



North Coast and Cascades Network Landbird Monitoring

Report for the 2023 Field Season



Black-throated Gray Warbler (*Setophaga nigrescens*), Olympic National Park.
THE INSTITUTE FOR BIRD POPULATIONS / ERIC GUZMAN

North Coast and Cascades Network landbird monitoring: Report for the 2023 field season

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Contents

	Page
Figures.....	iv
Tables.....	vii
Abstract.....	viii
Acknowledgments.....	ix
Introduction.....	1
Study Area	4
Methods.....	5
Sample Design.....	5
Crew Training and Certification.....	10
Data Collection.....	10
Data Management.....	11
Data Analysis	12
Results.....	13
2023 Field Season.....	13
2023 Bird Counts.....	13
2023 Bird Counts Compared to Previous Years.....	51
Literature Cited	52
Appendix A: Detailed Survey History	58

Figures

	Page
Figure 1. National Park Service units participating in the North Coast and Cascades Network Landbird Monitoring Project.	4
Figure 2. Approximate locations of transects conducted at Mount Rainier National Park in 2023.	6
Figure 3. Approximate locations of transects conducted at North Cascades National Park Service Complex in 2023.	7
Figure 4. Approximate locations of transects conducted at Olympic National Park in 2023.	8
Figure 5. Locations of point count stations surveyed at San Juan Island National Historical Park in 2023; adjacent point count stations are 350 m apart.	9
Figure 6. Number of times each species (Sooty Grouse, Band-tailed Pigeon, Black Swift, and Vaux’s Swift) 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 2005–2023 field seasons.	34
Figure 7. Number of times each species (Rufous Hummingbird, Spotted Sandpiper, Red-breasted Sapsucker, and Hairy Woodpecker) 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 2005–2023 field seasons.	35
Figure 8. Number of times each species (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 2005–2023 field seasons.	36
Figure 9. Number of times each species (Hammond’s Flycatcher, Dusky Flycatcher, Western Flycatcher, and Cassin’s 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 2005–2023 field seasons.	37
Figure 10. Number of times each species (Warbling Vireo, Red-eyed Vireo, Canada Jay, and Steller’s Jay) 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 2005–2023 field seasons.	38

Figures (continued)

Page

Figure 11. Number of times each species (Clark’s Nutcracker, Common Raven, Violet-green Swallow, and Mountain 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 2005–2023 field seasons.	39
Figure 12. Number of times each species (Chestnut-backed Chickadee, Red-breasted Nuthatch, Brown Creeper, and Pacific Wren) 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 2005–2023 field seasons.	40
Figure 13. Number of times each species (Golden-crowned Kinglet, Ruby-crowned Kinglet, Townsend’s Solitaire, and Swainson’s Thrush) 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 2005–2023 field seasons.	41
Figure 14. Number of times each species (Hermit Thrush, American Robin, Varied Thrush, and Cedar Waxwing) 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 2005–2023 field seasons.	42
Figure 15. Number of times each species (American Pipit, Evening Grosbeak, Pine Grosbeak, and Gray-crowned Rosy-Finch) 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 2005–2023 field seasons.	43
Figure 16. Number of times each species (Cassin’s Finch, Red Crossbill, Pine Siskin, and Chipping Sparrow) 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 2005–2023 field seasons.	44
Figure 17. Number of times each species (Fox Sparrow, Dark-eyed Junco, White-crowned Sparrow, and Song Sparrow) 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 2005–2023 field seasons.	45

Figures (continued)

Page

Figure 18. Number of times each species (Brown-headed Cowbird, Nashville Warbler, MacGillivray’s Warbler, and Yellow 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 2005–2023 field seasons. 46

Figure 19. Number of times each species (Yellow-rumped Warbler, Black-throated Gray Warbler, Townsend’s/Hermit Warbler, and Wilson’s 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 2005–2023 field seasons.....47

Figure 20. Number of times each species (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 2005–2023 field seasons.....48

Tables

	Page
Table 1. Observers who conducted point counts in the North Coast and Cascades Network in 2023.	10
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 2023.	13
Table 3. Summary history of North Coast and Cascades Network landbird monitoring transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks completed through 2023.....	16
Table 4. All species recorded in the three large North Coast and Cascades Network parks during the 2023 field season, including the pre-season training session.	17
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 2023.....	23
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 2023.....	28
Table 7. Species listed under the Endangered Species Act recorded on “Rare Bird Report Forms” in each park in 2023, excluding individuals that were also detected during point counts.	49
Table 8. Number of points with detections and number of individual detections for each species detected during point counts at San Juan Island National Historical Park in 2023.....	49
Table 9. Detailed survey history of each transect sampled in the large parks to date.....	58

Abstract

The North Coast and Cascades Network (NCCN) continued to implement the network’s Landbird Monitoring Protocol in 2023, 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 been implemented fully (including data collection on the annual panel and five alternating panels) for the past 16 years (2007–2023), except for 2017 when data collection was temporarily suspended to reallocate resources for a 5-year data synthesis. In 2023, we conducted surveys at 1,174 point count stations along 68 transects in the large wilderness parks of the NCCN, including Mount Rainier National Park (MORA), North Cascades National Park Service Complex (NOCA), and Olympic National Park (OLYM); and 54 point counts at San Juan Island National Historical Park (SAJH). Lewis and Clark National Historical Park (LEWI) was not surveyed in 2023 as SAJH and LEWI are surveyed in alternating years.

Across the three large parks, we documented the presence of 158 species, 100 of which were detected during point counts. The remaining 58 species were recorded only as incidental detections or on “Rare Bird Report Forms.” For the most frequently detected species over the 2005–2023 field seasons, we present the total number of detections of each species on each park’s annual panel transects over that period of time.

The number of bird detections on annual-panel transects across all three large parks increased by 2,239 between 2022 and 2023. When factoring in the number of point counts conducted each year, all three parks saw an increase in the average number of birds per count (an increase of 17% at MORA, 42% at OLYM, and 21% at NOCA). This overall increase in detections across the network is in part due to a high number of Red Crossbill detections in 2023, particularly at OLYM. Several other species (Red-breasted Nuthatch, Townsend’s/Hermit Warbler, American Robin, and Hammond’s Flycatcher) were also detected in higher numbers in the three large parks in 2023 than in 2022. Despite these changes, overall detection numbers of most species across the parks were not markedly different between the two years. We caution 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.

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2023 field crew member Molly Hetherwick at San Juan Island National Historical Park. THE INSTITUTE FOR BIRD POPULATIONS / MANDY HOLMGREN

Introduction

Many bird species in North America have declined substantially during the past half century, with an estimated 3 billion birds, nearly 30% of the total, lost since the 1970s (Rosenberg et al. 2019). Causes of these losses are varied and in some instances are not fully understood, but in the Pacific Northwest have historically included outright habitat loss as well as forest management practices that discouraged the development of old-growth conditions and greatly reduced the extent of old-growth forest conditions throughout the region (Bolsinger and Waddell 1993). Landscapes that have been managed for timber production have been largely converted to early- and mid-successional forests (Bunnell et al. 1997), with increased fragmentation as well as a variety of altered structural characteristics that likely affect bird community composition. Species that breed in the subalpine and alpine zones face other stressors, including recreation impacts and ecological changes resulting from alterations of the natural fire regime.

More recently, climate change has been increasingly understood to be both a driver of recent changes in bird populations and is the greatest known threat in the coming decades (Thomas et al. 2004). Climatic warming and drying may negatively affect birds directly through physiological stress (Khaliq et al. 2014, McKechnie 2019), or indirectly through changes in vegetation (including changes prompted by climate-altered fire regimes), reduced prey availability, phenological shifts in prey availability, disease outbreaks, or other ecological changes (Crick 2004, Albright et al. 2010, Auer and Martin 2013, Matthews et al. 2011, Scridel et al. 2018). Ecological consequences may be complex and inter-related and depend on traits of individual species (Cormont et al. 2011, Tingley et al. 2012) and ecosystems (Albright et al. 2010), with montane ecosystems considered particularly susceptible to effects of climate change (IPCC 2013, 2014).

Climatic and other stressors are expected to increase in the coming years, and challenge national park resources (National Park System Advisory Board Science Committee 2012, Monahan and Fisichelli 2014). Understanding the responses of bird populations to these stressors is critical, especially in mountainous regions where steep and complex terrain can function as climate refugia that can be harnessed in contemporary plans for critical habitat management and species conservation in the face of climate change (Morelli et al. 2016). However, disentangling implications of recent climate change for bird populations across the broader landscape is challenging, in part because of confounding factors associated with habitat loss and changing land use and land management (Scridel et al. 2018). Fortunately, national parks provide opportunities to assess effects of climate change in the absence or diminution of some of these confounding factors (Silsbee and Peterson 1991, Simons et al. 1999, Siegel et al. 2012), although migratory bird species may nevertheless be affected by such factors during other portions of their annual life cycle.

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. 2009d). 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 regularly occurring bird species at all five parks (Siegel et al. 2009a, Siegel et al. 2009b, Siegel et al. 2009c, Siegel et al. 2009d, Wilkerson et al. 2009a), have provided baseline information for assessing changes in bird abundance and distribution over time due to climate change or other factors, as well as reference information for assessing recent trends within the parks and the effects of more intensive land management practices elsewhere in the region (Siegel et al. 2012, Ray et al. 2017a, Ray et al. 2019). We add to this baseline information through our monitoring of landbirds, which we conduct annually at OLYM, NOCA, and MORA, and in alternate years between SAJH and LEWI.

National parks in the NCCN and elsewhere fill vital roles as both refuges for bird species dependent on late-successional forest conditions (North 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). 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 basic comparisons between data collected in 2023 and the previous 17 years of data collection (Siegel et al. 2008, Wilkerson et al. 2009b, 2010, Holmgren et al. 2011–2017, 2019–2023). This report and previous annual reports for the Landbird Monitoring Project are intended primarily as administrative data reports. More comprehensive analyses of these data, including trend analysis that accounts for the potentially confounding effects of variation in detectability and sampling effort, are conducted in conjunction with periodic detailed trend analyses. The first trend analysis report summarizes data from 2005–2012 (Saracco et al. 2014). An analytical framework has been developed for this project that integrates several recent developments in Bayesian N-mixture modeling to assess landbird trends and evaluates the role of climatic and other

spatiotemporal variables in driving those trends, yielding a technical report and two published papers (Ray et al. 2017a, 2017b, 2019).

Study Area

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

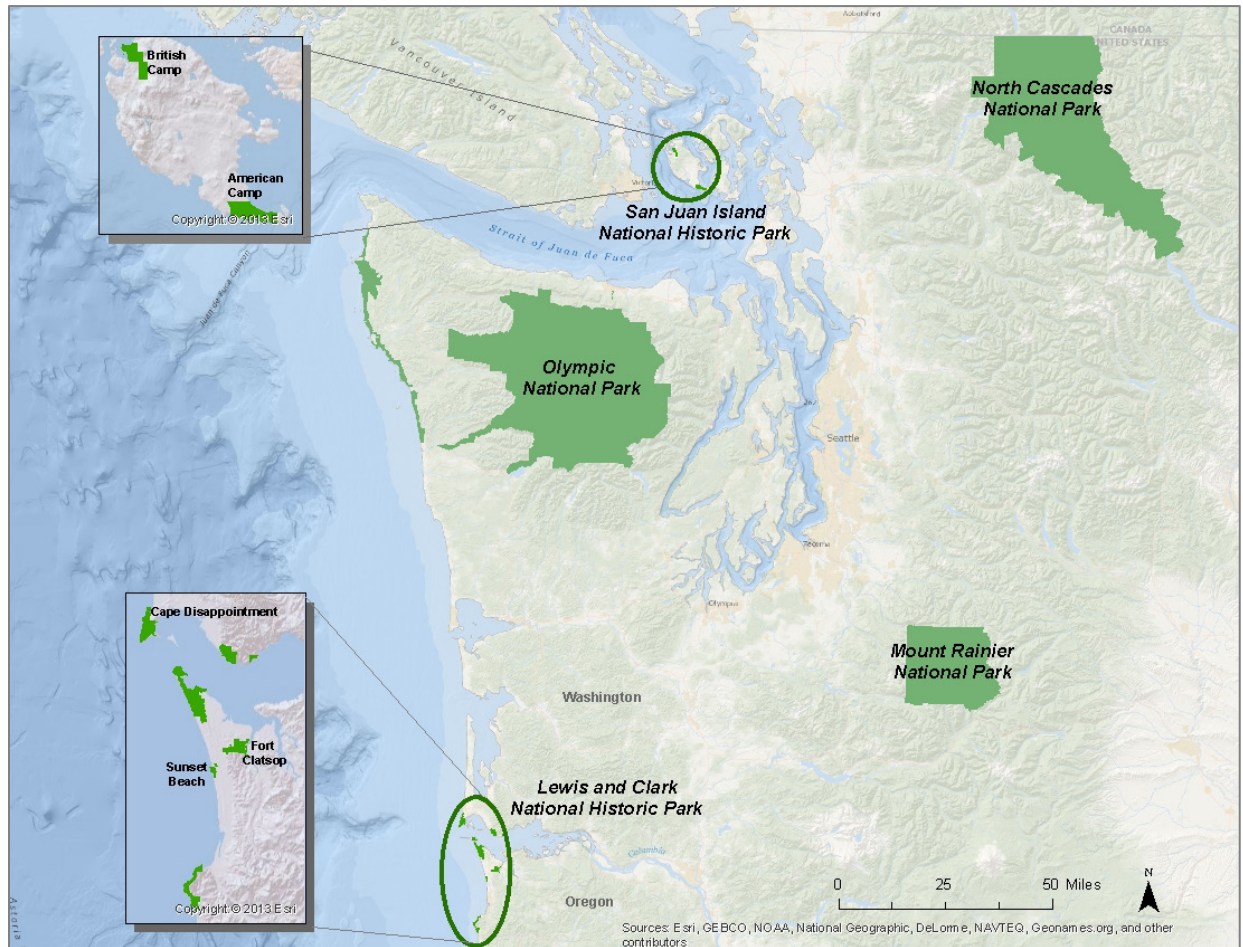


Figure 1. National Park Service units participating in the North Coast and Cascades Network Landbird Monitoring Project. NPS.

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. Transects at OLYM, MORA, and NOCA are based on an augmented serially alternating panel design where one set, or panel, of transects is surveyed annually (that is, the annual panel) and 5 sets of transects are surveyed on a 5-year return interval (that is, the alternating panels). Each year we sample all annual panel transects and one of the five alternating panels at each large park. At the small parks, SAJH and LEWI, we sample bird populations from points distributed as a systematic grid (with a random starting point) covering each park area in its entirety. There are 54 point count stations at SAJH and 71 point count stations at LEWI.

In 2023, we implemented the full study design in the three large parks for the sixteenth year, including surveys of the annual panel (“Ann1”) as well as the first alternating panel (“Alt2”) (Figures 2–4). The protocol was initially field-tested with data collected from the annual panel only as part of protocol development during 2005–2006, and has subsequently been implemented fully (including data collection on the annual panel as well as all of the five alternating panels) for the past 16 years (2007–2023), except for 2017 when data collection was temporarily suspended to reallocate resources for a 5-year data synthesis (Ray et al. 2018). Results from each of the first 15 years of full implementation are presented in Siegel et al. (2008), Wilkerson et al. (2009b, 2010), and Holmgren et al. (2011–2017, 2019–2023). 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 2023, we surveyed the grid at SAJH (Figure 5). Multi-year trend analyses for the small parks are provided in Ray et al. (2019).

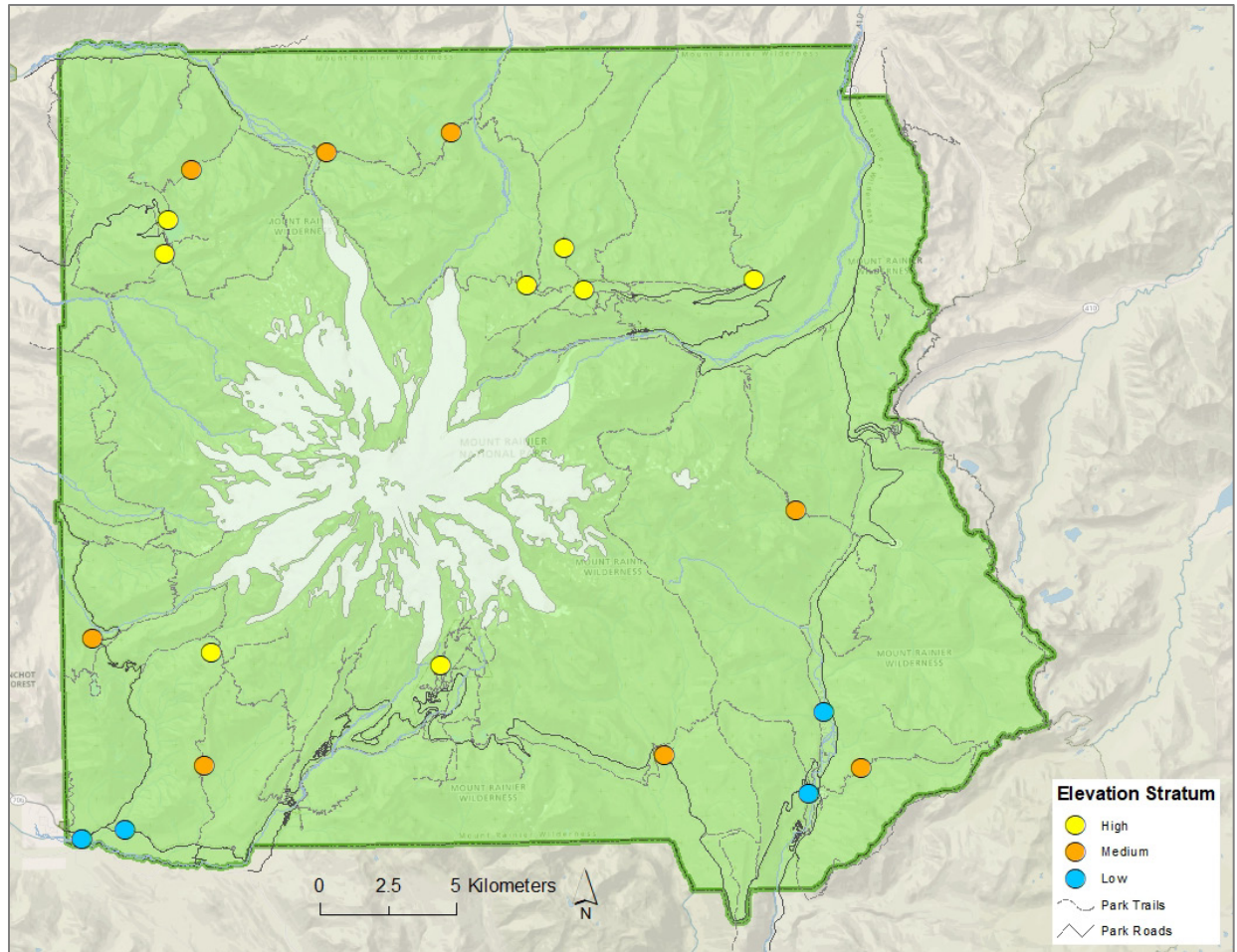


Figure 2. Approximate locations of transects conducted at Mount Rainier National Park in 2023. NPS.

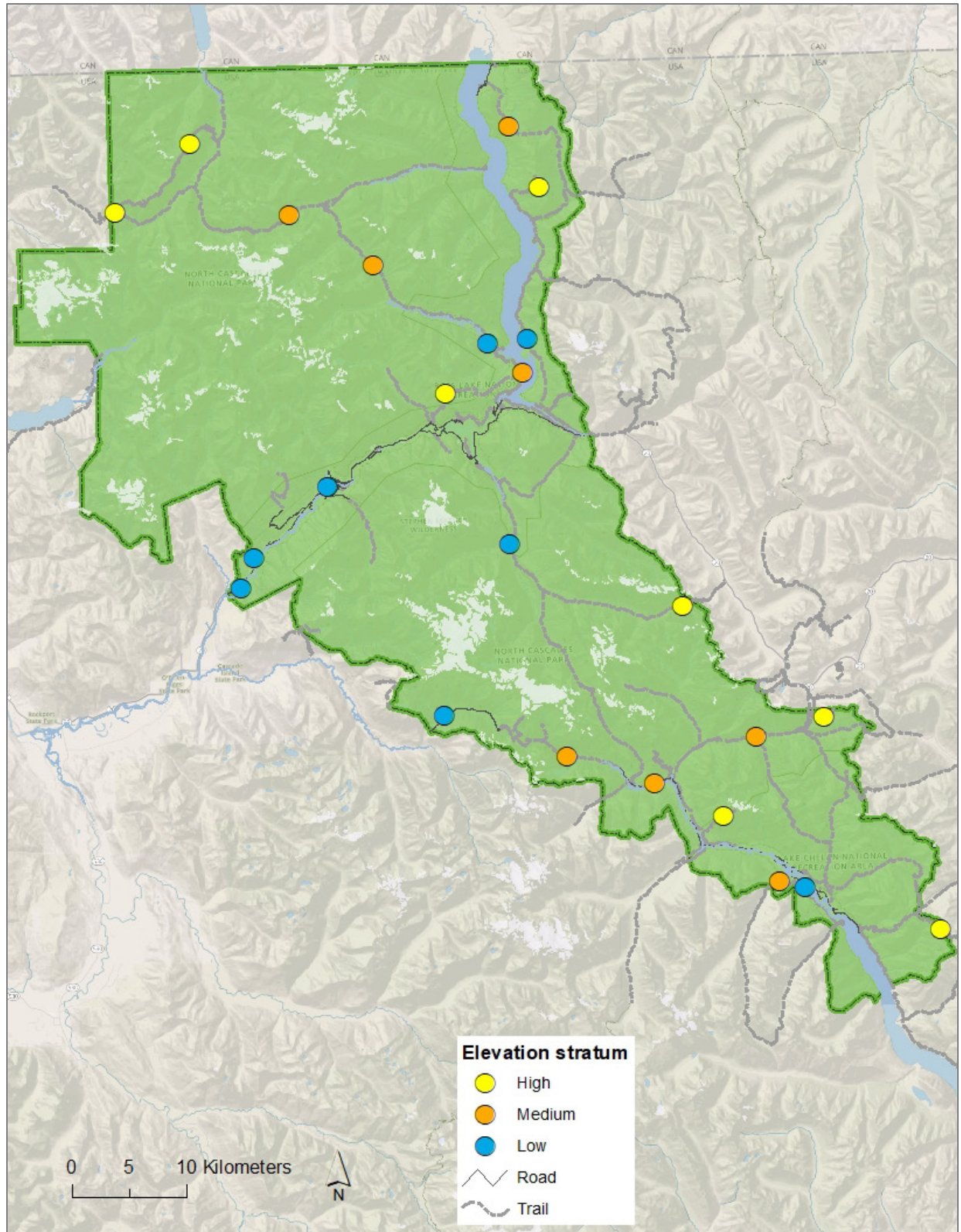


Figure 3. Approximate locations of transects conducted at North Cascades National Park Service Complex in 2023. NPS.

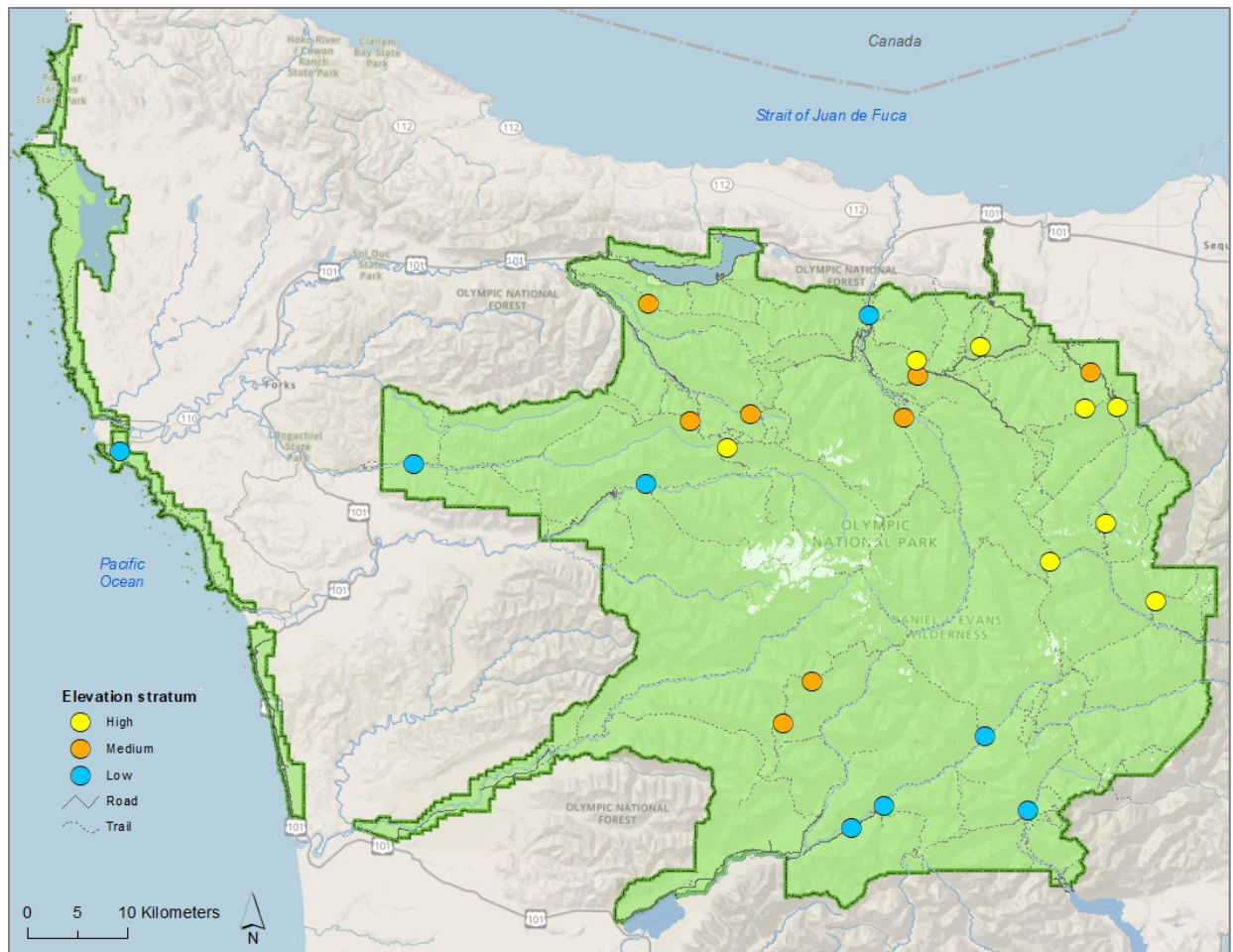


Figure 4. Approximate locations of transects conducted at Olympic National Park in 2023. NPS.

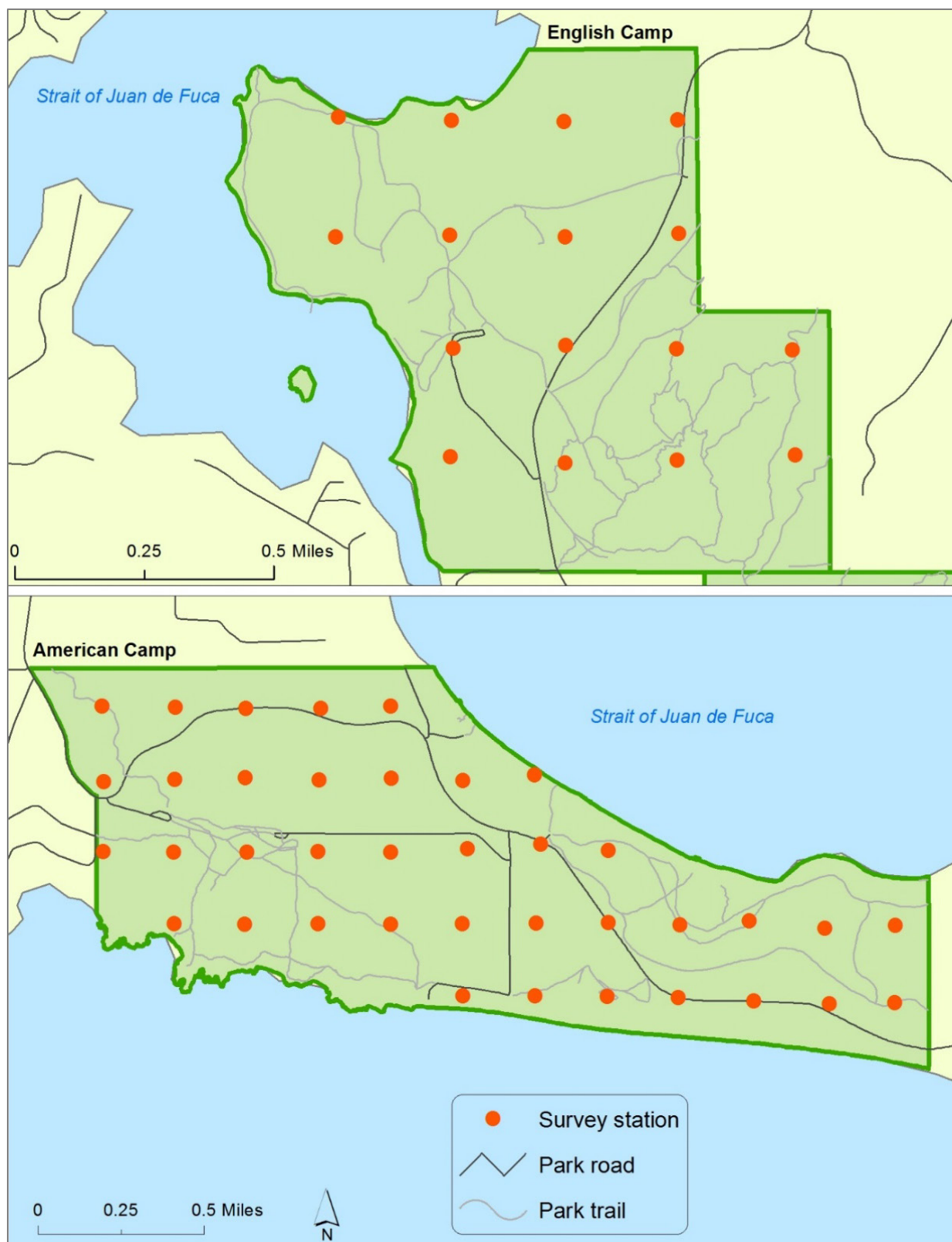


Figure 5. Locations of point count stations surveyed at San Juan Island National Historical Park in 2023; adjacent point count stations are 350 m apart. NPS.

Crew Training and Certification

Mandy Holmgren, a Staff Biologist with The Institute for Bird Populations, served as the 2023 Field Lead. Mandy began training five field technicians on May 1, including one returning crew member who assisted with training and two other technicians who were also returning from previous years. Only two crew members were new in 2023. 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, neither of the two new field technicians had passed the rigorous point count certification exam. However, both passed the exam within two weeks of the end of training and were able to begin collecting data. All individuals who collected data during the 2023 field season (Table 1) were employees of The Institute for Bird Populations.

Table 1. Observers who conducted point counts in the North Coast and Cascades Network in 2023.

Observer	Role
Fen Conway	Technician
Eric Guzman	Technician
Molly Hetherwick	Technician
Mandy Holmgren	Field Lead
Melissa Marshall	Assistant Field Lead
Matt Schumaker	Technician
Wren Wagenbach	Technician

Data Collection

All point count data were collected between June 6 and July 29 at MORA, between June 8 and July 30 at NOCA, and between May 30 and July 23 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, splitting up to survey independently along the transect. 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. 2019), 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. Prior to 2011 we used point counts with durations of only five minutes broken into two time intervals (0–3:00, 3:01–5:00), but in 2011 we added the third time interval to make the data more useful for analysis within an occupancy modeling framework that relies on detection or non-detection of individual birds within multiple time intervals to estimate detection probability (Ray et al. 2017b).

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 if any new survey points were established. 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 and Assistant 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 and Assistant 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 2023 season were sourced from the Office of the Washington State Climatologist (2023). 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

2023 Field Season

We completed our seventeenth year of full implementation of the NCCN Landbird Monitoring Project with the experience gained from two pilot field seasons (2005 and 2006) and 15 previous years of full protocol implementation. Our procedures for season preparation, data collection, data management, data analysis, and reporting have all been well vetted and required no substantial changes this year.

The season started off with a near-average snowpack across all three parks on May 1, but a very warm May led to rapid melting, two weeks earlier than usual in many locations, and there was essentially no snow by the time we surveyed our high elevation transects in July. Precipitation was well below average in May and June, with “abnormally dry conditions” or “moderate drought” by the beginning of July, developing into “extreme drought” in some locations by the end of July. May–June ranked among the warmest and driest 10% of the historical record across all survey areas. The early snowmelt and warm, dry conditions resulted in well below normal streamflow in June and July for rivers across the parks (Office of Washington State Climatologist Data), which made for markedly less ambient noise during counts this year. Despite the dry conditions, no significant fires started in Washington until after our field season was over, so we did not have to deal with smoky conditions or fire-related closures this year.

2023 Bird Counts

In 2023 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 (Tables 2 and 3). We also conducted 54 point counts at SAJH, including 16 at English Camp and 38 at American Camp.

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 2023.

Park	Panel	Elevation	Transect	No. of points surveyed
MORA	Ann1	Low	4001	19
MORA	Ann1	Low	4005	15
MORA	Ann1	Mid	4002	16
MORA	Ann1	Mid	4004	16
MORA	Ann1	Mid	4009	15
MORA	Ann1	Mid	4012	23
MORA	Ann1	High	4003	16
MORA	Ann1	High	4007	23
MORA	Ann1	High	4011	18
MORA	Ann1	High	4014	23
MORA	Alt2	Low	4006	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 2023.

Park	Panel	Elevation	Transect	No. of points surveyed
MORA	Alt2	Low	4008	13
MORA	Alt2	Mid	4015	11
MORA	Alt2	Mid	4017	14
MORA	Alt2	Mid	4020	16
MORA	Alt2	Mid	4026	12
MORA	Alt2	High	4016	21
MORA	Alt2	High	4019	21
MORA	Alt2	High	4027	17
MORA	Alt2	High	4075	22
NOCA	Ann1	Low	1013	17
NOCA	Ann1	Low	1017	15
NOCA	Ann1	Low	1020	20
NOCA	Ann1	Low	1023	22
NOCA	Ann1	Mid	1015	22
NOCA	Ann1	Mid	1018	24
NOCA	Ann1	Mid	1022	19
NOCA	Ann1	Mid	1024	14
NOCA	Ann1	High	1014	21
NOCA	Ann1	High	1016	18
NOCA	Ann1	High	1019	16
NOCA	Ann1	High	1021	26
NOCA	Alt2	Low	1001	13
NOCA	Alt2	Low	1005	14
NOCA	Alt2	Low	1006	14
NOCA	Alt2	Low	1010	17
NOCA	Alt2	Mid	1003	17
NOCA	Alt2	Mid	1004	15
NOCA	Alt2	Mid	1009	19
NOCA	Alt2	Mid	1011	22
NOCA	Alt2	High	1002	21
NOCA	Alt2	High	1007	17
NOCA	Alt2	High	1008	14
NOCA	Alt2	High	1012	17
OLYM	Ann1	Low	3001	14
OLYM	Ann1	Low	3121	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 2023.

Park	Panel	Elevation	Transect	No. of points surveyed
OLYM	Ann1	Low	3126	19
OLYM	Ann1	Low	3134	20
OLYM	Ann1	Mid	3122	18
OLYM	Ann1	Mid	3123	17
OLYM	Ann1	Mid	3130	12
OLYM	Ann1	Mid	3200	24
OLYM	Ann1	High	3124	15
OLYM	Ann1	High	3125	17
OLYM	Ann1	High	3127	16
OLYM	Ann1	High	3128	16
OLYM	Alt2	Low	3138	13
OLYM	Alt2	Low	3142	17
OLYM	Alt2	Low	3144	17
OLYM	Alt2	Low	3145	15
OLYM	Alt2	Mid	3133	16
OLYM	Alt2	Mid	3135	13
OLYM	Alt2	Mid	3137	13
OLYM	Alt2	Mid	3141	16
OLYM	Alt2	High	3132	22
OLYM	Alt2	High	3136	14
OLYM	Alt2	High	3139	17
OLYM	Alt2	High	3140	14

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 2023.

Park	Elevation Stratum	Number of transects completed																	
		2005 ^A	2006 ^A	2007 ^B	2008 ^C	2009 ^D	2010 ^E	2011 ^F	2012 ^B	2013 ^C	2014 ^D	2015 ^E	2016 ^F	2018 ^B	2019 ^C	2020 ^D	2021 ^E	2022 ^F	2023 ^B
MORA	Low	2	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
MORA	Medium	4	4	8	8	8	8	6	8	8	8	8	8	8	8	8	8	8	8
MORA	High	4	4	8	8	8	7	3	8	8	8	8	8	8	8	8	8	8	8
MORA	All	10	10	20	20	20	19	13	20	20	20	20	20	20	20	20	20	20	20
NOCA	Low	4	4	8	8	7	8	8	8	8	8	7	8	8	8	8	8	8	8
NOCA	Medium	4	4	7	7	8	8	8	8	7	8	8	8	8	8	8	8	8	8
NOCA	High	4	4	7	5	8	6	5	8	8	8	8	7	8	7	8	8	8	8
NOCA	All	12	12	22	20	23	22	21	24	23	24	23	23	24	23	24	24	24	24
OLYM	Low	4	4	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
OLYM	Medium	4	3	8	7	8	8	7	8	8	8	8	7	8	8	8	8	8	8
OLYM	High	4	4	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
OLYM	All	12	11	23	23	24	24	23	24	24	24	24	23	24	24	24	24	24	24

^A Only the annual panel transects were surveyed in 2005 and 2006, during the protocol development phase of the project.

^B The annual panel along with the first alternating panel were surveyed in 2007, 2012, 2018, and 2023.

^C The annual panel along with the second alternating panel were surveyed in 2008, 2013, and 2019.

^D The annual panel along with the third alternating panel were surveyed in 2009, 2014, and 2020.

^E The annual panel along with the fourth alternating panel were surveyed in 2010, 2015, and 2021.

^F The annual panel along with the fifth alternating panel were surveyed in 2011, 2016, and 2022.

Appendix A provides a detailed multi-year survey history of all transects sampled in the large parks to date. In 2023 we conducted 346 individual point counts at MORA, 434 point counts at NOCA and 394 point counts at OLYM (Table 2). During the 1,174 point counts in the three large parks, we counted 14,286 individual birds. Across the three large parks, we documented the presence of 158 species (Table 4), 100 of which were detected during point counts. The remaining 58 species were recorded only as incidental detections or on “Rare Bird Report Forms.”

Table 4. All species recorded in the three large North Coast and Cascades Network parks during the 2023 field season, including the pre-season training session.

Species	Scientific Name
Cackling Goose ^A	<i>Branta hutchinsii</i>
Canada Goose	<i>Branta canadensis</i>
Wood Duck ^A	<i>Aix sponsa</i>
Gadwall ^A	<i>Mareca strepera</i>
Mallard ^A	<i>Anas platyrhynchos</i>
Green-winged Teal ^A	<i>Anas crecca</i>
Ring-necked Duck ^A	<i>Aythya collaris</i>
Harlequin Duck ^A	<i>Histrionicus histrionicus</i>
Bufflehead ^A	<i>Bucephala albeola</i>
Barrow's Goldeneye ^A	<i>Bucephala islandica</i>
Hooded Merganser ^A	<i>Lophodytes cucullatus</i>
Common Merganser	<i>Mergus merganser</i>
Red-breasted Merganser ^A	<i>Mergus serrator</i>
Ruddy Duck ^A	<i>Oxyura jamaicensis</i>
California Quail ^A	<i>Callipepla californica</i>
Ruffed Grouse	<i>Bonasa umbellus</i>
White-tailed Ptarmigan ^A	<i>Lagopus leucura</i>
Sooty Grouse	<i>Dendragapus fuliginosus</i>
Dusky Grouse	<i>Dendragapus obscurus pallidus</i>
Western Grebe ^A	<i>Aechmophorus occidentalis</i>
Rock Pigeon ^A	<i>Columba livia</i>
Band-tailed Pigeon	<i>Patagioenas fasciata</i>
Eurasian Collared-dove ^A	<i>Streptopelia decaocto</i>
Mourning Dove ^A	<i>Zenaida macroura</i>
Common Nighthawk	<i>Chordeiles minor</i>
Black Swift	<i>Cypseloides niger</i>
Vaux's Swift	<i>Chaetura vauxi</i>
Anna's Hummingbird ^A	<i>Calypte anna</i>
Rufous Hummingbird	<i>Selasphorus rufus</i>

^A 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 2023 field season, including the pre-season training session.

Species	Scientific Name
Calliope Hummingbird	<i>Selasphorus calliope</i>
Sandhill Crane ^A	<i>Antigone canadensis</i>
Black Oystercatcher ^A	<i>Haematopus bachmani</i>
Killdeer ^A	<i>Charadrius vociferous</i>
Whimbrel ^A	<i>Numenius phaeopus</i>
Least Sandpiper ^A	<i>Calidris minutilla</i>
Long-billed Dowitcher ^A	<i>Limnodromus scolopaceus</i>
Spotted Sandpiper	<i>Actitis macularius</i>
Marbled Murrelet ^A	<i>Brachyramphus marmoratus</i>
Cassin's Auklet	<i>Ptychoramphus aleuticus</i>
Tufted Puffin ^A	<i>Fratercula cirrhata</i>
Western Gull ^A	<i>Larus occidentalis</i>
California Gull ^A	<i>Larus californicus</i>
Caspian Tern ^A	<i>Hydroprogne caspia</i>
Pacific Loon	<i>Gavia pacifica</i>
Common Loon	<i>Gavia immer</i>
Flesh-footed Shearwater ^A	<i>Ardenna carneipes</i>
Brandt's Cormorant ^A	<i>Urile penicillatus</i>
Double-crested Cormorant ^A	<i>Nannopterum auratus</i>
Pelagic Cormorant ^A	<i>Urile pelagicus</i>
Brown Pelican ^A	<i>Pelecanus occidentalis</i>
Great Blue Heron ^A	<i>Ardea herodias</i>
Turkey Vulture	<i>Cathartes aura</i>
Osprey	<i>Pandion haliaetus</i>
Golden Eagle ^A	<i>Aquila chrysaetos</i>
Northern Harrier ^A	<i>Circus cyaneus</i>
Sharp-shinned Hawk	<i>Accipiter striatus</i>
Cooper's Hawk	<i>Accipiter cooperii</i>
American Goshawk ^A	<i>Accipiter atricapillus</i>
Bald Eagle ^A	<i>Haliaeetus leucocephalus</i>
Red-tailed Hawk	<i>Buteo jamaicensis</i>
Great Horned Owl ^A	<i>Bubo virginianus</i>
Northern Pygmy-Owl	<i>Glaucidium gnoma</i>
Barred Owl	<i>Strix varia</i>
Long-eared Owl ^A	<i>Asio otus</i>

^A 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 2023 field season, including the pre-season training session.

Species	Scientific Name
Belted Kingfisher	<i>Megaceryle alcyon</i>
Red-naped Sapsucker ^A	<i>Sphyrapicus nuchalis</i>
Red-breasted Sapsucker	<i>Sphyrapicus ruber</i>
American Three-toed Woodpecker	<i>Picoides dorsalis</i>
Black-backed Woodpecker	<i>Picoides arcticus</i>
Downy Woodpecker	<i>Picoides pubescens</i>
Hairy Woodpecker	<i>Picoides villosus</i>
Northern Flicker	<i>Colaptes auratus</i>
Pileated Woodpecker	<i>Dryocopus pileatus</i>
American Kestrel ^A	<i>Falco sparverius</i>
Merlin ^A	<i>Falco columbarius</i>
Peregrine Falcon	<i>Falco peregrinus</i>
Olive-sided Flycatcher	<i>Contopus cooperi</i>
Western Wood-Pewee	<i>Contopus sordidulus</i>
Willow Flycatcher	<i>Empidonax traillii</i>
Hammond's Flycatcher	<i>Empidonax hammondii</i>
Dusky Flycatcher	<i>Empidonax oberholseri</i>
Western Flycatcher	<i>Empidonax difficilis</i>
Say's Phoebe	<i>Sayornis saya</i>
Hutton's Vireo ^A	<i>Vireo huttoni</i>
Cassin's Vireo	<i>Vireo cassinii</i>
Warbling Vireo	<i>Vireo gilvus</i>
Red-eyed Vireo	<i>Vireo olivaceus</i>
Canada Jay	<i>Perisoreus canadensis</i>
Steller's Jay	<i>Cyanocitta stelleri</i>
Clark's Nutcracker	<i>Nucifraga columbiana</i>
American Crow	<i>Corvus brachyrhynchos</i>
Common Raven	<i>Corvus corax</i>
Horned Lark	<i>Eremophila alpestris</i>
Tree Swallow ^A	<i>Tachycineta bicolor</i>
Violet-green Swallow	<i>Tachycineta thalassina</i>
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>
Barn Swallow	<i>Hirundo rustica</i>
Black-capped Chickadee ^A	<i>Poecile atricapillus</i>
Mountain Chickadee	<i>Poecile gambeli</i>

^A 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 2023 field season, including the pre-season training session.

Species	Scientific Name
Chestnut-backed Chickadee	<i>Poecile rufescens</i>
Bushtit ^A	<i>Psaltiriparus minimus</i>
Red-breasted Nuthatch	<i>Sitta canadensis</i>
White-breasted Nuthatch	<i>Sitta carolinensis</i>
Pygmy Nuthatch	<i>Sitta pygmaea</i>
Brown Creeper	<i>Certhia americana</i>
Rock Wren	<i>Salpinctes obsoletus</i>
Canyon Wren ^A	<i>Catherpes mexicanus</i>
House Wren	<i>Troglodytes aedon</i>
Pacific Wren	<i>Troglodytes pacificus</i>
Bewick's Wren ^A	<i>Thryomanes bewickii</i>
American Dipper	<i>Cinclus mexicanus</i>
Golden-crowned Kinglet	<i>Regulus satrapa</i>
Ruby-crowned Kinglet	<i>Regulus calendula</i>
Mountain Bluebird	<i>Sialia currucoides</i>
Townsend's Solitaire	<i>Myadestes townsendi</i>
Veery	<i>Catharus fuscescens</i>
Swainson's Thrush	<i>Catharus ustulatus</i>
Hermit Thrush	<i>Catharus guttatus</i>
American Robin	<i>Turdus migratorius</i>
Varied Thrush	<i>Ixoreus naevius</i>
European Starling ^A	<i>Sturnus vulgaris</i>
Cedar Waxwing	<i>Bombycilla cedrorum</i>
American Pipit	<i>Anthus rubescens</i>
Evening Grosbeak	<i>Coccothraustes vespertinus</i>
Pine Grosbeak	<i>Pinicola enucleator</i>
Gray-crowned Rosy-Finch	<i>Leucosticte tephrocotis</i>
House Finch ^A	<i>Haemorhous mexicanus</i>
Purple Finch	<i>Haemorhous purpureus</i>
Cassin's Finch	<i>Haemorhous cassinii</i>
Red Crossbill	<i>Loxia curvirostra</i>
Pine Siskin	<i>Spinus pinus</i>
American Goldfinch ^A	<i>Spinus tristis</i>
Chipping Sparrow	<i>Spizella passerine</i>
Fox Sparrow	<i>Passerella iliaca</i>

^A 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 2023 field season, including the pre-season training session.

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

^A Species that were detected only at times other than 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 55 bird species during point counts at MORA, 76 species during point counts at NOCA, and 55 species during point counts at OLYM (Table 5). Pooling detections on annual-panel transects across all species, we amassed 1,445 individual bird detections (average of 7.85 detections/point) at MORA, 3,103 detections (average of 13.26 detections/point) at NOCA, and 2,937 detections (average of 14.19 detections per point) at OLYM (Table 5). The five most frequently detected species on the annual-panel transects in 2023 were: Red Crossbill (1,008 detections), Dark-eyed Junco (563 detections), Pine Siskin (429 detections), Red-breasted Nuthatch (403 detections), and Townsend's/Hermit Warbler (382 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 60 bird species during point counts at MORA, 90 species during point counts at NOCA, and 60 species during point counts at OLYM (Table 6). Considering data from both panels, the five most frequently detected species were: Red Crossbill (1,642 detections), Dark-eyed Junco (1,023 detections), Pine Siskin (933 detections), Red-breasted Nuthatch (863 detections), and Chestnut-backed Chickadee (668 detections).

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 2023.

Species	Number of transects with detections				Number of individual detections			
	MORA	NOCA	OLYM	All	MORA	NOCA	OLYM	Total
Canada Goose	–	–	1	1	–	–	2	2
Sooty Grouse	5	5	12	22	7	12	41	60
Band-tailed Pigeon	3	1	6	10	5	1	16	22
Common Nighthawk	1	1	1	3	1	1	2	4
Black Swift	–	1	–	1	–	1	–	1
Vaux's Swift	7	5	7	19	31	8	53	92
Rufous Hummingbird	4	10	7	21	5	34	14	53
Spotted Sandpiper	2	2	1	5	4	3	2	9
Turkey Vulture	–	1	–	1	–	1	–	1
Osprey	–	2	1	3	–	2	3	5
Sharp-shinned Hawk	–	–	1	1	–	–	1	1
Cooper's Hawk	–	1	–	1	–	2	–	2
Red-tailed Hawk	–	–	1	1	–	–	1	1
Northern Pygmy-Owl	1	–	–	1	1	–	–	1
Barred Owl	–	1	–	1	–	1	–	1
Belted Kingfisher	–	–	1	1	–	–	2	2
Red-breasted Sapsucker	2	6	1	9	4	27	1	32
American Three-toed Woodpecker	1	–	–	1	1	–	–	1
Black-backed Woodpecker	–	1	–	1	–	2	–	2
Downy Woodpecker	–	1	–	1	–	1	–	1
Hairy Woodpecker	3	9	10	22	7	31	31	69
Northern Flicker	2	4	8	14	2	10	30	42

^A 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 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 2023.

Species	Number of transects with detections				Number of individual detections			
	MORA	NOCA	OLYM	All	MORA	NOCA	OLYM	Total
Pileated Woodpecker	–	3	2	5	–	4	5	9
Olive-sided Flycatcher	3	7	9	19	8	25	27	60
Western Wood-Pewee	–	7	1	8	–	19	1	20
Willow Flycatcher	–	1	–	1	–	2	–	2
Hammond's Flycatcher	5	10	9	24	21	172	86	279
Dusky Flycatcher	–	2	–	2	–	7	–	7
Western Flycatcher	8	4	11	23	74	24	179	277
Say's Phoebe	–	1	–	1	–	1	–	1
Cassin's Vireo	–	4	–	4	–	22	–	22
Warbling Vireo	2	8	5	15	7	65	27	99
Red-eyed Vireo	–	2	–	2	–	13	–	13
Canada Jay	5	4	10	19	22	22	38	81
Steller's Jay	7	3	7	17	28	3	29	60
Clark's Nutcracker	1	1	–	2	5	21	–	26
American Crow	–	–	2	2	–	–	6	6
Common Raven	6	2	6	14	10	3	15	28
Horned Lark	1	–	–	1	1	–	–	1
Violet-green Swallow	2	1	2	5	10	16	2	28
Barn Swallow	1	–	–	1	11	–	–	11
Mountain Chickadee	2	4	–	6	6	29	–	35
Chestnut-backed Chickadee	8	9	12	29	92	153	109	354
Red-breasted Nuthatch	10	11	10	31	78	207	118	403

^A 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 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 2023.

Species	Number of transects with detections				Number of individual detections			
	MORA	NOCA	OLYM	All	MORA	NOCA	OLYM	Total
White-breasted Nuthatch	–	2	–	2	–	7	–	7
Pygmy Nuthatch	–	1	–	1	–	2	–	2
Brown Creeper	7	11	11	29	23	46	34	103
House Wren	–	2	–	2	–	4	–	4
Pacific Wren	9	10	8	27	74	87	107	268
American Dipper	1	–	3	4	1	–	3	4
Golden-crowned Kinglet	9	10	12	31	66	62	122	250
Ruby-crowned Kinglet	–	2	2	4	–	4	4	8
Mountain Bluebird	1	1	–	2	2	2	–	4
Townsend's Solitaire	3	3	4	10	5	5	6	16
Veery	–	1	–	1	–	10	–	10
Swainson's Thrush	4	7	5	16	17	205	45	267
Hermit Thrush	7	6	8	21	77	67	98	242
American Robin	9	10	12	31	85	134	117	336
Varied Thrush	9	11	11	31	101	96	99	296
Cedar Waxwing	–	5	–	5	–	38	–	38
American Pipit	2	1	1	4	19	2	2	23
Evening Grosbeak	9	7	4	20	27	34	23	84
Pine Grosbeak	1	2	1	4	1	5	3	9
Gray-crowned Rosy-Finch	1	–	–	1	17	–	–	17
Purple Finch	–	1	–	1	–	6	–	6
Cassin's Finch	3	3	–	6	4	23	–	27

^A 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 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 2023.

Species	Number of transects with detections				Number of individual detections			
	MORA	NOCA	OLYM	All	MORA	NOCA	OLYM	Total
Red Crossbill	6	8	11	25	72	161	775	1008
Pine Siskin	6	11	8	25	65	299	65	429
Chipping Sparrow	3	5	1	9	19	43	2	64
Fox Sparrow	2	2	–	4	8	9	–	17
Dark-eyed Junco	10	10	12	32	123	163	277	563
White-crowned Sparrow	3	1	1	5	6	15	7	28
Song Sparrow	1	5	5	11	5	16	12	33
Lincoln's Sparrow	1	–	–	1	2	–	–	2
Spotted Towhee	–	2	–	2	–	4	–	4
Red-winged Blackbird	1	–	–	1	1	–	–	1
Brown-headed Cowbird	–	1	–	1	–	1	–	1
Orange-crowned Warbler	–	1	3	4	–	2	3	5
Nashville Warbler	–	6	–	6	–	25	–	25
MacGillivray's Warbler	–	7	2	9	–	83	3	86
American Redstart	–	1	–	1	–	2	–	2
Yellow Warbler	–	6	3	9	–	45	6	51
Yellow-rumped Warbler	3	11	5	19	13	189	26	228
Black-throated Gray Warbler	2	3	3	8	5	22	27	54
Townsend's/Hermit Warbler ^A	9	11	9	29	141	100	141	382
Wilson's Warbler	2	1	5	8	4	1	51	56
Western Tanager	4	12	7	23	18	119	29	166
Black-headed Grosbeak	2	4	2	8	3	19	9	31

^A 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 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 2023.

Species	Number of transects with detections				Number of individual detections			
	MORA	NOCA	OLYM	All	MORA	NOCA	OLYM	Total
Lazuli Bunting	–	1	–	1	–	1	–	1
All species pooled	n/a	n/a	n/a	n/a	1445	3103	2937	7484
Number of detections per point (all species pooled)	n/a	n/a	n/a	n/a	7.85	13.26	14.19	11.97

^A 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 2023.

Species	Number of transects with detections				Number of individual detections			
	MORA	NOCA	OLYM	All	MORA	NOCA	OLYM	ALL
Canada Goose	–	1	1	2	–	2	2	4
Common Merganser	–	2	1	3	–	9	1	10
Ruffed Grouse	–	–	1	1	–	–	1	1
Sooty Grouse	7	11	19	37	9	27	68	104
Dusky Grouse	–	1	–	1	–	2	–	2
Band-tailed Pigeon	5	2	12	19	8	2	32	42
Common Nighthawk	2	4	1	7	3	4	2	9
Black Swift	–	6	–	6	–	21	–	21
Vaux's Swift	14	10	13	37	59	20	68	147
Rufous Hummingbird	6	20	14	40	7	69	29	105
Calliope Hummingbird	–	1	–	1	–	6	–	6
Spotted Sandpiper	3	4	1	8	5	5	2	12
Pacific Loon	–	1	–	1	–	1	–	1
Common Loon	–	1	–	1	–	2	–	2
Turkey Vulture	–	1	–	1	–	1	–	1
Osprey	–	2	1	3	–	2	3	5
Sharp-shinned Hawk	–	–	1	1	–	–	1	1
Cooper's Hawk	–	1	–	1	–	2	–	2
Red-tailed Hawk	1	–	1	2	3	–	1	4
Northern Pygmy-Owl	1	–	–	1	1	–	–	1
Barred Owl	–	3	–	3	–	4	–	4
Belted Kingfisher	–	–	2	2	–	–	3	3

^A 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 (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 2023.

Species	Number of transects with detections				Number of individual detections			
	MORA	NOCA	OLYM	All	MORA	NOCA	OLYM	ALL
Red-breasted Sapsucker	7	10	3	20	10	40	8	58
American Three-toed Woodpecker	2	–	1	3	2	–	1	3
Black-backed Woodpecker	–	1	–	1	–	2	–	2
Downy Woodpecker	–	1	–	1	–	1	–	1
Hairy Woodpecker	8	17	17	42	21	50	49	120
Northern Flicker	4	5	15	24	6	13	69	88
Pileated Woodpecker	3	4	5	12	3	6	13	22
Peregrine Falcon	–	1	–	1	–	1	–	1
Olive-sided Flycatcher	9	16	13	38	29	65	51	145
Western Wood-Pewee	–	11	1	12	–	43	1	44
Willow Flycatcher	–	3	–	3	–	18	–	18
Hammond's Flycatcher	11	18	19	48	46	311	154	511
Dusky Flycatcher	–	5	–	5	–	15	–	15
Western Flycatcher	15	7	21	43	138	32	360	530
Say's Phoebe	–	1	–	1	–	1	–	1
Cassin's Vireo	–	11	–	11	–	51	–	51
Warbling Vireo	3	17	10	30	10	146	44	200
Red-eyed Vireo	–	4	–	4	–	17	–	17
Canada Jay	12	11	21	44	55	51	80	186
Steller's Jay	14	9	13	36	50	24	60	134
Clark's Nutcracker	4	3	–	7	37	28	–	65

^A 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 (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 2023.

Species	Number of transects with detections				Number of individual detections			
	MORA	NOCA	OLYM	All	MORA	NOCA	OLYM	ALL
American Crow	–	1	3	4	–	1	7	8
Common Raven	10	6	12	28	21	12	27	60
Horned Lark	3	–	–	3	20	–	–	20
Violet-green Swallow	2	3	3	8	10	18	8	36
Northern Rough-winged Swallow	–	1	–	1	–	1	–	1
Barn Swallow	1	1	–	2	11	2	–	13
Mountain Chickadee	5	8	–	13	35	49	–	84
Chestnut-backed Chickadee	16	20	23	59	179	279	210	668
Red-breasted Nuthatch	20	22	20	62	247	350	266	863
White-breasted Nuthatch	–	2	–	2	–	7	–	7
Pygmy Nuthatch	–	1	–	1	–	2	–	2
Brown Creeper	16	21	20	57	73	75	57	205
Rock Wren	–	–	1	1	–	–	1	1
House Wren	–	4	–	4	–	8	–	8
Pacific Wren	17	19	17	53	151	139	205	495
American Dipper	1	1	3	5	1	1	3	5
Golden-crowned Kinglet	19	20	24	63	134	113	243	490
Ruby-crowned Kinglet	–	3	3	6	–	7	6	13
Mountain Bluebird	1	2	–	3	2	3	–	5
Townsend's Solitaire	7	6	5	18	14	11	7	32
Veery	–	1	–	1	–	10	–	10

^A 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 (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 2023.

Species	Number of transects with detections				Number of individual detections			
	MORA	NOCA	OLYM	All	MORA	NOCA	OLYM	ALL
Swainson's Thrush	8	18	9	35	35	388	62	485
Hermit Thrush	16	12	16	44	160	174	174	508
American Robin	17	21	23	61	125	238	196	559
Varied Thrush	19	19	21	59	219	155	215	589
Cedar Waxwing	2	11	1	14	4	84	2	90
American Pipit	4	3	1	8	52	4	2	58
Evening Grosbeak	15	16	9	40	43	100	37	180
Pine Grosbeak	2	4	4	10	2	8	13	23
Gray-crowned Rosy-Finch	2	–	–	2	23	–	–	23
Purple Finch	–	3	–	3	–	8	–	8
Cassin's Finch	5	6	–	11	44	44	–	88
Red Crossbill	11	15	22	48	152	242	1248	1642
Pine Siskin	11	23	16	50	127	526	280	933
Chipping Sparrow	6	9	3	18	31	61	4	96
Fox Sparrow	4	6	–	10	13	27	–	40
Dark-eyed Junco	20	22	23	65	216	333	474	1023
White-crowned Sparrow	3	2	2	7	6	16	9	31
Savannah Sparrow	–	1	–	1	–	3	–	3
Song Sparrow	2	8	5	15	6	25	12	43
Lincoln's Sparrow	1	1	–	2	2	1	–	3
Spotted Towhee	–	4	–	4	–	25	–	25

^A 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 (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 2023.

Species	Number of transects with detections				Number of individual detections			
	MORA	NOCA	OLYM	All	MORA	NOCA	OLYM	ALL
Bullock's Oriole	–	1	–	1	–	1	–	1
Red-winged Blackbird	1	–	–	1	1	–	–	1
Brown-headed Cowbird	–	3	–	3	–	7	–	7
Orange-crowned Warbler	1	1	6	8	2	2	7	11
Nashville Warbler	–	13	–	13	–	59	–	59
MacGillivray's Warbler	2	16	4	22	5	146	7	158
American Redstart	–	2	–	2	–	5	–	5
Yellow Warbler	–	9	5	14	–	128	10	138
Yellow-rumped Warbler	8	23	9	40	56	351	58	465
Black-throated Gray Warbler	2	7	6	15	5	64	36	105
Townsend's/Hermit Warbler ^A	18	22	18	58	225	197	236	658
Wilson's Warbler	9	2	11	22	19	2	81	102
Western Tanager	7	24	12	43	28	254	61	343
Black-headed Grosbeak	2	10	3	15	3	41	10	54
Lazuli Bunting	–	2	–	2	–	4	–	4
All species pooled	n/a	n/a	n/a	n/a	3004	5905	5377	14286
Detections per point (all species pooled)	n/a	n/a	n/a	n/a	8.68	13.61	13.65	11.98
Number of species detected during point counts	55	76	55	100	n/a	n/a	n/a	n/a

^A 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.

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 6–20. 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 during point counts at OLYM, and also detected at times (other than a point count) this year and was documented on "Rare Bird Report Forms." Detections of both listed species at times other than point counts are summarized in Table 7.

For the most frequently detected species over the 2005–2023 field seasons, we present the total number of detections of each species on each park's annual panel transects over that period of time (Figures 6–20). 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 SAJH our 54 point counts yielded 1,294 detections of 69 species (Table 8), a detection rate of 23.96 birds per point. The most frequently detected species was American Robin (89 detections), followed by House Wren (79 detections), Brown-headed Cowbird (78 detections), Swainson's Thrush (63 detections), and Western Flycatcher (60 detections).

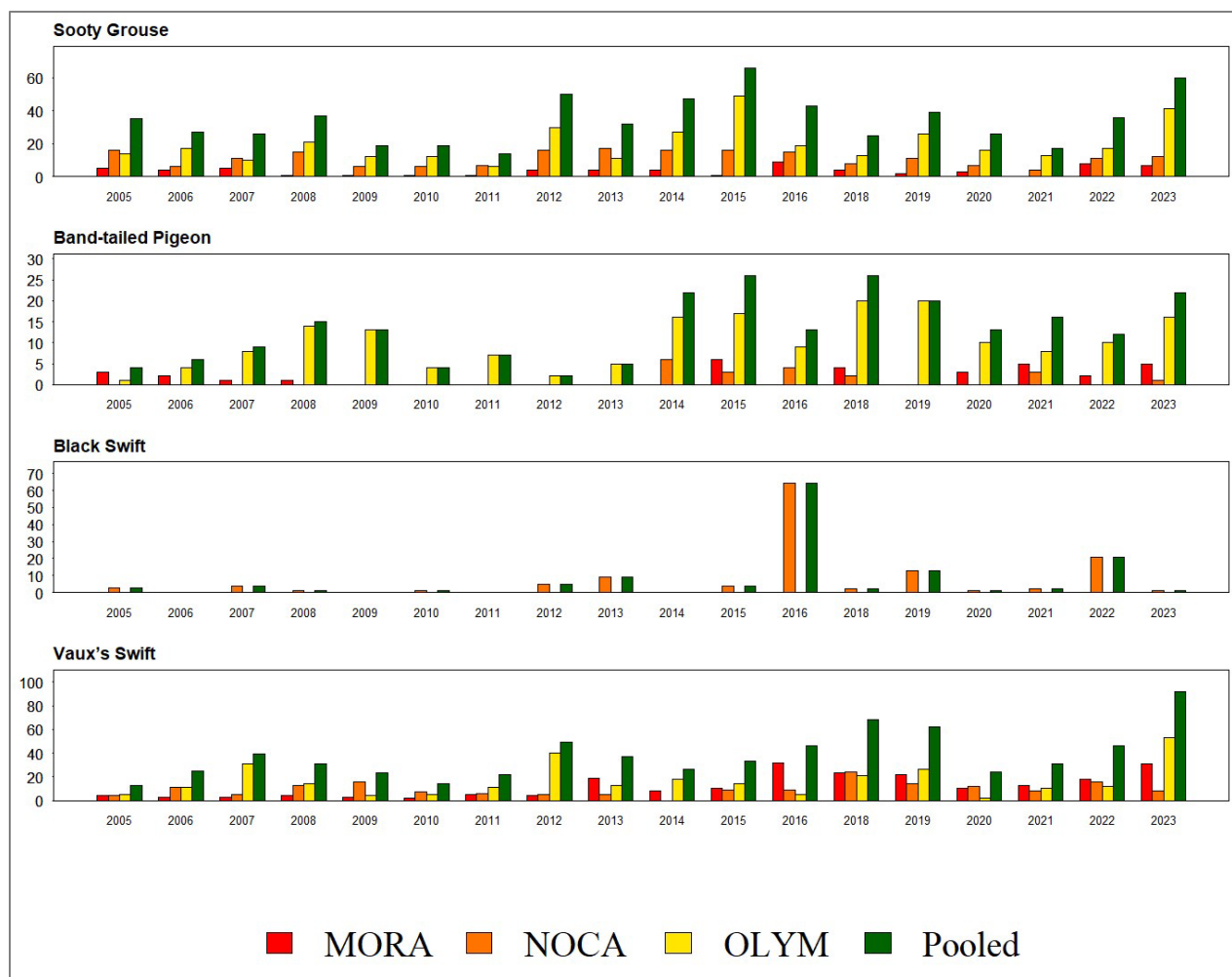


Figure 6. Number of times each species (Sooty Grouse, Band-tailed Pigeon, Black Swift, and Vaux's Swift) was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2023 field seasons. Figures 6–20 include all species for which we amassed more than 100 point count detections on annual-panel transects over the 18 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. COURTESY OF THE INSTITUTE FOR BIRD POPULATIONS.

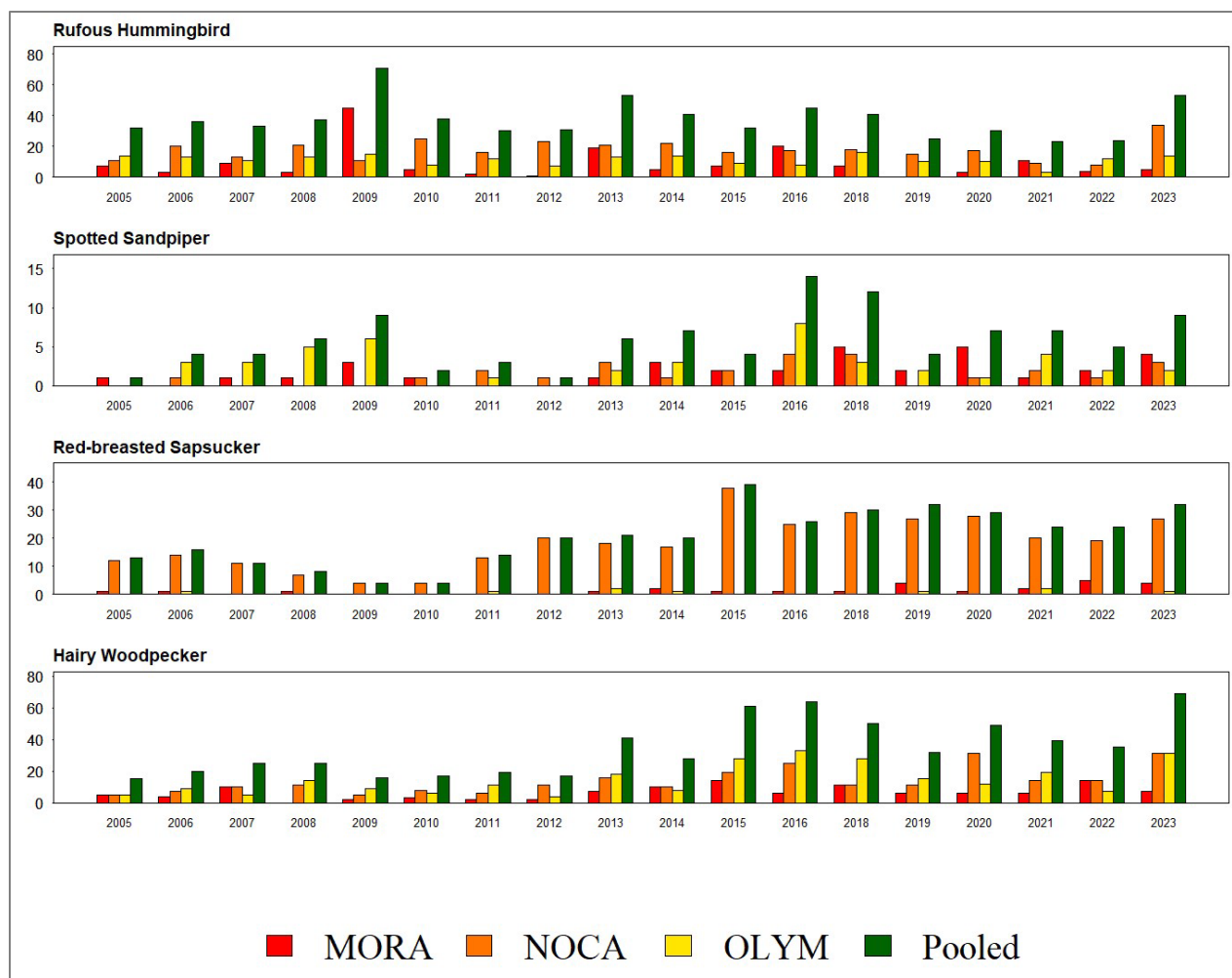


Figure 7. Number of times each species (Rufous Hummingbird, Spotted Sandpiper, Red-breasted Sapsucker, and Hairy Woodpecker) was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2023 field seasons. Figures 6–20 include all species for which we amassed more than 100 point count detections on annual-panel transects over the 18 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. COURTESY OF THE INSTITUTE FOR BIRD POPULATIONS.

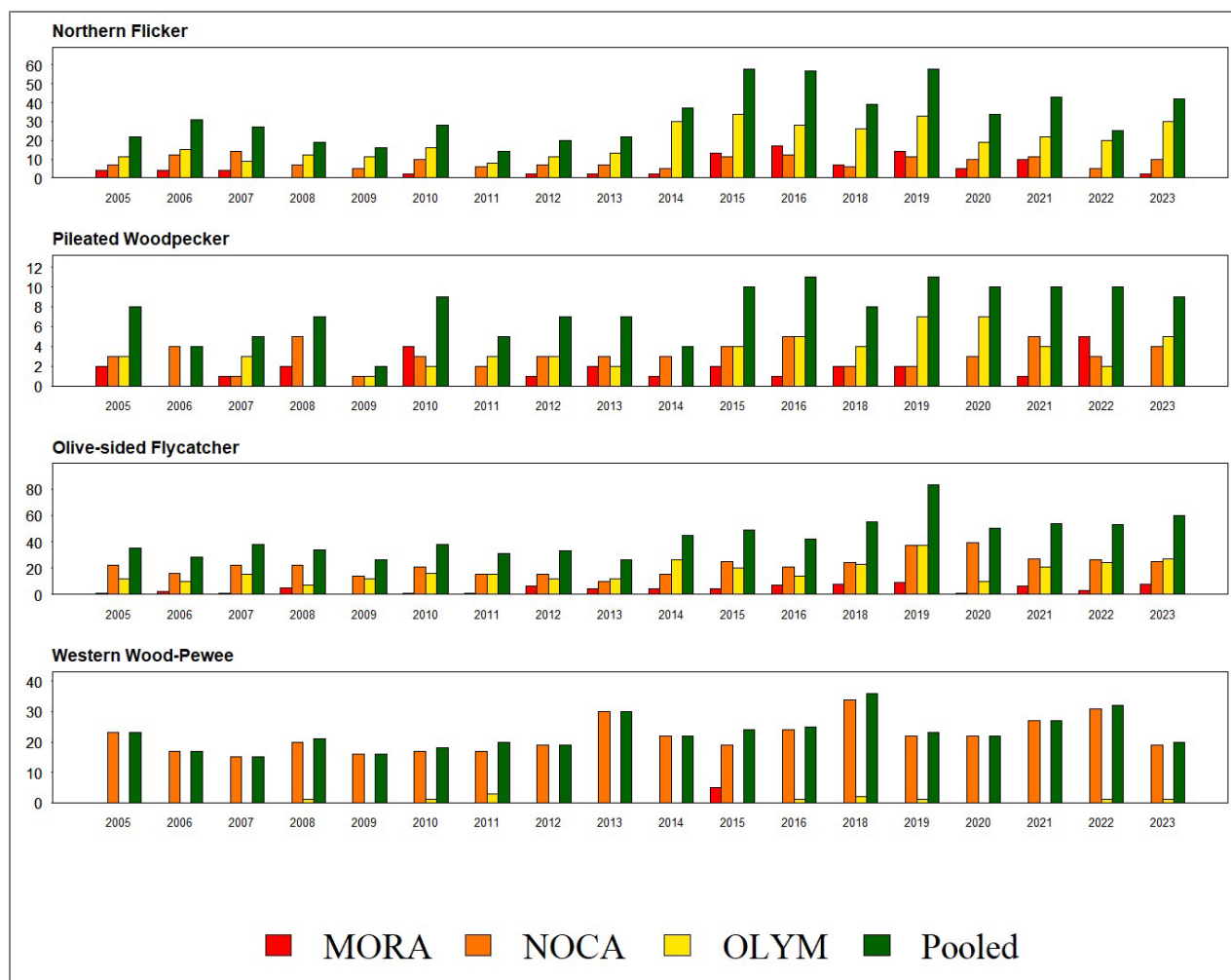


Figure 8. Number of times each species (Northern Flicker, Pileated Woodpecker, Olive-sided Flycatcher, and Western Wood-Pewee) was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2023 field seasons. Figures 6–20 include all species for which we amassed more than 100 point count detections on annual-panel transects over the 18 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. COURTESY OF THE INSTITUTE FOR BIRD POPULATIONS.

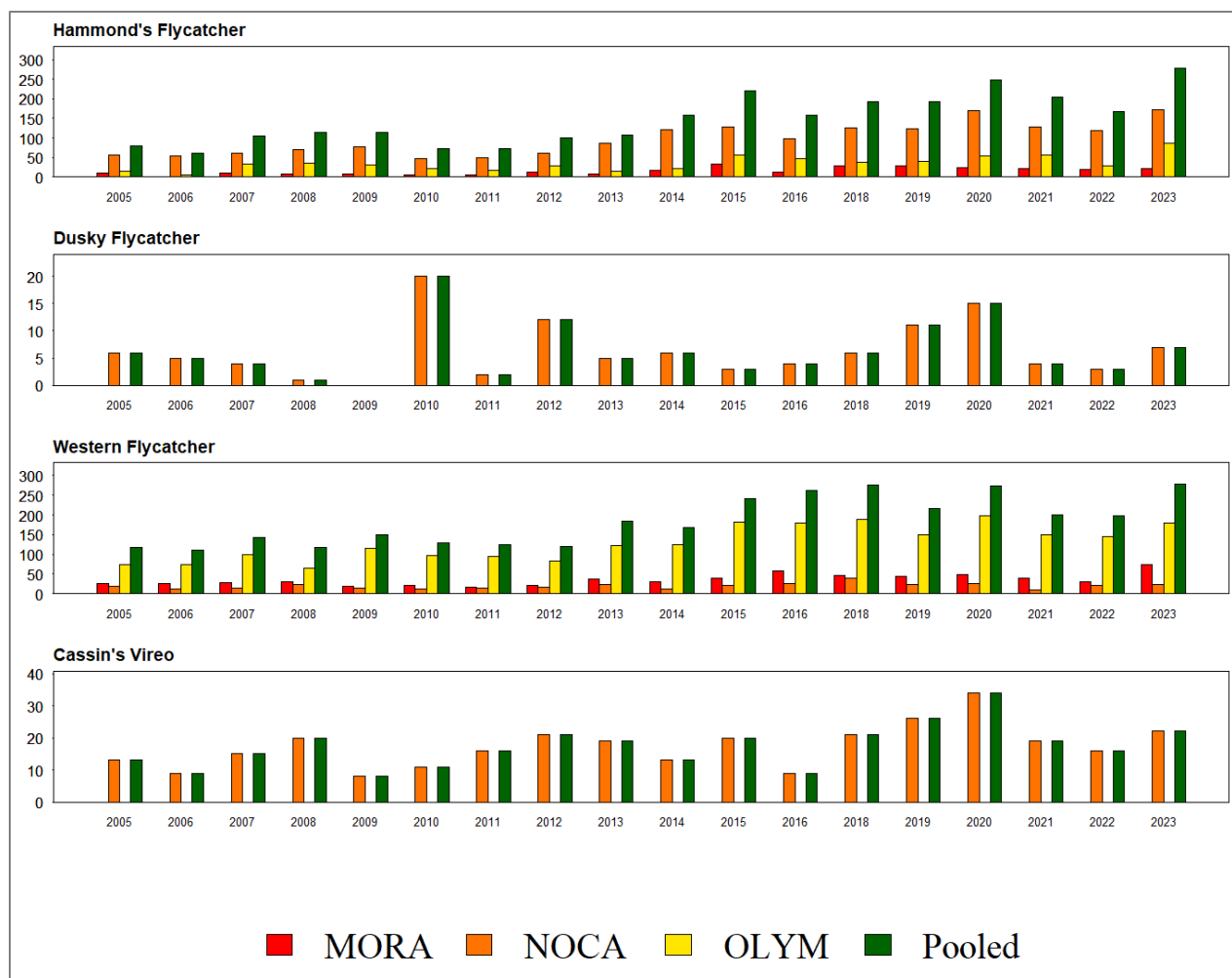


Figure 9. Number of times each species (Hammond's Flycatcher, Dusky Flycatcher, Western Flycatcher, and Cassin's Vireo) was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2023 field seasons. Figures 6–20 include all species for which we amassed more than 100 point count detections on annual-panel transects over the 18 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. COURTESY OF THE INSTITUTE FOR BIRD POPULATIONS.

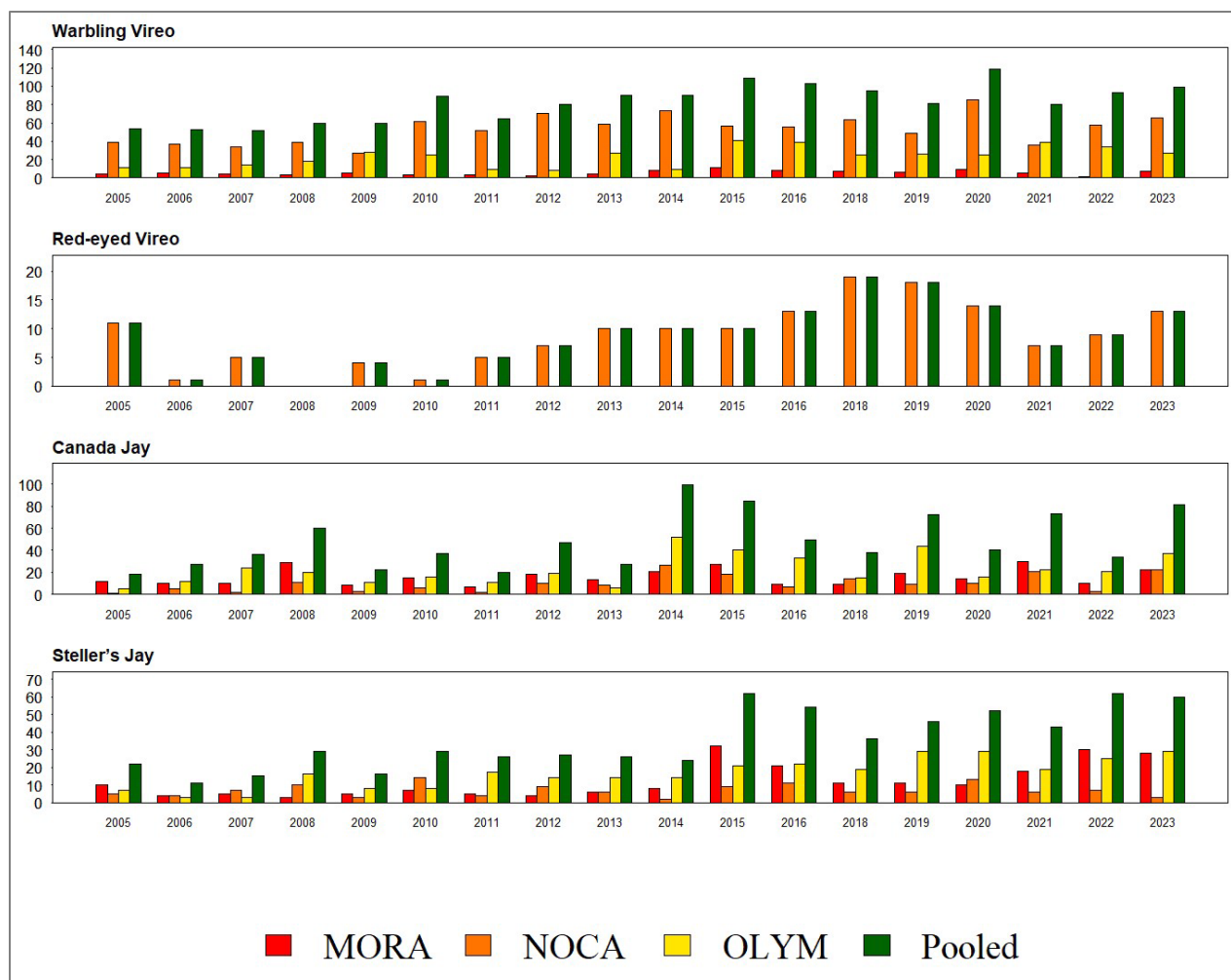


Figure 10. Number of times each species (Warbling Vireo, Red-eyed Vireo, Canada Jay, and Steller's Jay) was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2023 field seasons. Figures 6–20 include all species for which we amassed more than 100 point count detections on annual-panel transects over the 18 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. COURTESY OF THE INSTITUTE FOR BIRD POPULATIONS.



Figure 11. Number of times each species (Clark's Nutcracker, Common Raven, Violet-green Swallow, and Mountain 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 2005–2023 field seasons. Figures 6–20 include all species for which we amassed more than 100 point count detections on annual-panel transects over the 18 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. COURTESY OF THE INSTITUTE FOR BIRD POPULATIONS.

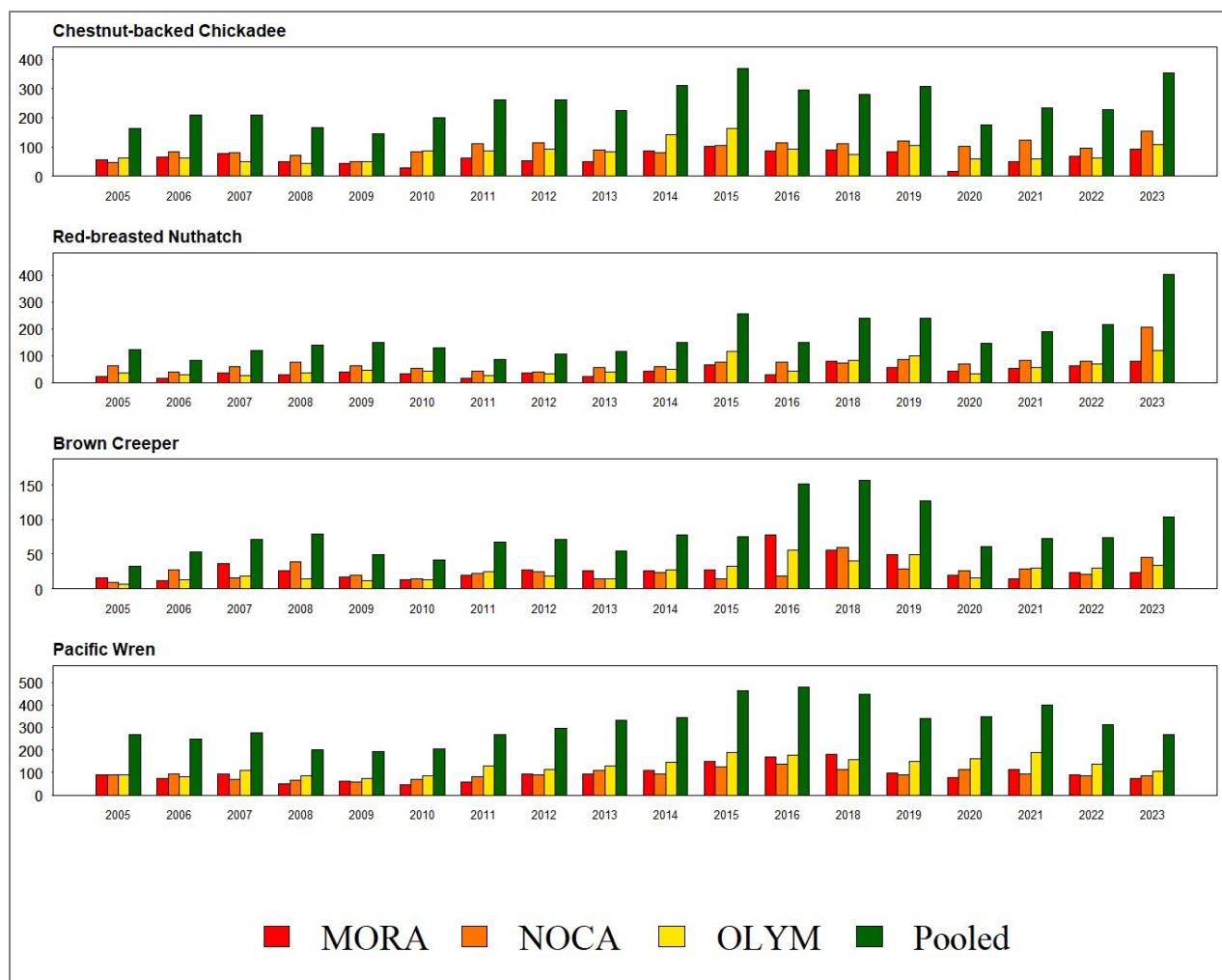


Figure 12. Number of times each species (Chestnut-backed Chickadee, Red-breasted Nuthatch, Brown Creeper, and Pacific Wren) was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2023 field seasons. Figures 6–20 include all species for which we amassed more than 100 point count detections on annual-panel transects over the 18 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. COURTESY OF THE INSTITUTE FOR BIRD POPULATIONS.

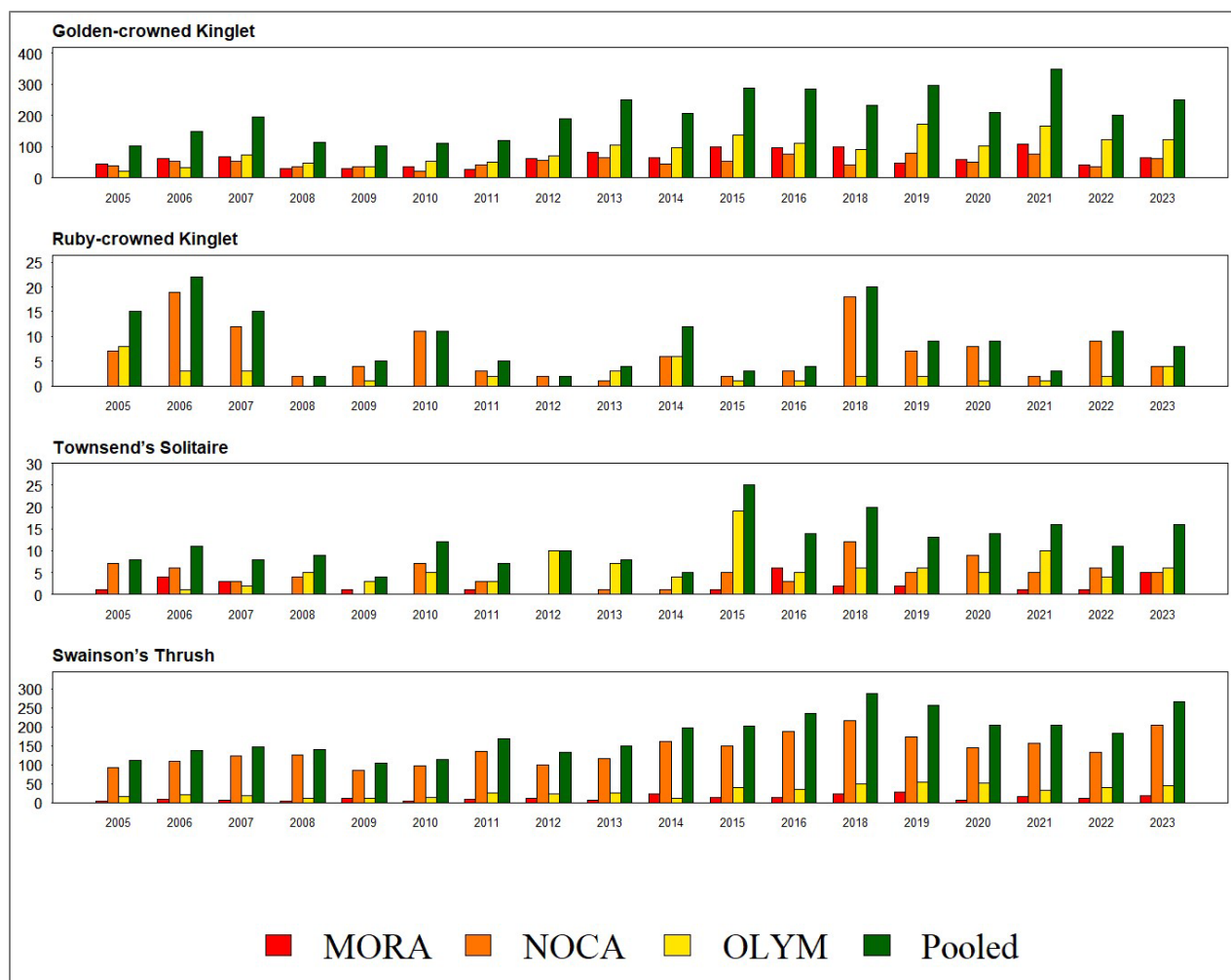


Figure 13. Number of times each species (Golden-crowned Kinglet, Ruby-crowned Kinglet, Townsend's Solitaire, and Swainson's Thrush) was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2023 field seasons. Figures 6–20 include all species for which we amassed more than 100 point count detections on annual-panel transects over the 18 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. COURTESY OF THE INSTITUTE FOR BIRD POPULATIONS.

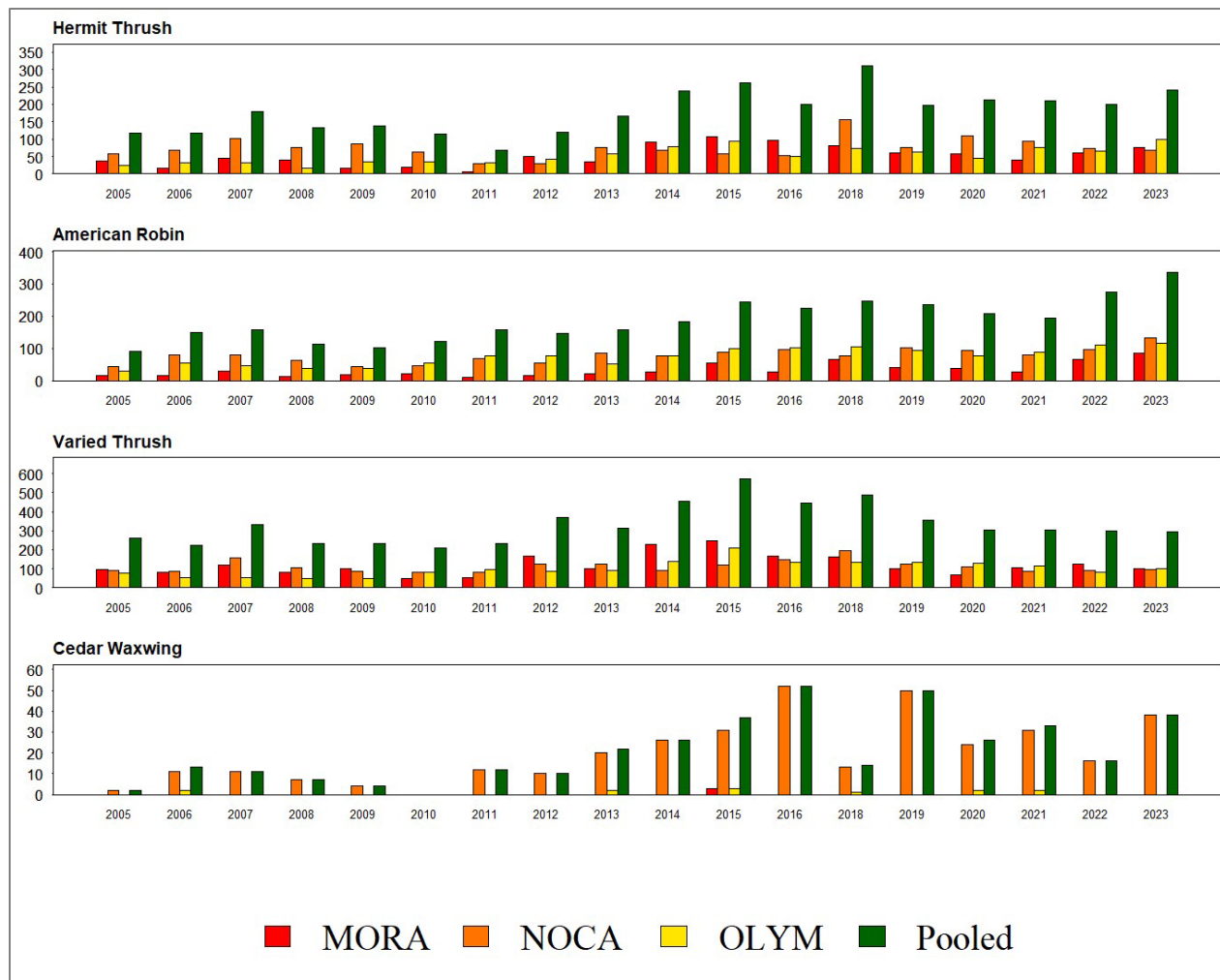


Figure 14. Number of times each species (Hermit Thrush, American Robin, Varied Thrush, and Cedar Waxwing) was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2023 field seasons. Figures 6–20 include all species for which we amassed more than 100 point count detections on annual-panel transects over the 18 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. COURTESY OF THE INSTITUTE FOR BIRD POPULATIONS.



Figure 15. Number of times each species (American Pipit, Evening Grosbeak, Pine Grosbeak, and Gray-crowned Rosy-Finch) 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 2005–2023 field seasons. Figures 6–20 include all species for which we amassed more than 100 point count detections on annual-panel transects over the 18 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. COURTESY OF THE INSTITUTE FOR BIRD POPULATIONS.

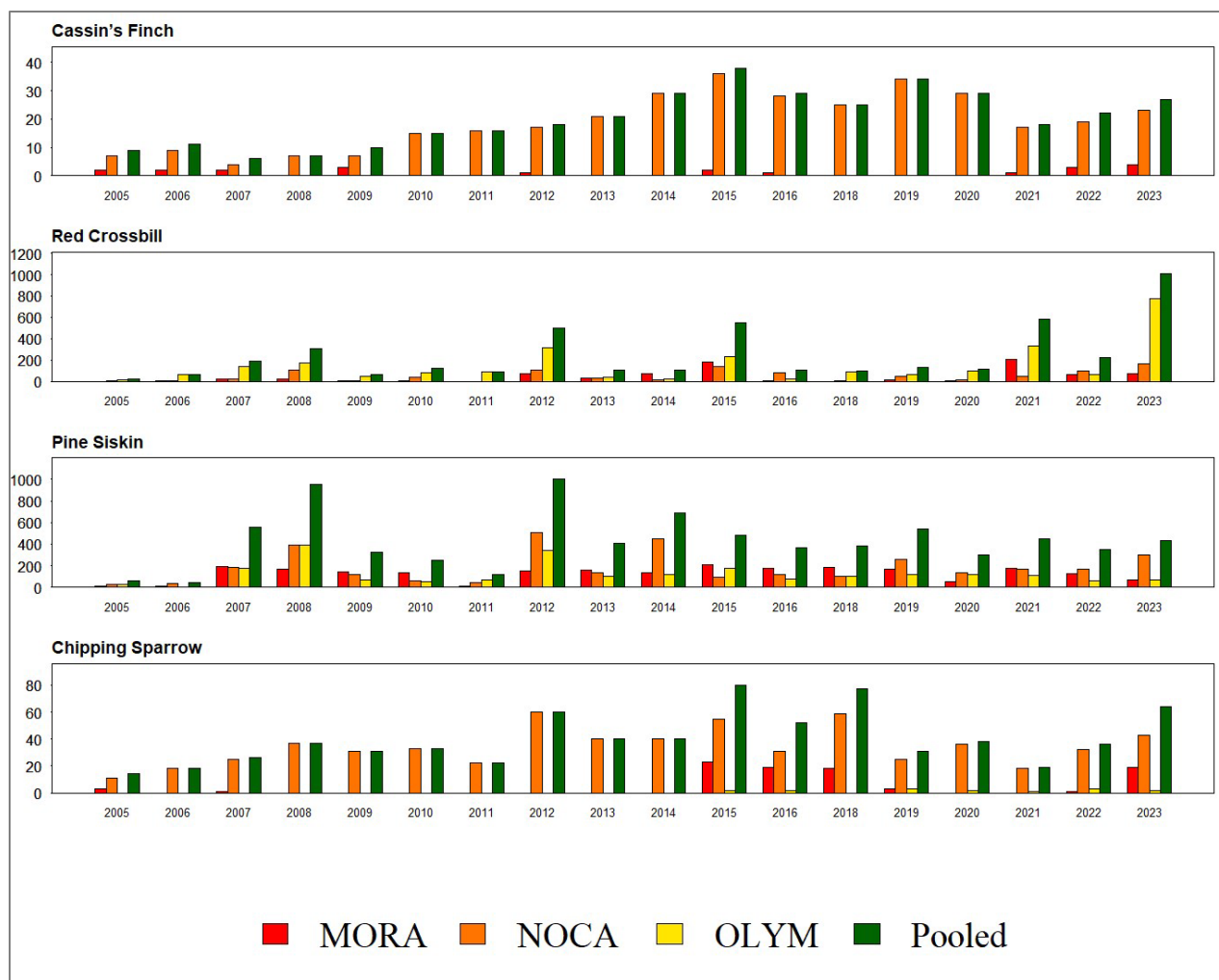


Figure 16. Number of times each species (Cassin's Finch, Red Crossbill, Pine Siskin, and Chipping Sparrow) was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2023 field seasons. Figures 6–20 include all species for which we amassed more than 100 point count detections on annual-panel transects over the 18 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. COURTESY OF THE INSTITUTE FOR BIRD POPULATIONS.



Figure 17. Number of times each species (Fox Sparrow, Dark-eyed Junco, White-crowned Sparrow, and Song Sparrow) 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 2005–2023 field seasons. Figures 6–20 include all species for which we amassed more than 100 point count detections on annual-panel transects over the 18 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. COURTESY OF THE INSTITUTE FOR BIRD POPULATIONS.

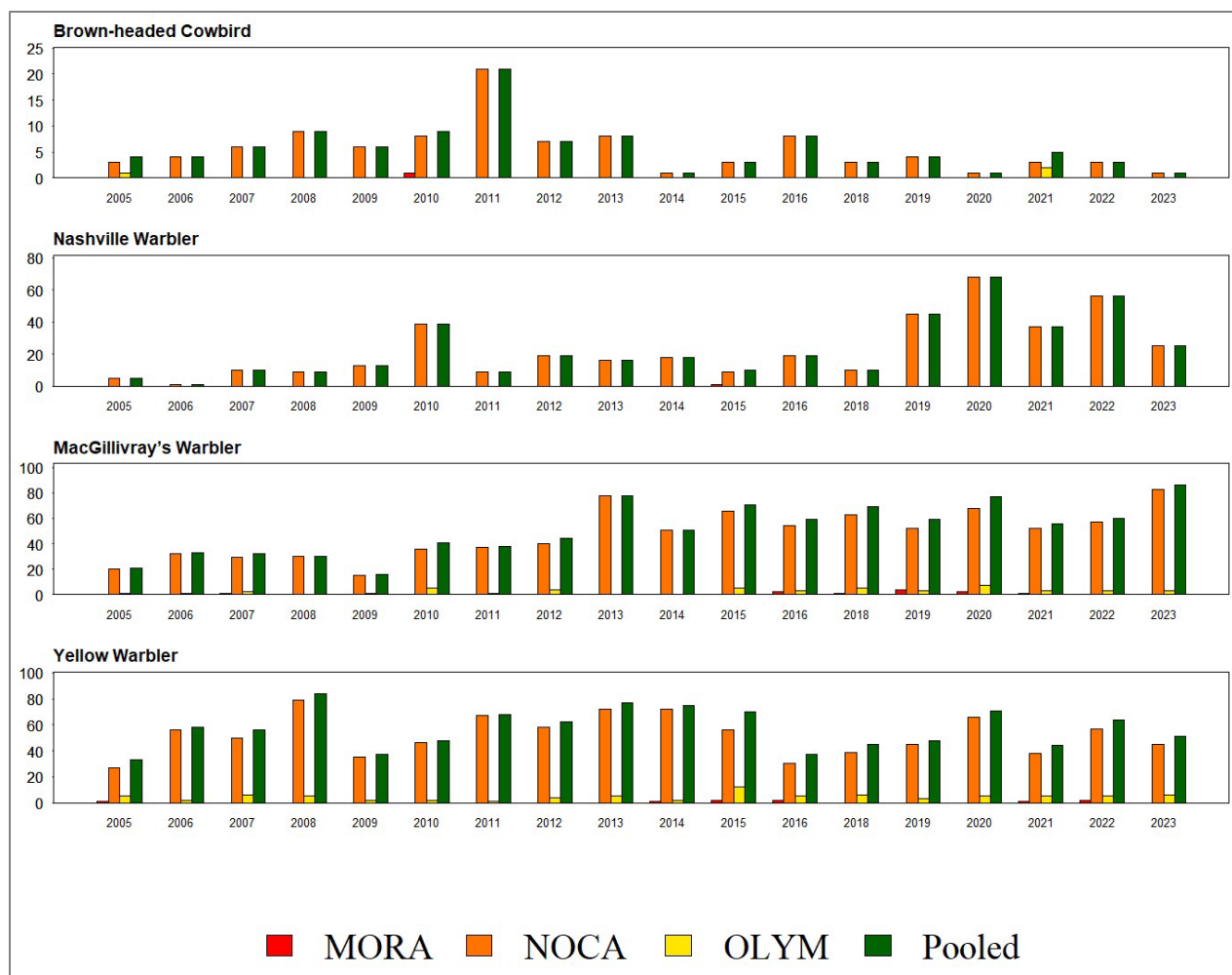


Figure 18. Number of times each species (Brown-headed Cowbird, Nashville Warbler, MacGillivray's Warbler, and Yellow Warbler) was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2023 field seasons. Figures 6–20 include all species for which we amassed more than 100 point count detections on annual-panel transects over the 18 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. COURTESY OF THE INSTITUTE FOR BIRD POPULATIONS.

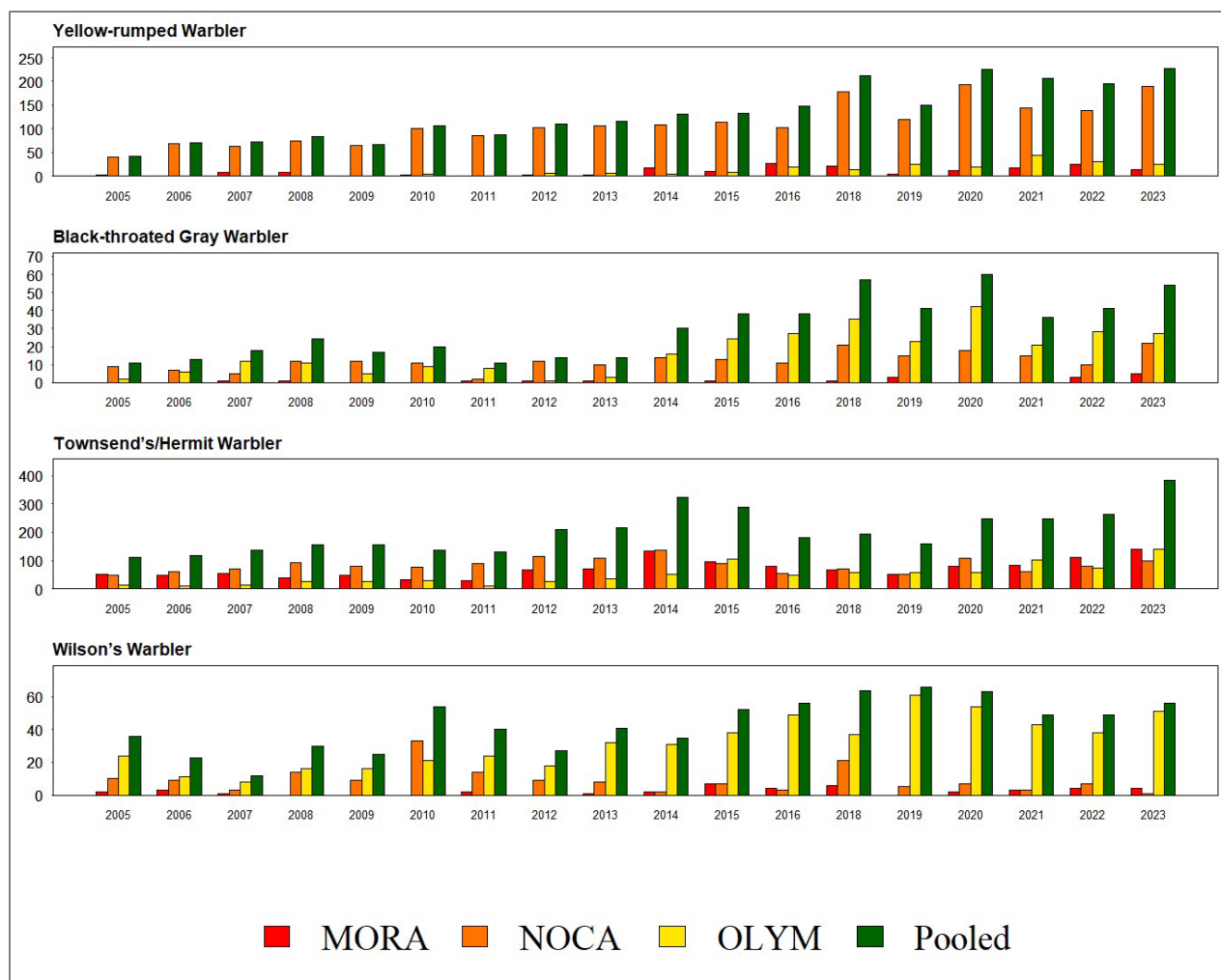


Figure 19. Number of times each species (Yellow-rumped Warbler, Black-throated Gray Warbler, Townsend's/Hermit Warbler, and Wilson's Warbler) was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2023 field seasons. Figures 6–20 include all species for which we amassed more than 100 point count detections on annual-panel transects over the 18 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. COURTESY OF THE INSTITUTE FOR BIRD POPULATIONS.



Figure 20. Number of times each species (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 2005–2023 field seasons. Figures 6–20 include all species for which we amassed more than 100 point count detections on annual-panel transects over the 18 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. COURTESY OF THE INSTITUTE FOR BIRD POPULATIONS.

Table 7. Species listed under the Endangered Species Act recorded on “Rare Bird Report Forms” in each park in 2023, excluding individuals that were also detected during point counts.

Species	Number of birds detected (excluding individuals also detected during point counts)		
	Mount Rainier	North Cascades	Olympic
Marbled Murrelet	–	–	2
Northern Spotted Owl	–	–	–

Table 8. Number of points with detections and number of individual detections for each species detected during point counts at San Juan Island National Historical Park in 2023.

Species	Number of points with detections	Number of individual detections
Canada Goose	11	39
Mallard	1	1
California Quail	7	9
Band-tailed Pigeon	4	5
Eurasian Collared-dove	5	7
Mourning Dove	5	5
Anna’s Hummingbird	6	6
Rufous Hummingbird	18	23
Black Oystercatcher	3	5
Killdeer	4	6
Long-billed Dowitcher	1	2
Caspian Tern	3	3
Common Loon	1	1
Pelagic Cormorant	1	2
Turkey Vulture	1	1
Northern Harrier	1	1
Bald Eagle	12	23
Red-tailed Hawk	4	4
Barred Owl	1	1
Belted Kingfisher	1	1
Red-breasted Sapsucker	1	1
Hairy Woodpecker	4	4
Northern Flicker	2	2
Pileated Woodpecker	5	5
Olive-sided Flycatcher	22	27

Table 8 (continued). Number of points with detections and number of individual detections for each species detected during point counts at San Juan Island National Historical Park in 2023.

Species	Number of points with detections	Number of individual detections
Willow Flycatcher	5	5
Western Flycatcher	30	60
Hutton's Vireo	6	6
Cassin's Vireo	1	1
Warbling Vireo	12	12
American Crow	8	10
Common Raven	15	16
Tree Swallow	3	4
Violet-green Swallow	4	7
Northern Rough-winged Swallow	4	5
Barn Swallow	5	12
Chestnut-backed Chickadee	30	46
Bushtit	1	2
Red-breasted Nuthatch	22	27
Brown Creeper	9	13
House Wren	36	79
Pacific Wren	3	4
Bewick's Wren	11	13
Golden-crowned Kinglet	7	8
Swainson's Thrush	34	63
American Robin	42	89
European Starling	8	11
Cedar Waxwing	12	30
House Finch	18	33
Purple Finch	20	26
Red Crossbill	2	3
American Goldfinch	26	38
Chipping Sparrow	8	11
Dark-eyed Junco	33	52
White-crowned Sparrow	33	58
Savannah Sparrow	17	38
Song Sparrow	27	38
Spotted Towhee	31	51
Red-winged Blackbird	5	15
Brown-headed Cowbird	41	78

Table 8 (continued). Number of points with detections and number of individual detections for each species detected during point counts at San Juan Island National Historical Park in 2023.

Species	Number of points with detections	Number of individual detections
Orange-crowned Warbler	26	37
Common Yellowthroat	11	17
Yellow Warbler	2	2
Yellow-rumped Warbler	14	18
Black-throated Gray Warbler	6	8
Townsend's Warbler	10	16
Wilson's Warbler	15	19
Western Tanager	6	6
Black-headed Grosbeak	19	23
Total detections	—	1294

2023 Bird Counts Compared to Previous Years

The number of bird detections on annual-panel transects across all three large parks increased by 2,239 between 2022 and 2023. When factoring in the number of point counts conducted each year, all three parks saw an increase in the average number of birds per count (an increase of 17% at MORA, 42% at OLYM, and 21% at NOCA).

This overall increase in detections across the network is in part due to a high number of Red Crossbill detections in 2023, particularly at OLYM. We detected them at higher numbers in OLYM than any other year since the start of the monitoring program. Several other species were also detected in higher numbers in the three large parks in 2023 than in 2022, which contributed to the overall increase in detections. Red-breasted Nuthatch, Townsend's/Hermit Warbler, American Robin, and Hammond's Flycatcher detections in particular increased across all three parks between 2022 and 2023 and also had more detections than almost any other year since the start of the monitoring program. Despite these changes, overall detection numbers of most species across the parks were not markedly different between the two years.

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Appendix A: Detailed Survey History

Table 9 contains information about each transect sampled in Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks since the North Coast and Cascades Network Landbird Monitoring Project began in 2005.

Table 9. 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	2020	2021	2022	2023
MORA	Ann1	Low	4001	10	12	12	12	12	10	11	14	16	16	15	15	15	16	18	18	18	19
MORA	Ann1	Low	4005	11	11	11	11	12	9	10	13	13	14	14	14	14	14	14	12	14	15
MORA	Ann1	Mid	4002	11	11	11	12	11	13	13	15	15	15	16	14	17	17	16	17	16	16
MORA	Ann1	Mid	4004	18	17	18	18	13	15	10	17	17	18	18	20	19	19	15	19	21	16
MORA	Ann1	Mid	4009	14	14	15	15	11	13	10	15	15	15	16	17	17	17	17	17	17	15
MORA	Ann1	Mid	4012	16	16	14	19	19	13	–	17	19	20	23	24	23	23	21	25	21	23
MORA	Ann1	High	4003	12	12	12	12	12	10	12	13	14	15	15	15	16	16	14	17	18	16
MORA	Ann1	High	4007	20	20	20	20	20	20	–	20	20	20	25	22	21	24	22	25	24	23
MORA	Ann1	High	4011	13	11	14	17	17	15	–	16	16	17	17	17	17	17	17	17	18	18
MORA	Ann1	High	4014	10	16	14	16	16	15	–	17	17	18	22	24	22	22	20	24	24	23
MORA	Alt2	Low	4006	–	–	10	–	–	–	–	9	–	–	–	–	12	–	–	–	–	15
MORA	Alt2	Low	4008	–	–	9	–	–	–	–	12	–	–	–	–	13	–	–	–	–	13
MORA	Alt2	Mid	4015	–	–	11	–	–	–	–	12	–	–	–	–	11	–	–	–	–	11
MORA	Alt2	Mid	4017	–	–	12	–	–	–	–	13	–	–	–	–	14	–	–	–	–	14
MORA	Alt2	Mid	4020	–	–	9	–	–	–	–	8	–	–	–	–	16	–	–	–	–	16
MORA	Alt2	Mid	4026	–	–	10	–	–	–	–	11	–	–	–	–	13	–	–	–	–	12
MORA	Alt2	High	4016	–	–	19	–	–	–	–	20	–	–	–	–	21	–	–	–	–	21
MORA	Alt2	High	4019	–	–	20	–	–	–	–	20	–	–	–	–	21	–	–	–	–	21
MORA	Alt2	High	4027	–	–	13	–	–	–	–	14	–	–	–	–	17	–	–	–	–	17
MORA	Alt2	High	4075	–	–	14	–	–	–	–	11	–	–	–	–	22	–	–	–	–	22
MORA	Alt3	Low	4010	–	–	–	13	–	–	–	–	14	–	–	–	–	17	–	–	–	–
MORA	Alt3	Low	4018	–	–	–	12	–	–	–	–	14	–	–	–	–	15	–	–	–	–
MORA	Alt3	Mid	4028	–	–	–	11	–	–	–	–	12	–	–	–	–	14	–	–	–	–
MORA	Alt3	Mid	4042	–	–	–	12	–	–	–	–	13	–	–	–	–	15	–	–	–	–
MORA	Alt3	Mid	4044	–	–	–	15	–	–	–	–	16	–	–	–	–	17	–	–	–	–
MORA	Alt3	Mid	4048	–	–	–	13	–	–	–	–	12	–	–	–	–	15	–	–	–	–
MORA	Alt3	High	4029	–	–	–	14	–	–	–	–	14	–	–	–	–	16	–	–	–	–
MORA	Alt3	High	4030	–	–	–	12	–	–	–	–	15	–	–	–	–	18	–	–	–	–
MORA	Alt3	High	4032	–	–	–	15	–	–	–	–	15	–	–	–	–	16	–	–	–	–
MORA	Alt3	High	4033	–	–	–	18	–	–	–	–	19	–	–	–	–	20	–	–	–	–
MORA	Alt4	Low	4021	–	–	–	–	12	–	–	–	–	13	–	–	–	–	16	–	–	–

Table 9 (continued). 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	2020	2021	2022	2023
MORA	Alt4	Low	4022	–	–	–	–	17	–	–	–	–	17	–	–	–	–	18	–	–	–
MORA	Alt4	Mid	4057	–	–	–	–	10	–	–	–	–	14	–	–	–	–	16	–	–	–
MORA	Alt4	Mid	4060	–	–	–	–	24	–	–	–	–	24	–	–	–	–	25	–	–	–
MORA	Alt4	Mid	4061	–	–	–	–	15	–	–	–	–	17	–	–	–	–	19	–	–	–
MORA	Alt4	Mid	4065	–	–	–	–	13	–	–	–	–	15	–	–	–	–	16	–	–	–
MORA	Alt4	High	4035	–	–	–	–	12	–	–	–	–	14	–	–	–	–	15	–	–	–
MORA	Alt4	High	4036	–	–	–	–	14	–	–	–	–	16	–	–	–	–	17	–	–	–
MORA	Alt4	High	4039	–	–	–	–	11	–	–	–	–	13	–	–	–	–	15	–	–	–
MORA	Alt4	High	4043	–	–	–	–	18	–	–	–	–	19	–	–	–	–	21	–	–	–
MORA	Alt5	Low	4024	–	–	–	–	–	25	–	–	–	–	25	–	–	–	–	27	–	–
MORA	Alt5	Low	4025	–	–	–	–	–	9	–	–	–	–	15	–	–	–	–	17	–	–
MORA	Alt5	Mid	4068	–	–	–	–	–	9	–	–	–	–	15	–	–	–	–	15	–	–
MORA	Alt5	Mid	4073	–	–	–	–	–	13	–	–	–	–	19	–	–	–	–	19	–	–
MORA	Alt5	Mid	4074	–	–	–	–	–	13	–	–	–	–	15	–	–	–	–	15	–	–
MORA	Alt5	Mid	4076	–	–	–	–	–	15	–	–	–	–	17	–	–	–	–	18	–	–
MORA	Alt5	High	4045	–	–	–	–	–	12	–	–	–	–	21	–	–	–	–	21	–	–
MORA	Alt5	High	4046	–	–	–	–	–	10	–	–	–	–	13	–	–	–	–	14	–	–
MORA	Alt5	High	4052	–	–	–	–	–	12	–	–	–	–	16	–	–	–	–	16	–	–
MORA	Alt5	High	4083	–	–	–	–	–	–	–	–	–	–	18	–	–	–	–	19	–	–
MORA	Alt6	Low	4031	–	–	–	–	–	–	10	–	–	–	–	13	–	–	–	–	17	–
MORA	Alt6	Low	4034	–	–	–	–	–	–	10	–	–	–	–	12	–	–	–	–	13	–
MORA	Alt6	Mid	4077	–	–	–	–	–	–	12	–	–	–	–	18	–	–	–	–	18	–
MORA	Alt6	Mid	4078	–	–	–	–	–	–	9	–	–	–	–	22	–	–	–	–	22	–
MORA	Alt6	Mid	4081	–	–	–	–	–	–	10	–	–	–	–	19	–	–	–	–	20	–
MORA	Alt6	Mid	4084	–	–	–	–	–	–	–	–	–	–	–	17	–	–	–	–	18	–
MORA	Alt6	High	4058	–	–	–	–	–	–	–	–	–	–	–	19	–	–	–	–	21	–
MORA	Alt6	High	4062	–	–	–	–	–	–	–	–	–	–	–	19	–	–	–	–	20	–
MORA	Alt6	High	4064	–	–	–	–	–	–	10	–	–	–	–	15	–	–	–	–	18	–
MORA	Alt6	High	4067	–	–	–	–	–	–	13	–	–	–	–	17	–	–	–	–	19	–
NOCA	Ann1	Low	1013	12	11	14	12	11	9	13	15	15	15	–	15	15	15	17	17	18	17
NOCA	Ann1	Low	1017	13	12	9	12	12	12	13	14	14	15	14	15	15	15	15	15	15	15
NOCA	Ann1	Low	1020	15	12	13	15	16	12	16	17	17	18	18	17	17	18	18	18	18	20
NOCA	Ann1	Low	1023	18	19	19	20	21	20	21	21	21	21	22	22	21	22	22	21	18	22
NOCA	Ann1	Mid	1015	12	16	17	17	15	15	16	17	17	19	18	19	18	18	19	20	20	22
NOCA	Ann1	Mid	1018	16	21	21	23	22	25	25	23	25	25	24	25	25	23	23	25	21	24
NOCA	Ann1	Mid	1022	13	13	11	13	14	13	14	15	15	17	16	18	17	18	19	18	17	19

Table 9 (continued). 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	2020	2021	2022	2023
NOCA	Ann1	Mid	1024	9	10	11	12	10	11	10	13	13	13	14	14	15	14	15	14	14	14
NOCA	Ann1	High	1014	15	19	19	–	20	–	–	20	21	21	22	22	23	–	23	22	22	21
NOCA	Ann1	High	1016	14	15	14	16	15	14	15	17	17	17	17	17	16	17	18	18	18	18
NOCA	Ann1	High	1019	12	12	10	12	12	12	12	13	13	13	14	–	14	14	15	16	16	16
NOCA	Ann1	High	1021	18	21	22	23	22	19	17	24	24	24	24	23	24	24	25	23	25	26
NOCA	Alt2	Low	1001	–	–	11	–	–	–	–	13	–	–	–	–	13	–	–	–	–	13
NOCA	Alt2	Low	1005	–	–	13	–	–	–	–	15	–	–	–	–	15	–	–	–	–	14
NOCA	Alt2	Low	1006	–	–	10	–	–	–	–	12	–	–	–	–	12	–	–	–	–	14
NOCA	Alt2	Low	1010	–	–	12	–	–	–	–	16	–	–	–	–	16	–	–	–	–	17
NOCA	Alt2	Mid	1003	–	–	12	–	–	–	–	15	–	–	–	–	15	–	–	–	–	17
NOCA	Alt2	Mid	1004	–	–	13	–	–	–	–	14	–	–	–	–	15	–	–	–	–	15
NOCA	Alt2	Mid	1009	–	–	–	–	–	–	–	16	–	–	–	–	17	–	–	–	–	19
NOCA	Alt2	Mid	1011	–	–	19	–	–	–	–	19	–	–	–	–	20	–	–	–	–	22
NOCA	Alt2	High	1002	–	–	18	–	–	–	–	20	–	–	–	–	20	–	–	–	–	21
NOCA	Alt2	High	1007	–	–	13	–	–	–	–	14	–	–	–	–	15	–	–	–	–	17
NOCA	Alt2	High	1008	–	–	–	–	–	–	–	14	–	–	–	–	14	–	–	–	–	14
NOCA	Alt2	High	1012	–	–	15	–	–	–	–	19	–	–	–	–	18	–	–	–	–	17
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	Mid	1025	–	–	–	15	–	–	–	–	15	–	–	–	–	15	–	–	–	–
NOCA	Alt3	Mid	1026	–	–	–	14	–	–	–	–	15	–	–	–	–	17	–	–	–	–
NOCA	Alt3	Mid	1031	–	–	–	19	–	–	–	–	20	–	–	–	–	18	–	–	–	–
NOCA	Alt3	Mid	1057	–	–	–	–	–	–	–	–	–	–	–	–	–	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	–	–	–	–	21	–	–	–
NOCA	Alt4	Low	1054	–	–	–	–	11	–	–	–	–	16	–	–	–	–	17	–	–	–
NOCA	Alt4	Low	1061	–	–	–	–	10	–	–	–	–	13	–	–	–	–	16	–	–	–
NOCA	Alt4	Low	1122	–	–	–	–	–	–	–	–	–	22	–	–	–	–	22	–	–	–
NOCA	Alt4	Mid	1033	–	–	–	–	20	–	–	–	–	23	–	–	–	–	23	–	–	–
NOCA	Alt4	Mid	1035	–	–	–	–	16	–	–	–	–	18	–	–	–	–	18	–	–	–
NOCA	Alt4	Mid	1038	–	–	–	–	13	–	–	–	–	18	–	–	–	–	18	–	–	–

Table 9 (continued). 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	2020	2021	2022	2023
NOCA	Alt4	Mid	1041	–	–	–	–	14	–	–	–	–	17	–	–	–	–	18	–	–	–
NOCA	Alt4	High	1048	–	–	–	–	11	–	–	–	–	13	–	–	–	–	17	–	–	–
NOCA	Alt4	High	1049	–	–	–	–	12	–	–	–	–	17	–	–	–	–	18	–	–	–
NOCA	Alt4	High	1050	–	–	–	–	13	–	–	–	–	16	–	–	–	–	17	–	–	–
NOCA	Alt4	High	1052	–	–	–	–	11	–	–	–	–	13	–	–	–	–	18	–	–	–
NOCA	Alt5	Low	1062	–	–	–	–	–	8	–	–	–	–	11	–	–	–	–	9	–	–
NOCA	Alt5	Low	1063	–	–	–	–	–	9	–	–	–	–	16	–	–	–	–	17	–	–
NOCA	Alt5	Low	1065	–	–	–	–	–	11	–	–	–	–	13	–	–	–	–	15	–	–
NOCA	Alt5	Low	1067	–	–	–	–	–	8	–	–	–	–	13	–	–	–	–	14	–	–
NOCA	Alt5	Mid	1042	–	–	–	–	–	15	–	–	–	–	17	–	–	–	–	18	–	–
NOCA	Alt5	Mid	1043	–	–	–	–	–	9	–	–	–	–	13	–	–	–	–	13	–	–
NOCA	Alt5	Mid	1044	–	–	–	–	–	11	–	–	–	–	15	–	–	–	–	15	–	–
NOCA	Alt5	Mid	1045	–	–	–	–	–	10	–	–	–	–	10	–	–	–	–	12	–	–
NOCA	Alt5	High	1055	–	–	–	–	–	13	–	–	–	–	16	–	–	–	–	16	–	–
NOCA	Alt5	High	1058	–	–	–	–	–	–	–	–	–	–	18	–	–	–	–	18	–	–
NOCA	Alt5	High	1060	–	–	–	–	–	9	–	–	–	–	14	–	–	–	–	16	–	–
NOCA	Alt5	High	1064	–	–	–	–	–	10	–	–	–	–	15	–	–	–	–	15	–	–
NOCA	Alt6	Low	1068	–	–	–	–	–	–	13	–	–	–	–	15	–	–	–	–	15	–
NOCA	Alt6	Low	1070	–	–	–	–	–	–	12	–	–	–	–	14	–	–	–	–	14	–
NOCA	Alt6	Low	1074	–	–	–	–	–	–	14	–	–	–	–	18	–	–	–	–	19	–
NOCA	Alt6	Low	1075	–	–	–	–	–	–	11	–	–	–	–	16	–	–	–	–	17	–
NOCA	Alt6	Mid	1047	–	–	–	–	–	–	13	–	–	–	–	15	–	–	–	–	13	–
NOCA	Alt6	Mid	1051	–	–	–	–	–	–	11	–	–	–	–	12	–	–	–	–	14	–
NOCA	Alt6	Mid	1053	–	–	–	–	–	–	13	–	–	–	–	19	–	–	–	–	19	–
NOCA	Alt6	Mid	1056	–	–	–	–	–	–	13	–	–	–	–	14	–	–	–	–	16	–
NOCA	Alt6	High	1072	–	–	–	–	–	–	–	–	–	–	–	9	–	–	–	–	16	–
NOCA	Alt6	High	1088	–	–	–	–	–	–	12	–	–	–	–	13	–	–	–	–	15	–
NOCA	Alt6	High	1090	–	–	–	–	–	–	–	–	–	–	–	16	–	–	–	–	17	–
NOCA	Alt6	High	1092	–	–	–	–	–	–	14	–	–	–	–	14	–	–	–	–	17	–
OLYM	Ann1	Low	3001	11	10	8	10	11	12	12	13	12	13	13	14	13	14	14	14	14	14
OLYM	Ann1	Low	3121	11	15	17	17	17	14	17	15	17	17	19	19	18	17	18	19	19	19
OLYM	Ann1	Low	3126	9	10	11	13	13	13	15	15	15	14	15	16	16	15	17	18	18	19
OLYM	Ann1	Low	3134	16	16	18	18	18	18	19	19	19	19	18	20	20	20	20	20	20	20
OLYM	Ann1	Mid	3122	14	12	14	–	16	16	–	16	17	18	18	–	18	17	18	17	18	18
OLYM	Ann1	Mid	3123	10	10	12	14	14	15	15	15	15	16	17	16	16	17	17	16	17	17
OLYM	Ann1	Mid	3130	9	9	8	9	9	9	9	10	10	10	10	10	10	8	11	11	11	12

Table 9 (continued). 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	2020	2021	2022	2023
OLYM	Ann1	Mid	3200	–	–	22	23	21	23	22	23	23	22	23	23	23	22	23	24	24	24
OLYM	Ann1	High	3124	9	10	10	11	11	11	11	12	12	13	14	14	13	14	14	14	14	15
OLYM	Ann1	High	3125	9	11	13	13	14	15	11	14	12	15	15	15	15	12	16	16	16	17
OLYM	Ann1	High	3127	7	9	13	15	14	15	15	15	15	15	16	15	16	16	16	16	16	16
OLYM	Ann1	High	3128	10	11	11	11	10	11	12	13	12	14	14	14	14	11	10	15	15	16
OLYM	Alt2	Low	3138	–	–	10	–	–	–	–	12	–	–	–	–	13	–	–	–	–	13
OLYM	Alt2	Low	3142	–	–	14	–	–	–	–	14	–	–	–	–	16	–	–	–	–	17
OLYM	Alt2	Low	3144	–	–	13	–	–	–	–	13	–	–	–	–	14	–	–	–	–	17
OLYM	Alt2	Low	3145	–	–	13	–	–	–	–	14	–	–	–	–	14	–	–	–	–	15
OLYM	Alt2	Mid	3133	–	–	8	–	–	–	–	16	–	–	–	–	16	–	–	–	–	16
OLYM	Alt2	Mid	3135	–	–	11	–	–	–	–	13	–	–	–	–	13	–	–	–	–	13
OLYM	Alt2	Mid	3137	–	–	10	–	–	–	–	11	–	–	–	–	11	–	–	–	–	13
OLYM	Alt2	Mid	3141	–	–	14	–	–	–	–	15	–	–	–	–	15	–	–	–	–	16
OLYM	Alt2	High	3132	–	–	19	–	–	–	–	19	–	–	–	–	18	–	–	–	–	22
OLYM	Alt2	High	3136	–	–	11	–	–	–	–	11	–	–	–	–	14	–	–	–	–	14
OLYM	Alt2	High	3139	–	–	16	–	–	–	–	13	–	–	–	–	16	–	–	–	–	17
OLYM	Alt2	High	3140	–	–	–	–	–	–	–	12	–	–	–	–	13	–	–	–	–	14
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	Mid	3143	–	–	–	10	–	–	–	–	11	–	–	–	–	9	–	–	–	–
OLYM	Alt3	Mid	3150	–	–	–	11	–	–	–	–	12	–	–	–	–	12	–	–	–	–
OLYM	Alt3	Mid	3152	–	–	–	11	–	–	–	–	13	–	–	–	–	13	–	–	–	–
OLYM	Alt3	Mid	3154	–	–	–	15	–	–	–	–	16	–	–	–	–	18	–	–	–	–
OLYM	Alt3	High	3147	–	–	–	19	–	–	–	–	19	–	–	–	–	22	–	–	–	–
OLYM	Alt3	High	3148	–	–	–	14	–	–	–	–	16	–	–	–	–	16	–	–	–	–
OLYM	Alt3	High	3156	–	–	–	10	–	–	–	–	11	–	–	–	–	13	–	–	–	–
OLYM	Alt3	High	3157	–	–	–	11	–	–	–	–	12	–	–	–	–	10	–	–	–	–
OLYM	Alt4	Low	3155	–	–	–	–	10	–	–	–	–	12	–	–	–	–	15	–	–	–
OLYM	Alt4	Low	3159	–	–	–	–	11	–	–	–	–	12	–	–	–	–	15	–	–	–
OLYM	Alt4	Low	3161	–	–	–	–	11	–	–	–	–	12	–	–	–	–	13	–	–	–
OLYM	Alt4	Low	3163	–	–	–	–	15	–	–	–	–	15	–	–	–	–	17	–	–	–
OLYM	Alt4	Mid	3160	–	–	–	–	10	–	–	–	–	12	–	–	–	–	12	–	–	–
OLYM	Alt4	Mid	3167	–	–	–	–	11	–	–	–	–	14	–	–	–	–	13	–	–	–
OLYM	Alt4	Mid	3168	–	–	–	–	10	–	–	–	–	15	–	–	–	–	16	–	–	–

Table 9 (continued). 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	2020	2021	2022	2023
OLYM	Alt4	Mid	3174	–	–	–	–	14	–	–	–	–	15	–	–	–	–	15	–	–	–
OLYM	Alt4	High	3158	–	–	–	–	14	–	–	–	–	18	–	–	–	–	19	–	–	–
OLYM	Alt4	High	3164	–	–	–	–	14	–	–	–	–	17	–	–	–	–	18	–	–	–
OLYM	Alt4	High	3171	–	–	–	–	12	–	–	–	–	15	–	–	–	–	16	–	–	–
OLYM	Alt4	High	3173	–	–	–	–	10	–	–	–	–	12	–	–	–	–	13	–	–	–
OLYM	Alt5	Low	3165	–	–	–	–	–	10	–	–	–	–	12	–	–	–	–	13	–	–
OLYM	Alt5	Low	3166	–	–	–	–	–	12	–	–	–	–	15	–	–	–	–	16	–	–
OLYM	Alt5	Low	3169	–	–	–	–	–	8	–	–	–	–	13	–	–	–	–	13	–	–
OLYM	Alt5	Low	3170	–	–	–	–	–	11	–	–	–	–	11	–	–	–	–	12	–	–
OLYM	Alt5	Mid	3178	–	–	–	–	–	11	–	–	–	–	14	–	–	–	–	16	–	–
OLYM	Alt5	Mid	3183	–	–	–	–	–	13	–	–	–	–	15	–	–	–	–	17	–	–
OLYM	Alt5	Mid	3184	–	–	–	–	–	16	–	–	–	–	20	–	–	–	–	20	–	–
OLYM	Alt5	Mid	3185	–	–	–	–	–	9	–	–	–	–	11	–	–	–	–	13	–	–
OLYM	Alt5	High	3175	–	–	–	–	–	12	–	–	–	–	15	–	–	–	–	14	–	–
OLYM	Alt5	High	3179	–	–	–	–	–	16	–	–	–	–	19	–	–	–	–	19	–	–
OLYM	Alt5	High	3180	–	–	–	–	–	16	–	–	–	–	19	–	–	–	–	19	–	–
OLYM	Alt5	High	3188	–	–	–	–	–	12	–	–	–	–	18	–	–	–	–	18	–	–
OLYM	Alt6	Low	3172	–	–	–	–	–	–	14	–	–	–	–	14	–	–	–	–	15	–
OLYM	Alt6	Low	3177	–	–	–	–	–	–	10	–	–	–	–	10	–	–	–	–	10	–
OLYM	Alt6	Low	3181	–	–	–	–	–	–	16	–	–	–	–	16	–	–	–	–	17	–
OLYM	Alt6	Low	3182	–	–	–	–	–	–	16	–	–	–	–	18	–	–	–	–	21	–
OLYM	Alt6	Mid	3187	–	–	–	–	–	–	20	–	–	–	–	21	–	–	–	–	23	–
OLYM	Alt6	Mid	3190	–	–	–	–	–	–	14	–	–	–	–	15	–	–	–	–	15	–
OLYM	Alt6	Mid	3195	–	–	–	–	–	–	12	–	–	–	–	13	–	–	–	–	13	–
OLYM	Alt6	Mid	3198	–	–	–	–	–	–	11	–	–	–	–	13	–	–	–	–	15	–
OLYM	Alt6	High	3189	–	–	–	–	–	–	16	–	–	–	–	16	–	–	–	–	17	–
OLYM	Alt6	High	3191	–	–	–	–	–	–	15	–	–	–	–	16	–	–	–	–	17	–
OLYM	Alt6	High	3192	–	–	–	–	–	–	14	–	–	–	–	15	–	–	–	–	15	–
OLYM	Alt6	High	3196	–	–	–	–	–	–	15	–	–	–	–	18	–	–	–	–	18	–

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