National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science

North Coast and Cascades Network Landbird Monitoring

Report for the 2019 Field Season

Natural Resource Data Series NPS/NCCN/NRDS—2020/1284

ON THIS PAGE
2019 field crew at North Cascades National Park Complex
Photograph taken by: Chris Ray, The Institute for Bird Populations

ON THE COVER
Sooty Grouse (*Dendragapus fuliginosus)*, Olympic National Park
Photograph taken by: Mandy Holmgren, The Institute for Bird Populations

North Coast and Cascades Network Landbird Monitoring

Report for the 2019 Field Season

Natural Resource Data Series NPS/NCCN/NRDS—2020/1284

Amanda L. Holmgren,[1] Robert L. Wilkerson,[1] Rodney B. Siegel,[1] Jason I. Ransom[2]

[1]The Institute for Bird Populations
P.O. Box 1346
Point Reyes Station, CA 94956-1346

[2]National Park Service
North Cascades National Park Service Complex
810 State Route 20
Sedro-Woolley, WA 98284

July 2020

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

The National Park Service, Natural Resource Stewardship and Science office in Fort Collins, Colorado, publishes a range of reports that address natural resource topics. These reports are of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

The Natural Resource Data Series is intended for the timely release of basic data sets and data summaries. Care has been taken to assure accuracy of raw data values, but a thorough analysis and interpretation of the data has not been completed. Consequently, the initial analyses of data in this report are provisional and subject to change.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner.

Data in this report were collected and analyzed using methods based on established, peer-reviewed protocols and were analyzed and interpreted within the guidelines of the protocols.

Views, statements, findings, conclusions, recommendations, and data in this report do not necessarily reflect views and policies of the National Park Service, U.S. Department of the Interior. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. Government.

This report is available in digital format from the North Coast and Cascades Network Inventory and Monitoring website and the Natural Resource Publications Management website. If you have difficulty accessing information in this publication, particularly if using assistive technology, please email irma@nps.gov.

Please cite this publication as:

Holmgren, A. L., R. L. Wilkerson, R. B. Siegel, and J. I. Ransom. 2020. North Coast and Cascades Network landbird monitoring: Report for the 2019 field season. Natural Resource Data Series NPS/NCCN/NRDS—2020/1284. National Park Service, Fort Collins, Colorado.

NPS 105/171145, 149/171145, 168/171145, July 2020

Contents

Figures

Page

Figures (continued)

Page

Tables

Page

Executive Summary

In 2019 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 12 years (2007–2019), except for 2017 when data collection was temporarily suspended to reallocate resources for a 5-year data synthesis. In 2019 we conducted 1,108 point counts at point count survey stations along 67 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 132 species, 90 of which were detected during point counts. For 57 species (all species for which we amassed at least 77 point count detections over the period 2005–2019), we present the total number of detections of each species on each park's annual panel transects during the 2005–2019 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.

We also conducted 73 point counts at Lewis and Clark National Historical Park (LEWI), including 36 at Cape Disappointment, 29 at Fort Clatsop, five at Sunset Beach, and three at Yeon. At LEWI our field crew detected 77 species, 64 of which were detected during point counts. We present the number of detections, and the number of points with detections, for each species detected during point counts at LEWI.

The number of bird detections on annual-panel transects across all three large parks decreased by 430 between 2018 and 2019, though the magnitude and direction of the change in detections varied substantially among the parks. At OLYM there was an increase of 177 detections on annual-panel transects, at MORA there was a decrease of 391 detections on annual-panel transects. At both parks, the number of point counts conducted changed little between the two years. At NOCA there was a decrease of 216 detections on annual-panel transects, but because there were fewer point counts conducted there in 2019 than in 2018, the average number of bird detections per point between the two years actually changed very little.

Many species were detected in slightly or moderately greater numbers in the three large parks in 2019 than in previous years. A few of these species include olive-sided flycatcher, Cassin's vireo, song sparrow, Nashville warbler, and Wilson's warbler. Each of these species had more detections in 2019 than in any of the previous 13 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 2019 crew members for their hard work and dedication to the project: N. Hoeme, K. Kleinschmidt, C. McElroy, K. Perlman, K. Ray, and M. Schumaker. 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, P. Happe, and C. Clatterbuck for providing program oversight at the respective parks; C. Ray and B. Boekelheide for assistance during training; S. Gremel and V. Gempko for help with logistics and field-work during the season; and R. Christophersen for boat rides on Ross Lake. We thank K. Beirne and N. Antonova for GIS training and support and K. Beirne 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; M. Huff, NCCN Inventory and Monitoring Program Manager, for his support of the project; and the ESRI Nonprofit Organization Program for software support provided to The Institute for Bird Populations. This is Contribution No. 664 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. 2017, 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 2019 and the previous 12 years of data collection (Siegel et al. 2008, Wilkerson et al. 2009b, 2010, Holmgren et al. 2011–2019). 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. For the first trend analysis report summarizes data from 2005–2012 (Saracco et al. 2014). More recently, a new 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. (Ray et al. 2017b). Two papers that evaluate population trends of dozens of birds across the NCCN parks, using the new framework, have now been published (Ray et al. 2017a, 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.

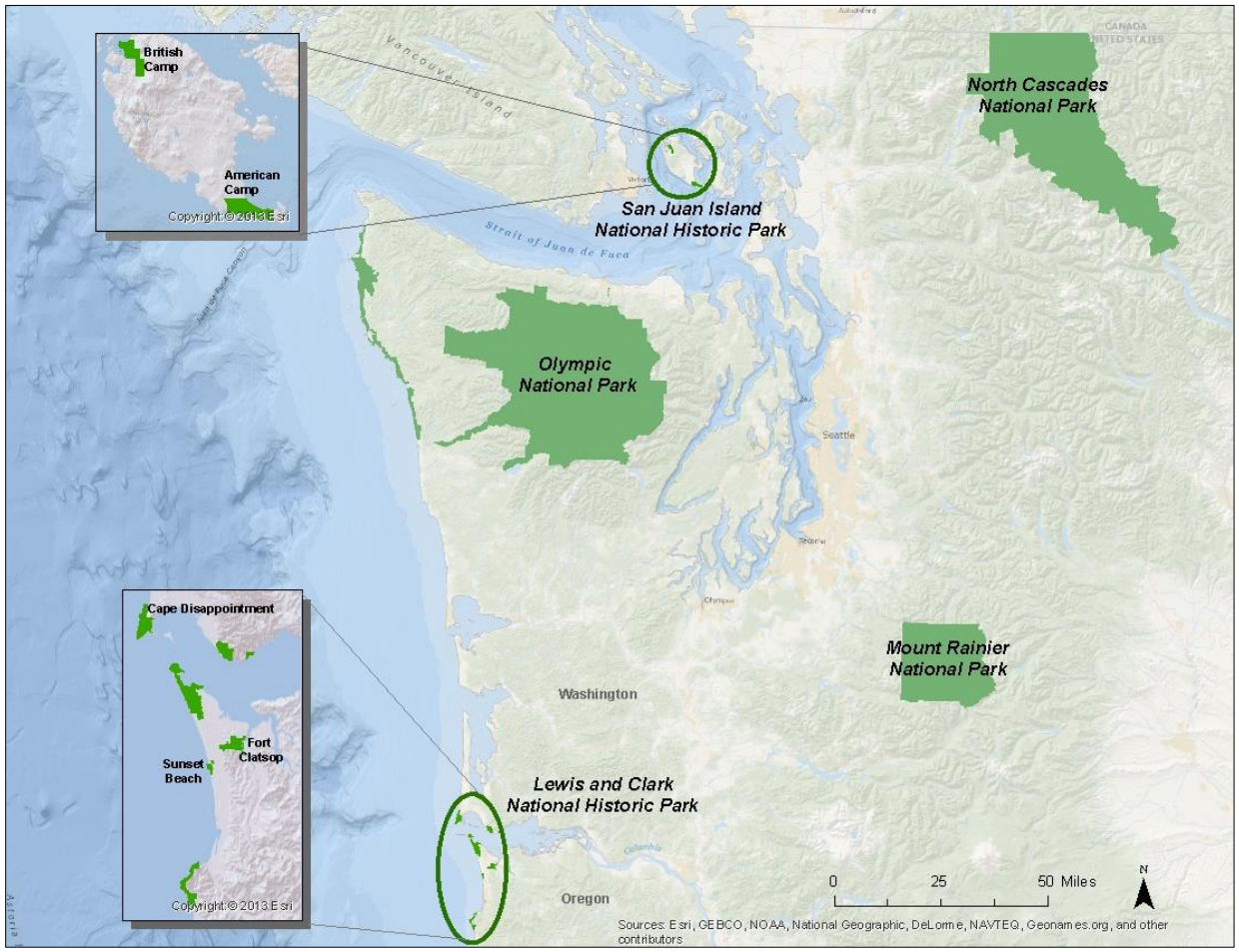

Figure 1. National Park Service units participating in the North Coast and Cascades Network Landbird Monitoring Project.

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 2019 we implemented the full study design in the three large parks for the twelfth year, including surveys of the annual panel ('Ann1') as well as the second alternating panel ('Alt3') (Figures 2–4). During the first two years of protocol development (2005–2006) we surveyed only the annual panel (Siegel et al. 2006, 2009b). Results from each of the first 11 years of full implementation are presented in Siegel et al. (2008), Wilkerson et al. (2009b, 2010), and Holmgren et al. (2011–2019). 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 2019 we surveyed the grid at LEWI (Figure 5). Multi-year trend analyses for the small parks are provided in Ray et al. (2019).

Crew Training and Certification

Mandy Holmgren, a Staff Biologist with The Institute for Bird Populations, served as the 2019 Field Lead. Mandy began training six field technicians on April 28, including one returning crew member, who assisted with training. Training followed guidelines described in the NCCN Landbird Monitoring Protocol (Siegel et al. 2007). By the end of the official training session on May 19, only one of the five new field technicians had passed the rigorous point count certification exam, and was able to begin collecting data. Two technicians passed within ten days of the end of training, and the other two technicians passed the exam about three additional weeks after that. All individuals who collected data during the 2019 field season (Table 1) were employees or volunteers of The Institute for Bird Populations.

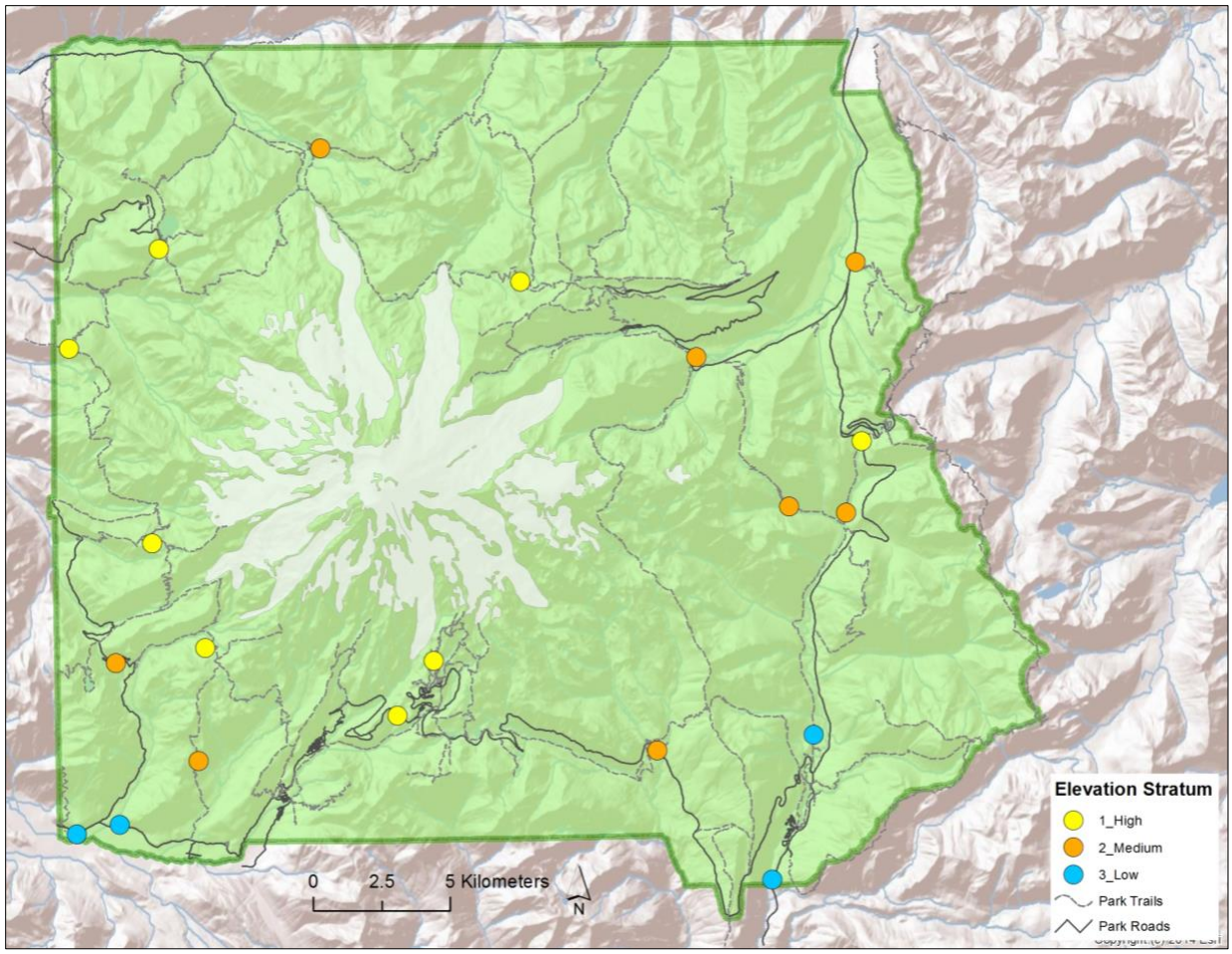

Figure 2. Approximate locations of transects conducted at Mount Rainier National Park in 2019.

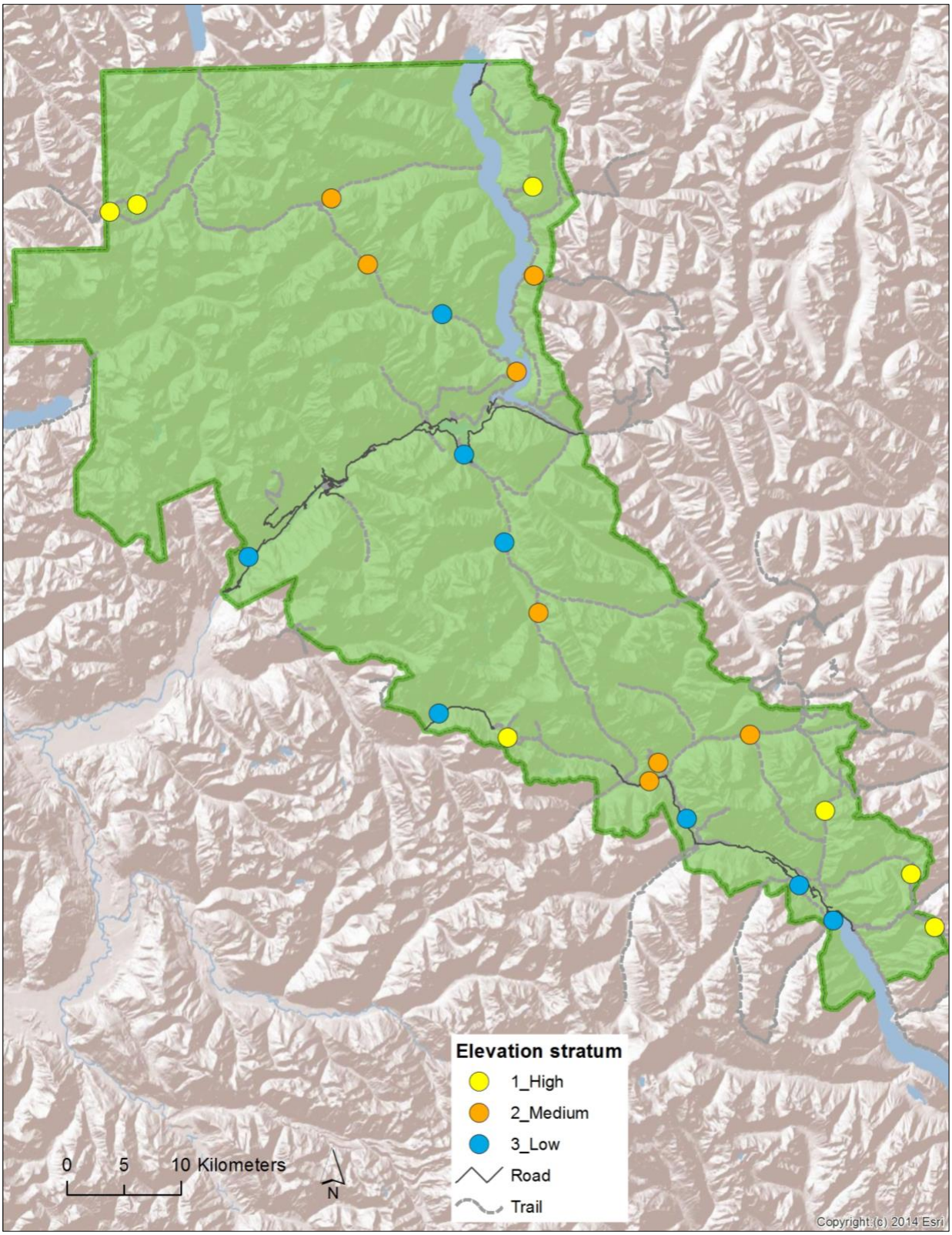

Figure 3. Approximate locations of transects conducted at North Cascades National Park Complex in 2019.

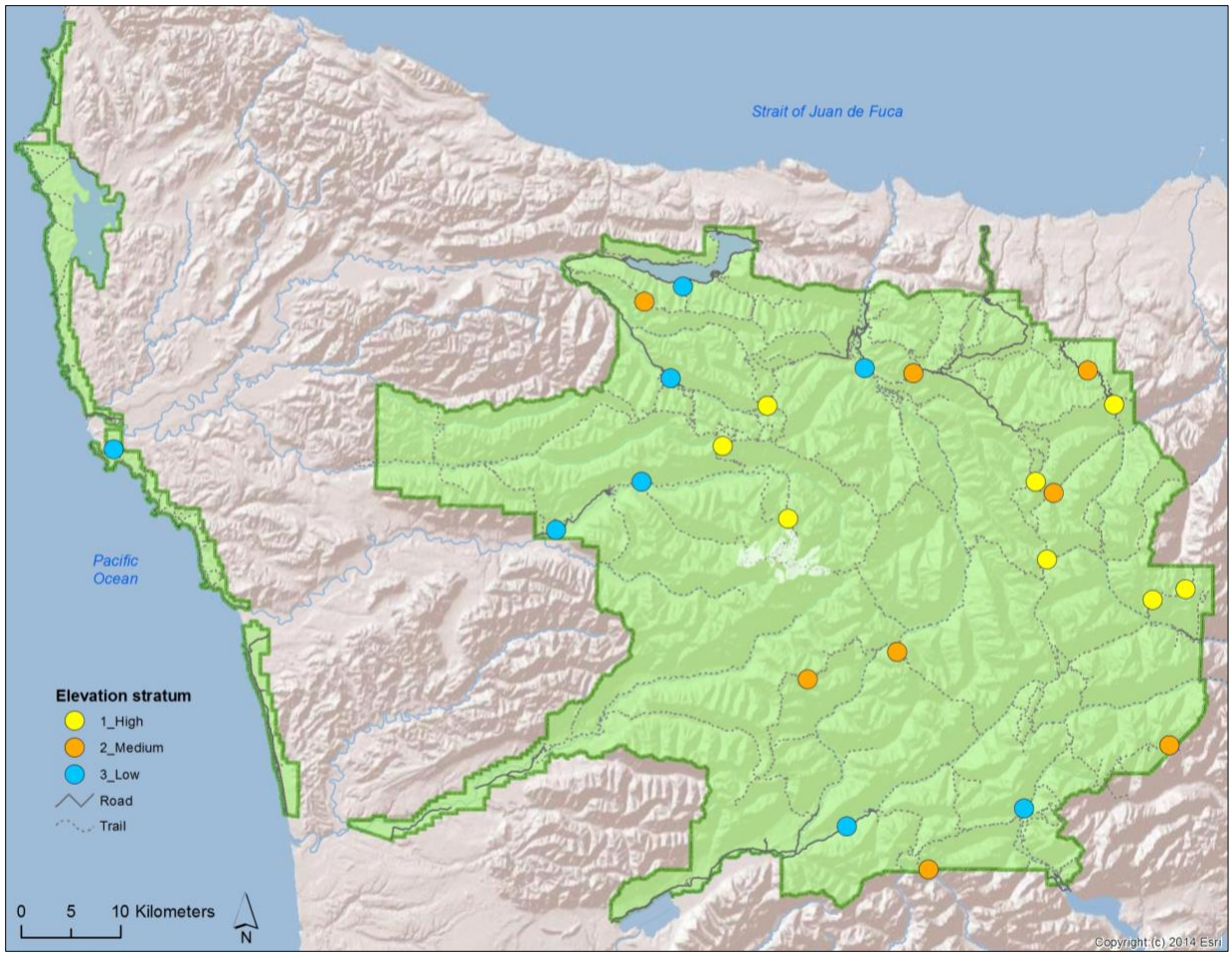

Figure 4. Approximate locations of transects conducted at Olympic National Park in 2019.

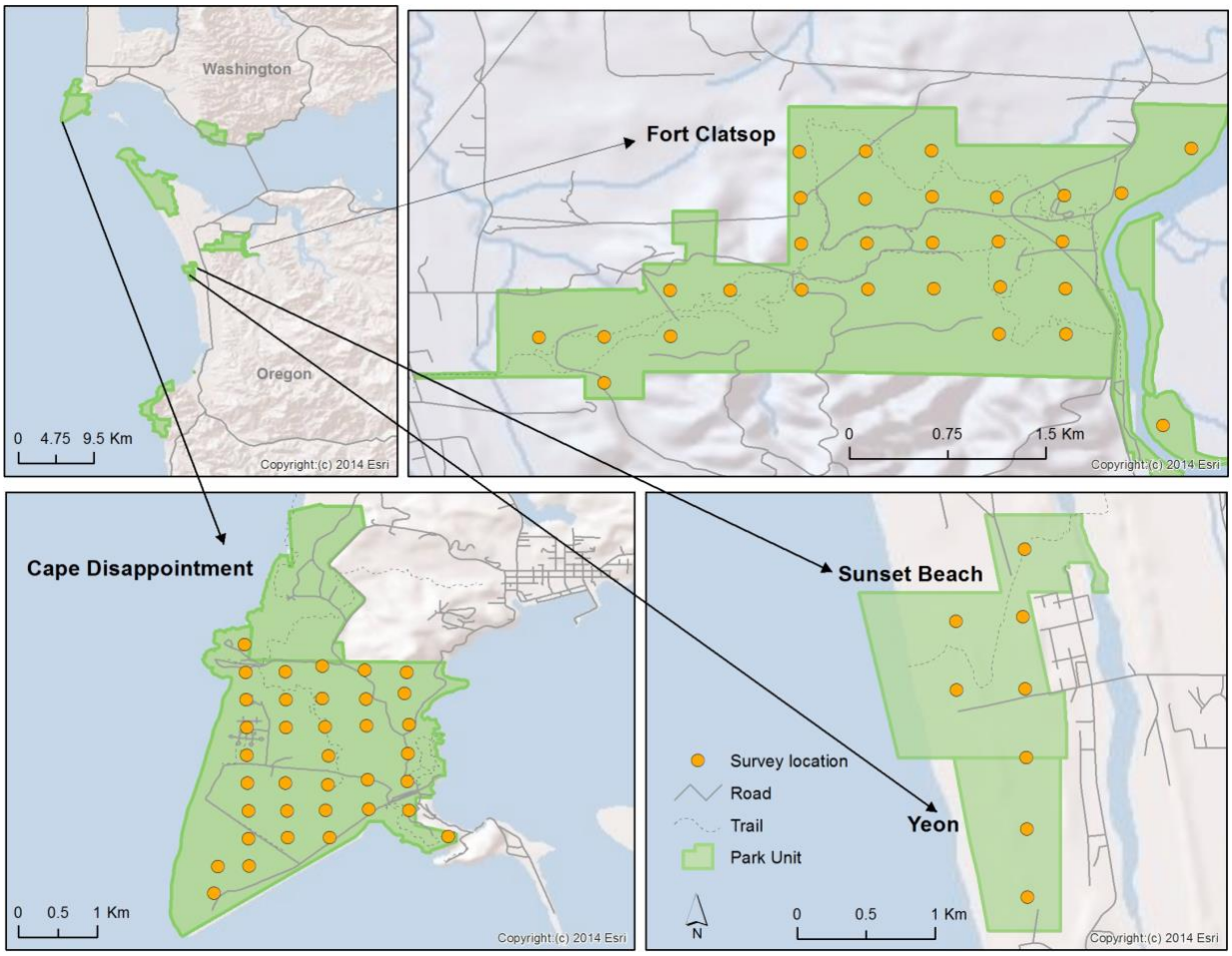

Figure 5. Locations of point count stations surveyed at Lewis and Clark National Historical Park in 2019; adjacent point count stations are 350 m apart.

Table 1. Observers who conducted point counts in the North Coast and Cascades Network in 2019.

Observer	Role
Nathan Hoeme	Technician
Mandy Holmgren	Field Lead
Kathleen Kleinschmidt	Technician
Collin McElroy	Technician
Kathryn Perlman	Technician
Katelyn Ray	Technician
Matthew Schumaker	Technician

Data Collection

All point count data were collected between May 24 and May 29 at LEWI, between June 4 and July 26 at MORA, between June 4 and July 30 at NOCA, and between June 4 and July 31 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 count 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 2019 season were sourced from the Office of the Washington State Climatologist (2019). 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

2019 Field Season

We completed our twelfth year of full implementation of the NCCN Landbird Monitoring Project with the experience gained from two pilot field seasons (2005 and 2006) and 11 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. No data were collection in 2017, when resources were allocated to conducting a five-year data analysis rather than collecting new data.

The season started with a below average snowpack across all three parks, ranging from about 60–70% of normal on May 1. The already low snowpack melted quickly, with above average temperatures in both May and June. May tied as the ninth warmest on record statewide, with temperatures 2–4 degrees Fahrenheit warmer than the 1981–2010 normal (Office of Washington State Climatologist data). Snow-related access issues were therefore not a factor this season. After a dry May and June, we saw a notable increase in precipitation in July. We were rained out on many occasions across all three parks at the end of June and during much of July, which is generally the driest and therefore the most reliable month for us to survey. Even mornings without hard rain were often misty with low clouds and very low visibility, which make for poor survey conditions. Because we were faced with many such mornings, some surveys that normally take place in June or early July were delayed well into July. However, we conducted more point counts across the large parks in 2019 than in all previous years (Appendix A), which can increase the number of birds detected.

2019 Bird Counts

In 2019 we surveyed all of the 68 intended transects in the large parks, including 34 transects from the annual-panel, and 34 transects from the first alternating panel (Table 2 and 3). However, one of the transect visits didn't yield usable data due to poor weather conditions, so the numbers in the tables reflect this discrepancy.

Appendix 1 provides a detailed multi-year survey history of all transects sampled in the large parks to date. In 2019 we conducted 348 individual point counts at MORA, 404 point counts at NOCA and 365 point counts at OLYM (Table 2). We also conducted 73 point counts at LEWI, including 36 at Cape Disappointment, 29 at Fort Clatsop, five at Sunset Beach, and three at Yeon. During the 1,108 point counts in the three large parks, we counted 11,105 individual birds. Across the three large parks, we documented the presence of 132 species (Table 4), 90 of which were detected during point counts. The remaining 42 species were recorded only as incidental detections or on “Rare Bird Report Forms.” At LEWI our field crew detected 77 species, 64 of which were detected during point counts.

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 47 bird species during point counts at MORA, 66 species during point counts at NOCA, and 61 species during point counts at OLYM (Table 5). Pooling detections on annual-panel transects across all species, we amassed 1,191

individual bird detections (average of 6.44 detections/point) at MORA, 2,404 detections (average of 12.14 detections/point) at NOCA, and 2,078 detections (average of 11.36 detections per point) at OLYM (Table 5). The five most frequently detected species on the annual-panel transects in 2019 were: pine siskin (529 detections), dark-eyed junco (429 detections), varied thrush (356 detections), Pacific wren (341 detections), and chestnut-backed chickadee (302 detections).

Pooling data across the annual-panel transects as well as the transects in the first alternating panel ("Alt2"), 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 50 bird species during point counts at MORA, 74 species during point counts at NOCA, and 64 species during point counts at OLYM (Table 6). Considering data from both panels, the five most frequently detected species were: pine siskin (1,099 detections), dark-eyed junco (887 detections), varied thrush (674 detections), Pacific wren (624 detections), and golden-crowned kinglet (591 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 a time other than a point count this year and was documented on "Rare Bird Report Forms." It was also detected during a point count 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 77 point count detections over the period 2005–2019), we present the total number of detections of each species on each park's annual panel transects during the 2005–2019 field seasons (Figures 6a–6j Figures 6). 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.

At LEWI our 73 point counts yielded 1,744 detections of 64 species (Table 8), a detection rate of 23.89 birds per point. The most frequently detected species was Swainson's thrush (215 detections), followed by Pacific-slope flycatcher (109 detections), Pacific wren (95 detections), Wilson's warbler (89 detections), and chestnut-backed chickadee (78 detections).

2019 Bird Counts Compared to Previous Years

The number of bird detections on annual-panel transects across all three large parks decreased by 430 between 2018 and 2019, though the magnitude and direction of the change in detections varied substantially among the parks. At OLYM there was an increase of 177 detections on annual-panel transects, at MORA there was a decrease of 391 detections on annual-panel transects. At both parks,

the number of point counts conducted changed little between the two years. At NOCA there was a decrease of 216 detections on annual-panel transects, but because there were fewer point counts conducted there in 2019 than in 2018, the average number of bird detections per point between the two years actually changed very little.

Many species were detected in slightly or moderately greater numbers in the three large parks in 2019 than in previous years. A few of these species include olive-sided flycatcher, Cassin's vireo, song sparrow, Nashville warbler, and Wilson's warbler. Each of these species had more detections in 2019 than in any of the previous 13 years. Olive-sided flycatcher, a species that has shown severe regional declines (Sauer et al. 2017), actually saw a 47% increase in detections since 2018.

In contrast, the number of red crossbill detections remained low in 2019. Evening grosbeak detections were also at the lowest they have been in 10 years. We had no gray-crowned rosy-finch detections in 2019, 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 2019 point counts is notable.

At LEWI, overall detections decreased slightly from 1,912 in 2016 to 1,744 in 2019. Caspian terns showed the largest change: 268 detected in 2016, which was unusually high, to 12 detected in 2019. Detections of several species increased notably, including Swainson's thrush, chestnut-backed chickadee, and evening grosbeak.

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 2019.

Park	Panel	Elevation	Transect	No. of points surveyed
MORA	Ann1	Low	4001	16
MORA	Ann1	Low	4005	14
MORA	Ann1	Medium	4002	17
MORA	Ann1	Medium	4004	19
MORA	Ann1	Medium	4009	17
MORA	Ann1	Medium	4012	23
MORA	Ann1	High	4003	16
MORA	Ann1	High	4007	24
MORA	Ann1	High	4011	17
MORA	Ann1	High	4014	22
MORA	Alt3	Low	4010	17
MORA	Alt3	Low	4018	15
MORA	Alt3	Medium	4028	14
MORA	Alt3	Medium	4042	15

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 2019.

Park	Panel	Elevation	Transect	No. of points surveyed
MORA	Alt3	Medium	4044	17
MORA	Alt3	Medium	4048	15
MORA	Alt3	High	4029	16
MORA	Alt3	High	4030	18
MORA	Alt3	High	4032	16
MORA	Alt3	High	4033	20
NOCA	Ann1	Low	1013	15
NOCA	Ann1	Low	1017	15
NOCA	Ann1	Low	1020	18
NOCA	Ann1	Low	1023	22
NOCA	Ann1	Medium	1015	18
NOCA	Ann1	Medium	1018	23
NOCA	Ann1	Medium	1022	18
NOCA	Ann1	Medium	1024	14
NOCA	Ann1	High	1014	0
NOCA	Ann1	High	1016	17
NOCA	Ann1	High	1019	14
NOCA	Ann1	High	1021	24
NOCA	Alt3	Low	1027	15
NOCA	Alt3	Low	1028	16
NOCA	Alt3	Low	1029	15
NOCA	Alt3	Low	1034	15
NOCA	Alt3	Medium	1025	15
NOCA	Alt3	Medium	1026	17
NOCA	Alt3	Medium	1031	18
NOCA	Alt3	Medium	1057	17
NOCA	Alt3	High	1032	15
NOCA	Alt3	High	1037	22
NOCA	Alt3	High	1039	22
NOCA	Alt3	High	1040	19

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 2019.

Park	Panel	Elevation	Transect	No. of points surveyed
OLYM	Ann1	Low	3001	14
OLYM	Ann1	Low	3121	17
OLYM	Ann1	Low	3126	15
OLYM	Ann1	Low	3134	20
OLYM	Ann1	Medium	3122	17
OLYM	Ann1	Medium	3123	17
OLYM	Ann1	Medium	3130	8
OLYM	Ann1	Medium	3200	22
OLYM	Ann1	High	3124	14
OLYM	Ann1	High	3125	12
OLYM	Ann1	High	3127	16
OLYM	Ann1	High	3128	11
OLYM	Alt3	Low	3146	15
OLYM	Alt3	Low	3149	12
OLYM	Alt3	Low	3151	17
OLYM	Alt3	Low	3153	16
OLYM	Alt3	Medium	3143	9
OLYM	Alt3	Medium	3150	12
OLYM	Alt3	Medium	3152	13
OLYM	Alt3	Medium	3154	18
OLYM	Alt3	High	3147	22
OLYM	Alt3	High	3148	16
OLYM	Alt3	High	3156	13
OLYM	Alt3	High	3157	10

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 2019.

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]
MORA	Low	2	2	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
MORA	High	4	4	8	8	8	7	3	8	8	8	8	8	8	8
ALL	All	10	10	20	20	20	19	13	20	20	20	20	20	20	20
NOCA	Low	4	4	8	8	7	8	8	8	8	8	7	8	8	8
NOCA	Medium	4	4	7	7	8	8	8	8	7	8	8	8	8	8
NOCA	High	4	4	7	5	8	6	5	8	8	8	8	7	8	7
ALL	All	12	12	22	20	23	22	21	24	23	24	23	23	24	23
OLYM	Low	4	4	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
OLYM	High	4	4	7	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

[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 and 2014.

[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 2019 field season, including the pre-season training session.

Common Name	Scientific Name
Greater White-fronted Goose *	*Anser albifrons*
Cackling Goose *	*Branta hutchinsii*
Canada Goose	*Branta canadensis*
Wood Duck *	*Aix sponsa*
Mallard *	*Anas platyrhynchos*
Ring-necked Duck *	*Aythya collaris*
Harlequin Duck *	*Histrionicus histrionicus*
Bufflehead *	*Bucephala albeola*
Barrow's Goldeneye *	*Bucephala islandica*
Common Merganser	*Mergus merganser*
Red-breasted Merganser *	*Mergus serrator*
Ruffed Grouse	*Bonasa umbellus*
White-tailed Ptarmigan *	*Lagopus leucura*
Sooty Grouse	*Dendragapus fuliginosus*
Band-tailed Pigeon	*Patagioenas fasciata*
Eurasian Collared-dove *	*Streptopelia decaocto*
Mourning Dove *	*Zenaida macroura*
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*
Virginia Rail *	*Rallus limicola*
American Coot *	*Fulica americana*
Black Oystercatcher *	*Haematopus bachmani*
Killdeer *	*Charadrius vociferus*
Spotted Sandpiper	*Actitis macularius*

* 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 2019 field season, including the pre-season training session. Asterisks indicate species that were detected only at times other than during point counts.

Common Name	Scientific Name
Greater Yellowlegs *	*Tringa melanoleuca*
Marbled Murrelet	*Brachyramphus marmoratus*
Pacific Loon *	*Gavia pacifica*
Common Loon *	*Gavia immer*
Double-crested Cormorant *	*Phalacrocorax auritus*
Pelagic Cormorant *	*Phalacrocorax pelagicus*
Great Blue Heron *	*Ardea herodias*
Turkey Vulture *	*Cathartes aura*
Osprey	*Pandion haliaetus*
Golden Eagle *	*Aquila chrysaetos*
Cooper's Hawk *	*Accipiter cooperii*
Bald Eagle	*Haliaeetus leucocephalus*
Red-tailed Hawk	*Buteo jamaicensis*
Western Screech-Owl *	*Megascops kennicottii*
Great Horned Owl *	*Bubo virginianus*
Northern Pygmy-Owl	*Glaucidium gnoma*
Barred Owl	*Strix varia*
Northern Saw-whet Owl *	*Aegolius acadicus*
Belted Kingfisher	*Megaceryle alcyon*
Red-breasted Sapsucker	*Sphyrapicus ruber*
American Three-toed Woodpecker *	*Picoides dorsalis*
Downy Woodpecker	*Picoides pubescens*
Hairy Woodpecker	*Picoides villosus*
Northern Flicker	*Colaptes auratus*
Pileated Woodpecker	*Dryocopus pileatus*
American Kestrel	*Falco sparverius*
Prairie Falcon	*Falco mexicanus*
Olive-sided Flycatcher	*Contopus cooperi*

* 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 2019 field season, including the pre-season training session. Asterisks indicate species that were detected only at times other than during point counts.

Common Name	Scientific Name
Western Wood-Pewee	*Contopus sordidulus*
Willow Flycatcher	*Empidonax traillii*
Least Flycatcher	*Empidonax minimus*
Hammond's Flycatcher	*Empidonax hammondii*
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*
Gray Jay	*Perisoreus canadensis*
Steller’s Jay	*Cyanocitta stelleri*
Clark’s Nutcracker	*Nucifraga columbiana*
American Crow	*Corvus brachyrhynchos*
Common Raven	*Corvus corax*
Tree Swallow	*Tachycineta bicolor*
Violet-green Swallow	*Tachycineta thalassina*
Northern Rough-winged Swallow *	*Stelgidopteryx serripennis*
Barn Swallow	*Hirundo rustica*
Black-capped Chickadee *	*Poecile atricapillus*
Mountain Chickadee	*Poecile gambeli*
Chestnut-backed Chickadee	*Poecile rufescens*
Bushtit *	*Psaltriparus minimus*
Red-breasted Nuthatch	*Sitta canadensis*
Brown Creeper	*Certhia americana*
Canyon Wren *	*Catherpes mexicanus*
House Wren	*Troglodytes aedon*

* 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 2019 field season, including the pre-season training session. Asterisks indicate species that were detected only at times other than during point counts.

Common Name	Scientific Name
Pacific Wren	*Troglodytes pacificus*
American Dipper	*Cinclus mexicanus*
Golden-crowned Kinglet	*Regulus satrapa*
Ruby-crowned Kinglet	*Regulus 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*
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*
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*
Fox Sparrow	*Passerella iliaca*
Dark-eyed Junco	*Junco hyemalis*
White-crowned Sparrow	*Zonotrichia leucophrys*
Golden-crowned Sparrow *	*Zonotrichia atricapilla*

* 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 2019 field season, including the pre-season training session. Asterisks indicate species that were detected only at times other than during point counts.

Common Name	Scientific Name
Savannah Sparrow	*Passerculus sandwichensis*
Song Sparrow	*Melospiza melodia*
Lincoln's Sparrow	*Melospiza lincolnii*
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*
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 2019.

	Number of transects with detections				Number of individual detections			
Species	**MORA**	**NOCA**	**OLYM**	**ALL**	**MORA**	**NOCA**	**OLYM**	**ALL**
Common Merganser	1	–	2	3	1	–	4	5
Ruffed Grouse	–	–	1	1	–	–	1	1
Sooty Grouse	2	6	9	17	2	11	26	39
Band-tailed Pigeon	–	–	7	7	–	–	20	20
Black Swift	–	2	–	2	–	13	–	13
Vaux's Swift	6	4	5	15	22	14	26	62
Rufous Hummingbird	–	7	7	14	–	15	10	25
Calliope Hummingbird	–	1	–	1	–	2	–	2
Spotted Sandpiper	1	–	1	2	2	–	2	4
Marbled Murrelet	–	–	1	1	–	–	1	1
Red-tailed Hawk	–	–	1	1	–	–	1	1
Northern Pygmy-Owl	–	1	1	2	–	1	2	3
Barred Owl	–	1	1	2	–	1	1	2
Belted Kingfisher	–	–	1	1	–	–	1	1
Red-breasted Sapsucker	3	4	1	8	4	27	1	32
Downy Woodpecker	–	3	1	4	–	4	2	6
Hairy Woodpecker	4	5	10	19	6	11	15	32
Northern Flicker	6	7	9	22	14	11	33	58
Pileated Woodpecker	1	2	4	7	2	2	7	11

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 2019.

	Number of transects with detections				Number of individual detections			
Species	**MORA**	**NOCA**	**OLYM**	**ALL**	**MORA**	**NOCA**	**OLYM**	**ALL**
American Kestrel	–	–	1	1	–	–	2	2
Prairie Falcon	1	–	–	1	1	–	–	1
Olive-sided Flycatcher	4	6	9	19	9	35	37	81
Western Wood-Pewee	–	4	1	5	–	22	1	23
Willow Flycatcher	–	1	–	1	–	4	–	4
Least Flycatcher	–	1	–	1	–	1	–	1
Hammond's Flycatcher	4	9	8	21	29	123	41	193
Dusky Flycatcher	–	3	–	3	–	11	–	11
Pacific-slope Flycatcher	6	3	10	19	43	24	149	216
Hutton’s Vireo	–	–	1	1	–	–	1	1
Cassin's Vireo	–	5	–	5	–	26	–	26
Warbling Vireo	3	8	4	15	6	49	26	81
Red-eyed Vireo	–	3	–	3	–	18	–	18
Gray Jay	6	4	7	17	19	8	44	71
Steller’s Jay	4	3	8	15	11	6	29	46
Clark’s Nutcracker	1	1	1	3	4	12	1	17
American Crow	–	–	3	3	–	–	5	5
Common Raven	3	7	5	15	6	21	10	37
Tree Swallow	–	1	–	1	–	2	–	2
Violet-green Swallow	1	1	1	3	2	2	4	8

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 2019.

	Number of transects with detections				Number of individual detections			
Species	**MORA**	**NOCA**	**OLYM**	**ALL**	**MORA**	**NOCA**	**OLYM**	**ALL**
Barn Swallow	1	–	–	1	3	–	–	3
Mountain Chickadee	1	2	–	3	2	23	–	25
Chestnut-backed Chickadee	8	8	11	27	84	114	104	302
Red-breasted Nuthatch	8	9	8	25	56	81	98	235
Brown Creeper	9	8	11	28	49	27	49	125
Pacific Wren	8	8	10	26	99	91	151	341
American Dipper	1	–	1	2	1	–	1	2
Golden-crowned Kinglet	8	11	12	31	47	72	171	290
Ruby-crowned Kinglet	–	2	2	4	–	7	2	9
Mountain Bluebird	–	1	–	1	–	1	–	1
Townsend’s Solitaire	2	3	3	8	2	5	6	13
Veery	–	1	–	1	–	2	–	2
Swainson’s Thrush	5	7	4	16	27	174	55	256
Hermit Thrush	8	6	8	22	60	74	63	197
American Robin	9	9	8	26	40	102	93	235
Varied Thrush	9	8	12	29	99	123	134	356
Cedar Waxwing	–	6	–	6	–	50	–	50
American Pipit	2	–	1	3	13	–	7	20
Evening Grosbeak	8	7	3	18	34	37	5	76
Pine Grosbeak	–	–	4	4	–	–	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 2019.

	Number of transects with detections				Number of individual detections			
Species	**MORA**	**NOCA**	**OLYM**	**ALL**	**MORA**	**NOCA**	**OLYM**	**ALL**
Purple Finch	–	1	–	1	–	7	–	7
Cassin's Finch	–	4	–	4	–	34	–	34
Red Crossbill	4	3	9	16	17	50	65	132
Pine Siskin	10	9	10	29	168	244	117	529
Chipping Sparrow	1	5	1	7	3	25	3	31
Fox Sparrow	1	1	–	2	1	1	–	2
Dark-eyed Junco	10	9	11	30	111	107	211	429
White-crowned Sparrow	1	1	2	4	2	2	11	15
Savannah Sparrow	2	–	–	2	5	–	–	5
Song Sparrow	2	4	3	9	6	18	7	31
Spotted Towhee	–	1	–	1	–	5	–	5
Brown-headed Cowbird	–	2	–	2	–	4	–	4
Orange-crowned Warbler	–	–	2	2	–	–	6	6
Nashville Warbler	–	4	–	4	–	45	–	45
MacGillivray's Warbler	4	7	2	13	4	52	3	59
Common Yellowthroat	–	–	1	1	–	–	1	1
American Redstart	–	1	–	1	–	3	–	3
Yellow Warbler	–	4	2	6	–	45	3	48
Yellow-rumped Warbler	4	10	4	18	5	117	25	147
Black-throated Gray Warbler	2	2	4	8	3	15	23	41

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 2019.

	Number of transects with detections				Number of individual detections			
Species	**MORA**	**NOCA**	**OLYM**	**ALL**	**MORA**	**NOCA**	**OLYM**	**ALL**
Townsend's/Hermit Warbler*	7	5	5	17	51	52	57	160
Wilson's Warbler	–	1	4	5	–	5	61	66
Western Tanager	3	10	3	16	11	92	35	138
Black-headed Grosbeak	2	7	1	10	5	21	2	28
Lazuli Bunting	–	1	–	1	–	1	–	1
All species pooled	–	–	–	–	1,191	2,404	2,078	5,673
Number of detections per point (all species pooled)					6.44	12.14	11.36	10.02

*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 2019.

	Number of transects with detections				Number of individual detections			
Species	**MORA**	**NOCA**	**OLYM**	**ALL**	**MORA**	**NOCA**	**OLYM**	**ALL**
Canada Goose	–	1	–	1	–	1	–	1
Common Merganser	1	–	2	3	1	–	4	5
Ruffed Grouse	–	–	1	1	–	–	1	1
Sooty Grouse	2	15	17	34	2	37	43	82
Band-tailed Pigeon	1	–	11	12	1	–	28	29
Common Nighthawk	–	1	–	1	–	2	–	2
Black Swift	–	4	–	4	–	17	–	17

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 2019.

	Number of transects with detections				Number of individual detections			
Species	**MORA**	**NOCA**	**OLYM**	**ALL**	**MORA**	**NOCA**	**OLYM**	**ALL**
Vaux's Swift	11	9	12	32	43	37	56	136
Rufous Hummingbird	–	14	15	29	–	40	26	66
Calliope Hummingbird	–	2	–	2	–	3	–	3
Spotted Sandpiper	3	3	1	7	8	4	2	14
Marbled Murrelet	–	–	1	1	–	–	1	1
Osprey	–	2	–	2	–	4	–	4
Bald Eagle	–	–	1	1	–	–	1	1
Red-tailed Hawk	–	–	1	1	–	–	1	1
Northern Pygmy-Owl	–	1	1	2	–	1	2	3
Barred Owl	–	2	2	4	–	2	2	4
Belted Kingfisher	–	–	3	3	–	–	3	3
Red-breasted Sapsucker	4	8	1	13	5	36	1	42
Downy Woodpecker	–	4	1	5	–	5	2	7
Hairy Woodpecker	9	12	20	41	11	24	39	74
Northern Flicker	9	13	19	41	21	30	69	120
Pileated Woodpecker	2	7	6	15	3	7	11	21
American Kestrel	–	–	2	2	–	–	3	3
Prairie Falcon	1	–	–	1	1	–	–	1
Olive-sided Flycatcher	9	13	18	40	20	61	81	162

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 2019.

	Number of transects with detections				Number of individual detections			
Species	**MORA**	**NOCA**	**OLYM**	**ALL**	**MORA**	**NOCA**	**OLYM**	**ALL**
Western Wood-Pewee	1	9	1	11	1	43	1	45
Willow Flycatcher	–	2	–	2	–	5	–	5
Least Flycatcher	–	1	–	1	–	1	–	1
Hammond's Flycatcher	9	19	20	48	48	216	89	353
Dusky Flycatcher	–	5	–	5	–	19	–	19
Pacific-slope Flycatcher	14	6	21	41	96	33	332	461
Hutton’s Vireo	–	–	2	2	–	–	2	2
Cassin's Vireo	–	11	–	11	–	45	–	45
Warbling Vireo	5	15	7	27	9	80	40	129
Red-eyed Vireo	–	4	–	4	–	22	–	22
Canada Jay	14	8	17	39	54	15	62	131
Steller’s Jay	11	10	17	38	33	25	60	118
Clark’s Nutcracker	1	3	1	5	4	21	1	26
American Crow	–	–	4	4	–	–	6	6
Common Raven	6	10	9	25	9	26	22	57
Tree Swallow	–	1	–	1	–	2	–	2
Violet-green Swallow	1	2	2	5	2	6	10	18
Barn Swallow	1	–	–	1	3	–	–	3
Mountain Chickadee	1	4	–	5	2	46	–	48

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 2019.

	Number of transects with detections				Number of individual detections			
Species	**MORA**	**NOCA**	**OLYM**	**ALL**	**MORA**	**NOCA**	**OLYM**	**ALL**
Chestnut-backed Chickadee	17	17	21	55	181	188	186	555
Red-breasted Nuthatch	17	20	19	56	137	174	172	483
Brown Creeper	19	19	22	60	90	60	105	255
House Wren	–	–	1	1	–	–	1	1
Pacific Wren	18	17	21	56	191	152	281	624
American Dipper	2	–	2	4	2	–	3	5
Golden-crowned Kinglet	17	21	24	62	110	145	336	591
Ruby-crowned Kinglet	–	4	6	10	–	11	16	27
Mountain Bluebird	–	2	–	2	–	9	–	9
Townsend’s Solitaire	2	9	6	17	2	13	13	28
Veery	–	3	–	3	–	4	–	4
Swainson’s Thrush	8	16	7	31	33	345	81	459
Hermit Thrush	18	13	16	47	149	132	147	428
American Robin	12	18	18	48	51	143	149	343
Varied Thrush	17	16	21	54	201	223	250	674
Cedar Waxwing	–	9	1	10	–	87	6	93
American Pipit	2	1	2	5	13	4	8	25
Evening Grosbeak	16	12	4	32	100	92	7	199
Pine Grosbeak	–	1	6	7	–	2	13	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 2019.

	Number of transects with detections				Number of individual detections			
Species	**MORA**	**NOCA**	**OLYM**	**ALL**	**MORA**	**NOCA**	**OLYM**	**ALL**
Purple Finch	–	2	–	2	–	18	–	18
Cassin's Finch	–	8	–	8	–	53	–	53
Red Crossbill	9	8	15	32	46	100	104	250
Pine Siskin	20	21	20	61	389	487	223	1099
Chipping Sparrow	2	10	1	13	5	57	3	65
Fox Sparrow	1	2	–	3	1	4	–	5
Dark-eyed Junco	20	20	23	63	200	282	405	887
White-crowned Sparrow	2	1	4	7	3	2	15	20
Savannah Sparrow	2	–	–	2	5	–	–	5
Song Sparrow	3	7	6	16	10	24	12	46
Lincoln's Sparrow	–	1	–	1	–	1	–	1
Spotted Towhee	–	1	–	1	–	5	–	5
Brown-headed Cowbird	–	3	–	3	–	9	–	9
Orange-crowned Warbler	–	–	2	2	–	–	6	6
Nashville Warbler	1	8	–	9	1	91	–	92
MacGillivray's Warbler	4	14	6	24	4	88	15	107
Common Yellowthroat	–	1	1	2	–	5	1	6
American Redstart	–	2	–	2	–	4	–	4
Yellow Warbler	–	8	3	11	–	52	4	56

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 2019.

	Number of transects with detections				Number of individual detections			
Species	**MORA**	**NOCA**	**OLYM**	**ALL**	**MORA**	**NOCA**	**OLYM**	**ALL**
Yellow-rumped Warbler	8	21	8	37	17	242	47	306
Black-throated Gray Warbler	2	6	5	13	3	26	30	59
Townsend's/Hermit Warbler*	13	13	12	38	127	132	149	408
Wilson's Warbler	–	1	12	13	–	5	102	107
Western Tanager	8	20	9	37	27	250	59	336
Black-headed Grosbeak	2	15	1	18	5	33	2	40
Lazuli Bunting	–	2	–	2	–	3	–	3
All species pooled	–	–	–	–	2,480	4,673	3,952	11,105
Detections per point (all species pooled)	–	–	–	–	7.13	11.57	11.1	10.02
Number of species detected during point counts					50	74	64	90

*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 2019, 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	–	–	1

Table 8. Number of points with detections and number of individual detections for each species detected during point counts at Lewis and Clark National Historical Park in 2019.

Species	**Number of points with detections**	**Number of individual detections**
Canada Goose	7	11
Mallard	7	9
Band-tailed Pigeon	6	6
Eurasian Collared-dove	6	7
Vaux’s Swift	1	2
Anna’s Hummingbird	3	3
Rufous Hummingbird	6	7
Caspian Tern	3	12
Brown Pelican	1	2
Turkey Vulture	2	5
Bald Eagle	7	11
Downy Woodpecker	3	3
Hairy Woodpecker	8	10
Northern Flicker	10	10
Pileated Woodpecker	2	2
Olive-sided Flycatcher	12	13
Western Wood-Pewee	1	1
Pacific-slope Flycatcher	56	109
Black Phoebe	1	1
Hutton’s Vireo	8	10
Warbling Vireo	9	12
Steller’s Jay	18	28

Table 8 (continued). Number of points with detections and number of individual detections for each species detected during point counts at Lewis and Clark National Historical Park in 2019.

Species	Number of points with detections	Number of individual detections
American Crow	38	66
Common Raven	13	14
Tree Swallow	7	9
Violet-green Swallow	6	11
Barn Swallow	12	35
Black-capped Chickadee	10	16
Chestnut-backed Chickadee	46	78
Bushtit	2	3
Red-breasted Nuthatch	7	9
Brown Creeper	17	21
Pacific Wren	46	95
Marsh Wren	8	21
Bewick's Wren	9	15
Golden-crowned Kinglet	42	63
Swainson's Thrush	67	215
American Robin	47	70
Varied Thrush	2	2
European Starling	1	2
Cedar Waxwing	12	52
Evening Grosbeak	11	33
House Finch	1	2
Purple Finch	24	31
Red Crossbill	7	37
American Goldfinch	9	12
Dark-eyed Junco	31	46
White-crowned Sparrow	16	29
Savannah Sparrow	3	3
Song Sparrow	30	64
Spotted Towhee	9	12

Table 8 (continued). Number of points with detections and number of individual detections for each species detected during point counts at Lewis and Clark National Historical Park in 2019.

Species	Number of points with detections	Number of individual detections
Red-winged Blackbird	9	22
Brown-headed Cowbird	26	35
Orange-crowned Warbler	24	35
Nashville Warbler	1	1
MacGillivray's Warbler	1	1
Common Yellowthroat	20	33
Yellow Warbler	13	24
Yellow-rumped Warbler	4	5
Black-throated Gray Warbler	22	30
Hermit Warbler	20	36
Wilson's Warbler	46	89
Western Tanager	40	51
Black-headed Grosbeak	28	42

Figure 6a. 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 2005–2019 field seasons. Figures 6a–6j include all species for which we amassed at least 77 point count detections on annual-panel transects over the 14 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.

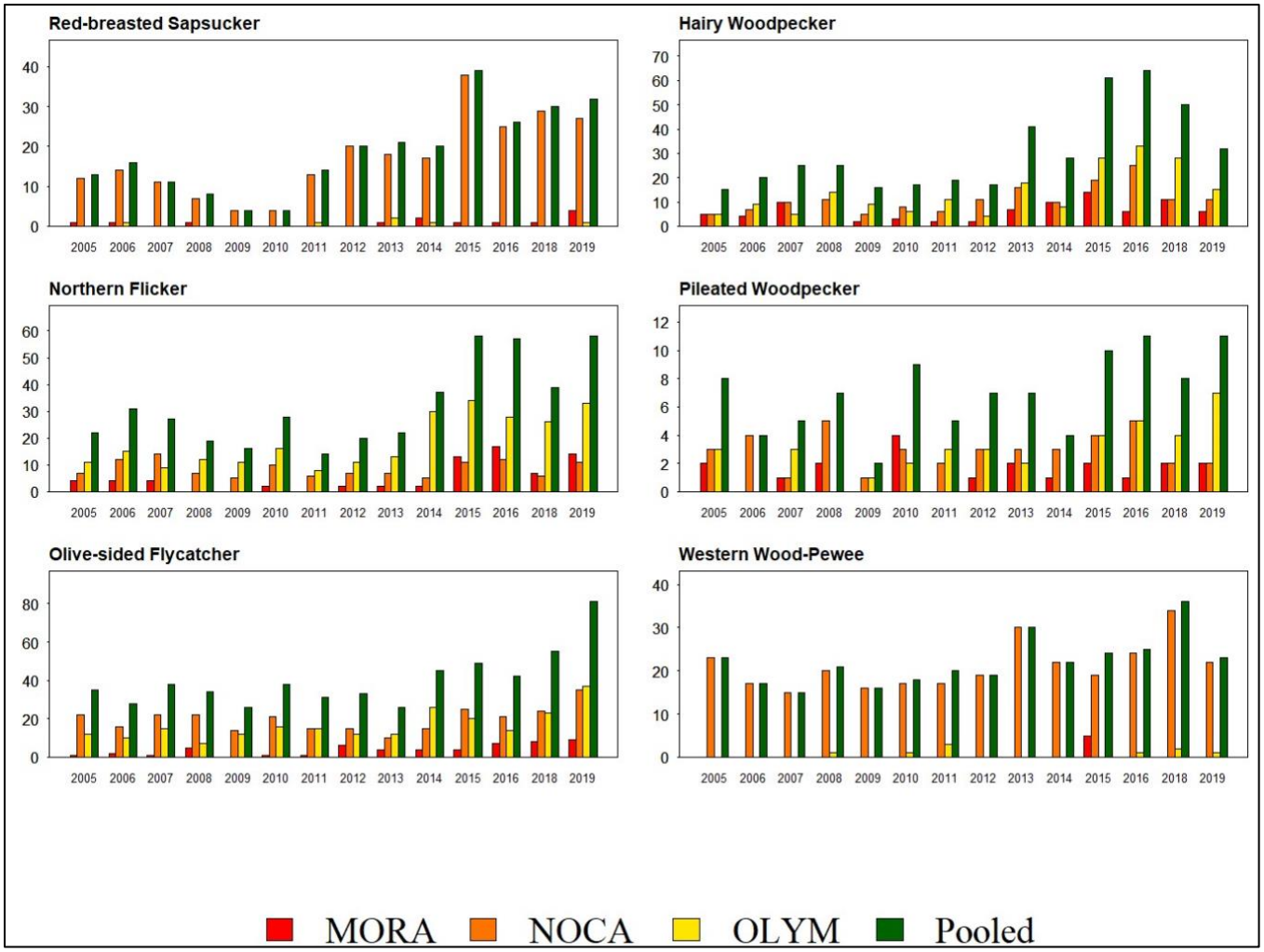

Figure 6b. Number of times each species (Red-breasted Sapsucker, Hairy Woodpecker, Northern Flicker, Pileated Woodpecker, Olive-sided Flycatcher, and Western Wood-Pewee) was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2019 field seasons. Figures 6a–6j include all species for which we amassed at least 77 point count detections on annual-panel transects over the 14 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.

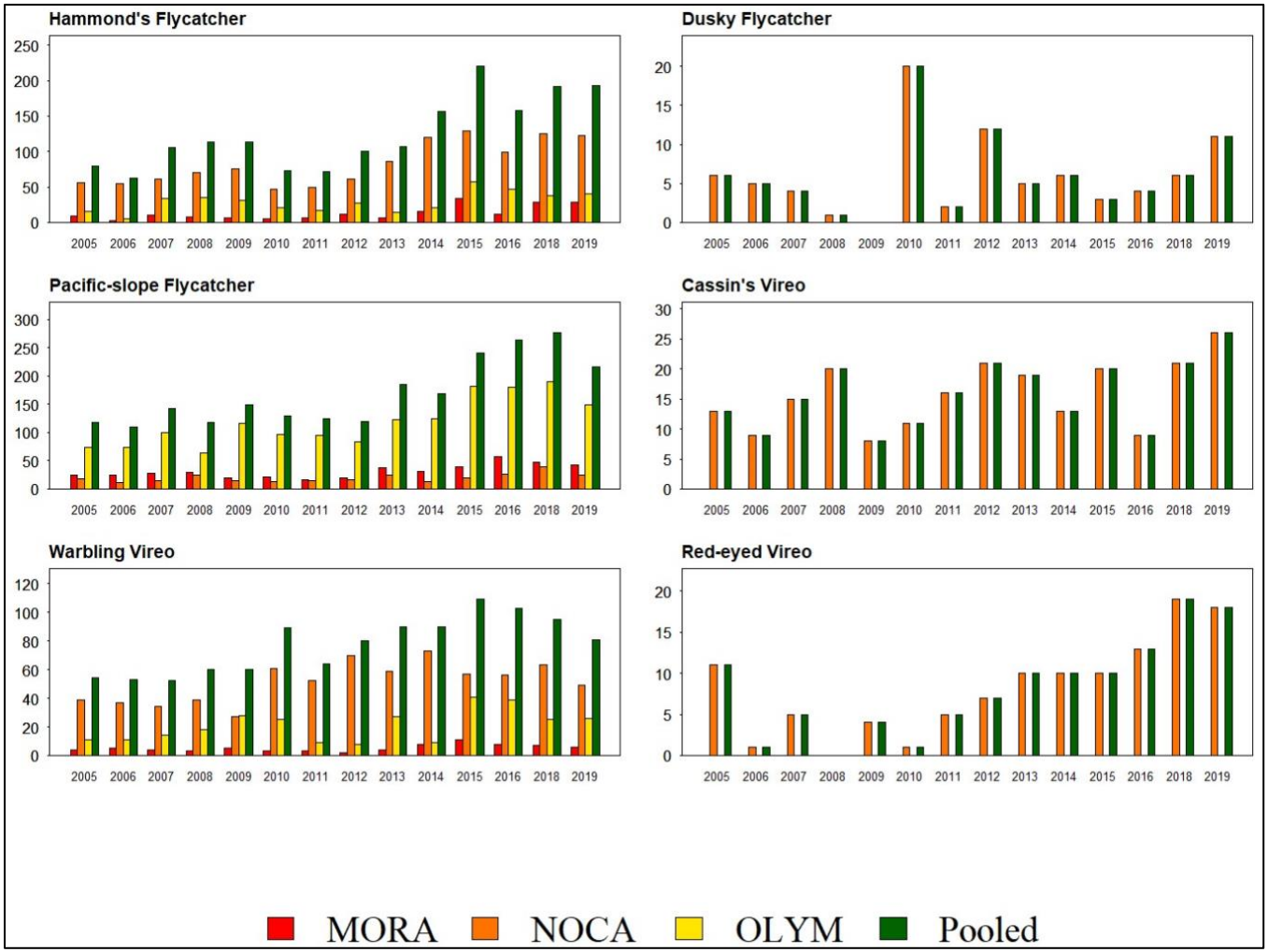

Figure 6c. Number of times each species (Hammond's Flycatcher, Dusky Flycatcher, Pacific-slope Flycatcher, Cassin's Vireo, Warbling Vireo, and Red-eyed Vireo) was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2019 field seasons. Figures 6a–6j include all species for which we amassed at least 77 point count detections on annual-panel transects over the 14 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.

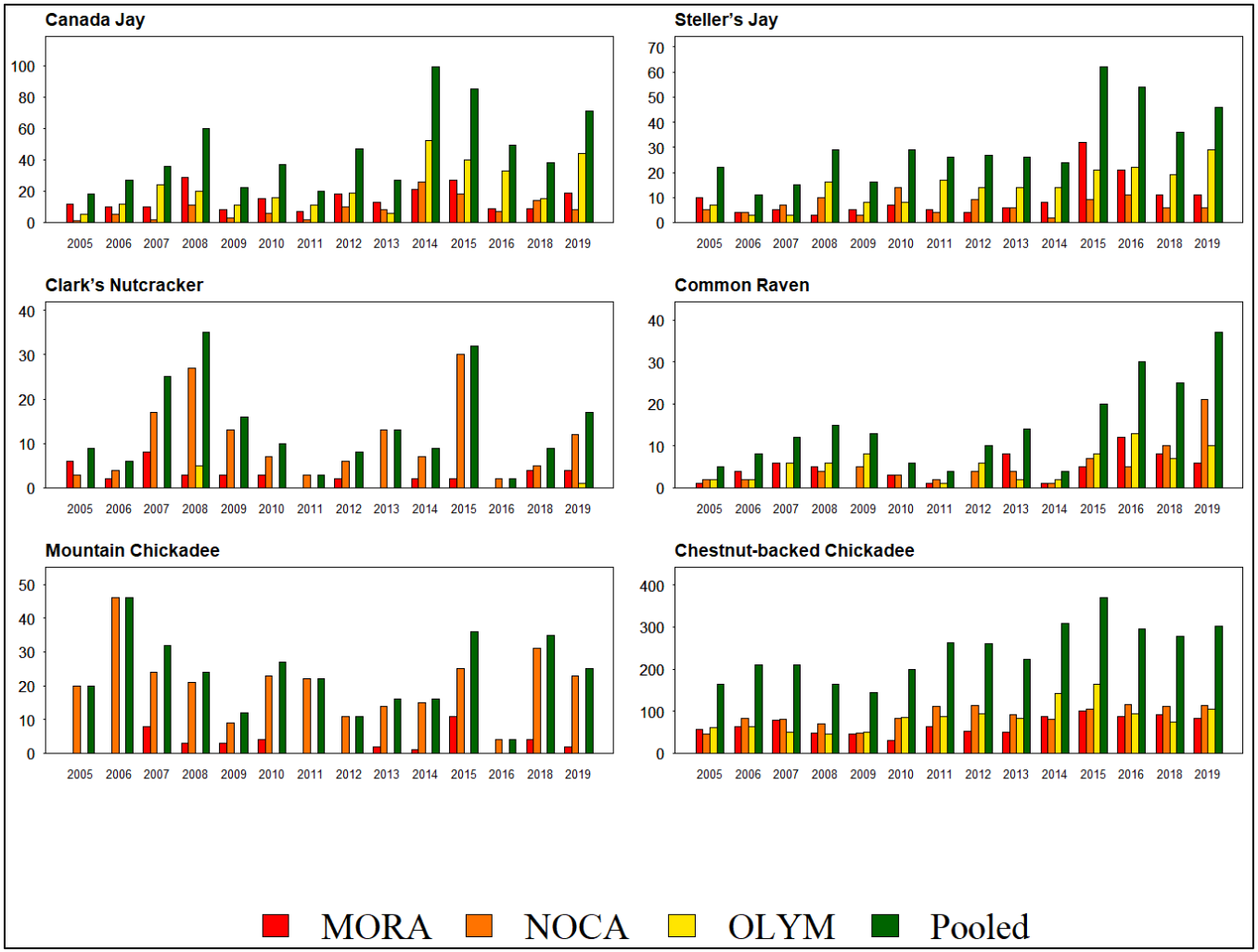

Figure 6d. Number of times each species (Canada Jay, Steller's Jay, Clark's Nutcracker, Common Raven, Mountain Chickadee, Chestnut-backed Chickadee) was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2019 field seasons. Figures 6a–6j include all species for which we amassed at least 77 point count detections on annual-panel transects over the 14 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.

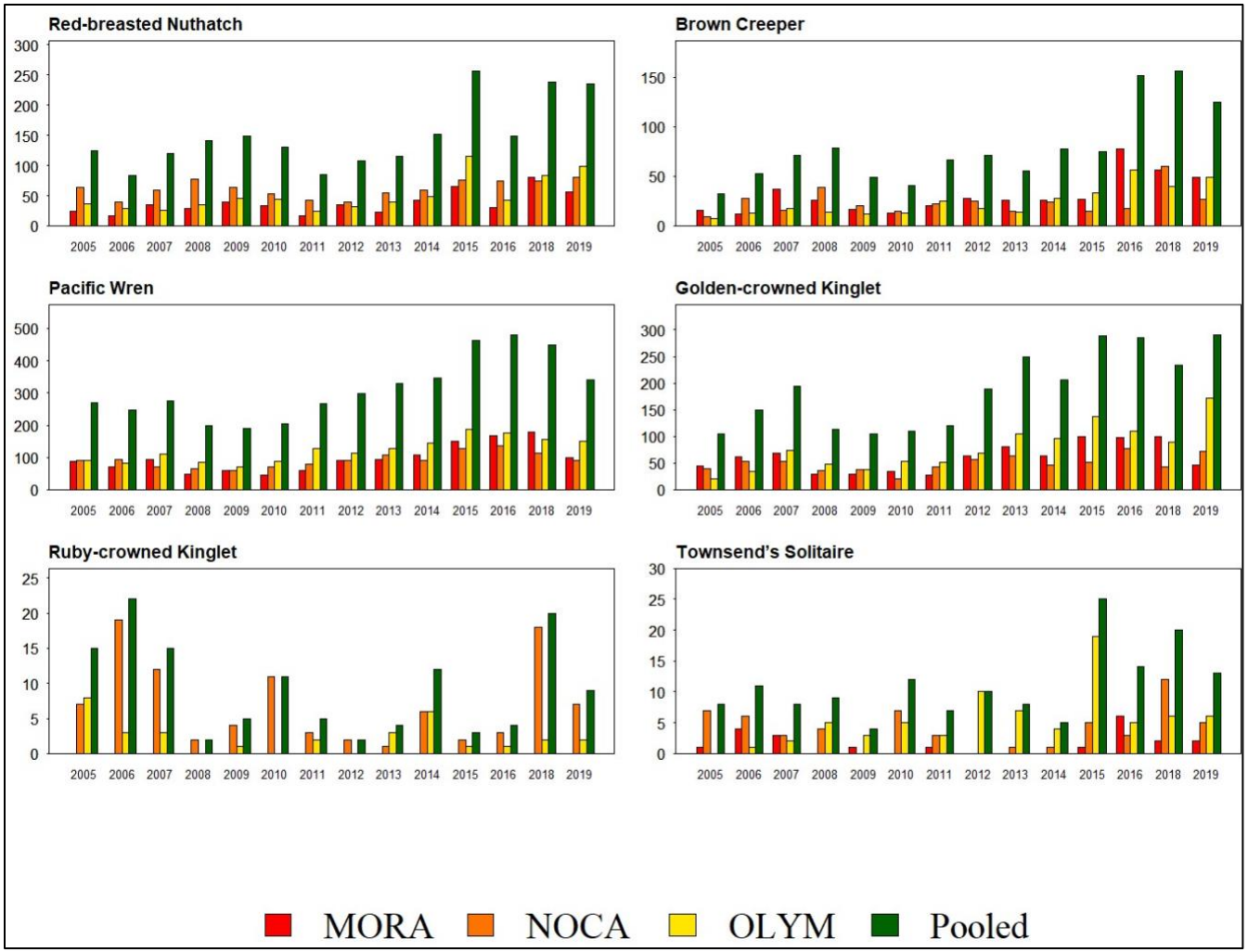

Figure 6e. Number of times each species (Red-breasted Nuthatch, Brown Creeper, Pacific Wren, Golden-crowned Kinglet, Ruby-crowned Kinglet, and Townsend's Solitaire) was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2019 field seasons. Figures 6a–6j include all species for which we amassed at least 77 point count detections on annual-panel transects over the 14 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 6f. 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 2005–2019 field seasons. Figures 6a–6j include all species for which we amassed at least 77 point count detections on annual-panel transects over the 14 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.

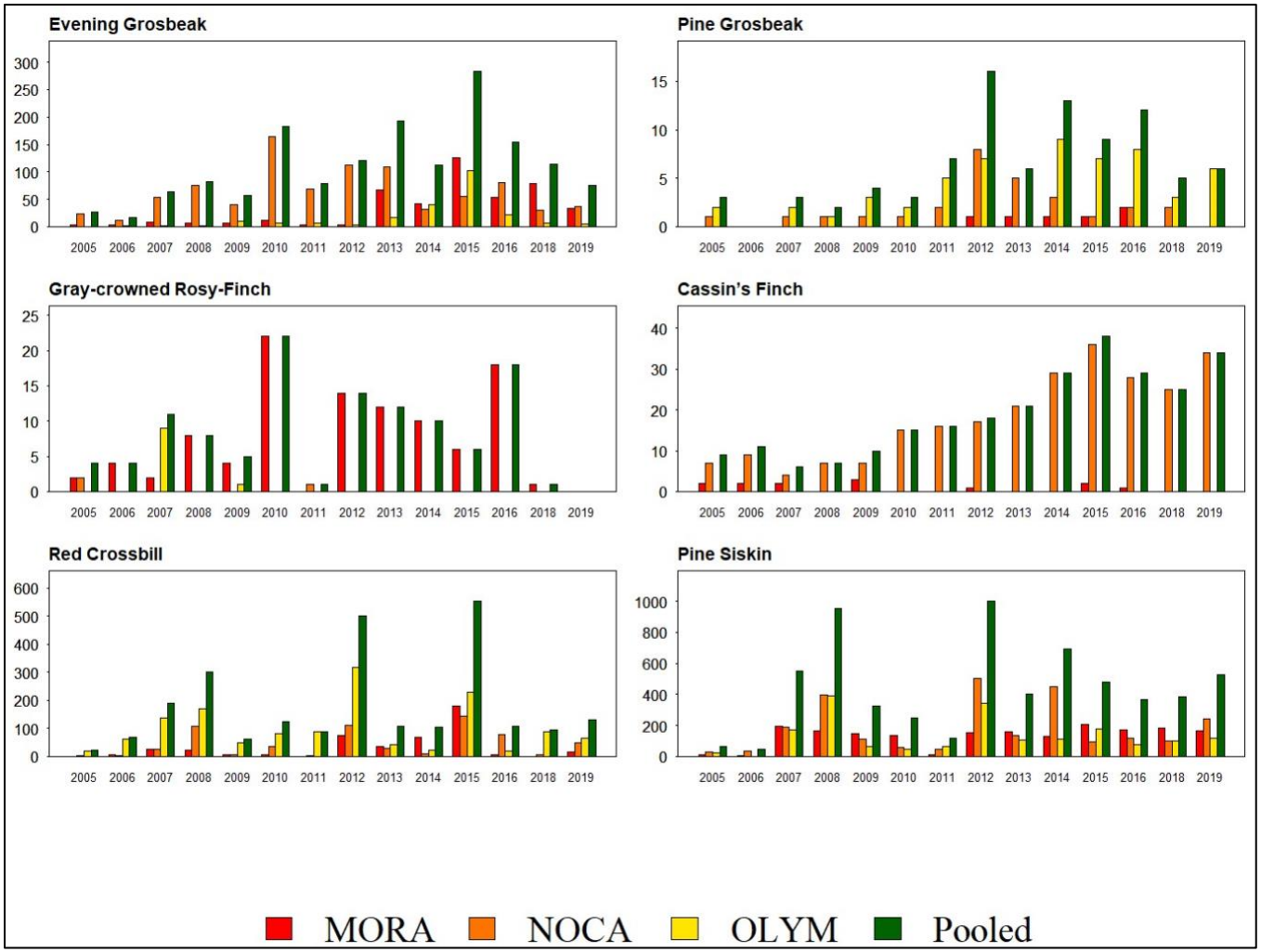

Figure 6g. Number of times each species (Evening Grosbeak, Pine Grosbeak, Gray-crowned Rosy-Finch, Cassin's Finch, Red Crossbill, and Pine Siskin) was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2019 field seasons. Figures 6a–6j include all species for which we amassed at least 77 point count detections on annual-panel transects over the 14 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 6h. 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 2005–2019 field seasons. Figures 6a–6j include all species for which we amassed at least 77 point count detections on annual-panel transects over the 14 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.

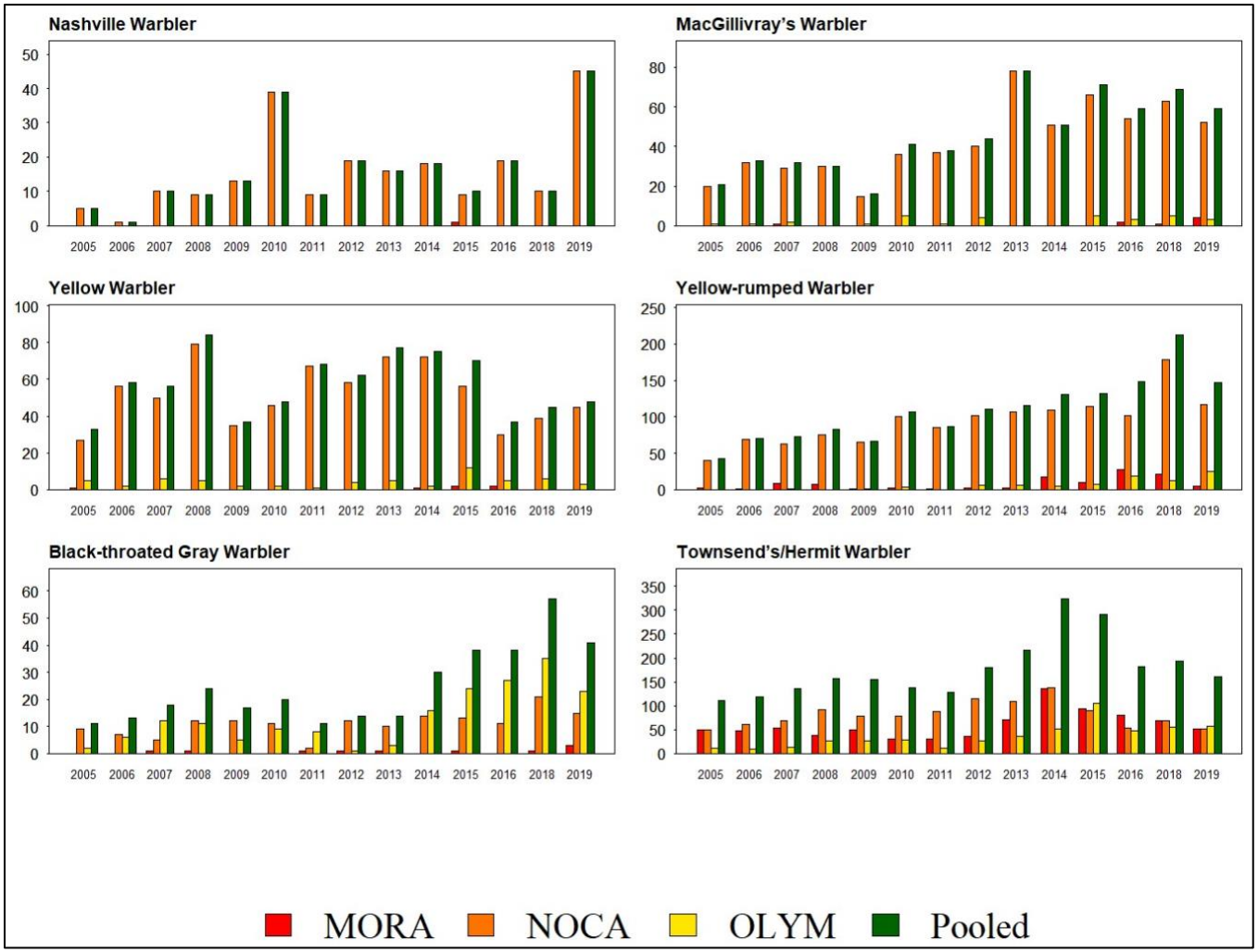

Figure 6i. Number of times each species (Nashville Warbler, MacGillivray's Warbler, Yellow Warbler, Yellow-rumped Warbler, Black-throated Gray Warbler, and Townsend's/Hermit Warbler) was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2019 field seasons. Figures 6a–6j include all species for which we amassed at least 77 point count detections on annual-panel transects over the 14 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.

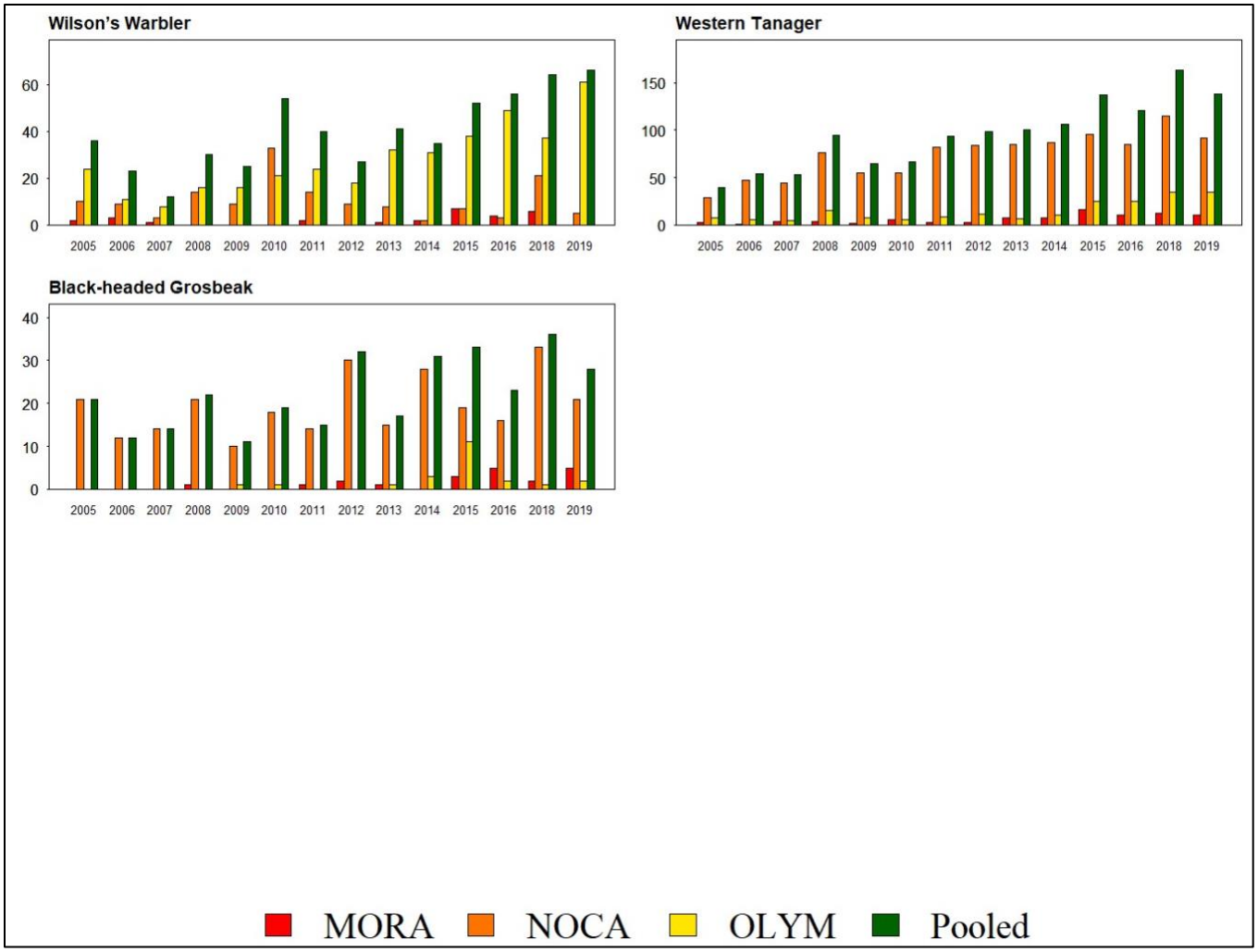

Figure 6j. Number of times each species (Wilson's Warbler, Western Tanager, and Black-headed Grosbeak) was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2019 field seasons. Figures 6a–6j include all species for which we amassed at least 77 point count detections on annual-panel transects over the 14 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.

Literature Cited

Altman, B. 1999. Conservation strategy for landbirds in coniferous forests of western Oregon and Washington. Version 1.0. Prepared for Oregon-Washington Partners in Flight for American Bird Conservancy, Boring, OR.

Altman, B. 2000. Conservation strategy for landbirds of the east slope of the Cascades. Version 1.0. Prepared for Oregon-Washington Partners in Flight by American Bird Conservancy, Corvallis, OR.

Altman, B., and J. Bart. 2001. Special species monitoring and assessment in Oregon and Washington: Landbird species not adequately monitored by the Breeding Bird Survey. Prepared for Oregon-Washington Partners in Flight by American Bird Conservancy and U.S. Geological Service, Boring, OR.

American Ornithologists' Union (AOU). 1998. Check-list of North American birds, 7th ed. American Ornithologists' Union, Washington D.C. 829 pp.

American Ornithologists' Union (AOU). R.T. Chesser, et al., comps. 2016. Fifty-seventh supplement to the American Ornithologists' Union check-List of North American birds. Auk 133:544-560. DOI: 10.1642/AUK-16-77.1.

Andelman, S. J., and A. Stock. 1994a. Management, research, and monitoring priorities for the conservation of Neotropical migratory landbirds that breed in Oregon. Washington Department of Natural Resources, Olympia, WA.

Andelman, S. J., and A. Stock. 1994b. Management, research, and monitoring priorities for the conservation of Neotropical migratory landbirds that breed in Washington. Washington Department of Natural Resources, Olympia, WA.

Atkinson, S., and F. A. Sharpe. 1985. Wild plants of the San Juan Islands. The Mountaineers, Seattle, WA.

Bolsinger, C. L., and K. L. Waddell. 1993. Area of old-growth forests in California, Oregon and Washington. USDA Forest Service Resource Bulletin PNW-RB-197. U.S. Department of Agriculture, U.S. Forest Service, Pacific Northwest Research Station, Portland, OR.

Buckland, S. T., D. R. Anderson, K. P. Burnham, J. L. Laake, D. L. Borchers, and L. Thomas. 2001. Introduction to distance sampling: estimating abundance of biological populations. Oxford University Press, Oxford, England.

Bunnell, F. L., L. L. Kremsater, and R. W. Wells. 1997. Likely consequences of forest management on terrestrial, forest-dwelling vertebrates in Oregon. Report M-7 of the Centre for Applied Conservation Biology, University of British Columbia, Vancouver, Canada.

DeSante, D. F., and T. L. George. 1994. Population trends in the landbirds of western North America. Pages 173-190 *in* J. R. Jehl Jr., and N. K. Johnson (eds.). A century of avifaunal change in western North America. Proceedings of an International Symposium at the Centennial Meeting of the Cooper Ornithological Society, Sacramento, CA, April 1993. Studies in Avian Biology No. 15.

Hagar, J. C., W. C. McComb, and C. C. Chambers. 1995. Effects of forest practices on wildlife. *In* R. P. Beschta et al. (eds). Cumulative effects of forest practices in Oregon: Literature and synthesis. Oregon State University, Corvallis, OR.

Holmgren, A. L., R. L. Wilkerson, R. B. Siegel, and P. J. Happe, 2014. North Coast and Cascades Network landbird monitoring: Report for the 2013 field season. Natural Resource Data Series NPS/NCCN/NRDS—2014/691. National Park Service, Fort Collins, CO.

Holmgren, A. L., R. L. Wilkerson, R. B. Siegel, and P. J. Happe. 2015. North Coast and Cascades Network landbird monitoring: Report for the 2014 field season. Natural Resource Data Series NPS/NCCN/NRDS—2015/1048. National Park Service, Fort Collins, CO.

Holmgren, A. L., R. L. Wilkerson, R. B. Siegel, and R. C. Kuntz II. 2011. North Coast and Cascades Network landbird monitoring: Report for the 2010 field season. Natural Resource Technical Report NPS/NCCN/NRTR—2011/473. National Park Service, Fort Collins, CO.

Holmgren, A. L., R. L. Wilkerson, R. B. Siegel, and R. C. Kuntz II. 2012. North Coast and Cascades Network landbird monitoring: Report for the 2011 field season. Natural Resource Technical Report NPS/NCCN/NRTR—2012/605. National Park Service, Fort Collins, CO.

Holmgren, A. L., R. L. Wilkerson, R. B. Siegel, and R. C. Kuntz II. 2013. North Coast and Cascades Network landbird monitoring: Report for the 2012 field season. Natural Resource Data Series NPS/NCCN/NRDS—2013/523. National Park Service, Fort Collins, CO.

Holmgren, A. L., R. L. Wilkerson, R. B. Siegel, and J. I. Ransom. 2016. North Coast and Cascades Network landbird monitoring: Report for the 2015 field season. Natural Resource Report NPS/NCCN/NRR—2016/1241. National Park Service, Fort Collins, CO.

Holmgren, A. L., R. L. Wilkerson, R. B. Siegel, and J. I. Ransom. 2017. North Coast and Cascades Network landbird monitoring: Report for the 2016 field season. Natural Resource Report NPS/NCCN/NRR—2017/1495. National Park Service, Fort Collins, CO.

Lewis, M. G., and F. A. Sharpe. 1987. Birding in the San Juan Islands. The Mountaineers, Seattle, WA.

Meslow, E. C., and H. M. Wight. 1975. Avifauna and succession in Douglas-fir forests of the Pacific Northwest. Pages 266-271 *in* D. R. Smith (ed.). Proceedings of the symposium on management of forest and rangeland habitats for non-game birds. USDA Forest Service General Technical Report WO-1.

Nichols, J. D., L. Thomas, and B. P. Conn. 2009. Inferences about landbird abundance from count data: recent advances and future directions. Pages 201-235 *in* D. L. Thomson, E. G. Cooch, and M. J. Conroy (eds.). Modeling demographic processes in marked populations. Springer, New York, NY.

North American Bird Conservation Initiative, U.S. Committee. 2009. The state of the birds, United States of America, 2009. U.S. Department of Interior, Washington, D.C.

North American Bird Conservation Initiative, U.S. Committee. 2011. The state of the birds 2011 report on public lands and waters. U.S. Department of Interior: Washington, D.C.

Office of the Washington State Climatologist, 2019. May 2019 report and outlook.

Pacific Meridian Resources. 1996. Vegetation and landform database development study: Final report. Pacific Meridian Resources, Portland, OR.

Peterjohn, B. G., J. R. Sauer, and C. S. Robbins. 1995. Population trends from North American breeding bird survey. Pages 3-39 *in* T. E. Martin and D. M Finch (eds.). Ecology and management of Neotropical migratory birds. Oxford Press, New York, NY.

Ray, C., J. F. Saracco, M. L. Holmgren, R. L. Wilkerson, R. B. Siegel, K. J. Jenkins, J. I. Ransom, P. J. Happe, J. R. Boetsch, and M. H. Huff. 2017. Recent stability of resident and migratory landbird populations in National Parks of the Pacific Northwest. Ecosphere 8:e01902.

Ray, C., J. Saracco, K. Jenkins, M. Huff, P. Happe, and J. Ransom. 2017b. Development of a robust analytical framework for assessing landbird population trends, dynamics and relationships with environmental covariates in the North Coast and Cascades Network. National Park Service Natural Resource Report NPS/NCCN/NRR—2017/1483. National Park Service, Fort Collins, CO.

Ray, C., M. L. Holmgren, R. L. Wilkerson, R. B. Siegel, J. R. Boetsch, K. J. Jenkins, and J. I. Ransom. 2019. Trends in landbird density at two national parks in fragmented, mixed-use landscapes of the Pacific Northwest. Northwestern Naturalist 100:1-25.

Robbins, C. S., J. R. Sauer, R. Greenburg, and S. Droege. 1989. Population declines in North American birds that migrate to the neotropics. Proceedings of the National Academy of Sciences 86:7658-7662.

Saab, V. A., and T. D. Rich. 1997. Large-scale conservation assessment for Neotropical migratory land birds in the interior Columbia River basin. Gen. Tech. Rep. PNW-GTR-285. USDA Forest Service, Pacific Northwest Research Station, Portland, OR.

Saracco, J. F., A. L. Holmgren, R. L. Wilkerson, R. B. Siegel, R. C. Kuntz, K. J. Jenkins II, P. J. Happe, J. R. Boetsch, and M. H. Huff. 2014. Landbird trends in national parks of the North Coast and Cascades Network, 2005–12. U.S. Geological Survey Open-File Report 2014–1202, U.S. Geological Survey, Reston, VA. Available online: http://dx.doi.org/10.3133/ofr20141202.

Sauer, J. R., D. K. Niven, J. E. Hines, D. J. Ziolkowski, Jr, K. L. Pardieck, J. E. Fallon, and W. A. Link. 2017. The North American Breeding Bird Survey, Results and Analysis 1966 - 2015. Version 2.07. 2017 USGS Patuxent Wildlife Research Center, Laurel, MD.

Sharp, B. E. 1996. Avian population trends in the Pacific Northwest. Bird Populations 3:26-45.

Siegel, R. B., R. L. Wilkerson, and S. Hall. 2009a. Landbird inventory for Olympic National Park (2002-2003). Natural Resource Technical Report NPS/NCCN/NRTR—2009/159. National Park Service, Fort Collins, CO.

Siegel, R. B., R. L. Wilkerson, K. J. Jenkins, R. C. Kuntz II, J. R. Boetsch, J. P. Schaberl, and P. J. Happe. 2007. Landbird monitoring protocol for national parks in the North Coast and Cascades Network. U.S. Geological Survey Techniques and Methods 2-A6. U.S. Geological Survey, Reston, VA.

Siegel, R. B., R. L. Wilkerson, and R. C. Kuntz II. 2006. Landbird monitoring in the North Coast and Cascades Network: report for the 2005 pilot field season. The Institute for Bird Populations, Point Reyes Station, CA.

Siegel, R. B., R. L. Wilkerson, and R. C. Kuntz II. 2008. North Coast and Cascades Network landbird monitoring report for the 2007 field season. Natural Resource Technical Report NPS/NCCN/NRTR—2008/114. National Park Service, Fort Collins, CO.

Siegel, R. B., R. L. Wilkerson, and R. C. Kuntz II. 2009b. Landbird monitoring in the North Coast and Cascades Network. Report for the 2006 Pilot Field Season**.** Natural Resource Technical Report NPS/NCCN/NRTR—2009/168. National Park Service, Fort Collins, CO.

Siegel, R. B., R. L. Wilkerson, and R. C. Kuntz II. 2009c. Landbird inventory for Lewis and Clark National Historical Park (2006)**.** Natural Resource Technical Report NPS/NCCN/NRTR—2009/166. National Park Service, Fort Collins, CO.

Siegel, R. B., R. L. Wilkerson, R. C. Kuntz II, and J. F. McLaughlin. 2009d. Landbird inventory for North Cascades National Park Service Complex (2001-2002). Natural Resource Technical Report NPS/NCCN/NRTR—2009/152. National Park Service, Fort Collins, CO.

Siegel, R. B., R. L. Wilkerson, R. C. Kuntz II, J. F. Saracco, and A. L. Holmgren. 2012. Elevation ranges of birds at Mount Rainier National Park, North Cascades National Park Complex, and Olympic National Park. Northwestern Naturalist 93:23-39.

Siegel, R. B., R. L. Wilkerson, H. K. Pedersen, and R. C. Kuntz II. 2009e. Landbird inventory of San Juan Island National Historical Park (2002). Natural Resource Technical Report NPS/NCCN/NRTR—2009/156. National Park Service, Fort Collins, CO.

Silsbee, G. G., and D. L. Peterson. 1991. Designing and implementing comprehensive long-term inventory and monitoring programs for National Park System lands. Natural Resources Report NPS/NRUW/NRR-91/04, Denver, CO.

Simons, T. R., K. N. Rabenold, D. A. Buehler, J. A. Collazo, and K. E. Fransreb. 1999. The role of indicator species: Neotropical migratory song birds. Pages 187-208 *in* J. D. Peine, (ed.). Ecosystem management for sustainability: Principles and practices illustrated by a regional biosphere reserve cooperative. Lewis Publishers, New York, NY.

Wilkerson, R. L., R. B. Siegel, and R. C. Kuntz II. 2009b. North Coast and Cascades Network landbird monitoring report for the 2008 field season. Natural Resource Technical Report NPS/NCCN/NRTR—2009/222. National Park Service, Fort Collins, CO.

Wilkerson, R. L., R. B. Siegel, and R. C. Kuntz II. 2010. North Coast and Cascades Network landbird monitoring report for the 2009 field season. Natural Resource Technical Report NPS/NCCN/NRTR—2009/392. National Park Service, Fort Collins, CO.

Wilkerson, R. L., R. B. Siegel, and J. Schaberl. 2009a. Landbird inventory of Mount Rainier National Park (2003-2004). Natural Resource Technical Report NPS/NCCN/NRTR—2009/164. National Park Service, Fort Collins, CO.

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

Park	Panel	Elevation Class	Transect	Number of points surveyed													
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018	2019
MORA	Ann1	Low	4001	10	12	12	12	12	10	11	14	16	16	15	15	15	16
MORA	Ann1	Low	4005	11	11	11	11	12	9	10	13	13	14	14	14	14	14
MORA	Ann1	Medium	4002	11	11	11	12	11	13	13	15	15	15	16	14	17	17
MORA	Ann1	Medium	4004	18	17	18	18	13	15	10	17	17	18	18	20	19	19
MORA	Ann1	Medium	4009	14	14	15	15	11	13	10	15	15	15	16	17	17	17
MORA	Ann1	Medium	4012	16	16	14	19	19	13	0	17	19	20	23	24	23	23
MORA	Ann1	High	4003	12	12	12	12	12	10	12	13	14	15	15	15	16	16
MORA	Ann1	High	4007	20	20	20	20	20	20	0	20	20	20	25	22	21	24
MORA	Ann1	High	4011	13	11	14	17	17	15	0	16	16	17	17	17	17	17
MORA	Ann1	High	4014	10	16	14	16	16	15	0	17	17	18	22	24	22	22
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	–
MORA	Alt2	High	4019	–	–	20	–	–	–	–	20	–	–	–	–	21	–

Park	Panel	Elevation Class	Transect	Number of points surveyed													
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018	2019
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	–	–	–	–
MORA	Alt4	Low	4022	–	–	–	–	17	–	–	–	–	17	–	–	–	–
MORA	Alt4	Medium	4057	–	–	–	–	10	–	–	–	–	14	–	–	–	–
MORA	Alt4	Medium	4060	–	–	–	–	24	–	–	–	–	24	–	–	–	–
MORA	Alt4	Medium	4061	–	–	–	–	15	–	–	–	–	17	–	–	–	–
MORA	Alt4	Medium	4065	–	–	–	–	13	–	–	–	–	15	–	–	–	–
MORA	Alt4	High	4035	–	–	–	–	12	–	–	–	–	14	–	–	–	–
MORA	Alt4	High	4036	–	–	–	–	14	–	–	–	–	16	–	–	–	–
MORA	Alt4	High	4039	–	–	–	–	11	–	–	–	–	13	–	–	–	–

Park	Panel	Elevation Class	Transect	Number of points surveyed													
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018	2019
MORA	Alt4	High	4043	–	–	–	–	18	–	–	–	–	19	–	–	–	–
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	–	–
MORA	Alt6	Medium	4084	–	–	–	–	–	–	0	–	–	–	–	17	–	–
MORA	Alt6	High	4058	–	–	–	–	–	–	0	–	–	–	–	19	–	–
MORA	Alt6	High	4062	–	–	–	–	–	–	0	–	–	–	–	19	–	–
MORA	Alt6	High	4064	–	–	–	–	–	–	10	–	–	–	–	15	–	–
MORA	Alt6	High	4067	–	–	–	–	–	–	13	–	–	–	–	17	–	–

Park	Panel	Elevation Class	Transect	Number of points surveyed													
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018	2019
NOCA	Ann1	Low	1013	12	11	14	12	11	9	13	15	15	15	0	15	15	15
NOCA	Ann1	Low	1017	13	12	9	12	12	12	13	14	14	15	14	15	15	15
NOCA	Ann1	Low	1020	15	12	13	15	16	12	16	17	17	18	18	17	17	18
NOCA	Ann1	Low	1023	18	19	19	20	21	20	21	21	21	21	22	22	22	22
NOCA	Ann1	Medium	1015	12	16	17	17	15	15	16	17	17	19	18	19	18	18
NOCA	Ann1	Medium	1018	16	21	21	23	22	25	25	23	25	25	24	25	25	23
NOCA	Ann1	Medium	1022	13	13	11	13	14	13	14	15	15	17	16	18	16	18
NOCA	Ann1	Medium	1024	9	10	11	12	10	11	10	13	13	13	14	14	15	14
NOCA	Ann1	High	1014	15	19	19	0	20	0	0	20	21	21	22	22	23	0
NOCA	Ann1	High	1016	14	15	14	16	15	14	15	17	17	17	17	17	16	17
NOCA	Ann1	High	1019	12	12	10	12	12	12	12	13	13	13	14	0	14	14
NOCA	Ann1	High	1021	18	21	22	23	22	19	17	24	24	24	24	23	24	24
NOCA	Alt2	Low	1001	–	–	11	–	–	–	–	13	–	–	–	–	13	–
NOCA	Alt2	Low	1005	–	–	13	–	–	–	–	15	–	–	–	–	15	–
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	–	–	0	–	–	–	–	16	–	–	–	–	17	–
NOCA	Alt2	Medium	1011	–	–	19	–	–	–	–	19	–	–	–	–	20	–
NOCA	Alt2	High	1002	–	–	18	–	–	–	–	20	–	–	–	–	20	–

Park	Panel	Elevation Class	Transect	Number of points surveyed													
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018	2019
NOCA	Alt2	High	1007	–	–	13	–	–	–	–	14	–	–	–	–	15	–
NOCA	Alt2	High	1008	–	–	0	–	–	–	–	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	–	–	–	–	–	–	–	–	13	–	–	–	–	17
NOCA	Alt3	High	1032	–	–	–	–	–	–	–	–	13	–	–	–	–	15
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	–	–	–	–
NOCA	Alt4	Low	1054	–	–	–	–	11	–	–	–	–	16	–	–	–	–
NOCA	Alt4	Low	1061	–	–	–	–	10	–	–	–	–	13	–	–	–	–
NOCA	Alt4	Low	1122	–	–	–	–	–	–	–	–	–	22	–	–	–	–
NOCA	Alt4	Medium	1033	–	–	–	–	20	–	–	–	–	23	–	–	–	–
NOCA	Alt4	Medium	1035	–	–	–	–	16	–	–	–	–	18	–	–	–	–

Park	Panel	Elevation Class	Transect	Number of points surveyed													
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018	2019
NOCA	Alt4	Medium	1038	–	–	–	–	13	–	–	–	–	18	–	–	–	–
NOCA	Alt4	Medium	1041	–	–	–	–	14	–	–	–	–	17	–	–	–	–
NOCA	Alt4	High	1048	–	–	–	–	11	–	–	–	–	13	–	–	–	–
NOCA	Alt4	High	1049	–	–	–	–	12	–	–	–	–	17	–	–	–	–
NOCA	Alt4	High	1050	–	–	–	–	13	–	–	–	–	16	–	–	–	–
NOCA	Alt4	High	1052	–	–	–	–	11	–	–	–	–	13	–	–	–	–
NOCA	Alt5	Low	1062	–	–	–	–	–	8	–	–	–	–	11	–	–	–
NOCA	Alt5	Low	1063	–	–	–	–	–	9	–	–	–	–	16	–	–	–
NOCA	Alt5	Low	1065	–	–	–	–	–	11	–	–	–	–	13	–	–	–
NOCA	Alt5	Low	1067	–	–	–	–	–	8	–	–	–	–	13	–	–	–
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	–	–	–	–	–	0	–	–	–	–	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	–	–

Park	Panel	Elevation Class	Transect	Number of points surveyed													
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018	2019
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	–	–	–	–	–	–	0	–	–	–	–	9	–	–
NOCA	Alt6	High	1088	–	–	–	–	–	–	12	–	–	–	–	13	–	–
NOCA	Alt6	High	1090	–	–	–	–	–	–	0	–	–	–	–	16	–	–
NOCA	Alt6	High	1092	–	–	–	–	–	–	14	–	–	–	–	14	–	–
OLYM	Ann1	Low	3001	11	10	8	10	11	12	12	13	12	13	13	14	13	14
OLYM	Ann1	Low	3121	11	15	17	17	17	14	17	15	17	17	19	19	18	17
OLYM	Ann1	Low	3126	9	10	11	13	13	13	15	15	15	14	15	16	16	15
OLYM	Ann1	Low	3134	16	16	18	18	18	18	19	19	19	19	18	20	20	20
OLYM	Ann1	Medium	3122	14	12	14	0	16	16	0	16	17	18	18	0	18	17
OLYM	Ann1	Medium	3123	10	10	12	14	14	15	15	15	15	16	17	16	16	17
OLYM	Ann1	Medium	3130	9	9	8	9	9	9	9	10	10	10	10	10	10	8
OLYM	Ann1	Medium	3200	–	–	22	23	21	23	22	23	23	22	23	23	23	22
OLYM	Ann1	High	3124	9	10	10	11	11	11	11	12	12	13	14	14	13	14
OLYM	Ann1	High	3125	9	11	13	13	14	15	11	14	12	15	15	15	15	12
OLYM	Ann1	High	3127	7	9	13	15	14	15	15	15	15	15	16	15	16	16
OLYM	Ann1	High	3128	10	11	11	11	10	11	12	13	12	14	14	14	14	11

Park	Panel	Elevation Class	Transect	Number of points surveyed													
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018	2019
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	–
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

Park	Panel	Elevation Class	Transect	Number of points surveyed													
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018	2019
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	–	–	–	–
OLYM	Alt4	Low	3159	–	–	–	–	11	–	–	–	–	12	–	–	–	–
OLYM	Alt4	Low	3161	–	–	–	–	11	–	–	–	–	12	–	–	–	–
OLYM	Alt4	Low	3163	–	–	–	–	15	–	–	–	–	15	–	–	–	–
OLYM	Alt4	Medium	3160	–	–	–	–	10	–	–	–	–	12	–	–	–	–
OLYM	Alt4	Medium	3167	–	–	–	–	11	–	–	–	–	14	–	–	–	–
OLYM	Alt4	Medium	3168	–	–	–	–	10	–	–	–	–	15	–	–	–	–
OLYM	Alt4	Medium	3174	–	–	–	–	14	–	–	–	–	15	–	–	–	–
OLYM	Alt4	High	3158	–	–	–	–	14	–	–	–	–	18	–	–	–	–
OLYM	Alt4	High	3164	–	–	–	–	14	–	–	–	–	17	–	–	–	–
OLYM	Alt4	High	3171	–	–	–	–	12	–	–	–	–	15	–	–	–	–
OLYM	Alt4	High	3173	–	–	–	–	10	–	–	–	–	12	–	–	–	–
OLYM	Alt5	High	3175	–	–	–	–	–	12	–	–	–	–	15	–	–	–
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	–	–	–

Park	Panel	Elevation Class	Transect	Number of points surveyed													
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018	2019
OLYM	Alt5	Medium	3184	–	–	–	–	–	16	–	–	–	–	20	–	–	–
OLYM	Alt5	Medium	3185	–	–	–	–	–	9	–	–	–	–	11	–	–	–
OLYM	Alt5	High	3179	–	–	–	–	–	16	–	–	–	–	19	–	–	–
OLYM	Alt5	High	3180	–	–	–	–	–	16	–	–	–	–	19	–	–	–
OLYM	Alt5	High	3188	–	–	–	–	–	12	–	–	–	–	18	–	–	–
OLYM	Alt5	Low	3165	–	–	–	–	–	10	–	–	–	–	12	–	–	–
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	–	–

The Department of the Interior protects and manages the nation’s natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

NPS 105/171145, 149/171145, 168/171145, July 2020

Natural Resource Stewardship and Science
1201 Oakridge Drive, Suite 150
Fort Collins, CO 80525