	2	–	–	2	2
Golden-crowned Kinglet	8	10	12	30	58	49	102	209
Ruby-crowned Kinglet	–	2	1	3	–	8	1	9
Western Bluebird	–	–	1	1	–	–	1	1
Mountain Bluebird	–	1	–	1	–	2	–	2
Townsend’s Solitaire	–	3	3	6	–	9	5	14
Veery	–	1	–	1	–	6	–	6
Swainson's Thrush	4	7	5	16	7	145	51	203
Hermit Thrush	8	7	8	23	59	110	44	213

Table 5 (continued). Number of transects with detections and number of individual detections for each species detected during point counts on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks in 2020.

	Number of transects with detections				Number of individual detections			
Species	**MORA**	**NOCA**	**OLYM**	**ALL**	**MORA**	**NOCA**	**OLYM**	**ALL**
American Robin	7	11	8	26	38	93	77	208
Varied Thrush	9	9	11	29	66	108	130	304
Cedar Waxwing	–	3	1	4	–	24	2	26
American Pipit	2	1	1	4	19	1	2	22
Evening Grosbeak	9	10	6	25	19	82	25	126
Pine Grosbeak	2	1	2	5	2	1	2	5
Gray-crowned Rosy-Finch	2	–	–	2	7	–	–	7
Purple Finch	–	1	–	1	–	10	–	10
Cassin's Finch	–	4	–	4	–	29	–	29
Red Crossbill	1	3	6	10	3	17	99	119
Pine Siskin	7	9	8	24	49	134	115	298
Chipping Sparrow	–	6	1	7	–	36	2	38
Fox Sparrow	1	2	–	3	3	12	–	15
Dark-eyed Junco	10	11	12	33	83	175	181	439
White-crowned Sparrow	2	2	2	6	6	3	11	20
Savannah Sparrow	1		–	1	1	–	–	1
Song Sparrow	2	5	4	11	8	22	14	44
Spotted Towhee	–	2	–	2	–	6	–	6

Table 5 (continued). Number of transects with detections and number of individual detections for each species detected during point counts on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks in 2020.

	Number of transects with detections				Number of individual detections			
Species	**MORA**	**NOCA**	**OLYM**	**ALL**	**MORA**	**NOCA**	**OLYM**	**ALL**
Red-winged Blackbird	1	–	–	1	1	–	–	1
Brown-headed Cowbird	–	1	–	1	–	1	–	1
Orange-crowned Warbler	–	–	2	2	–	–	3	3
Nashville Warbler	–	6	–	6	–	68	–	68
MacGillivray's Warbler	1	8	4	13	2	68	7	77
American Redstart	–	1	–	1	–	4	–	4
Yellow Warbler	–	6	2	8	–	66	5	71
Yellow-rumped Warbler	3	12	3	18	12	194	20	226
Black-throated Gray Warbler	–	3	4	7	–	18	42	60
Hermit/Townsend's Warbler*	6	10	6	22	81	107	59	247
Wilson's Warbler	1	2	5	8	2	7	54	63
Western Tanager	3	10	4	17	7	114	23	144
Black-headed Grosbeak	–	5	4	9	–	15	7	22
Lazuli Bunting	–	2	–	2	–	2	–	2
All species pooled	–	–	–	–	852	2,629	1,791	5,272
Number of detections per point (all species pooled)					4.9	11.48	9.23	8.54

*This classification includes individuals identified in the field as Townsend's warblers, hermit warblers, Townsend's/hermit warbler hybrids, and unidentified Townsend's/hermit warblers.

Table 6. Number of transects with detections and number of individual detections for each species detected during point counts (annual- and alternating-panel transects combined) at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks in 2020.

	Number of transects with detections				Number of individual detections			
Species	**MORA**	**NOCA**	**OLYM**	**ALL**	**MORA**	**NOCA**	**OLYM**	**ALL**
Common Merganser	1	2	1	4	2	10	1	13
Sooty Grouse	5	10	13	28	6	26	30	62
Band-tailed Pigeon	1	–	11	12	3	–	23	26
Common Nighthawk	–	1	1	2	–	3	1	4
Black Swift	–	2	–	2	–	4	–	4
Vaux's Swift	8	7	4	19	23	14	8	45
Anna's Hummingbird	1	–	–	1	1	–	–	1
Rufous Hummingbird	3	16	10	29	4	30	16	50
Calliope Hummingbird	–	2	–	2	–	3	–	3
Spotted Sandpiper	1	4	2	7	5	9	2	16
Marbled Murrelet	–	–	2	2	–	–	4	4
Common Loon	–	2	–	2	–	4	–	4
Turkey Vulture	1	1	–	2	1	1	–	2
Osprey	–	2	–	2	–	3	–	3
Northern Goshawk	1	1	1	3	1	1	1	3
Red-tailed Hawk	–	–	1	1	–	–	1	1
Northern Pygmy-Owl	4	–	2	6	4	–	3	7
Barred Owl	1	–	1	2	1	–	2	3

Table 6 (continued). Number of transects with detections and number of individual detections for each species detected during point counts (annual- and alternating-panel transects combined) at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks in 2020.

	Number of transects with detections				Number of individual detections			
Species	**MORA**	**NOCA**	**OLYM**	**ALL**	**MORA**	**NOCA**	**OLYM**	**ALL**
Belted Kingfisher	–	–	2	2	–	–	4	4
Red-breasted Sapsucker	6	10	2	18	8	47	2	57
American Three-toed Woodpecker	1	–	2	3	1	–	3	4
Hairy Woodpecker	7	15	12	34	13	37	23	73
Northern Flicker	8	11	16	35	16	15	50	81
Pileated Woodpecker	–	4	5	9	–	5	10	15
American Kestrel	–	–	2	2	–	–	2	2
Red-naped x Red-breasted Sapsucker Hybrid	–	2	–	2	–	2	–	2
Olive-sided Flycatcher	3	16	13	32	4	59	32	95
Western Wood-Pewee	–	5	1	6	–	34	1	35
Willow Flycatcher	–	1	–	1	–	1	–	1
Hammond's Flycatcher	8	17	20	45	59	269	105	433
Dusky Flycatcher	1	4	–	5	1	24	–	25
Pacific-slope Flycatcher	13	9	22	44	97	46	344	487
Say's Phoebe	–	1	–	1	–	1	–	1
Hutton’s Vireo	–	–	1	1	–	–	1	1
Cassin's Vireo	–	12	–	12	–	68	–	68

Table 6 (continued). Number of transects with detections and number of individual detections for each species detected during point counts (annual- and alternating-panel transects combined) at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks in 2020.

	Number of transects with detections				Number of individual detections			
Species	**MORA**	**NOCA**	**OLYM**	**ALL**	**MORA**	**NOCA**	**OLYM**	**ALL**
Warbling Vireo	5	12	10	27	14	112	46	172
Red-eyed Vireo	–	3	–	3	–	17	–	17
Canada Jay	10	10	10	30	25	18	37	80
Steller's Jay	9	11	14	34	24	17	49	90
Clark's Nutcracker	2	1	–	3	12	1	–	13
American Crow	–	–	4	4	–	–	11	11
Common Raven	8	5	6	19	20	9	10	39
Horned Lark	–	1	1	2	–	1	3	4
Tree Swallow	–	1	1	2	–	2	1	3
Violet-green Swallow	2	2	–	4	13	6	–	19
Barn Swallow	1	–	–	1	9	–	–	9
Black-capped Chickadee	–	–	1	1	–	–	1	1
Mountain Chickadee	2	6	–	8	9	32	–	41
Chestnut-backed Chickadee	14	19	22	55	38	204	119	361
Red-breasted Nuthatch	18	22	20	60	116	135	66	317
White-breasted Nuthatch	1	–	–	1	1	–	–	1
Brown Creeper	14	17	14	45	61	52	41	154
House Wren	–	1	2	3	–	2	2	4

Table 6 (continued). Number of transects with detections and number of individual detections for each species detected during point counts (annual- and alternating-panel transects combined) at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks in 2020.

	Number of transects with detections				Number of individual detections			
Species	**MORA**	**NOCA**	**OLYM**	**ALL**	**MORA**	**NOCA**	**OLYM**	**ALL**
Pacific Wren	19	20	23	62	168	192	290	650
American Dipper	–	1	2	3	–	1	2	3
Golden-crowned Kinglet	17	20	24	61	107	120	191	418
Ruby-crowned Kinglet	1	4	3	8	2	16	4	22
Western Bluebird	–	–	2	2	–	–	2	2
Mountain Bluebird	–	1	–	1	–	2	–	2
Townsend's Solitaire	1	5	6	12	1	15	10	26
Veery	–	2	–	2	–	10	–	10
Swainson's Thrush	7	16	10	33	21	251	75	347
Hermit Thrush	17	16	16	49	167	231	114	512
American Robin	14	19	17	50	69	138	151	358
Varied Thrush	18	21	22	61	169	254	188	611
Cedar Waxwing	–	5	1	6	–	35	2	37
American Pipit	4	2	4	10	21	3	6	30
Evening Grosbeak	15	20	11	46	44	144	46	234
Pine Grosbeak	5	2	5	12	8	4	6	18
Gray-crowned Rosy-Finch	2	1	–	3	7	1	–	8
Purple Finch	–	2	–	2	–	15	–	15

Table 6 (continued). Number of transects with detections and number of individual detections for each species detected during point counts (annual- and alternating-panel transects combined) at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks in 2020.

	Number of transects with detections				Number of individual detections			
Species	**MORA**	**NOCA**	**OLYM**	**ALL**	**MORA**	**NOCA**	**OLYM**	**ALL**
Cassin's Finch	–	7	–	7	–	45	–	45
Red Crossbill	5	8	13	26	23	40	166	229
Pine Siskin	14	20	17	51	122	233	161	516
Chipping Sparrow	1	10	1	12	7	50	2	59
Fox Sparrow	4	5		9	7	36	–	43
Dark-eyed Junco	20	23	24	67	198	354	397	949
White-crowned Sparrow	3	4	3	10	7	10	14	31
Savannah Sparrow	2	1	–	3	3	2	–	5
Song Sparrow	4	7	6	17	11	32	18	61
Spotted Towhee	1	2	–	3	1	6	–	7
Red-winged Blackbird	1	–	–	1	1	–	–	1
Brown-headed Cowbird	–	1	–	1	–	1	–	1
Orange-crowned Warbler	–	–	4	4	–	–	6	6
Nashville Warbler	–	11	–	11	–	158	–	158
MacGillivray's Warbler	4	13	6	23	9	94	10	113
Common Yellowthroat	–	1	–	1	–	1	–	1
American Redstart	–	1	–	1	–	4	–	4
Yellow Warbler	–	8	5	13	–	74	10	84

Table 6 (continued). Number of transects with detections and number of individual detections for each species detected during point counts (annual- and alternating-panel transects combined) at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks in 2020.

	Number of transects with detections				Number of individual detections			
Species	**MORA**	**NOCA**	**OLYM**	**ALL**	**MORA**	**NOCA**	**OLYM**	**ALL**
Yellow-rumped Warbler	8	23	8	39	61	331	49	441
Black-throated Gray Warbler	1	6	6	13	1	25	62	88
Hermit/Townsend's Warbler*	15	20	13	48	212	191	115	518
Wilson's Warbler	3	5	11	19	6	12	78	96
Western Tanager	8	19	9	36	15	252	50	317
Black-headed Grosbeak	1	9	5	15	2	19	13	34
Lazuli Bunting	–	2	–	2	–	2	–	2
All species pooled	–	–	–	–	2,062	4,728	3,293	10,083
Detections per point (all species pooled)	–	–	–	–	5.86	10.46	8.76	8.36
Number of species detected during point counts					60	79	65	96

*This classification includes individuals identified in the field as Townsend's warblers, hermit warblers, Townsend's/hermit warbler hybrids, and unidentified Townsend's/hermit warblers.

Table 7. Species listed under the Endangered Species Act recorded on "Rare Bird Detection Forms" in each park in 2020, excluding individuals that were also detected during point counts.

	Number of birds detected (excluding individuals also detected during point counts)		
Species	**Mount Rainier**	**North Cascades**	**Olympic**
Marbled Murrelet	–	–	3

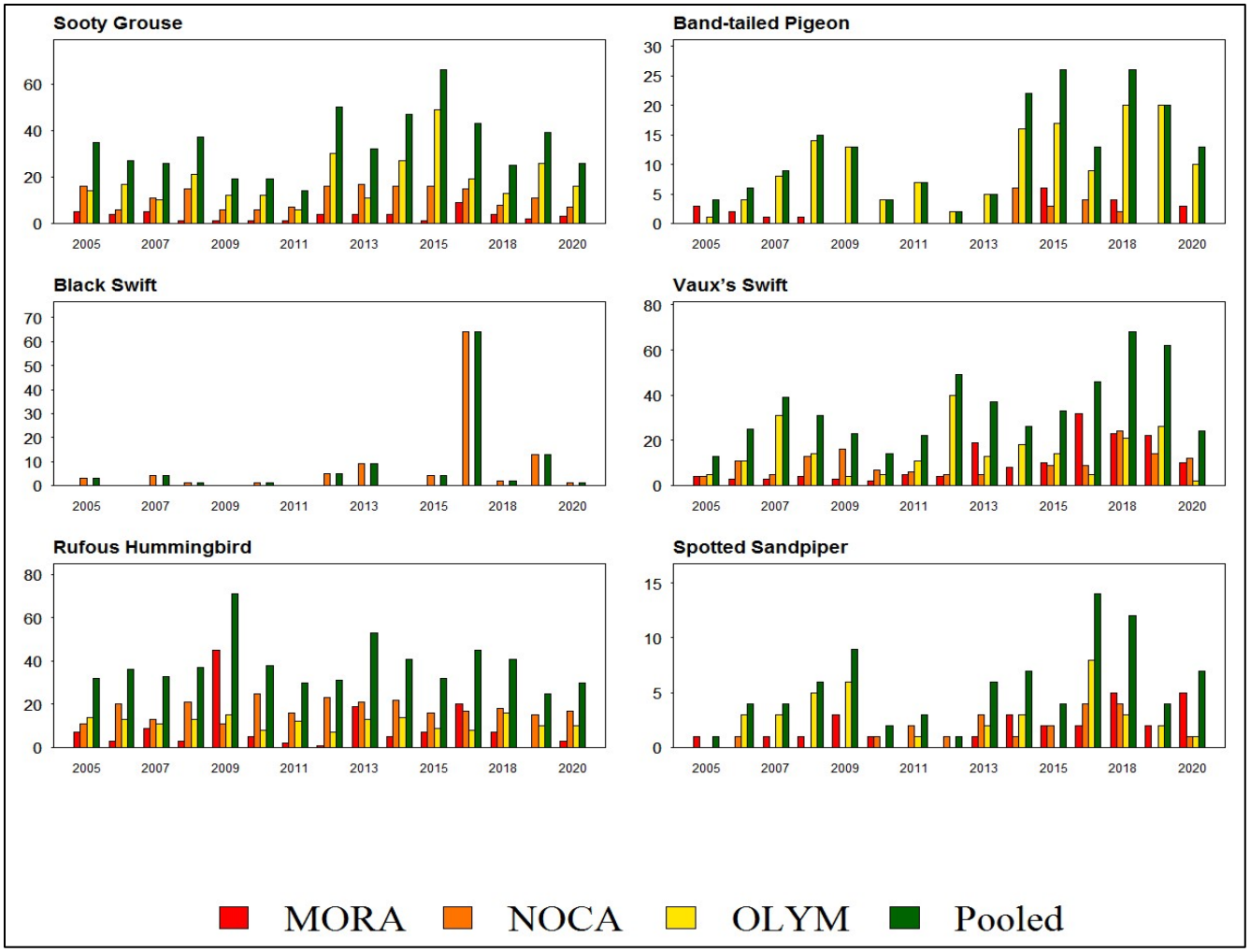

Figure 5a. Number of times each species (Sooty Grouse, Band-tailed Pigeon, Black Swift, Vaux's Swift, Rufous Hummingbird, and Spotted Sandpiper) was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2020 field seasons. Figures 5a–5j include all species for which we amassed at least 84 point count detections on annual-panel transects over the 15 years indicated. Numbers of detections are unadjusted for differences in survey effort or potential differences in detectability of birds between years. These adjustments will be made in conjunction with periodic trend analyses.

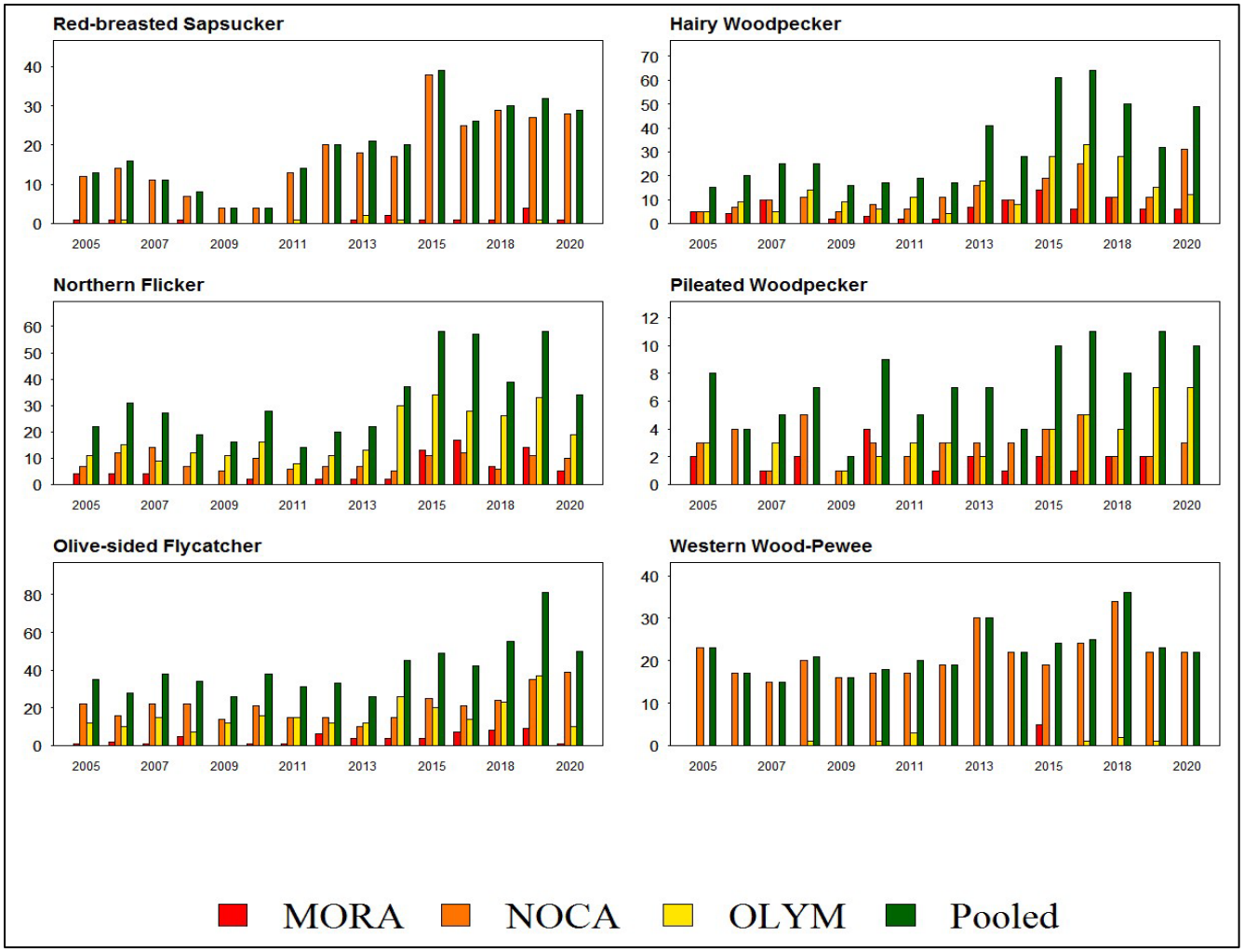

Figure 5b. Number of times each species (Red-breasted Sapsucker, Hairy Woodpecker, Northern Flicker, Pileated Woodpecker, Olive-sided Flycatcher, and Western Wood-Pewee) was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2020 field seasons. Figures 5a–5j include all species for which we amassed at least 84 point count detections on annual-panel transects over the 15 years indicated. Numbers of detections are unadjusted for differences in survey effort or potential differences in detectability of birds between years. These adjustments will be made in conjunction with periodic trend analyses.

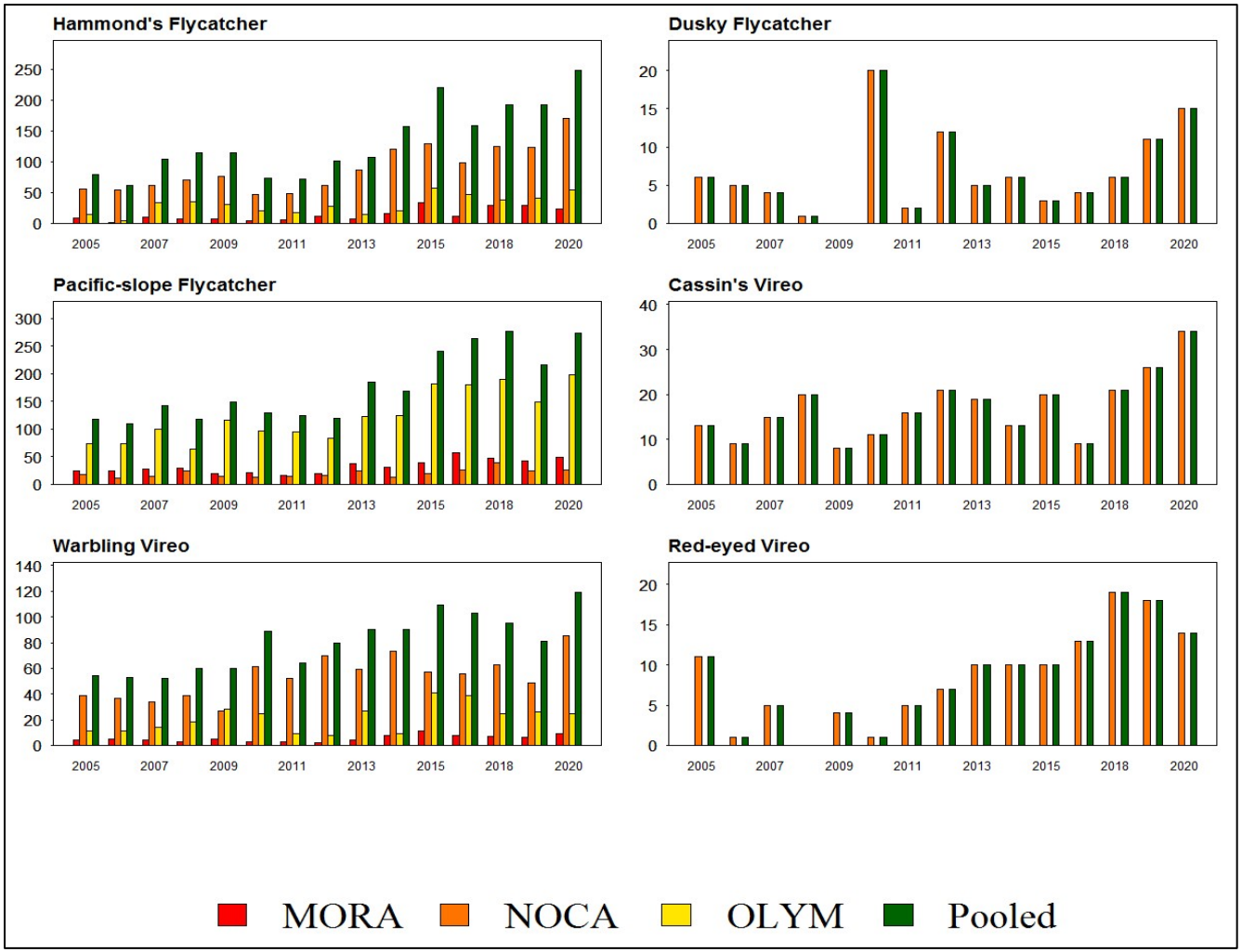

Figure 5c. Number of times each species (Hammond's Flycatcher, Dusky Flycatcher, Pacific-slope Flycatcher, Cassin's Vireo, Warbling Vireo, and Red-eyed Vireo) was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2020 field seasons. Figures 5a–5j include all species for which we amassed at least 84 point count detections on annual-panel transects over the 15 years indicated. Numbers of detections are unadjusted for differences in survey effort or potential differences in detectability of birds between years. These adjustments will be made in conjunction with periodic trend analyses.

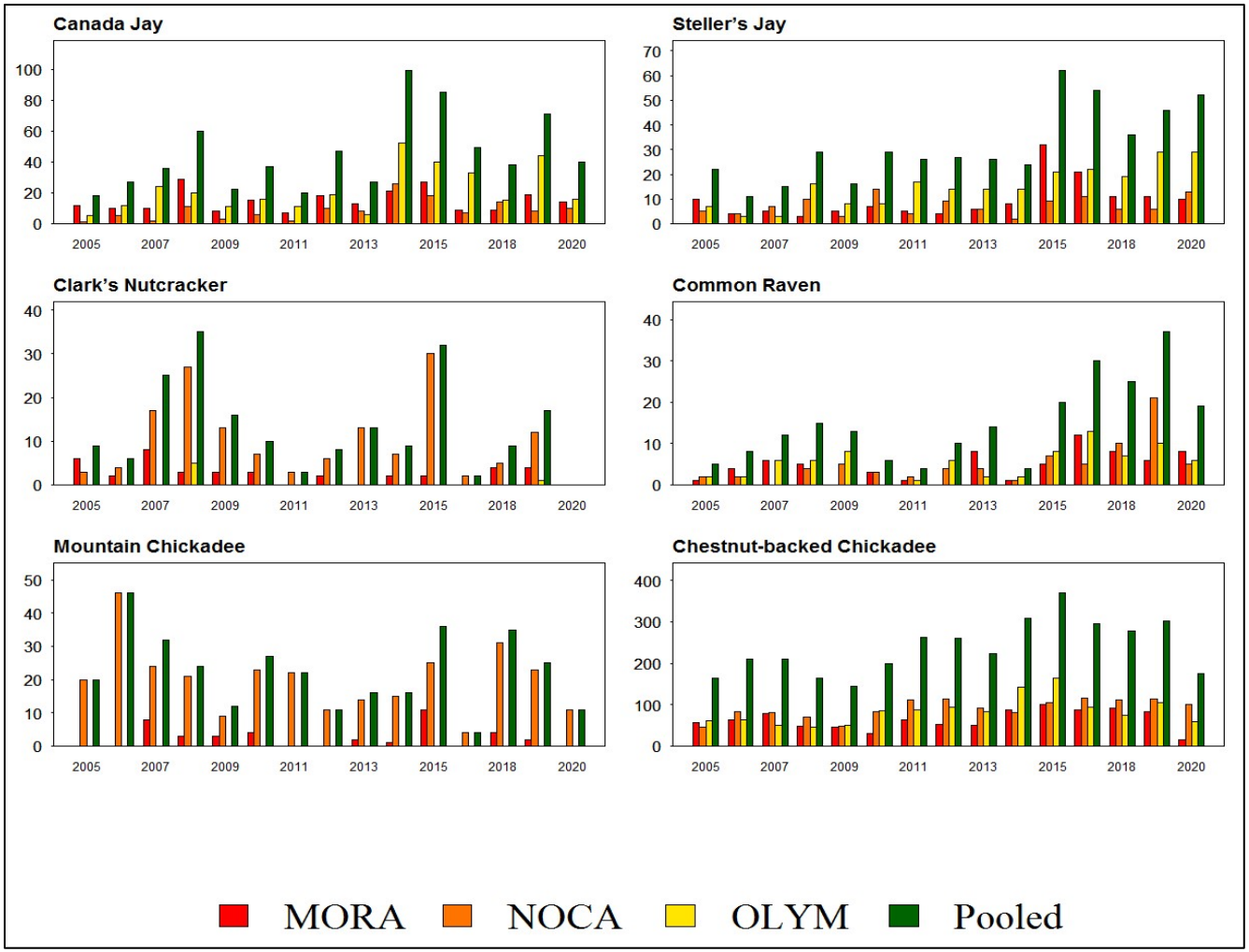

Figure 5d. Number of times each species (Canada Jay, Steller's Jay, Clark's Nutcracker, Common Raven, Mountain Chickadee, Chestnut-backed Chickadee) was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2020 field seasons. Figures 5a–5j include all species for which we amassed at least 84 point count detections on annual-panel transects over the 15 years indicated. Numbers of detections are unadjusted for differences in survey effort or potential differences in detectability of birds between years. These adjustments will be made in conjunction with periodic trend analyses.

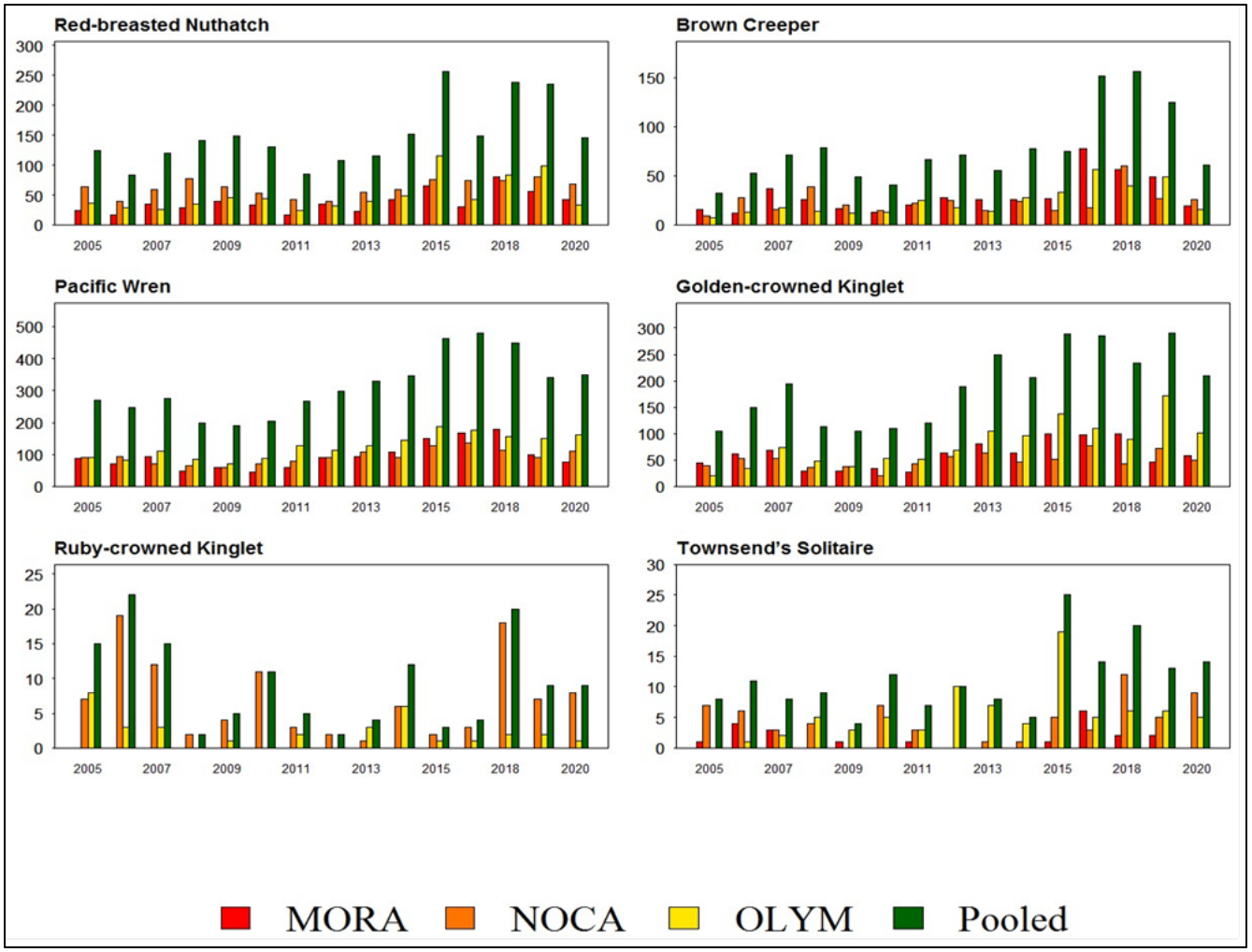

Figure 5e. Number of times each species (Red-breasted Nuthatch, Brown Creeper, Pacific Wren, Golden-crowned Kinglet, Ruby-crowned Kinglet, and Townsend's Solitaire) was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2020 field seasons. Figures 5a–5j include all species for which we amassed at least 84 point count detections on annual-panel transects over the 15 years indicated. Numbers of detections are unadjusted for differences in survey effort or potential differences in detectability of birds between years. These adjustments will be made in conjunction with periodic trend analyses.

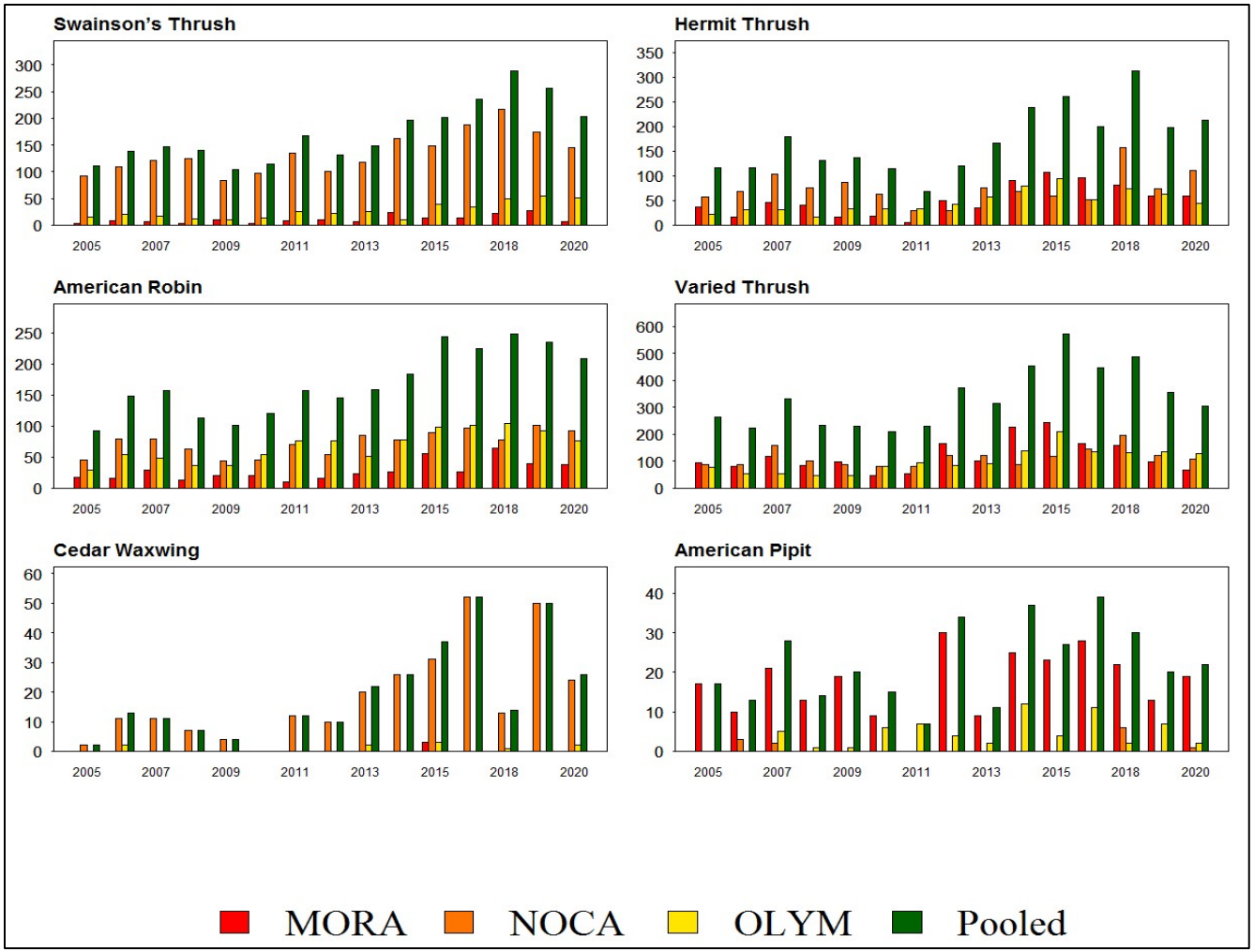

Figure 5f. Number of times each species (Swainson's Thrush, Hermit Thrush, American Robin, Varied Thrush, Cedar Waxwing, and American Pipit) was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2020 field seasons. Figures 5a–5j include all species for which we amassed at least 84 point count detections on annual-panel transects over the 15 years indicated. Numbers of detections are unadjusted for differences in survey effort or potential differences in detectability of birds between years. These adjustments will be made in conjunction with periodic trend analyses.

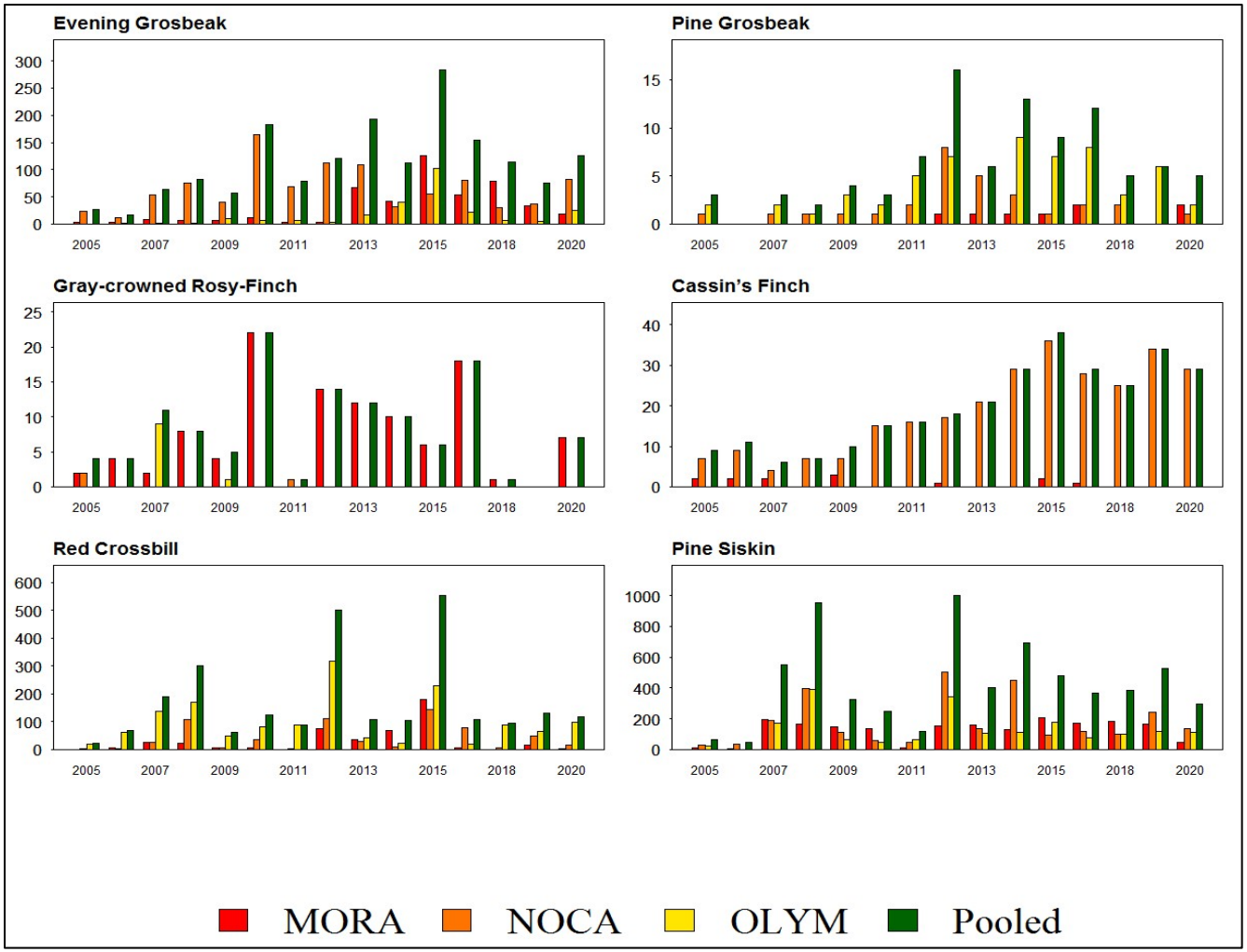

Figure 5g. Number of times each species (Evening Grosbeak, Pine Grosbeak, Gray-crowned Rosy-Finch, Cassin's Finch, Red Crossbill, and Pine Siskin) was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2020 field seasons. Figures 5a–5j include all species for which we amassed at least 84 point count detections on annual-panel transects over the 15 years indicated. Numbers of detections are unadjusted for differences in survey effort or potential differences in detectability of birds between years. These adjustments will be made in conjunction with periodic trend analyses.

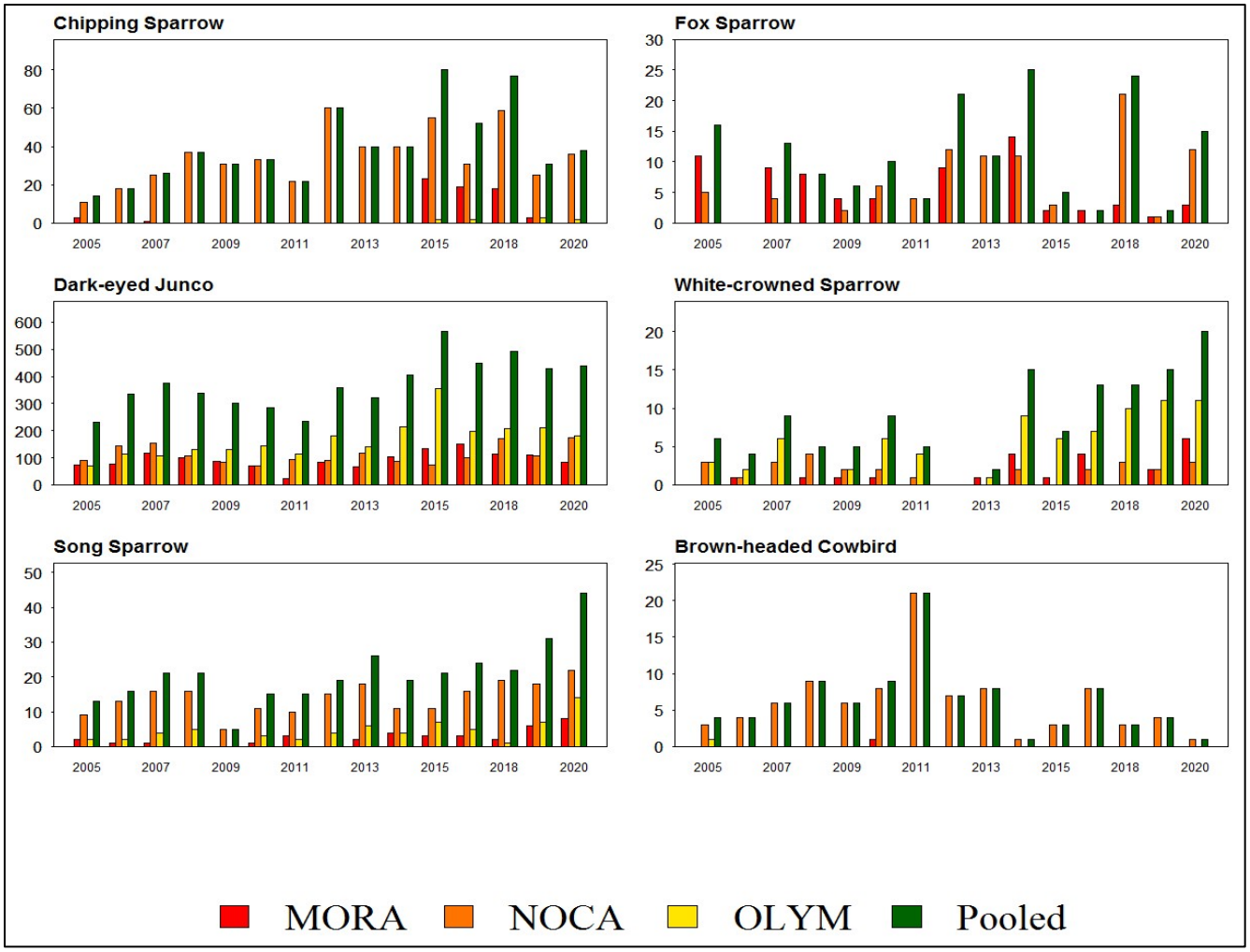

Figure 5h. Number of times each species (Chipping Sparrow, Fox Sparrow, Dark-eyed Junco, White-crowned Sparrow, Song Sparrow, and Brown-headed Cowbird) was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2020 field seasons. Figures 5a–5j include all species for which we amassed at least 84 point count detections on annual-panel transects over the 15 years indicated. Numbers of detections are unadjusted for differences in survey effort or potential differences in detectability of birds between years. These adjustments will be made in conjunction with periodic trend analyses.

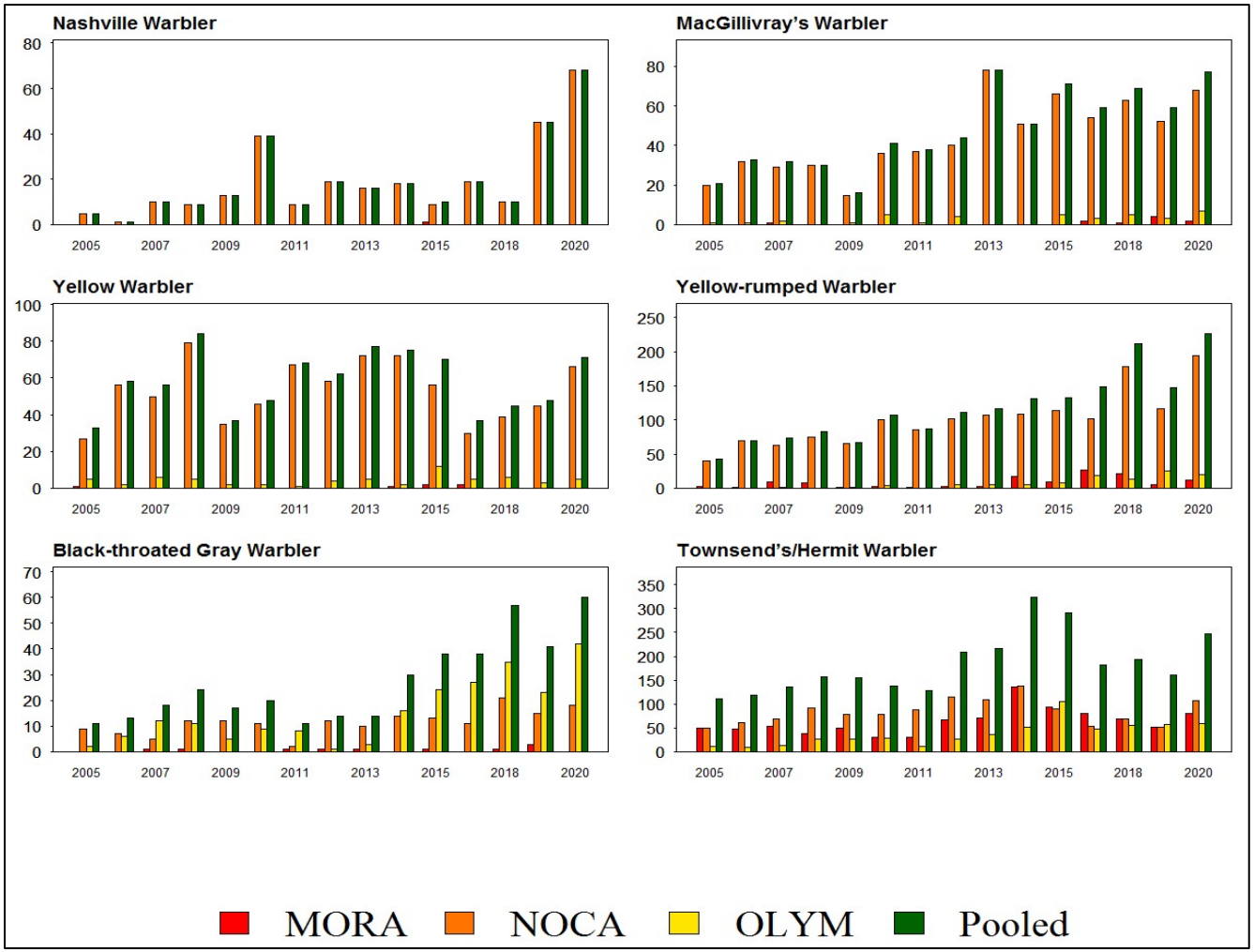

Figure 5i. Number of times each species (Nashville Warbler, MacGillivray's Warbler, Yellow Warbler, Yellow-rumped Warbler, Black-throated Gray Warbler, and Townsend's/Hermit Warbler) was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2020 field seasons. Figures 5a–5j include all species for which we amassed at least 84 point count detections on annual-panel transects over the 15 years indicated. Numbers of detections are unadjusted for differences in survey effort or potential differences in detectability of birds between years. These adjustments will be made in conjunction with periodic trend analyses.

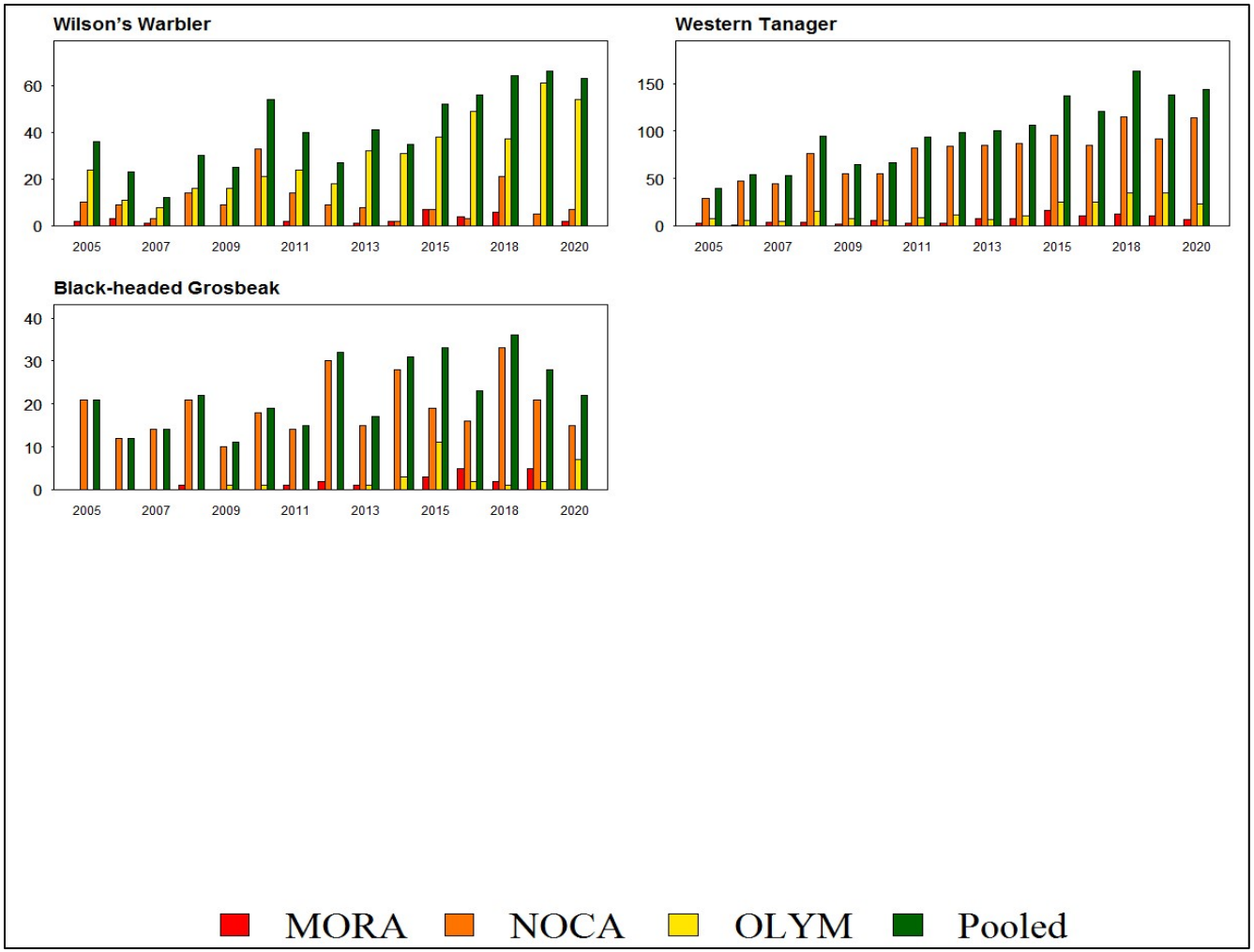

Figure 5j. Number of times each species (Wilson's Warbler, Western Tanager, and Black-headed Grosbeak) was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2020 field seasons. Figures 5a–5j include all species for which we amassed at least 84 point count detections on annual-panel transects over the 15 years indicated. Numbers of detections are unadjusted for differences in survey effort or potential differences in detectability of birds between years. These adjustments will be made in conjunction with periodic trend analyses.

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Appendix A: Detailed Survey History

Appendix A1. Detailed survey history of each transect sampled in the large parks to date.

				Number of points surveyed														
Park	**Panel**	**Elev. Class**	**Transect**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2018**	**2019**	**2020**
MORA	Ann1	Low	4001	10	12	12	12	12	10	11	14	16	16	15	15	15	16	18
MORA	Ann1	Low	4005	11	11	11	11	12	9	10	13	13	14	14	14	14	14	14
MORA	Ann1	Medium	4002	11	11	11	12	11	13	13	15	15	15	16	14	17	17	16
MORA	Ann1	Medium	4004	18	17	18	18	13	15	10	17	17	18	18	20	19	19	15
MORA	Ann1	Medium	4009	14	14	15	15	11	13	10	15	15	15	16	17	17	17	17
MORA	Ann1	Medium	4012	16	16	14	19	19	13	–	17	19	20	23	24	23	23	21
MORA	Ann1	High	4003	12	12	12	12	12	10	12	13	14	15	15	15	16	16	14
MORA	Ann1	High	4007	20	20	20	20	20	20	–	20	20	20	25	22	21	24	22
MORA	Ann1	High	4011	13	11	14	17	17	15	–	16	16	17	17	17	17	17	17
MORA	Ann1	High	4014	10	16	14	16	16	15	–	17	17	18	22	24	22	22	20
MORA	Alt2	Low	4006	–	–	10	–	–	–	–	9	–	–	–	–	12	–	–
MORA	Alt2	Low	4008	–	–	9	–	–	–	–	12	–	–	–	–	13	–	–
MORA	Alt2	Medium	4015	–	–	11	–	–	–	–	12	–	–	–	–	11	–	–
MORA	Alt2	Medium	4017	–	–	12	–	–	–	–	13	–	–	–	–	14	–	–
MORA	Alt2	Medium	4020	–	–	9	–	–	–	–	8	–	–	–	–	16	–	–
MORA	Alt2	Medium	4026	–	–	10	–	–	–	–	11	–	–	–	–	13	–	–
MORA	Alt2	High	4016	–	–	19	–	–	–	–	20	–	–	–	–	21	–	–

Appendix A1 (continued). Detailed survey history of each transect sampled in the large parks to date.

Park	Panel	Elev. Class	Transect	Number of points surveyed														
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018	2019	2020
MORA	Alt2	High	4019	–	–	20	–	–	–	–	20	–	–	–	–	21	–	–
MORA	Alt2	High	4027	–	–	13	–	–	–	–	14	–	–	–	–	17	–	–
MORA	Alt2	High	4075	–	–	14	–	–	–	–	11	–	–	–	–	22	–	–
MORA	Alt3	Low	4010	–	–	–	13	–	–	–	–	14	–	–	–	–	17	–
MORA	Alt3	Low	4018	–	–	–	12	–	–	–	–	14	–	–	–	–	15	–
MORA	Alt3	Medium	4028	–	–	–	11	–	–	–	–	12	–	–	–	–	14	–
MORA	Alt3	Medium	4042	–	–	–	12	–	–	–	–	13	–	–	–	–	15	–
MORA	Alt3	Medium	4044	–	–	–	15	–	–	–	–	16	–	–	–	–	17	–
MORA	Alt3	Medium	4048	–	–	–	13	–	–	–	–	12	–	–	–	–	15	–
MORA	Alt3	High	4029	–	–	–	14	–	–	–	–	14	–	–	–	–	16	–
MORA	Alt3	High	4030	–	–	–	12	–	–	–	–	15	–	–	–	–	18	–
MORA	Alt3	High	4032	–	–	–	15	–	–	–	–	15	–	–	–	–	16	–
MORA	Alt3	High	4033	–	–	–	18	–	–	–	–	19	–	–	–	–	20	–
MORA	Alt4	Low	4021	–	–	–	–	12	–	–	–	–	13	–	–	–	–	16
MORA	Alt4	Low	4022	–	–	–	–	17	–	–	–	–	17	–	–	–	–	18
MORA	Alt4	Medium	4057	–	–	–	–	10	–	–	–	–	14	–	–	–	–	16
MORA	Alt4	Medium	4060	–	–	–	–	24	–	–	–	–	24	–	–	–	–	25
MORA	Alt4	Medium	4061	–	–	–	–	15	–	–	–	–	17	–	–	–	–	19
MORA	Alt4	Medium	4065	–	–	–	–	13	–	–	–	–	15	–	–	–	–	16

Appendix A1 (continued). Detailed survey history of each transect sampled in the large parks to date.

Park	Panel	Elev. Class	Transect	Number of points surveyed														
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018	2019	2020
MORA	Alt4	High	4035	–	–	–	–	12	–	–	–	–	14	–	–	–	–	15
MORA	Alt4	High	4036	–	–	–	–	14	–	–	–	–	16	–	–	–	–	17
MORA	Alt4	High	4039	–	–	–	–	11	–	–	–	–	13	–	–	–	–	15
MORA	Alt4	High	4043	–	–	–	–	18	–	–	–	–	19	–	–	–	–	21
MORA	Alt5	Low	4024	–	–	–	–	–	25	–	–	–	–	25	–	–	–	–
MORA	Alt5	Low	4025	–	–	–	–	–	9	–	–	–	–	15	–	–	–	–
MORA	Alt5	Medium	4068	–	–	–	–	–	9	–	–	–	–	15	–	–	–	–
MORA	Alt5	Medium	4073	–	–	–	–	–	13	–	–	–	–	19	–	–	–	–
MORA	Alt5	Medium	4074	–	–	–	–	–	13	–	–	–	–	15	–	–	–	–
MORA	Alt5	Medium	4076	–	–	–	–	–	15	–	–	–	–	17	–	–	–	–
MORA	Alt5	High	4045	–	–	–	–	–	12	–	–	–	–	21	–	–	–	–
MORA	Alt5	High	4046	–	–	–	–	–	10	–	–	–	–	13	–	–	–	–
MORA	Alt5	High	4052	–	–	–	–	–	12	–	–	–	–	16	–	–	–	–
MORA	Alt5	High	4083	–	–	–	–	–	–	–	–	–	–	18	–	–	–	–
MORA	Alt6	Low	4031	–	–	–	–	–	–	10	–	–	–	–	13	–	–	–
MORA	Alt6	Low	4034	–	–	–	–	–	–	10	–	–	–	–	12	–	–	–
MORA	Alt6	Medium	4077	–	–	–	–	–	–	12	–	–	–	–	18	–	–	–
MORA	Alt6	Medium	4078	–	–	–	–	–	–	9	–	–	–	–	22	–	–	–
MORA	Alt6	Medium	4081	–	–	–	–	–	–	10	–	–	–	–	19	–	–	–

Appendix A1 (continued). Detailed survey history of each transect sampled in the large parks to date.

Park	Panel	Elev. Class	Transect	Number of points surveyed														
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018	2019	2020
MORA	Alt6	Medium	4084	–	–	–	–	–	–	–	–	–	–	–	17	–	–	–
MORA	Alt6	High	4058	–	–	–	–	–	–	–	–	–	–	–	19	–	–	–
MORA	Alt6	High	4062	–	–	–	–	–	–	–	–	–	–	–	19	–	–	–
MORA	Alt6	High	4064	–	–	–	–	–	–	10	–	–	–	–	15	–	–	–
MORA	Alt6	High	4067	–	–	–	–	–	–	13	–	–	–	–	17	–	–	–
NOCA	Ann1	Low	1013	12	11	14	12	11	9	13	15	15	15	–	15	15	15	17
NOCA	Ann1	Low	1017	13	12	9	12	12	12	13	14	14	15	14	15	15	15	15
NOCA	Ann1	Low	1020	15	12	13	15	16	12	16	17	17	18	18	17	17	18	18
NOCA	Ann1	Low	1023	18	19	19	20	21	20	21	21	21	21	22	22	22	22	22
NOCA	Ann1	Medium	1015	12	16	17	17	15	15	16	17	17	19	18	19	18	18	19
NOCA	Ann1	Medium	1018	16	21	21	23	22	25	25	23	25	25	24	25	25	23	23
NOCA	Ann1	Medium	1022	13	13	11	13	14	13	14	15	15	17	16	18	16	18	19
NOCA	Ann1	Medium	1024	9	10	11	12	10	11	10	13	13	13	14	14	15	14	15
NOCA	Ann1	High	1014	15	19	19	–	20	–	–	20	21	21	22	22	23	–	23
NOCA	Ann1	High	1016	14	15	14	16	15	14	15	17	17	17	17	17	16	17	18
NOCA	Ann1	High	1019	12	12	10	12	12	12	12	13	13	13	14	–	14	14	15
NOCA	Ann1	High	1021	18	21	22	23	22	19	17	24	24	24	24	23	24	24	25
NOCA	Alt2	Low	1001	–	–	11	–	–	–	–	13	–	–	–	–	13	–	–
NOCA	Alt2	Low	1005	–	–	13	–	–	–	–	15	–	–	–	–	15	–	–

Appendix A1 (continued). Detailed survey history of each transect sampled in the large parks to date.

Park	Panel	Elev. Class	Transect	Number of points surveyed														
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018	2019	2020
NOCA	Alt2	Low	1006	–	–	10	–	–	–	–	12	–	–	–	–	12	–	–
NOCA	Alt2	Low	1010	–	–	12	–	–	–	–	16	–	–	–	–	16	–	–
NOCA	Alt2	Medium	1003	–	–	12	–	–	–	–	15	–	–	–	–	15	–	–
NOCA	Alt2	Medium	1004	–	–	13	–	–	–	–	14	–	–	–	–	15	–	–
NOCA	Alt2	Medium	1009	–	–	–	–	–	–	–	16	–	–	–	–	17	–	–
NOCA	Alt2	Medium	1011	–	–	19	–	–	–	–	19	–	–	–	–	20	–	–
NOCA	Alt2	High	1002	–	–	18	–	–	–	–	20	–	–	–	–	20	–	–
NOCA	Alt2	High	1007	–	–	13	–	–	–	–	14	–	–	–	–	15	–	–
NOCA	Alt2	High	1008	–	–	–	–	–	–	–	14	–	–	–	–	14	–	–
NOCA	Alt2	High	1012	–	–	15	–	–	–	–	19	–	–	–	–	18	–	–
NOCA	Alt3	Low	1027	–	–	–	13	–	–	–	–	16	–	–	–	–	15	–
NOCA	Alt3	Low	1028	–	–	–	13	–	–	–	–	14	–	–	–	–	16	–
NOCA	Alt3	Low	1029	–	–	–	13	–	–	–	–	15	–	–	–	–	15	–
NOCA	Alt3	Low	1034	–	–	–	13	–	–	–	–	14	–	–	–	–	15	–
NOCA	Alt3	Medium	1025	–	–	–	15	–	–	–	–	15	–	–	–	–	15	–
NOCA	Alt3	Medium	1026	–	–	–	14	–	–	–	–	15	–	–	–	–	17	–
NOCA	Alt3	Medium	1031	–	–	–	19	–	–	–	–	20	–	–	–	–	18	–
NOCA	Alt3	Medium	1057	–	–	–	–	–	–	–	–	–	–	–	–	–	17	–
NOCA	Alt3	High	1032	–	–	–	–	–	–	–	–	13	–	–	–	–	15	–

Appendix A1 (continued). Detailed survey history of each transect sampled in the large parks to date.

Park	Panel	Elev. Class	Transect	Number of points surveyed														
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018	2019	2020
NOCA	Alt3	High	1037	–	–	–	–	–	–	–	–	20	–	–	–	–	22	–
NOCA	Alt3	High	1039	–	–	–	20	–	–	–	–	20	–	–	–	–	22	–
NOCA	Alt3	High	1040	–	–	–	21	–	–	–	–	19	–	–	–	–	19	–
NOCA	Alt4	Low	1036	–	–	–	–	20	–	–	–	–	25	–	–	–	–	21
NOCA	Alt4	Low	1054	–	–	–	–	11	–	–	–	–	16	–	–	–	–	17
NOCA	Alt4	Low	1061	–	–	–	–	10	–	–	–	–	13	–	–	–	–	16
NOCA	Alt4	Low	1122	–	–	–	–	–	–	–	–	–	22	–	–	–	–	22
NOCA	Alt4	Medium	1033	–	–	–	–	20	–	–	–	–	23	–	–	–	–	23
NOCA	Alt4	Medium	1035	–	–	–	–	16	–	–	–	–	18	–	–	–	–	18
NOCA	Alt4	Medium	1038	–	–	–	–	13	–	–	–	–	18	–	–	–	–	18
NOCA	Alt4	Medium	1041	–	–	–	–	14	–	–	–	–	17	–	–	–	–	18
NOCA	Alt4	High	1048	–	–	–	–	11	–	–	–	–	13	–	–	–	–	17
NOCA	Alt4	High	1049	–	–	–	–	12	–	–	–	–	17	–	–	–	–	18
NOCA	Alt4	High	1050	–	–	–	–	13	–	–	–	–	16	–	–	–	–	17
NOCA	Alt4	High	1052	–	–	–	–	11	–	–	–	–	13	–	–	–	–	18
NOCA	Alt5	Low	1062	–	–	–	–	–	8	–	–	–	–	11	–	–	–	–
NOCA	Alt5	Low	1063	–	–	–	–	–	9	–	–	–	–	16	–	–	–	–
NOCA	Alt5	Low	1065	–	–	–	–	–	11	–	–	–	–	13	–	–	–	–
NOCA	Alt5	Low	1067	–	–	–	–	–	8	–	–	–	–	13	–	–	–	–

Appendix A1 (continued). Detailed survey history of each transect sampled in the large parks to date.

Park	Panel	Elev. Class	Transect	Number of points surveyed														
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018	2019	2020
NOCA	Alt5	Medium	1042	–	–	–	–	–	15	–	–	–	–	17	–	–	–	–
NOCA	Alt5	Medium	1043	–	–	–	–	–	9	–	–	–	–	13	–	–	–	–
NOCA	Alt5	Medium	1044	–	–	–	–	–	11	–	–	–	–	15	–	–	–	–
NOCA	Alt5	Medium	1045	–	–	–	–	–	10	–	–	–	–	10	–	–	–	–
NOCA	Alt5	High	1055	–	–	–	–	–	13	–	–	–	–	16	–	–	–	–
NOCA	Alt5	High	1058	–	–	–	–	–	–	–	–	–	–	18	–	–	–	–
NOCA	Alt5	High	1060	–	–	–	–	–	9	–	–	–	–	14	–	–	–	–
NOCA	Alt5	High	1064	–	–	–	–	–	10	–	–	–	–	15	–	–	–	–
NOCA	Alt6	Low	1068	–	–	–	–	–	–	13	–	–	–	–	15	–	–	–
NOCA	Alt6	Low	1070	–	–	–	–	–	–	12	–	–	–	–	14	–	–	–
NOCA	Alt6	Low	1074	–	–	–	–	–	–	14	–	–	–	–	18	–	–	–
NOCA	Alt6	Low	1075	–	–	–	–	–	–	11	–	–	–	–	16	–	–	–
NOCA	Alt6	Medium	1047	–	–	–	–	–	–	13	–	–	–	–	15	–	–	–
NOCA	Alt6	Medium	1051	–	–	–	–	–	–	11	–	–	–	–	12	–	–	–
NOCA	Alt6	Medium	1053	–	–	–	–	–	–	13	–	–	–	–	19	–	–	–
NOCA	Alt6	Medium	1056	–	–	–	–	–	–	13	–	–	–	–	14	–	–	–
NOCA	Alt6	High	1072	–	–	–	–	–	–	–	–	–	–	–	9	–	–	–
NOCA	Alt6	High	1088	–	–	–	–	–	–	12	–	–	–	–	13	–	–	–
NOCA	Alt6	High	1090	–	–	–	–	–	–	–	–	–	–	–	16	–	–	–

Appendix A1 (continued). Detailed survey history of each transect sampled in the large parks to date.

Park	Panel	Elev. Class	Transect	Number of points surveyed														
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018	2019	2020
NOCA	Alt6	High	1092	–	–	–	–	–	–	14	–	–	–	–	14	–	–	–
OLYM	Ann1	Low	3001	11	10	8	10	11	12	12	13	12	13	13	14	13	14	14
OLYM	Ann1	Low	3121	11	15	17	17	17	14	17	15	17	17	19	19	18	17	18
OLYM	Ann1	Low	3126	9	10	11	13	13	13	15	15	15	14	15	16	16	15	17
OLYM	Ann1	Low	3134	16	16	18	18	18	18	19	19	19	19	18	20	20	20	20
OLYM	Ann1	Medium	3122	14	12	14	–	16	16	–	16	17	18	18	–	18	17	18
OLYM	Ann1	Medium	3123	10	10	12	14	14	15	15	15	15	16	17	16	16	17	17
OLYM	Ann1	Medium	3130	9	9	8	9	9	9	9	10	10	10	10	10	10	8	11
OLYM	Ann1	Medium	3200	–	–	22	23	21	23	22	23	23	22	23	23	23	22	23
OLYM	Ann1	High	3124	9	10	10	11	11	11	11	12	12	13	14	14	13	14	14
OLYM	Ann1	High	3125	9	11	13	13	14	15	11	14	12	15	15	15	15	12	16
OLYM	Ann1	High	3127	7	9	13	15	14	15	15	15	15	15	16	15	16	16	16
OLYM	Ann1	High	3128	10	11	11	11	10	11	12	13	12	14	14	14	14	11	10
OLYM	Alt2	Low	3138	–	–	10	–	–	–	–	12	–	–	–	–	13	–	–
OLYM	Alt2	Low	3142	–	–	14	–	–	–	–	14	–	–	–	–	16	–	–
OLYM	Alt2	Low	3144	–	–	13	–	–	–	–	13	–	–	–	–	14	–	–
OLYM	Alt2	Low	3145	–	–	13	–	–	–	–	14	–	–	–	–	14	–	–
OLYM	Alt2	Medium	3133	–	–	8	–	–	–	–	16	–	–	–	–	16	–	–
OLYM	Alt2	Medium	3135	–	–	11	–	–	–	–	13	–	–	–	–	13	–	–

Appendix A1 (continued). Detailed survey history of each transect sampled in the large parks to date.

Park	Panel	Elev. Class	Transect	Number of points surveyed														
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018	2019	2020
OLYM	Alt2	Medium	3137	–	–	10	–	–	–	–	11	–	–	–	–	11	–	–
OLYM	Alt2	Medium	3141	–	–	14	–	–	–	–	15	–	–	–	–	15	–	–
OLYM	Alt2	High	3132	–	–	19	–	–	–	–	19	–	–	–	–	18	–	–
OLYM	Alt2	High	3136	–	–	11	–	–	–	–	11	–	–	–	–	14	–	–
OLYM	Alt2	High	3139	–	–	16	–	–	–	–	13	–	–	–	–	16	–	–
OLYM	Alt2	High	3140	–	–	–	–	–	–	–	12	–	–	–	–	13	–	–
OLYM	Alt3	Low	3146	–	–	–	15	–	–	–	–	15	–	–	–	–	15	–
OLYM	Alt3	Low	3149	–	–	–	10	–	–	–	–	12	–	–	–	–	12	–
OLYM	Alt3	Low	3151	–	–	–	12	–	–	–	–	17	–	–	–	–	17	–
OLYM	Alt3	Low	3153	–	–	–	11	–	–	–	–	16	–	–	–	–	16	–
OLYM	Alt3	Medium	3143	–	–	–	10	–	–	–	–	11	–	–	–	–	9	–
OLYM	Alt3	Medium	3150	–	–	–	11	–	–	–	–	12	–	–	–	–	12	–
OLYM	Alt3	Medium	3152	–	–	–	11	–	–	–	–	13	–	–	–	–	13	–
OLYM	Alt3	Medium	3154	–	–	–	15	–	–	–	–	16	–	–	–	–	18	–
OLYM	Alt3	High	3147	–	–	–	19	–	–	–	–	19	–	–	–	–	22	–
OLYM	Alt3	High	3148	–	–	–	14	–	–	–	–	16	–	–	–	–	16	–
OLYM	Alt3	High	3156	–	–	–	10	–	–	–	–	11	–	–	–	–	13	–
OLYM	Alt3	High	3157	–	–	–	11	–	–	–	–	12	–	–	–	–	10	–
OLYM	Alt4	Low	3155	–	–	–	–	10	–	–	–	–	12	–	–	–	–	15

Appendix A1 (continued). Detailed survey history of each transect sampled in the large parks to date.

Park	Panel	Elev. Class	Transect	Number of points surveyed														
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018	2019	2020
OLYM	Alt4	Low	3159	–	–	–	–	11	–	–	–	–	12	–	–	–	–	15
OLYM	Alt4	Low	3161	–	–	–	–	11	–	–	–	–	12	–	–	–	–	13
OLYM	Alt4	Low	3163	–	–	–	–	15	–	–	–	–	15	–	–	–	–	17
OLYM	Alt4	Medium	3160	–	–	–	–	10	–	–	–	–	12	–	–	–	–	12
OLYM	Alt4	Medium	3167	–	–	–	–	11	–	–	–	–	14	–	–	–	–	13
OLYM	Alt4	Medium	3168	–	–	–	–	10	–	–	–	–	15	–	–	–	–	16
OLYM	Alt4	Medium	3174	–	–	–	–	14	–	–	–	–	15	–	–	–	–	15
OLYM	Alt4	High	3158	–	–	–	–	14	–	–	–	–	18	–	–	–	–	19
OLYM	Alt4	High	3164	–	–	–	–	14	–	–	–	–	17	–	–	–	–	18
OLYM	Alt4	High	3171	–	–	–	–	12	–	–	–	–	15	–	–	–	–	16
OLYM	Alt4	High	3173	–	–	–	–	10	–	–	–	–	12	–	–	–	–	13
OLYM	Alt5	Low	3165	–	–	–	–	–	10	–	–	–	–	12	–	–	–	–
OLYM	Alt5	Low	3166	–	–	–	–	–	12	–	–	–	–	15	–	–	–	–
OLYM	Alt5	Low	3169	–	–	–	–	–	8	–	–	–	–	13	–	–	–	–
OLYM	Alt5	Low	3170	–	–	–	–	–	11	–	–	–	–	11	–	–	–	–
OLYM	Alt5	Medium	3178	–	–	–	–	–	11	–	–	–	–	14	–	–	–	–
OLYM	Alt5	Medium	3183	–	–	–	–	–	13	–	–	–	–	15	–	–	–	–
OLYM	Alt5	Medium	3184	–	–	–	–	–	16	–	–	–	–	20	–	–	–	–
OLYM	Alt5	Medium	3185	–	–	–	–	–	9	–	–	–	–	11	–	–	–	–

Appendix A1 (continued). Detailed survey history of each transect sampled in the large parks to date.

Park	Panel	Elev. Class	Transect	Number of points surveyed														
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018	2019	2020
OLYM	Alt5	High	3175	–	–	–	–	–	12	–	–	–	–	15	–	–	–	–
OLYM	Alt5	High	3179	–	–	–	–	–	16	–	–	–	–	19	–	–	–	–
OLYM	Alt5	High	3180	–	–	–	–	–	16	–	–	–	–	19	–	–	–	–
OLYM	Alt5	High	3188	–	–	–	–	–	12	–	–	–	–	18	–	–	–	–
OLYM	Alt6	Low	3172	–	–	–	–	–	–	14	–	–	–	–	14	–	–	–
OLYM	Alt6	Low	3177	–	–	–	–	–	–	10	–	–	–	–	10	–	–	–
OLYM	Alt6	Low	3181	–	–	–	–	–	–	16	–	–	–	–	16	–	–	–
OLYM	Alt6	Low	3182	–	–	–	–	–	–	16	–	–	–	–	18	–	–	–
OLYM	Alt6	Medium	3187	–	–	–	–	–	–	20	–	–	–	–	21	–	–	–
OLYM	Alt6	Medium	3190	–	–	–	–	–	–	14	–	–	–	–	15	–	–	–
OLYM	Alt6	Medium	3195	–	–	–	–	–	–	12	–	–	–	–	13	–	–	–
OLYM	Alt6	Medium	3198	–	–	–	–	–	–	11	–	–	–	–	13	–	–	–
OLYM	Alt6	High	3189	–	–	–	–	–	–	16	–	–	–	–	16	–	–	–
OLYM	Alt6	High	3191	–	–	–	–	–	–	15	–	–	–	–	16	–	–	–
OLYM	Alt6	High	3192	–	–	–	–	–	–	14	–	–	–	–	15	–	–	–
OLYM	Alt6	High	3196	–	–	–	–	–	–	15	–	–	–	–	18	–	–	–

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NPS 105/177824, 149/177824, 168/177824, November 2021

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