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Natural Resource Stewardship and Science

North Coast and Cascades Network Landbird Monitoring

Report for the 2018 Field Season

Natural Resource Data Series NPS/NCCN/NRDS—2019/1224

ON THIS PAGE
2018 field crew at North Cascades National Park Complex
Photograph taken by: Mandy Holmgren, The Institute for Bird Populations

ON THE COVER
Red-breasted Sapsucker (*Sphyrapicus ruber*), Olympic National Park
Photograph taken by: Hannah Toutonghi, The Institute for Bird Populations

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Report for the 2018 Field Season

Natural Resource Data Series NPS/NCCN/NRDS—2019/1224

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

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

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

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

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

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Executive Summary

In 2018 the North Coast and Cascades Network (NCCN) continued to implement the Network's Landbird Monitoring Protocol, in partnership with The Institute for Bird Populations. The protocol was partially implemented (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 11 years (2007–2018), except for 2017 when data collection was temporarily suspended to reallocate resources for a 5-year data synthesis. In 2018 we conducted 1,116 point counts at point count survey stations along 68 transects in the large wilderness parks of the NCCN, including Mount Rainier National Park (MORA), North Cascades National Park Complex (NOCA), and Olympic National Park (OLYM).

We detected 143 bird species and one hybrid in the three large parks, 99 of which were detected during one or more point counts. For 58 species (all species detected at least 50 times on annual-panel transects between 2005 and 2018), we present the total number of detections on annual-panel transects in each park during the 2005–2018 field seasons. We caution, however, that these detection totals have not been adjusted for differences in survey effort, observer effects, or potential differences in detectability of birds between years; such adjustments will be made in conjunction with our periodic trend analyses.

We also conducted 54 point counts at San Juan Island National Historical Park (SAJH) in 2018, including 38 at American Camp and 16 at English Camp. Our field crew detected 77 bird species while in the park, 67 of which were detected during point counts. We present the number of detections, and the number of points with detections, for each species detected during point counts at SAJH.

There was a small increase in the number of bird detections on annual-panel transects between 2016 and 2018, but since there were also more point counts conducted in 2018, there was little change in the average number of bird detections per point between the two years. Many species were detected in slightly or moderately greater numbers in the three large parks in 2018 than in previous years, most notably at NOCA. A few of these species include Swainson's thrush, hermit thrush, black-throated gray warbler, and red-eyed vireo. Each of these species had more detections in 2018 than in any of the previous 12 years. Interpretation of these results will need to wait until our next multi-year trend analysis, which will account for annual variation in survey effort, observer effects, and detection probability.

Acknowledgments

We thank the 2018 crew members for their hard work and dedication to the project: K. Bonnette, K. Hamm, F. Lane, A. Mazur, K. Ray, and H. Toutonghi. We thank K. Jenkins (FRESC Olympic Field Station) and the entire NCCN Landbird Monitoring Group for their contributions toward developing the NCCN Landbird Monitoring Protocol and guiding its implementation. We thank T. Chestnut, P. Happe, and J. Shrum for providing program oversight at the respective parks; B. Boekelheide for assistance during training; S. Gremel and V. Gempko for help with logistics and field-work during the season; and R. Christophersen and M. Wilson for boat rides on Ross Lake. We thank K. Beirne and N. Antonova for GIS training and support and K. Beirne for providing maps for this report; J. Boetsch for extensive help with data management; L. Grace for help with formatting this report to National Park Service standards; M. Huff, NCCN Inventory and Monitoring Program Manager, for his support of the project; and the ESRI Nonprofit Organization Program for software support provided to The Institute for Bird Populations. This is Contribution No. 626 of The Institute for Bird Populations.

Introduction

Reported declines of many Neotropical migratory bird species and other bird species breeding in North America have stimulated interest in avian population trends and mechanisms driving those trends (Robbins et al. 1989, DeSante and George 1994, Peterjohn et al. 1995). Data from the North American Breeding Bird Survey indicate that many landbird populations in Pacific Northwest coniferous forests have been declining (Andelman and Stock 1994a, 1994b, Sharp 1996, Saab and Rich 1997, Altman 1999, 2000, Sauer et al. 2008, North American Bird Conservation Initiative, U.S. Committee 2009).

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

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

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

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

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

Comparisons were made between data collected in 2018 and the previous 12 years of data collection (Siegel et al. 2008, Wilkerson et al. 2009b, 2010), Holmgren et al. 2011-2016) and are described in the results section of this report.

This report and subsequent annual reports for the Landbird Monitoring Project are intended primarily as administrative reports. More comprehensive analyses of the data, including trend analysis that accounts for the potentially confounding effects of variation in detectability and sampling effort, are conducted in conjunction with periodic detailed trend analyses. For the first trend analysis report, which summarizes data from 2005–2012, see Saracco et al. (2014). More recently, we developed a new analytical framework for this project that integrates several recent developments in Bayesian N-mixture modeling to assess landbird trends and evaluate the role of climatic and other spatiotemporal variables in driving those trends. (Ray et al. 2017b). We have subsequently utilized the new framework in two published papers that evaluate population trends of dozens of birds across the NCCN parks (Ray et al. 2017a, 2019).

Study Area

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

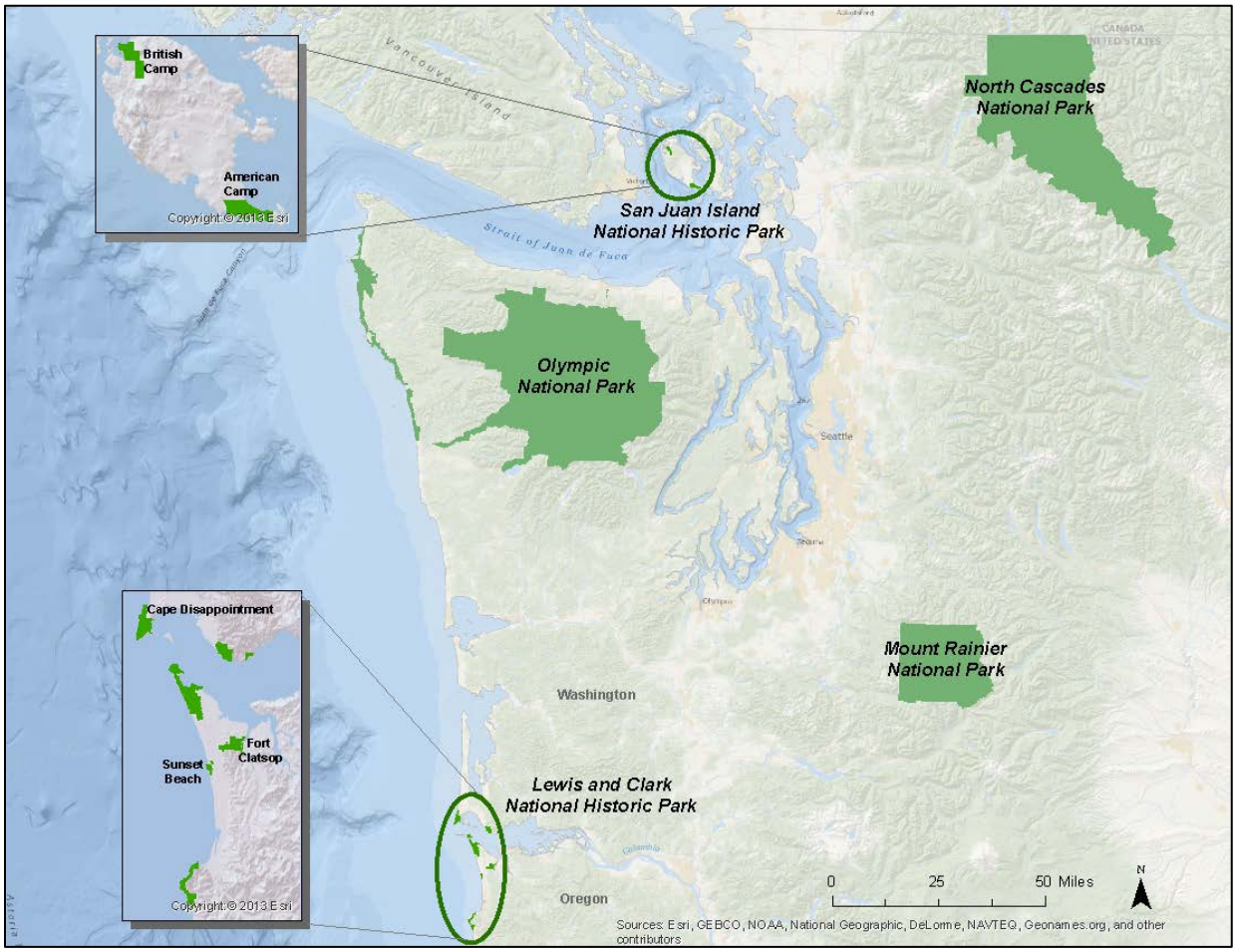

Figure 1. National Park Service units participating in the North Coast and Cascades Network Landbird Monitoring Project.

Methods

Sample Design

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

In 2018 we implemented the full study design in the three large parks for the eleventh year, including surveys of the annual panel (‘Ann1’) as well as the first alternating panel (‘Alt2’) (Figures 2–4). During the first two years of protocol development (2005–2006) we surveyed only the annual panel (Siegel et al. 2006, 2009b). We provide results from each of the first ten years of full implementation in Siegel et al. (2008), Wilkerson et al. (2009b, 2010), and Holmgren et al. (2011-2017). 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 2018 we surveyed the grid at SAJH (Figure 5). Multi-year trend analyses for the small parks are provided in Ray et al. (2019).

Crew Training and Certification

Mandy Holmgren, a Staff Biologist with The Institute for Bird Populations, served as the 2018 Field Lead. Mandy began training six field technicians on April 29. Training followed guidelines described in the NCCN Landbird Monitoring Protocol (Siegel et al. 2007). By the end of the official training session on May 19, only one of the six field technicians had passed the rigorous point count certification exam, and was able to begin collecting data. Three technicians passed within two weeks of the end of training, and the other two technicians passed the exam two additional weeks after that. All individuals who collected data during the 2018 field season (Table 1) were employees or volunteers of The Institute for Bird Populations or employees of the National Park Service.

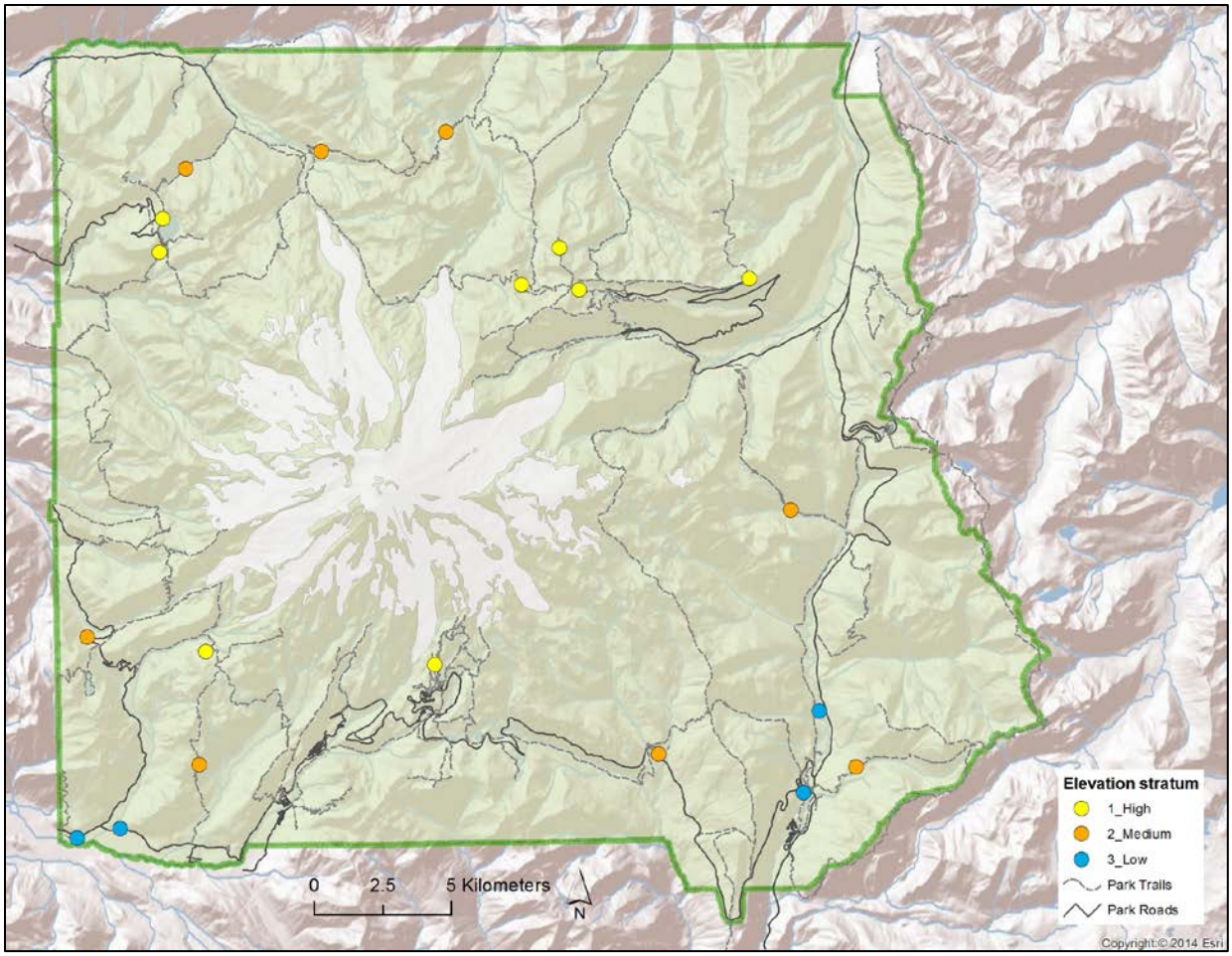

Figure 2. Approximate locations of transects conducted at Mount Rainier National Park in 2018.

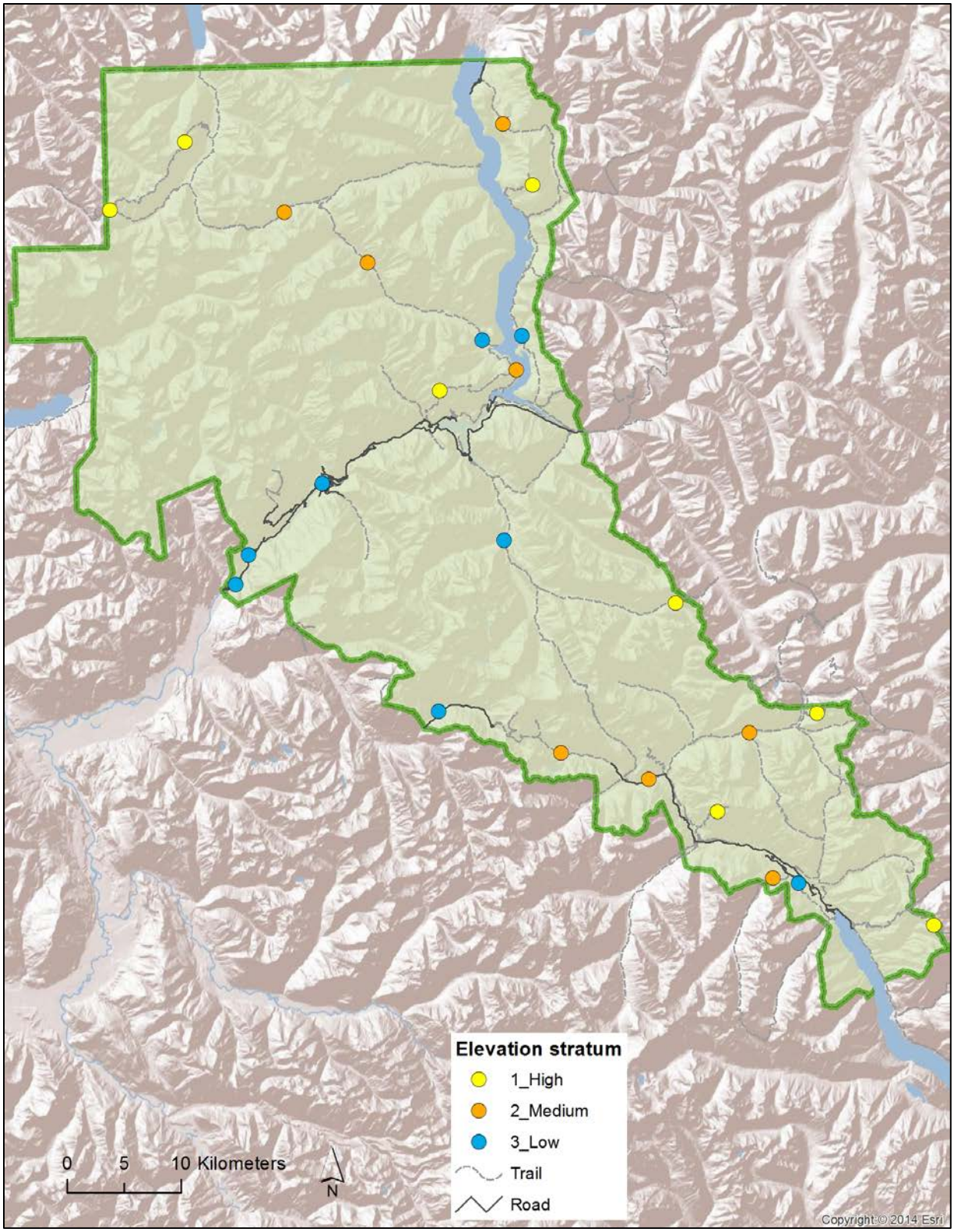

Figure 3. Approximate locations of transects conducted at North Cascades National Park Complex in 2018.

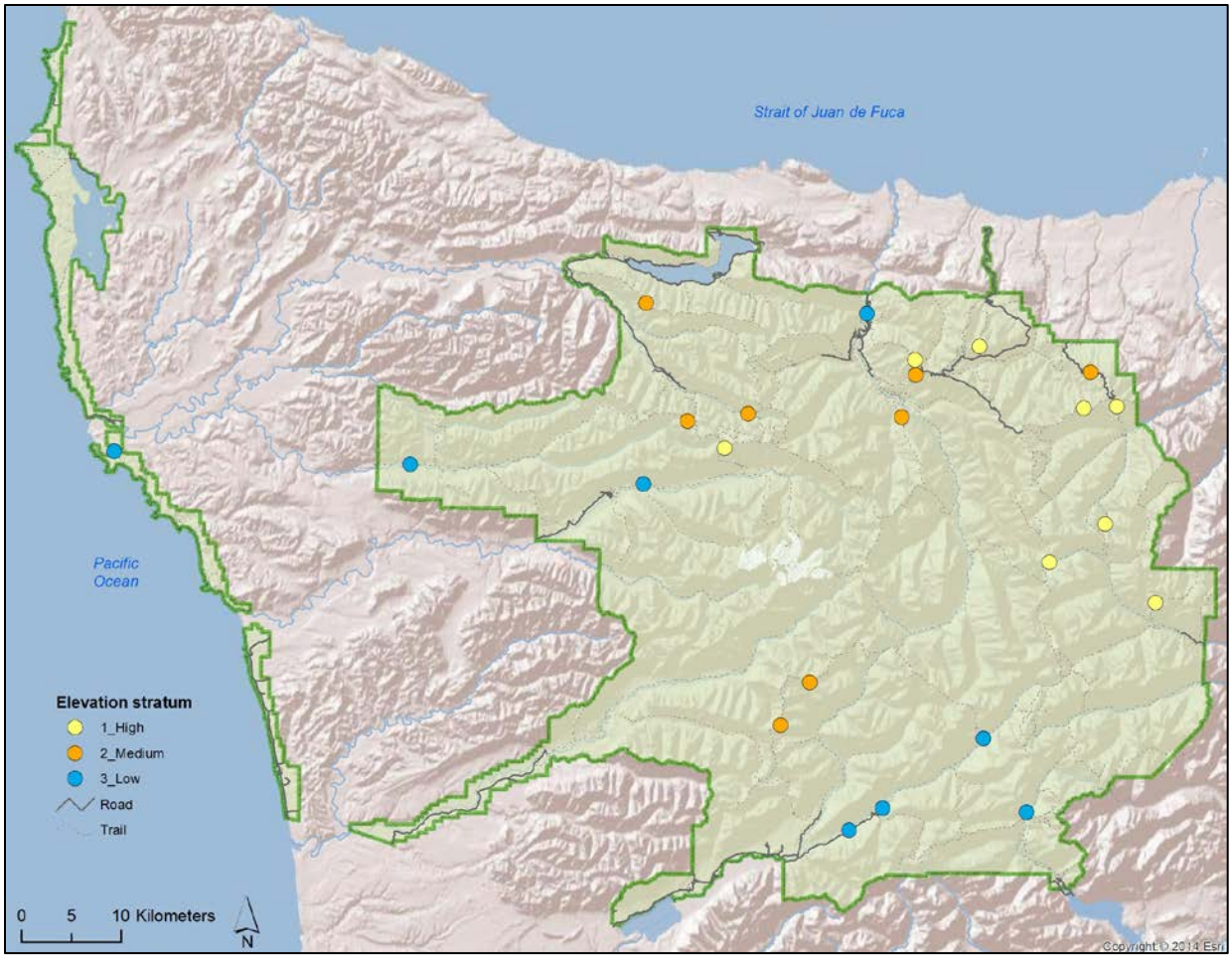

Figure 4. Approximate locations of transects conducted at Olympic National Park in 2018.

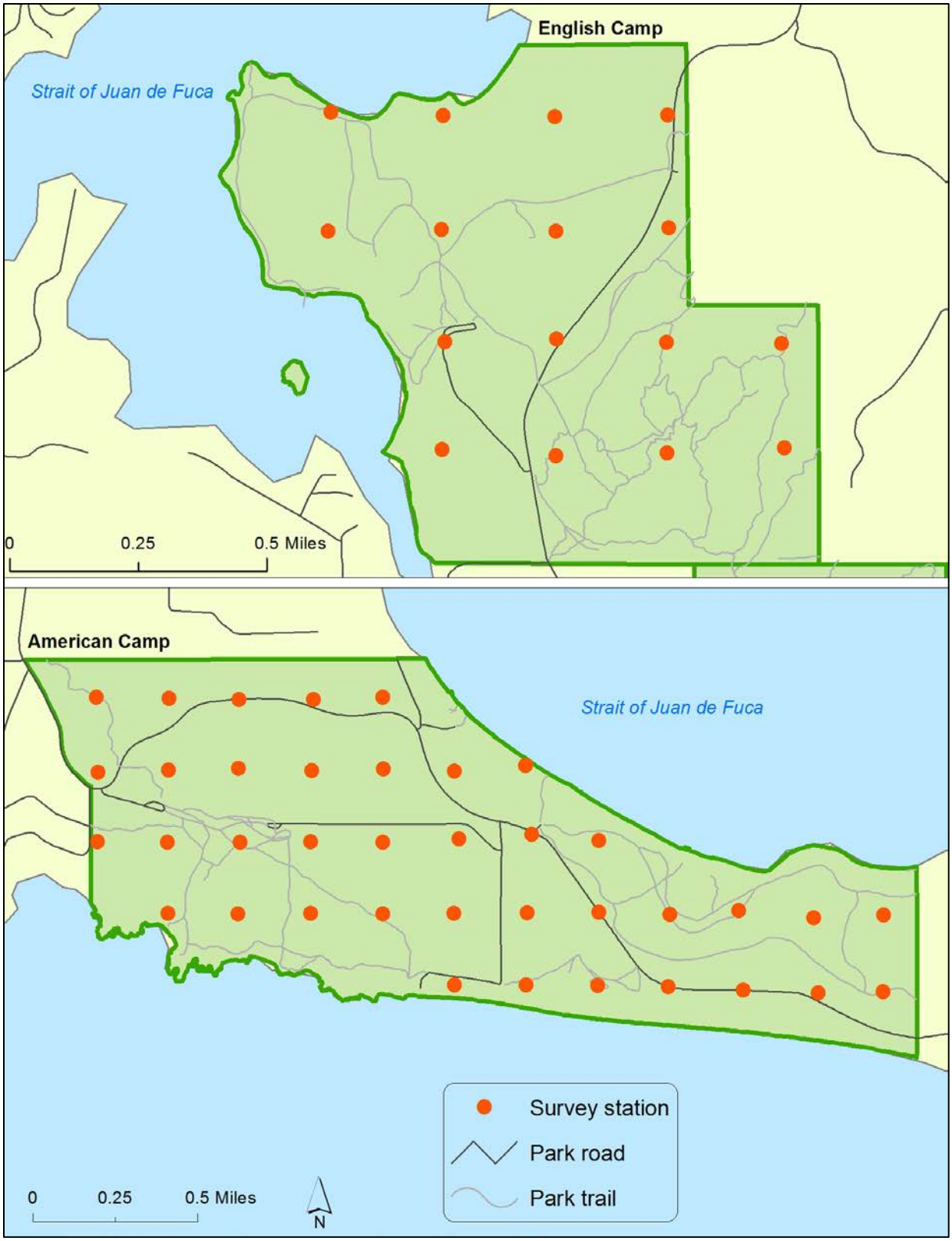

Figure 5. Locations of point count stations surveyed at San Juan Island National Historical Park in 2018; adjacent point count stations are 350 m apart.

Table 1. Observers who conducted point counts in the North Coast and Cascades Network in 2018.

Observer	Role
Kayla Bonnette	Technician
Kelsey Hamm	Technician
Scott Gremel	NPS Biologist
Mandy Holmgren	Field Lead
Fanter Lane	Technician
Aidan Mazur	Technician
Katelyn Ray	Technician
Hannah Toutonghi	Technician

Data Collection

All point count data were collected between May 25 and May 29 at SAJH, between June 14 and July 25 at MORA, between June 5 and July 28 at NOCA, and between June 5 and July 28 at OLYM. At the three large parks, low-elevation transects were generally surveyed first, followed by the mid-elevation transects, and finally the high-elevation transects.

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

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

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

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

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

Data Management

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

The project database includes built-in quality assurance components such as pick-lists and validation rules to test for missing data or illogical combinations. After entering the data, the crew members and 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 2018 season were sourced from the Office of the Washington State Climatologist (2018). 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

2018 Field Season

We completed our eleventh year of full implementation of the NCCN Landbird Monitoring Project with the experience gained from two pilot field seasons (2005 and 2006) and ten previous years of full protocol implementation. Our procedures for season preparation, data collection, data management, data analysis, and reporting have all been well vetted, and required no substantial changes this year. No data were collected in 2017, when resources were allocated to conducting a five-year data analysis rather than collecting new data.

Snowpack was slightly above average when the field season began at the end of April, but all of the regions in which we survey experienced an extremely warm May, causing the snowpack to melt faster than usual. It was the second warmest May on record statewide, with temperatures 5.8 degrees Fahrenheit warmer than the 1981–2010 normal. Temperatures normalized in June, but July temperatures were again above normal. Precipitation was below normal for all three months. Low precipitation and warm temperatures facilitated our reaching all of the intended transects with relative ease, facing fewer access challenges than in many previous years. The low precipitation also allowed us to complete surveys on most attempts.

2018 Bird Counts

In 2018 we surveyed all of the 68 intended transects in the large parks, including 34 transects from the annual-panel, and 34 transects from the first alternating panel (Table 2-3). Appendix 1 provides a detailed multi-year survey history of all transects sampled in the large parks to date. In 2018 we conducted 341 individual point counts at MORA, 410 point counts at NOCA and 365 point counts at OLYM (Table 2). We also conducted 54 point counts at SAJH, including 38 at American Camp and 16 at English Camp. During the 1,116 point counts in the three large parks, we counted 11,706 individual birds. Across the three large parks, we documented the presence of 143 species and one hybrid (Table 4), 99 of which were detected during point counts. The remaining 44 species were recorded only as incidental detections or on “Rare Bird Report Forms”. At SAJH our field crew detected 77 species, 67 of which were detected during point counts.

For the annual-panel transects only, the number of individuals of each species detected during point counts (unlimited radius) and the number of transects on which each species was detected are provided in Table 5. On the annual-panel transects we detected 55 bird species and one hybrid during point counts at MORA, 72 species during point counts at NOCA, and 58 species during point counts at OLYM (Table 5). Pooling detections on annual-panel transects across all species, we amassed 1,582 individual bird detections (average of 8.74 detections/point) at MORA, 2,620 detections (average of 11.91 detections/point) at NOCA, and 1,901 detections (average of 9.90 detections per point) at OLYM (Table 5). The five most frequently detected species on the annual-panel transects in 2018 were: dark-eyed junco (492 detections), varied thrush (487 detections), Pacific wren (448 detections), pine siskin (386 detections), and hermit thrush (312 detections).

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 2018.

Park	Panel	Elevation	Transect	No. of points surveyed
MORA	Ann1	Low	4001	15
MORA	Ann1	Low	4005	14
MORA	Ann1	Medium	4002	17
MORA	Ann1	Medium	4004	19
MORA	Ann1	Medium	4009	17
MORA	Ann1	Medium	4012	23
MORA	Ann1	High	4003	16
MORA	Ann1	High	4007	21
MORA	Ann1	High	4011	17
MORA	Ann1	High	4014	22
MORA	Alt2	Low	4006	12
MORA	Alt2	Low	4008	13
MORA	Alt2	Medium	4015	11
MORA	Alt2	Medium	4017	14
MORA	Alt2	Medium	4020	16
MORA	Alt2	Medium	4026	13
MORA	Alt2	High	4016	21
MORA	Alt2	High	4019	21
MORA	Alt2	High	4027	17
MORA	Alt2	High	4075	22
NOCA	Ann1	Low	1013	15
NOCA	Ann1	Low	1017	15
NOCA	Ann1	Low	1020	17
NOCA	Ann1	Low	1023	22
NOCA	Ann1	Medium	1015	18
NOCA	Ann1	Medium	1018	25
NOCA	Ann1	Medium	1022	16
NOCA	Ann1	Medium	1024	15
NOCA	Ann1	High	1014	23

Table 2 (continued). North Coast and Cascades Network landbird monitoring transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks that were surveyed in 2018.

Park	Panel	Elevation	Transect	No. of points surveyed
NOCA	Ann1	High	1016	16
NOCA	Ann1	High	1019	14
NOCA	Ann1	High	1021	24
NOCA	Alt2	Low	1001	13
NOCA	Alt2	Low	1005	15
NOCA	Alt2	Low	1006	12
NOCA	Alt2	Low	1010	16
NOCA	Alt2	Medium	1003	15
NOCA	Alt2	Medium	1004	15
NOCA	Alt2	Medium	1009	17
NOCA	Alt2	Medium	1011	20
NOCA	Alt2	High	1002	20
NOCA	Alt2	High	1007	15
NOCA	Alt2	High	1008	14
NOCA	Alt2	High	1012	18
OLYM	Ann1	Low	3001	13
OLYM	Ann1	Low	3121	18
OLYM	Ann1	Low	3126	16
OLYM	Ann1	Low	3134	20
OLYM	Ann1	Medium	3122	18
OLYM	Ann1	Medium	3123	16
OLYM	Ann1	Medium	3130	10
OLYM	Ann1	Medium	3200	23
OLYM	Ann1	High	3124	13
OLYM	Ann1	High	3125	15
OLYM	Ann1	High	3127	16
OLYM	Ann1	High	3128	14
OLYM	Alt2	Low	3138	13
OLYM	Alt2	Low	3142	16

Table 2 (continued). North Coast and Cascades Network landbird monitoring transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks that were surveyed in 2018.

Park	Panel	Elevation	Transect	No. of points surveyed
OLYM	Alt2	Low	3144	14
OLYM	Alt2	Low	3145	14
OLYM	Alt2	Medium	3133	16
OLYM	Alt2	Medium	3135	13
OLYM	Alt2	Medium	3137	11
OLYM	Alt2	Medium	3141	15
OLYM	Alt2	High	3132	18
OLYM	Alt2	High	3136	14
OLYM	Alt2	High	3139	16
OLYM	Alt2	High	3140	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 2018.

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]
MORA	Low	2	2	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
MORA	High	4	4	8	8	8	7	3	8	8	8	8	8	8
ALL	All	10	10	20	20	20	19	13	20	20	20	20	20	20
NOCA	Low	4	4	8	8	7	8	8	8	8	8	7	8	8
NOCA	Medium	4	4	7	7	8	8	8	8	7	8	8	8	8
NOCA	High	4	4	7	5	8	6	5	8	8	8	8	7	8
ALL	All	12	12	22	20	23	22	21	24	24	24	23	23	24
OLYM	Low	4	4	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
OLYM	High	4	4	7	8	8	8	8	8	8	8	8	8	8
ALL	All	12	11	23	23	24	24	23	24	24	24	24	23	24
ALL	Low	10	10	20	20	20	20	20	20	20	20	19	20	20
ALL	Medium	12	11	23	22	24	24	21	24	24	24	24	23	24
ALL	High	12	12	22	21	24	21	16	24	24	24	24	23	24
ALL	All	34	33	65	63	68	65	57	68	68	68	67	66	68

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

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

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

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

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

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

Table 4. All species recorded in the three large North Coast and Cascades Network parks during the 2018 field season, including the pre-season training session. Asterisks indicate species that were detected only at times other than during point counts.

Common Name	Scientific Name
Canada Goose	*Branta canadensis*
Trumpeter Swan *	*Cygnus buccinator*
Wood Duck *	*Aix sponsa*
Mallard	*Anas platyrhynchos*
Blue-winged Teal *	*Anas discors*
Northern Shoveler *	*Anas clypeata*
Ring-necked Duck *	*Aythya collaris*
Harlequin Duck *	*Histrionicus histrionicus*
Bufflehead *	*Bucephala albeola*
Barrow's Goldeneye *	*Bucephala islandica*
Common Merganser	*Mergus merganser*
Ruddy Duck *	*Oxyura jamaicensis*
Ruffed Grouse	*Bonasa umbellus*
White-tailed Ptarmigan	*Lagopus leucura*
Sooty Grouse	*Dendragapus fuliginosus*
Pied-billed Grebe *	*Podilymbus podiceps*
Western Grebe *	*Aechmophorus occidentalis*
Band-tailed Pigeon	*Patagioenas fasciata*
Eurasian Collared-dove *	*Streptopelia decaocto*
Mourning Dove	*Zenaida macroura*
Common Nighthawk	*Chordeiles minor*
Black Swift	*Cypseloides niger*
Vaux's Swift	*Chaetura vauxi*
Anna's Hummingbird *	*Calypte anna*
Rufous Hummingbird	*Selasphorus rufus*
Calliope Hummingbird	*Selasphorus calliope*
Sora *	*Porzana carolina*
Killdeer *	*Charadrius vociferus*

Table 4 (continued). All species recorded in the three large North Coast and Cascades Network parks during the 2018 field season, including the pre-season training session. Asterisks indicate species that were detected only at times other than during point counts.

Common Name	Scientific Name
Spotted Sandpiper	*Actitis macularius*
Greater Yellowlegs *	*Tringa melanoleuca*
Marbled Murrelet	*Brachyramphus marmoratus*
California Gull *	*Larus californicus*
Common Loon	*Gavia immer*
Pelagic Cormorant *	*Phalacrocorax pelagicus*
Great Blue Heron *	*Ardea herodias*
Turkey Vulture *	*Cathartes aura*
Osprey	*Pandion haliaetus*
Bald Eagle *	*Haliaeetus leucocephalus*
Northern Harrier *	*Circus cyaneus*
Sharp-shinned Hawk *	*Accipiter striatus*
Cooper's Hawk	*Accipiter cooperii*
Northern Goshawk	*Accipiter gentilis*
Red-tailed Hawk *	*Buteo jamaicensis*
Golden Eagle *	*Aquila chrysaetos*
Great Horned Owl *	*Bubo virginianus*
Northern Pygmy-Owl	*Glaucidium gnoma*
Barred Owl	*Strix varia*
Belted Kingfisher	*Megaceryle alcyon*
Lewis's Woodpecker *	*Melanerpes lewis*
Red-naped Sapsucker *	*Sphyrapicus nuchalis*
Red-breasted Sapsucker	*Sphyrapicus ruber*
Downy Woodpecker	*Picoides pubescens*
Hairy Woodpecker	*Picoides villosus*
American Three-toed Woodpecker	*Picoides dorsalis*
Northern Flicker	*Colaptes auratus*
Pileated Woodpecker	*Dryocopus pileatus*

Table 4 (continued). All species recorded in the three large North Coast and Cascades Network parks during the 2018 field season, including the pre-season training session. Asterisks indicate species that were detected only at times other than during point counts.

Common Name	Scientific Name
American Kestrel	*Falco sparverius*
Merlin	*Falco columbarius*
Olive-sided Flycatcher	*Contopus cooperi*
Western Wood-Pewee	*Contopus sordidulus*
Willow Flycatcher	*Empidonax traillii*
Hammond's Flycatcher	*Empidonax hammondii*
Dusky Flycatcher	*Empidonax oberholseri*
Pacific-slope Flycatcher	*Empidonax difficilis*
Say's Phoebe *	*Sayornis saya*
Western Kingbird *	*Tyrannus verticalis*
Hutton’s Vireo	*Vireo huttoni*
Cassin's Vireo	*Vireo cassinii*
Warbling Vireo	*Vireo gilvus*
Red-eyed Vireo	*Vireo olivaceus*
Gray Jay	*Perisoreus canadensis*
Steller’s Jay	*Cyanocitta stelleri*
Clark’s Nutcracker	*Nucifraga columbiana*
American Crow	*Corvus brachyrhynchos*
Common Raven	*Corvus corax*
Horned Lark	*Eremophila alpestris*
Tree Swallow	*Tachycineta bicolor*
Violet-green Swallow	*Tachycineta thalassina*
Northern Rough-winged Swallow *	*Stelgidopteryx serripennis*
Cliff Swallow *	*Petrochelidon pyrrhonota*
Barn Swallow	*Hirundo rustica*
Black-capped Chickadee *	*Poecile atricapillus*
Mountain Chickadee	*Poecile gambeli*
Chestnut-backed Chickadee	*Poecile rufescens*

Table 4 (continued). All species recorded in the three large North Coast and Cascades Network parks during the 2018 field season, including the pre-season training session. Asterisks indicate species that were detected only at times other than during point counts.

Common Name	Scientific Name
Bushtit *	*Psaltriparus minimus*
Red-breasted Nuthatch	*Sitta canadensis*
Brown Creeper	*Certhia americana*
Rock Wren	*Salpinctes obsoletus*
House Wren	*Troglodytes aedon*
Pacific Wren	*Troglodytes pacificus*
American Dipper	*Cinclus mexicanus*
Golden-crowned Kinglet	*Regulus satrapa*
Ruby-crowned Kinglet	*Regulus calendula*
Western Bluebird	*Sialia mexicana*
Mountain Bluebird	*Sialia currucoides*
Townsend's Solitaire	*Myadestes townsendi*
Veery	*Catharus fuscescens*
Swainson's Thrush	*Catharus ustulatus*
Hermit Thrush	*Catharus guttatus*
American Robin	*Turdus migratorius*
Varied Thrush	*Ixoreus naevius*
Gray Catbird	*Dumetella carolinensis*
European Starling *	*Sturnus vulgaris*
Cedar Waxwing	*Bombycilla cedrorum*
House Sparrow *	*Passer domesticus*
American Pipit	*Anthus rubescens*
Gray-crowned Rosy-Finch	*Leucosticte tephrocotis*
Pine Grosbeak	*Pinicola enucleator*
House Finch *	*Haemorhous mexicanus*
Purple Finch	*Haemorhous purpureus*
Cassin's Finch	*Haemorhous cassinii*
Red Crossbill	*Loxia curvirostra*

Table 4 (continued). All species recorded in the three large North Coast and Cascades Network parks during the 2018 field season, including the pre-season training session. Asterisks indicate species that were detected only at times other than during point counts.

Common Name	Scientific Name
Pine Siskin	*Spinus pinus*
American Goldfinch *	*Spinus tristis*
Evening Grosbeak	*Coccothraustes vespertinus*
Orange-crowned Warbler	*Oreothlypis celata*
Nashville Warbler	*Oreothlypis ruficapilla*
MacGillivray's Warbler	*Geothlypis tolmiei*
Common Yellowthroat *	*Geothlypis trichas*
American Redstart	*Setophaga ruticilla*
Yellow Warbler	*Setophaga petechia*
Yellow-rumped Warbler	*Setophaga coronata*
Black-throated Gray Warbler	*Setophaga nigrescens*
Townsend's Warbler	*Setophaga townsendi*
Townsend's x Hermit Warbler hybrid	*Setophaga townsendi x occidentalis*
Hermit Warbler	*Setophaga occidentalis*
Wilson's Warbler	*Cardellina pusilla*
Spotted Towhee	*Pipilo maculatus*
Chipping Sparrow	*Spizella passerina*
Lark Sparrow *	*Chondestes grammacus*
Savannah Sparrow	*Passerculus sandwichensis*
Fox Sparrow	*Passerella iliaca*
Song Sparrow	*Melospiza melodia*
Lincoln's Sparrow	*Melospiza lincolnii*
White-crowned Sparrow	*Zonotrichia leucophrys*
Golden-crowned Sparrow *	*Zonotrichia atricapilla*
Dark-eyed Junco	*Junco hyemalis*
Western Tanager	*Piranga ludoviciana*
Black-headed Grosbeak	*Pheucticus melanocephalus*
Lazuli Bunting	*Passerina amoena*

Table 4 (continued). All species recorded in the three large North Coast and Cascades Network parks during the 2018 field season, including the pre-season training session. Asterisks indicate species that were detected only at times other than during point counts.

Common Name	Scientific Name
Red-winged Blackbird *	*Agelaius phoeniceus*
Yellow-headed Blackbird *	*Xanthocephalus xanthocephalus*
Brown-headed Cowbird	*Molothrus ater*
Bullock's Oriole *	*Icterus bullockii*

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 2018.

	Number of transects with detections				Number of individual detections			
Species	**MORA**	**NOCA**	**OLYM**	**ALL**	**MORA**	**NOCA**	**OLYM**	**ALL**
Canada Goose	1	–	–	1	3	–	–	3
Mallard	1	1	–	2	1	1	–	2
Common Merganser	–	–	1	1	–	–	1	1
Sooty Grouse	1	4	8	13	4	8	13	25
Band-tailed Pigeon	1	1	7	9	4	2	20	26
Common Nighthawk	1	1	–	2	1	1	–	2
Black Swift	–	1	–	1	–	2	–	2
Vaux's Swift	4	5	2	11	23	24	21	68
Rufous Hummingbird	2	10	7	19	7	18	16	41
Calliope Hummingbird	–	1	–	1	–	1	–	1
Spotted Sandpiper	2	2	1	5	5	4	3	12
Marbled Murrelet	–	–	1	1	–	–	2	2
Osprey	2	–	–	2	3	–	–	3
Cooper's Hawk	–	–	1	1	–	–	1	1
Northern Goshawk	–	1	1	2	–	1	1	2
Northern Pygmy-Owl	–	–	1	1	–	–	1	1
Barred Owl	1	–	–	1	1	–	–	1
Belted Kingfisher	–	–	2	2	–	–	3	3

*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 2018.

	Number of transects with detections				Number of individual detections			
Species	**MORA**	**NOCA**	**OLYM**	**ALL**	**MORA**	**NOCA**	**OLYM**	**ALL**
Red-breasted Sapsucker	1	6	–	7	1	29	–	30
Downy Woodpecker	–	1	1	2	–	1	1	2
Hairy Woodpecker	2	6	8	16	11	11	28	50
American Three-toed Woodpecker	–	1	–	1	–	1	–	1
Northern Flicker	2	4	9	15	7	6	26	39
Pileated Woodpecker	1	2	2	5	2	2	4	8
Olive-sided Flycatcher	1	9	6	16	8	24	23	55
Western Wood-Pewee	–	5	2	7	–	34	2	36
Hammond's Flycatcher	5	9	9	23	29	125	38	192
Dusky Flycatcher	–	3	–	3	–	6	–	6
Pacific-slope Flycatcher	7	3	10	20	47	40	189	276
Hutton’s Vireo	–	–	1	1	–	–	1	1
Cassin's Vireo	–	5	–	5	–	21	–	21
Warbling Vireo	4	7	4	15	7	63	25	95
Red-eyed Vireo	–	2	–	2	–	19	–	19
Gray Jay	4	2	5	11	9	14	15	38
Steller’s Jay	7	3	5	15	11	6	19	36
Clark’s Nutcracker	1	1	–	2	4	5	–	9

*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 2018.

	Number of transects with detections				Number of individual detections			
Species	**MORA**	**NOCA**	**OLYM**	**ALL**	**MORA**	**NOCA**	**OLYM**	**ALL**
American Crow	–	–	4	4	–	–	10	10
Common Raven	4	6	3	13	8	10	7	25
Tree Swallow	–	1	1	2	–	2	1	3
Violet-green Swallow	1	1	–	2	4	2	–	6
Barn Swallow	1	–	–	1	1	–	–	1
Mountain Chickadee	2	3	–	5	4	31	–	35
Chestnut-backed Chickadee	9	10	10	29	91	112	75	278
Red-breasted Nuthatch	10	9	9	28	80	74	84	238
Brown Creeper	8	10	11	29	56	60	40	156
Rock Wren	1	–	–	1	1	–	–	1
House Wren	–	–	2	2	–	–	3	3
Pacific Wren	10	9	11	30	179	113	156	448
American Dipper	1	–	1	2	1	–	1	2
Golden-crowned Kinglet	9	10	12	31	100	43	90	233
Ruby-crowned Kinglet	–	2	2	4	–	18	2	20
Mountain Bluebird	–	1	–	1	–	1	–	1
Townsend’s Solitaire	1	4	3	8	2	12	6	20
Veery	–	1	–	1	–	1	–	1

*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 2018.

	Number of transects with detections				Number of individual detections			
Species	**MORA**	**NOCA**	**OLYM**	**ALL**	**MORA**	**NOCA**	**OLYM**	**ALL**
Swainson's Thrush	5	7	4	16	22	217	49	288
Hermit Thrush	9	7	8	24	81	157	74	312
American Robin	7	11	12	30	65	78	105	248
Varied Thrush	10	11	12	33	160	195	132	487
Gray Catbird	–	1	–	1	–	1	–	1
Cedar Waxwing	–	3	1	4	–	13	1	14
American Pipit	2	2	1	5	22	6	2	30
Gray-crowned Rosy-Finch	1	–	–	1	1	–	–	1
Pine Grosbeak	–	2	3	5	–	2	3	5
Purple Finch	–	1	–	1	–	4	–	4
Cassin's Finch	–	3	–	3	–	25	–	25
Red Crossbill	1	4	6	11	1	5	90	96
Pine Siskin	8	8	8	24	186	102	98	386
Evening Grosbeak	9	9	3	21	78	30	6	114
Orange-crowned Warbler	–	1	2	3	–	1	4	5
Nashville Warbler	–	2	–	2	–	10	–	10
MacGillivray's Warbler	1	9	3	13	1	63	5	69
American Redstart	–	2	–	2	–	7	–	7

*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 2018.

	Number of transects with detections				Number of individual detections			
Species	**MORA**	**NOCA**	**OLYM**	**ALL**	**MORA**	**NOCA**	**OLYM**	**ALL**
Yellow Warbler	–	5	3	8	–	39	6	45
Yellow-rumped Warbler	6	12	4	22	21	178	13	212
Black-throated Gray Warbler	1	2	3	6	1	21	35	57
Townsend's/Hermit Warbler*	5	7	5	19	68	69	56	193
Wilson's Warbler	3	3	4	10	6	21	37	64
Spotted Towhee	–	1	1	2	–	1	1	2
Chipping Sparrow	4	7	–	11	18	59	–	77
Savannah Sparrow	2	–	–	2	3	–	–	3
Fox Sparrow	1	3	–	4	3	21	–	24
Song Sparrow	1	4	1	6	2	19	1	22
White-crowned Sparrow	–	1	2	3	–	3	10	13
Dark-eyed Junco	10	12	12	34	113	170	209	492
Western Tanager	3	11	4	18	13	115	35	163
Black-headed Grosbeak	2	6	1	9	2	33	1	36
Brown-headed Cowbird	–	1	–	1	–	3	–	3
All species pooled	–	–	–	–	1,582	2,620	1,901	6,103
Detections per point (all species pooled)	–	–	–	–	8.74	11.91	9.9	10.29

*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.

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 62 bird species and one hybrid during point counts at MORA, 80 species during point counts at NOCA, and 66 species during point counts at OLYM (Table 6). Considering data from both panels, the five most frequently detected species were: dark-eyed junco (923 detections), pine siskin (862 detections), Pacific wren (860 detections), varied thrush (843 detections), and hermit thrush (552 detections).

We combined detections of Townsend's warbler, hermit warbler, Townsend's/hermit warbler hybrids, and unidentified Townsend's/hermit warblers in Tables 5 and 6, and Figure 6i. 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.

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 2018.

	Number of transects with detections				Number of individual detections			
Species	**MORA**	**NOCA**	**OLYM**	**ALL**	**MORA**	**NOCA**	**OLYM**	**ALL**
Canada Goose	1	–	–	1	3	–	–	3
Mallard	1	1	–	2	1	1	–	2
Common Merganser	–	1	3	4	–	5	3	8
Ruffed Grouse	1	–	–	1	1	–	–	1
White-tailed Ptarmigan	1	–	–	1	1	–	–	1
Sooty Grouse	3	11	13	27	6	20	37	63
Band-tailed Pigeon	3	1	11	15	7	2	29	38
Mourning Dove	–	1	–	1	–	1	–	1
Common Nighthawk	1	3	1	5	1	3	1	5
Black Swift	–	6	–	6	–	29	–	29
Vaux's Swift	7	8	4	19	46	39	28	113
Rufous Hummingbird	4	18	13	35	10	40	26	76
Calliope Hummingbird	–	2	–	2	–	9	–	9
Spotted Sandpiper	2	4	2	8	5	8	4	17
Marbled Murrelet	–	–	1	1	–	–	2	2
Common Loon	–	2	–	2	–	5	–	5
Osprey	3	–	–	3	4	–	–	4
Cooper's Hawk	–	–	1	1	–	–	1	1

*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 2018.

	Number of transects with detections				Number of individual detections			
Species	**MORA**	**NOCA**	**OLYM**	**ALL**	**MORA**	**NOCA**	**OLYM**	**ALL**
Northern Goshawk	–	1	1	2	–	1	1	2
Northern Pygmy-Owl	–	–	1	1	–	–	1	1
Barred Owl	2	–	–	2	2	–	–	2
Belted Kingfisher	–	–	2	2	–	–	3	3
Red-breasted Sapsucker	4	11	3	18	4	46	6	56
Downy Woodpecker	–	1	1	2	–	1	1	2
Hairy Woodpecker	7	11	14	32	18	25	50	93
American Three-toed Woodpecker	–	1	1	2	–	1	1	2
Northern Flicker	5	7	19	31	16	9	50	75
Pileated Woodpecker	4	6	6	16	5	8	16	29
American Kestrel	–	–	2	2	–	–	4	4
Merlin	–	–	1	1	–	–	3	3
Olive-sided Flycatcher	4	17	11	32	20	57	40	117
Western Wood-Pewee	–	11	4	15	–	78	5	83
Willow Flycatcher	–	4	–	4	–	20	–	20
Hammond's Flycatcher	10	19	17	46	43	257	91	391
Dusky Flycatcher	–	5	–	5	–	11	–	11
Pacific-slope Flycatcher	13	5	20	38	101	50	381	532

*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 2018.

	Number of transects with detections				Number of individual detections			
Species	**MORA**	**NOCA**	**OLYM**	**ALL**	**MORA**	**NOCA**	**OLYM**	**ALL**
Hutton's Vireo	–	–	2	2	–	–	4	4
Cassin's Vireo	–	13	–	13	–	66	–	66
Warbling Vireo	6	14	9	29	10	130	54	194
Red-eyed Vireo	–	5	–	5	–	24	–	24
Gray Jay	10	4	11	25	28	18	27	73
Steller's Jay	13	6	9	28	24	15	32	71
Clark's Nutcracker	3	3	–	6	14	18	–	32
American Crow	–	–	4	4	–	–	10	10
Common Raven	8	10	7	25	16	14	13	43
Horned Lark	2	–	–	2	2	–	–	2
Tree Swallow	–	1	1	2	–	2	1	3
Violet-green Swallow	1	2	–	3	4	6	–	10
Barn Swallow	1	1	–	2	1	1	–	2
Mountain Chickadee	4	5	–	9	14	38	–	52
Chestnut-backed Chickadee	17	19	21	57	136	228	159	523
Red-breasted Nuthatch	20	18	18	56	153	164	146	463
Brown Creeper	17	19	20	56	98	102	71	271
Rock Wren	1	–	–	1	1	–	–	1

*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 2018.

	Number of transects with detections				Number of individual detections			
Species	**MORA**	**NOCA**	**OLYM**	**ALL**	**MORA**	**NOCA**	**OLYM**	**ALL**
House Wren	–	–	4	4	–	–	6	6
Pacific Wren	19	19	22	60	341	208	311	860
American Dipper	1	–	1	2	1	–	1	2
Golden-crowned Kinglet	17	21	24	62	163	145	211	519
Ruby-crowned Kinglet	–	3	4	7	–	19	7	26
Western Bluebird	–	–	1	1	–	–	1	1
Mountain Bluebird	–	1	1	2	–	1	1	2
Townsend’s Solitaire	3	9	6	18	7	22	10	39
Veery	–	1	–	1	–	1	–	1
Swainson’s Thrush	9	18	7	34	32	375	62	469
Hermit Thrush	19	15	14	48	170	250	132	552
American Robin	16	22	23	61	105	160	194	459
Varied Thrush	19	19	22	60	329	274	240	843
Gray Catbird	–	1	–	1	–	1	–	1
Cedar Waxwing	1	5	1	7	1	30	1	32
American Pipit	3	3	1	7	37	8	2	47
Gray-crowned Rosy-Finch	2	1	–	3	4	1	–	5
Pine Grosbeak	2	4	6	12	3	5	8	16

*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 2018.

	Number of transects with detections				Number of individual detections			
Species	**MORA**	**NOCA**	**OLYM**	**ALL**	**MORA**	**NOCA**	**OLYM**	**ALL**
Purple Finch	–	3	–	3	–	8	–	8
Cassin's Finch	3	6	–	9	7	47	–	54
Red Crossbill	3	5	10	18	12	8	134	154
Pine Siskin	17	15	15	47	448	209	205	862
Evening Grosbeak	16	15	8	39	187	57	17	261
Orange-crowned Warbler	–	4	4	8	–	4	7	11
Nashville Warbler	–	8	–	8	–	45	–	45
MacGillivray's Warbler	2	17	5	24	3	136	14	153
American Redstart	–	4	–	4	–	9	–	9
Yellow Warbler	–	10	4	14	–	116	7	123
Yellow-rumped Warbler	10	24	9	43	51	311	39	401
Black-throated Gray Warbler	1	5	6	12	1	70	41	112
Townsend's/Hermit Warbler*	10	17	12	42	90	134	73	297
Wilson's Warbler	6	5	8	19	14	25	54	93
Spotted Towhee	1	4	1	6	1	14	1	16
Chipping Sparrow	8	12	1	21	51	78	2	131
Savannah Sparrow	3	1	–	4	6	3	–	9
Fox Sparrow	4	5	–	9	16	30	–	46

*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 2018.

	Number of transects with detections				Number of individual detections			
Species	**MORA**	**NOCA**	**OLYM**	**ALL**	**MORA**	**NOCA**	**OLYM**	**ALL**
Song Sparrow	1	9	1	11	2	28	1	31
Lincoln's Sparrow	–	1	–	1	–	3	–	3
White-crowned Sparrow	–	3	4	7	–	7	14	21
Dark-eyed Junco	20	23	24	67	222	322	379	923
Western Tanager	7	22	7	36	18	248	63	329
Black-headed Grosbeak	2	10	2	14	2	62	2	66
Lazuli Bunting	–	3	–	3	–	15	–	15
Brown-headed Cowbird	–	3	–	3	–	5	–	5
All species pooled	–	–	–	–	3,119	5,046	3,541	11,706
Detections per point (all species pooled)	–	–	–	–	9.15	12.31	9.7	10.49
Number of species detected during point counts	–	–	–	–	61	80	66	98

*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.

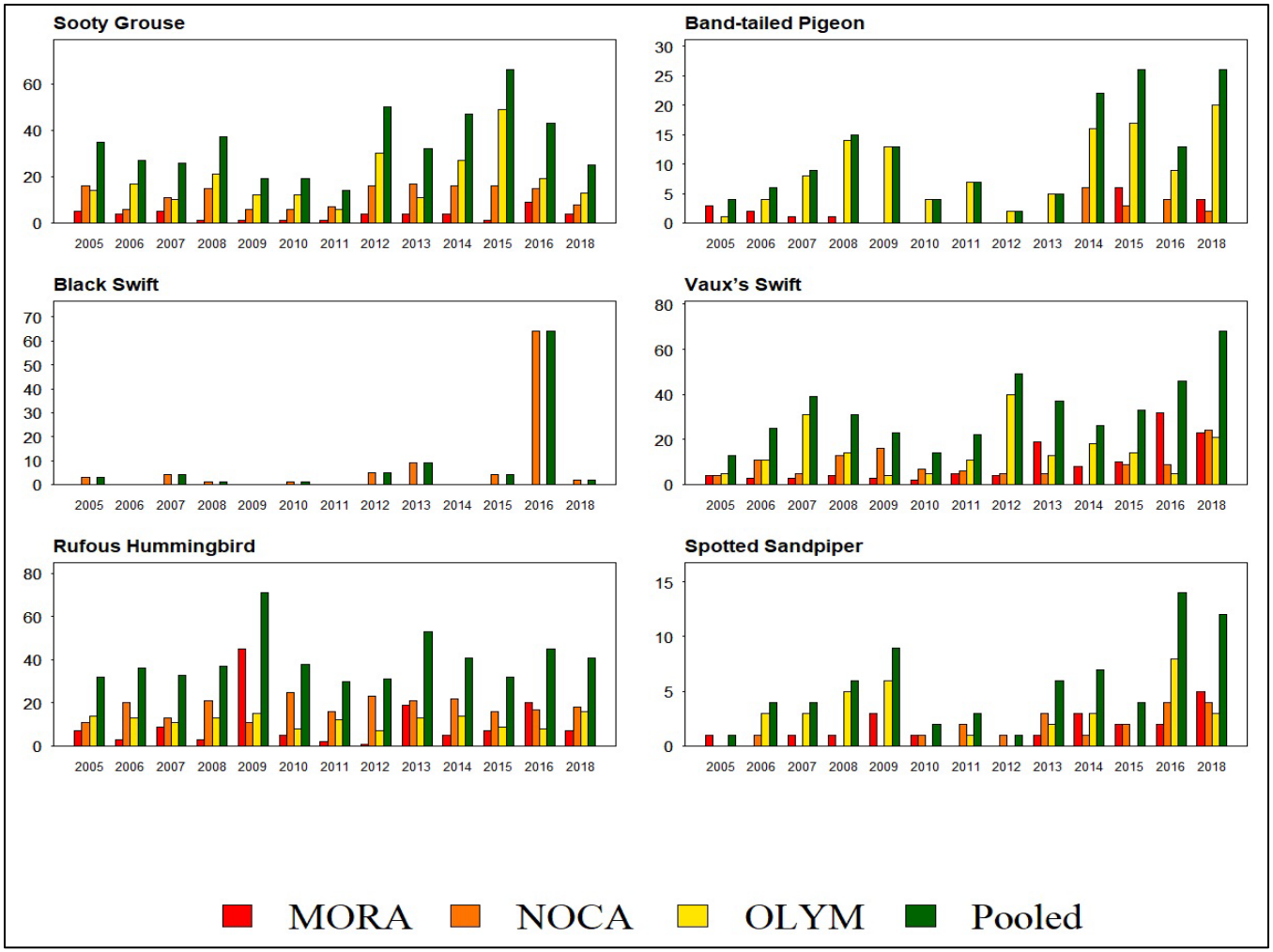

Figure 6a. Number of times each species was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2018 field seasons. The figure includes all species for which we amassed at least 50 point count detections on annual-panel transects over the 13 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 our periodic trend analyses.

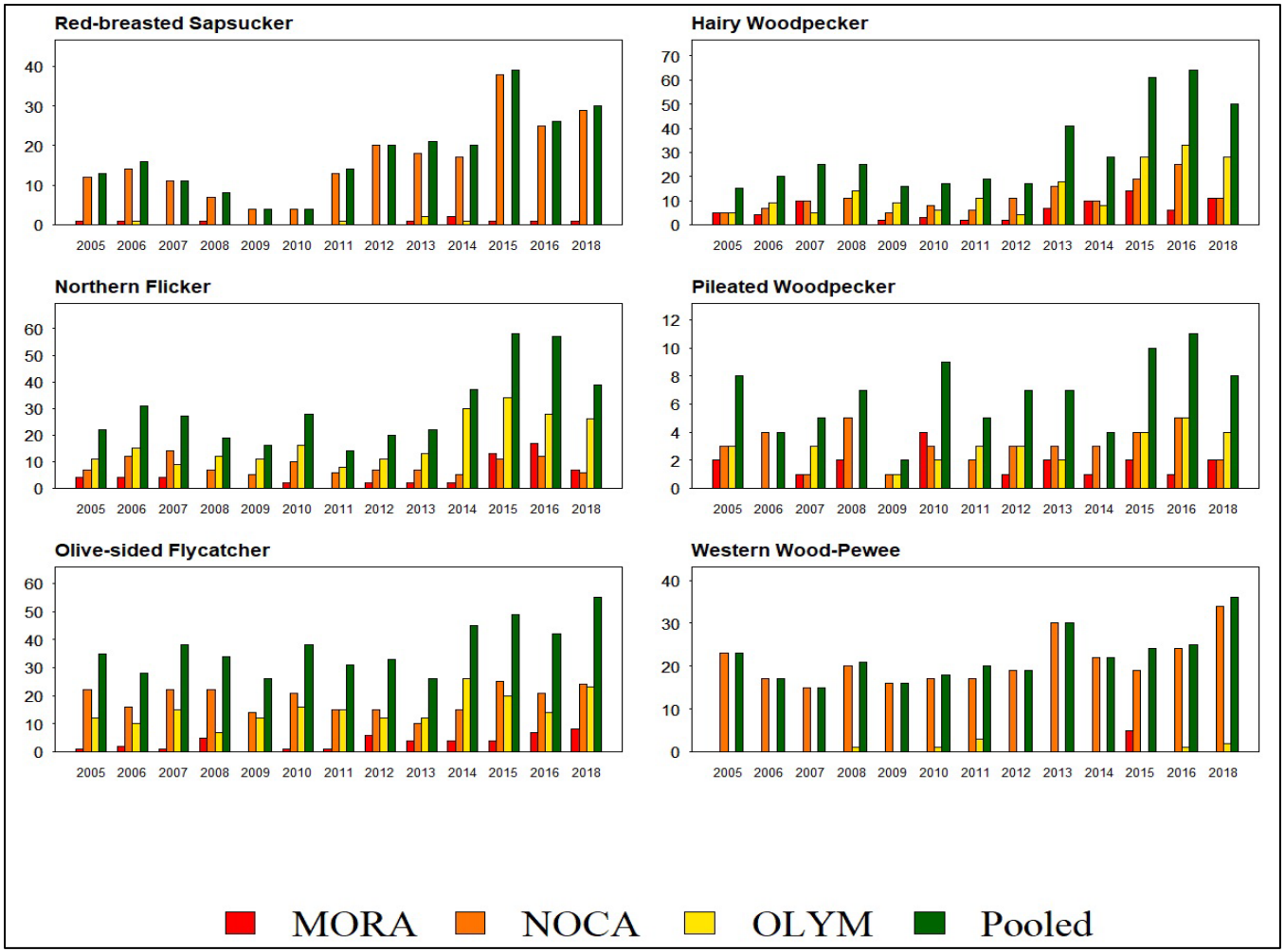

Figure 6b. Number of times each species was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2018 field seasons. The figure includes all species for which we amassed at least 50 point count detections on annual-panel transects over the 13 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 our periodic trend analyses.

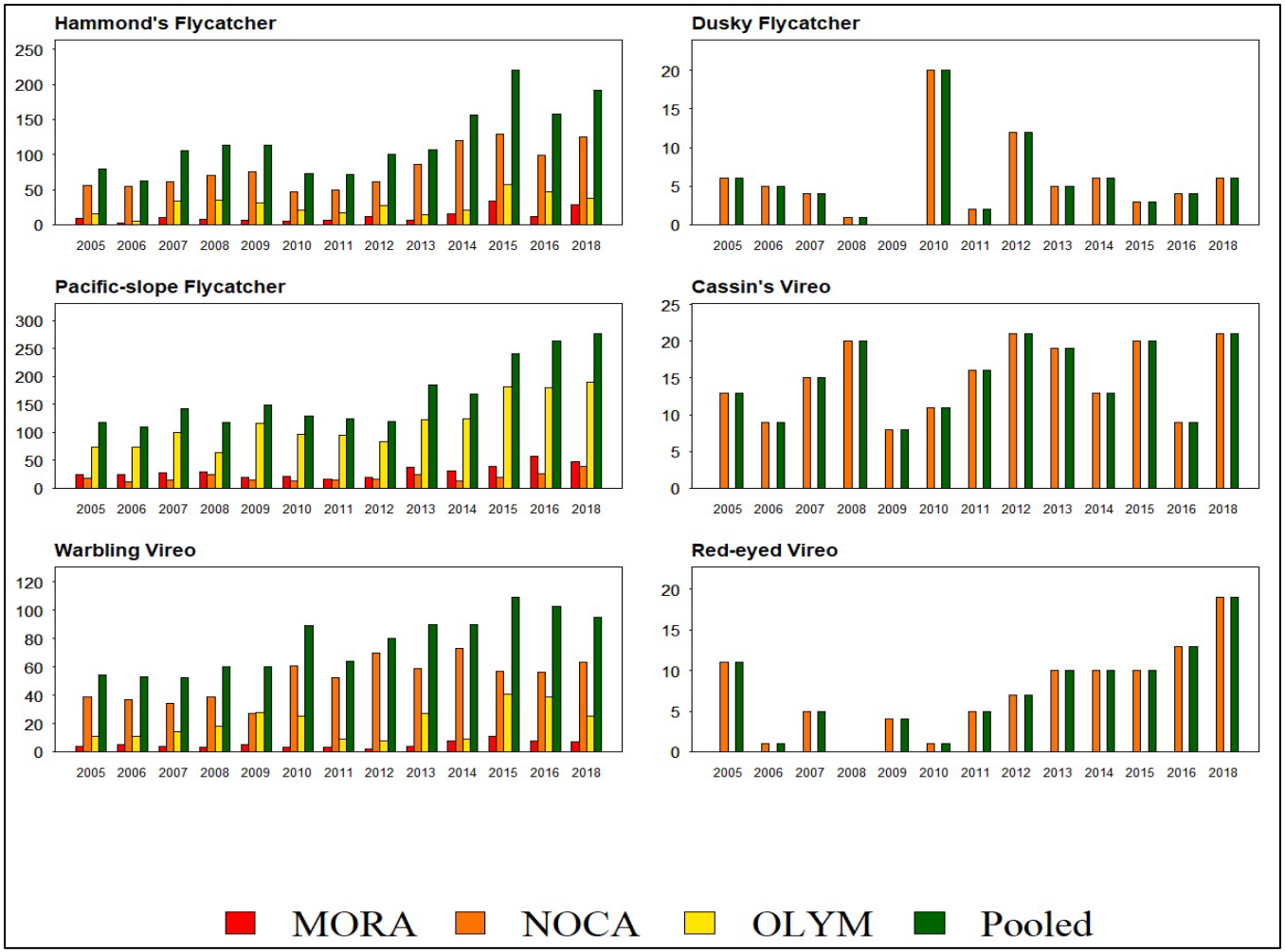

Figure 6c. Number of times each species was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2018 field seasons. The figure includes all species for which we amassed at least 50 point count detections on annual-panel transects over the 13 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 our periodic trend analyses.

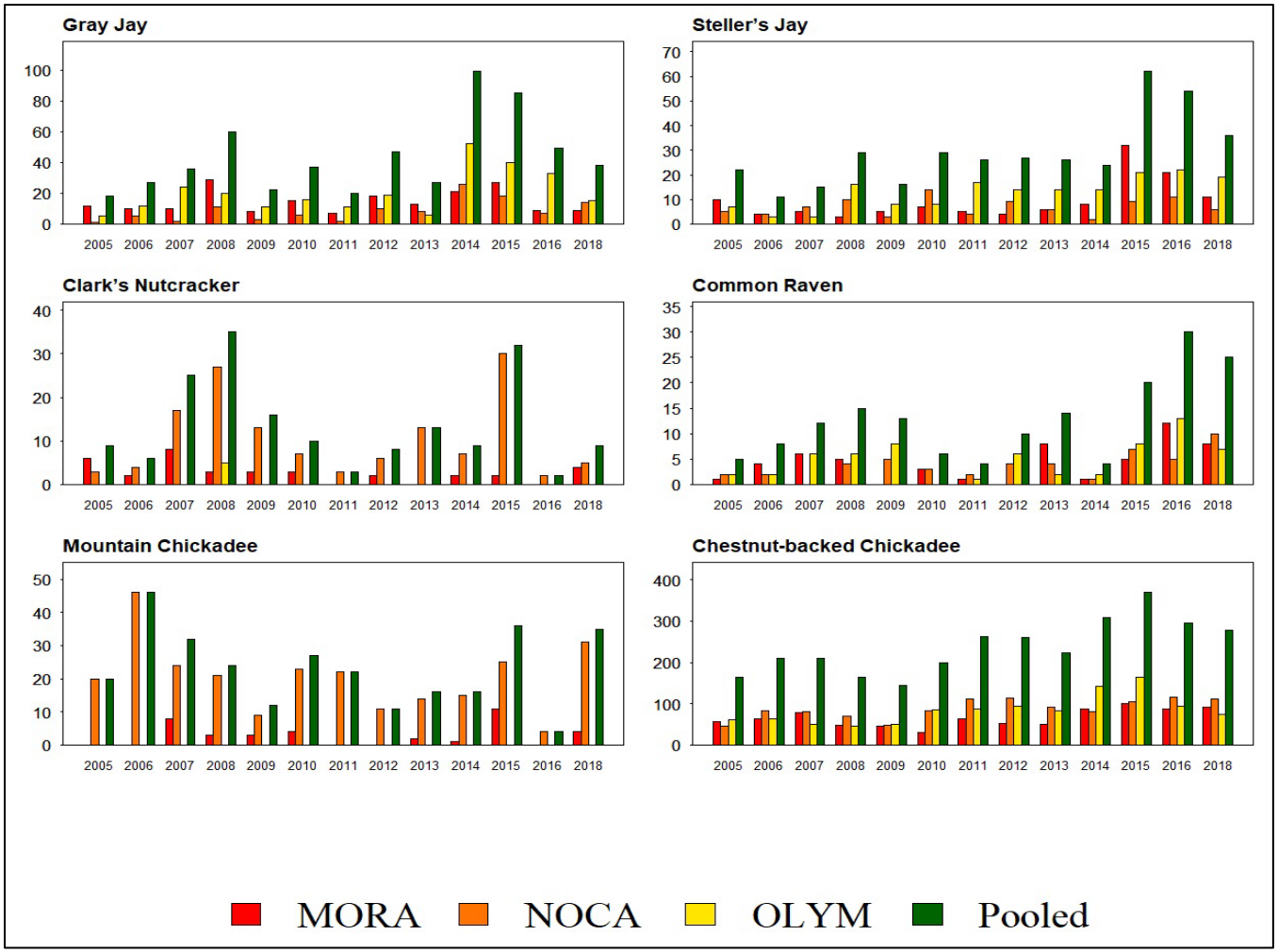

Figure 6d. Number of times each species was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2018 field seasons. The figure includes all species for which we amassed at least 50 point count detections on annual-panel transects over the 13 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 our periodic trend analyses.

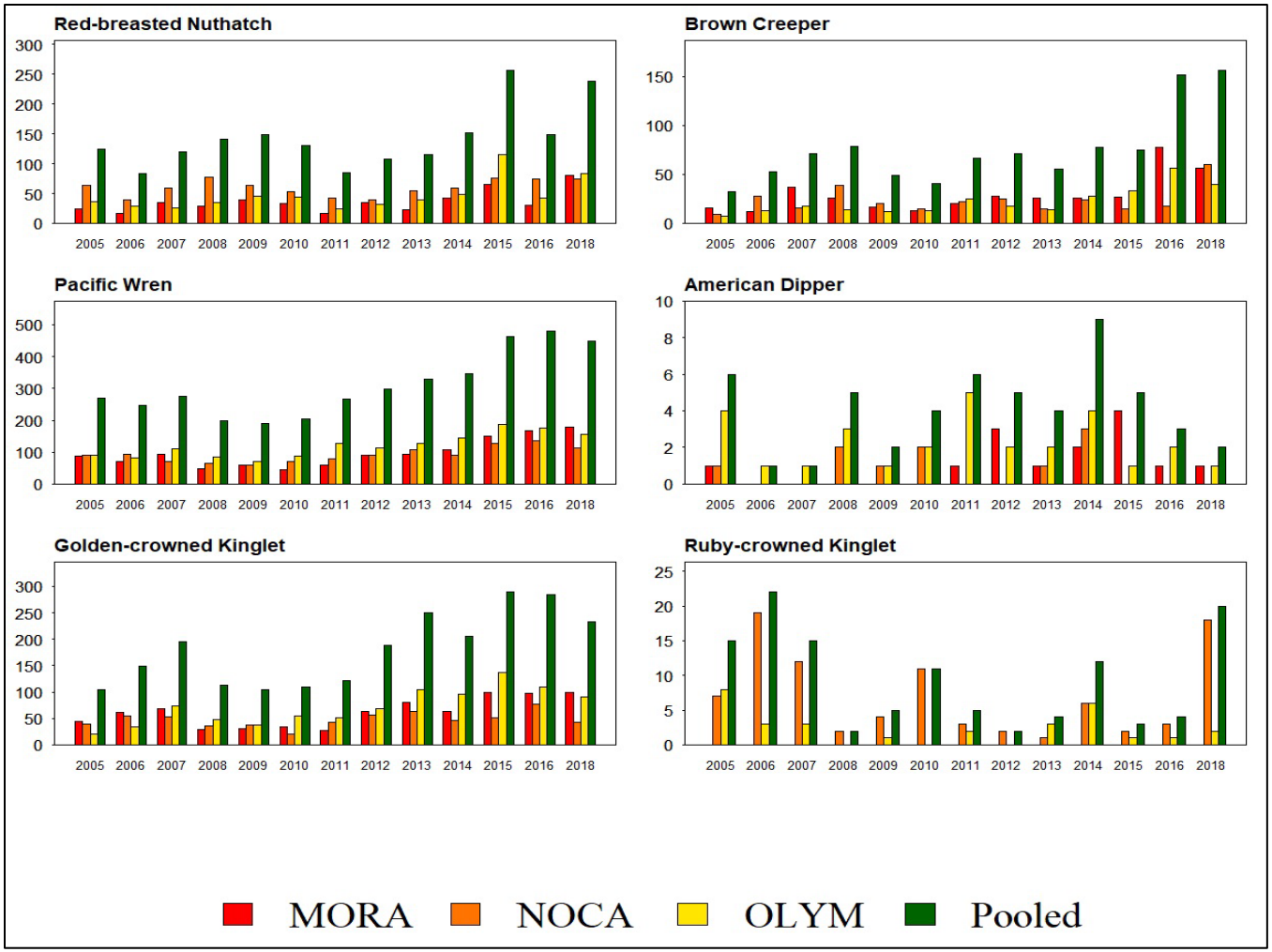

Figure 6e. Number of times each species was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2018 field seasons. The figure includes all species for which we amassed at least 50 point count detections on annual-panel transects over the 13 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 our periodic trend analyses.

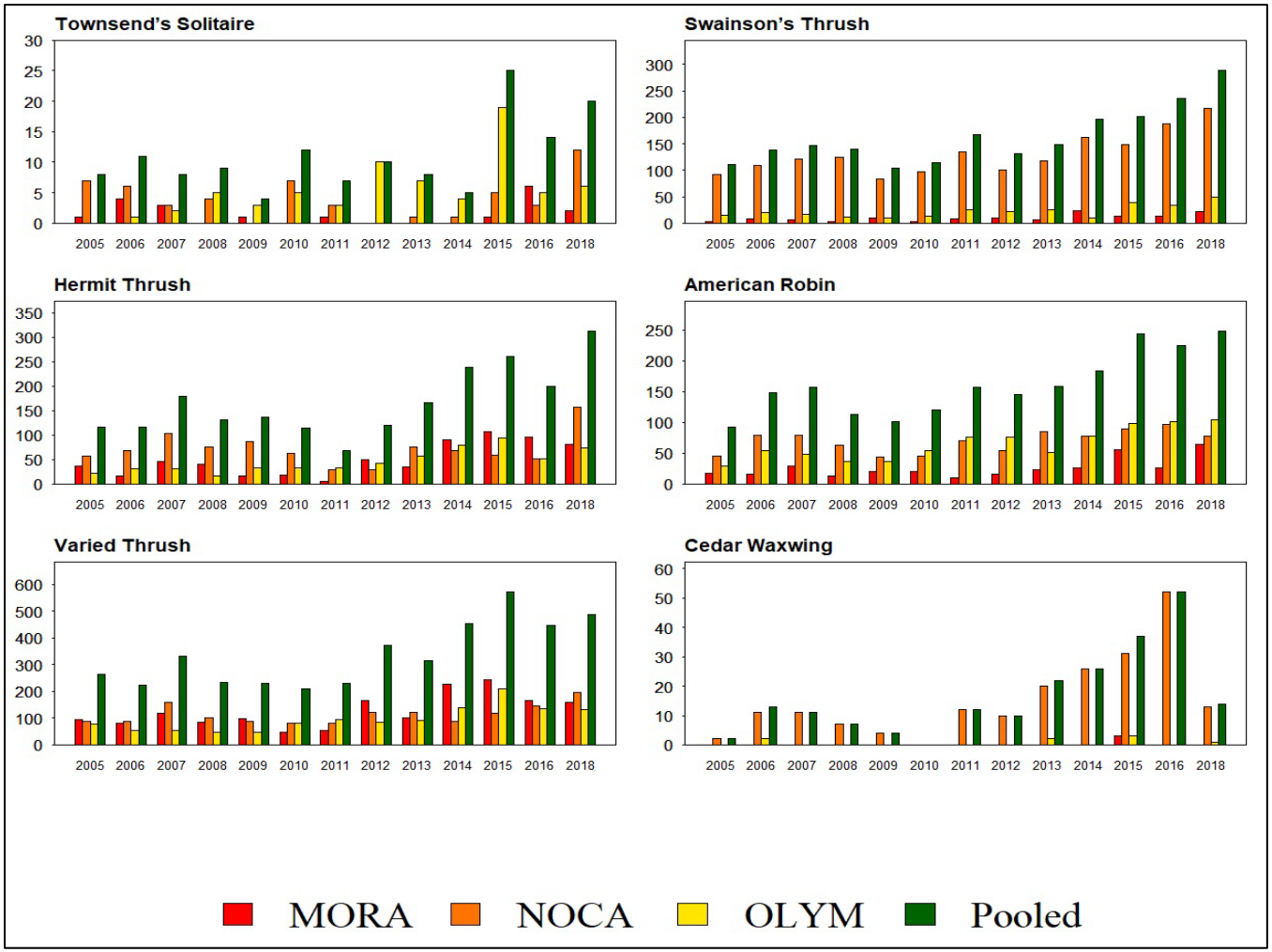

Figure 6f. Number of times each species was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2018 field seasons. The figure includes all species for which we amassed at least 50 point count detections on annual-panel transects over the 13 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 our periodic trend analyses.

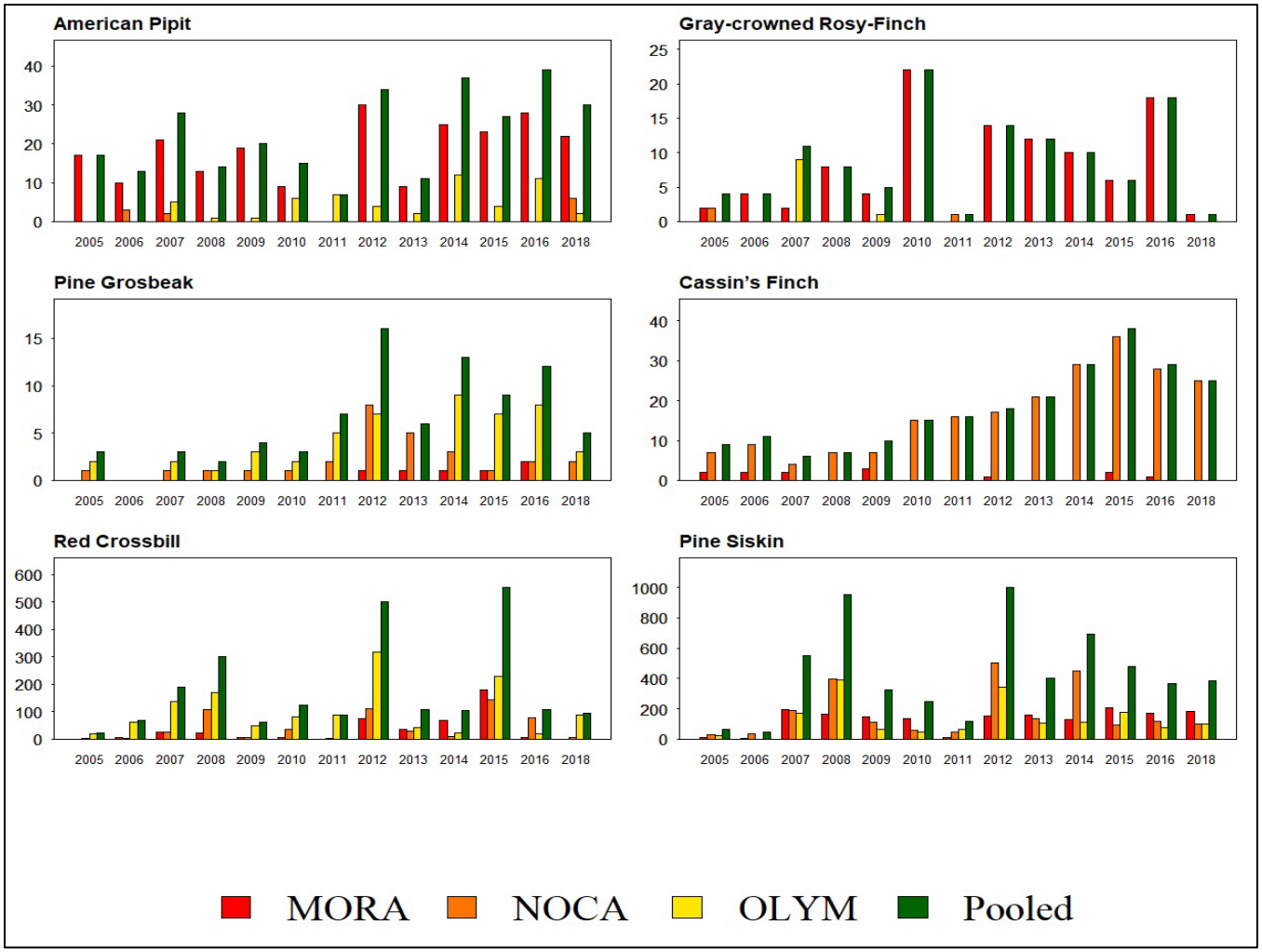

Figure 6g. Number of times each species was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2018 field seasons. The figure includes all species for which we amassed at least 50 point count detections on annual-panel transects over the 13 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 our periodic trend analyses.

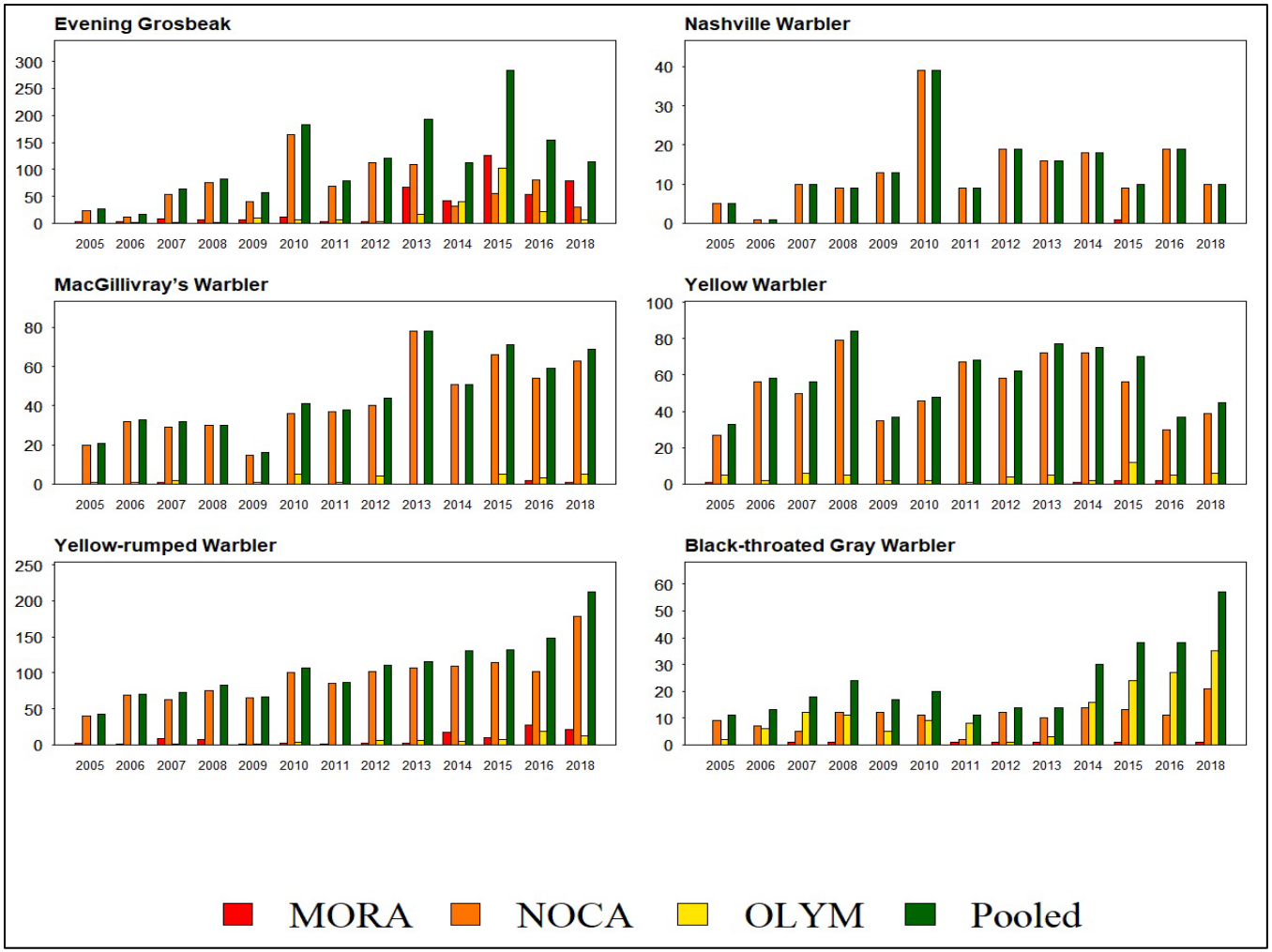

Figure 6h. Number of times each species was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2018 field seasons. The figure includes all species for which we amassed at least 50 point count detections on annual-panel transects over the 13 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 our periodic trend analyses.

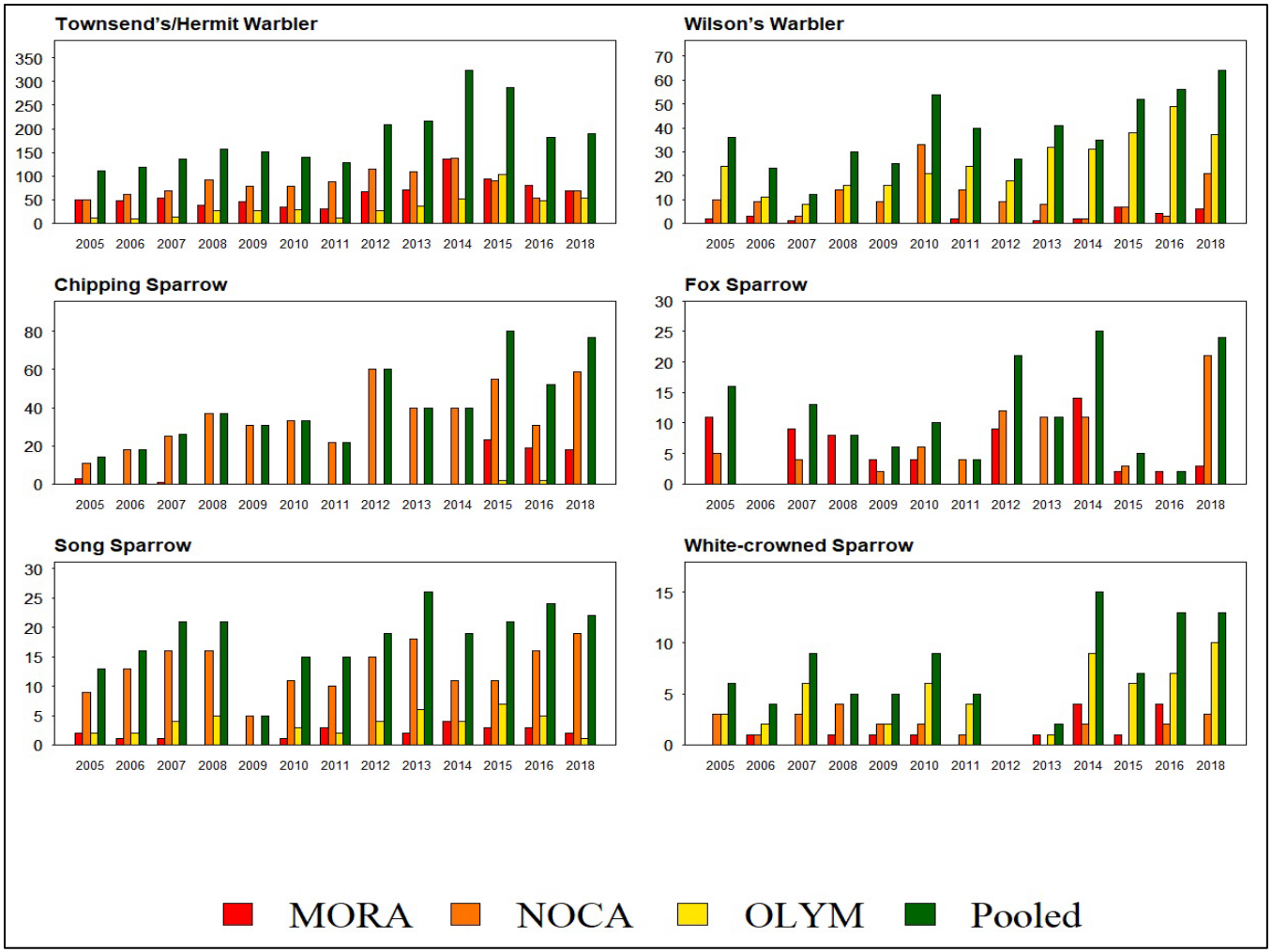

Figure 6i. Number of times each species was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2018 field seasons. The figure includes all species for which we amassed at least 50 point count detections on annual-panel transects over the 13 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 our periodic trend analyses.

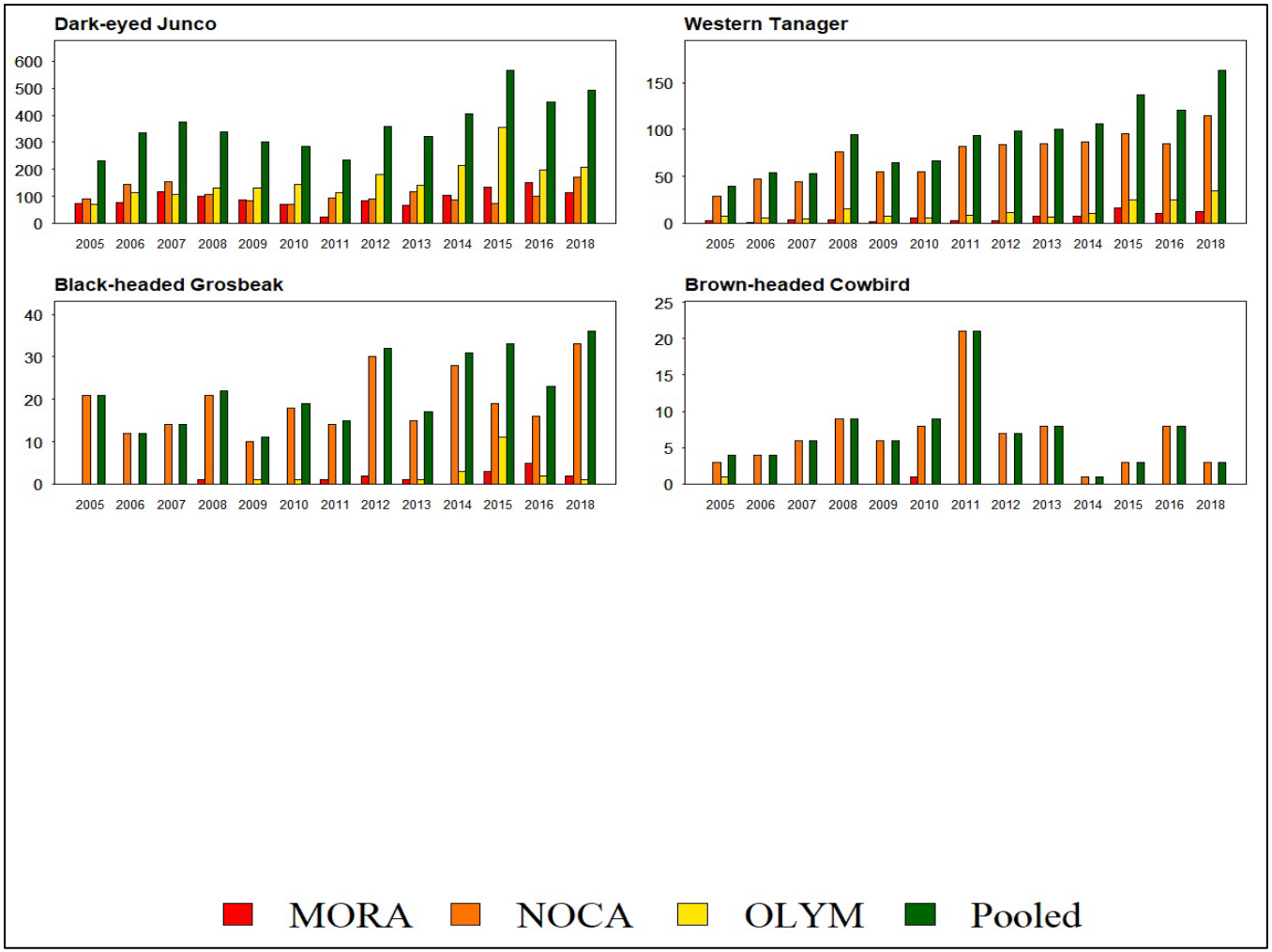

Figure 6j. Number of times each species was detected on annual-panel transects at Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM) National Parks, and all three parks pooled (always presented in that order) during the 2005–2018 field seasons. The figure includes all species for which we amassed at least 50 point count detections on annual-panel transects over the 13 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 our periodic trend analyses.

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

Table 7. For species listed under the Endangered Species Act, number of birds recorded on "Rare Bird Detection Forms" in each park in 2018, excluding individuals that were also detected during point counts.

Species	Mount Rainier	North Cascades	Olympic
Marbled Murrelet	0	0	2

For 58 species (all species for which we amassed at least 50 point count detections over the period 2005–2018), we present the total number of detections of each species on each park's annual panel transects during the 2005–2018 field seasons (Figures 6a-j). 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 1,356 detections of 67 species (Table 8), a detection rate of 25.11 birds per point. The most frequently detected species was American robin (115 detections), followed by house wren (92 detections), European starling (84 detections), Pacific-slope flycatcher (77 detections), and Swainson's thrush (71 detections).

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 2018.

Species	Number of points with detections	Number of individual detections
Canada Goose	12	41
Gadwall	1	1
Mallard	1	3
California Quail	8	13
Eurasian Collared-dove	5	5
Anna's Hummingbird	4	4
Rufous Hummingbird	14	16
Killdeer	1	1
Glaucous-winged Gull	1	2
Pacific Loon	2	3

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 2018.

Species	Number of points with detections	Number of individual detections
Pelagic Cormorant	3	8
Turkey Vulture	1	1
Osprey	1	1
Bald Eagle	5	8
Red-breasted Sapsucker	1	1
Hairy Woodpecker	5	6
Northern Flicker	2	2
Pileated Woodpecker	2	2
Olive-sided Flycatcher	13	15
Western Wood-Pewee	4	4
Willow Flycatcher	5	5
Pacific-slope Flycatcher	33	77
Hutton’s Vireo	5	6
Cassin's Vireo	4	4
Warbling Vireo	10	13
American Crow	14	19
Common Raven	8	10
Violet-green Swallow	1	2
Northern Rough-winged Swallow	3	5
Barn Swallow	5	6
Chestnut-backed Chickadee	18	30
Bushtit	2	11
Red-breasted Nuthatch	20	27
Brown Creeper	8	9
House Wren	41	92
Pacific Wren	5	5
Bewick’s Wren	7	10
Golden-crowned Kinglet	9	9

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 2018.

Species	Number of points with detections	Number of individual detections
Swainson's Thrush	31	71
American Robin	47	115
Varied Thrush	1	1
European Starling	11	84
Cedar Waxwing	6	9
House Finch	22	48
Purple Finch	12	16
Pine Siskin	3	4
American Goldfinch	34	60
Orange-crowned Warbler	34	57
Common Yellowthroat	12	24
Yellow Warbler	5	7
Yellow-rumped Warbler	8	12
Black-throated Gray Warbler	8	11
Townsend's Warbler	10	23
Wilson's Warbler	11	11
Spotted Towhee	32	52
Chipping Sparrow	3	8
Vesper Sparrow	1	1
Savannah Sparrow	17	55
Fox Sparrow	1	1
Song Sparrow	21	31
White-crowned Sparrow	31	62
Dark-eyed Junco	22	27
Western Tanager	11	16
Black-headed Grosbeak	13	19
Lazuli Bunting	1	1
Red-winged Blackbird	1	1
Brown-headed Cowbird	32	52

2018 Bird Counts Compared to Previous Years

The number of bird detections on annual-panel transects increased slightly between 2016 and 2018, but because there were also more point counts conducted in 2017, there was little change in the average number of bird detections per point between the two years. Many species were detected in slightly or moderately greater numbers in the three large parks in 2018 than in previous years, most notably at NOCA. A few of these species include Swainson's thrush, hermit thrush, black-throated gray warbler, and red-eyed vireo. Each of these species had more detections in 2018 than in any of the previous 12 years. Yellow-rumped warbler detections have also substantially increased since the start of the monitoring program in 2005, with an 80 percent increase between 2005 and 2018. After a spike in 2016, brown creeper detections remained high in 2018. While many of these upticks in numbers of birds counted may reflect real population increases in 2018, it should be noted that we conducted more point counts across the large parks than in all previous years (Appendix A), which likely accounts for at least a portion of the increased detections.

In contrast, the number of pine siskin and red crossbill detections remained low in 2018. Gray-crowned rosy-finch detections dropped to only one individual in 2018, the lowest since 2011. We usually do not detect this species in high numbers, but its sharp decline from 18 detections in 2016 is notable.

At SAJH, overall detections increased slightly from 1,330 in 2015 to 1,356 in 2018. Detections of several species increased notably, including house wren, European starling, and house finch. Red crossbill detections decreased sharply, from 96 in 2015 to zero in 2018.

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

Park	Panel	Elevation class	Transect	Number of points surveyed												
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018
MORA	Ann1	Low	4001	10	12	12	12	12	10	11	14	16	16	15	15	15
MORA	Ann1	Low	4005	11	11	11	11	12	9	10	13	13	14	14	14	14
MORA	Ann1	Medium	4002	11	11	11	12	11	13	13	15	15	15	16	14	14
MORA	Ann1	Medium	4004	18	17	18	18	13	15	10	17	17	18	18	20	20
MORA	Ann1	Medium	4009	14	14	15	15	11	13	10	15	15	15	16	17	17
MORA	Ann1	Medium	4012	16	16	14	19	19	13	0	17	19	20	23	24	24
MORA	Ann1	High	4003	12	12	12	12	12	10	12	13	14	15	15	15	16
MORA	Ann1	High	4007	20	20	20	20	20	20	0	20	20	20	25	22	21
MORA	Ann1	High	4011	13	11	14	17	17	15	0	16	16	17	17	17	17
MORA	Ann1	High	4014	10	16	14	16	16	15	0	17	17	18	22	24	22
MORA	Alt2	Low	4006	–	–	10	–	–	–	–	9	–	–	–	–	12
MORA	Alt2	Low	4008	–	–	9	–	–	–	–	12	–	–	–	–	13
MORA	Alt2	Medium	4015	–	–	11	–	–	–	–	12	–	–	–	–	11
MORA	Alt2	Medium	4017	–	–	12	–	–	–	–	13	–	–	–	–	14
MORA	Alt2	Medium	4020	–	–	9	–	–	–	–	8	–	–	–	–	16
MORA	Alt2	Medium	4026	–	–	10	–	–	–	–	11	–	–	–	–	13
MORA	Alt2	High	4016	–	–	19	–	–	–	–	20	–	–	–	–	21
MORA	Alt2	High	4019	–	–	20	–	–	–	–	20	–	–	–	–	21
MORA	Alt2	High	4027	–	–	13	–	–	–	–	14	–	–	–	–	17

Park	Panel	Elevation class	Transect	Number of points surveyed												
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018
MORA	Alt2	High	4075	–	–	14	–	–	–	–	11	–	–	–	–	22
MORA	Alt3	Low	4010	–	–	–	13	–	–	–	–	14	–	–	–	–
MORA	Alt3	Low	4018	–	–	–	12	–	–	–	–	14	–	–	–	–
MORA	Alt3	Medium	4028	–	–	–	11	–	–	–	–	12	–	–	–	–
MORA	Alt3	Medium	4042	–	–	–	12	–	–	–	–	13	–	–	–	–
MORA	Alt3	Medium	4044	–	–	–	15	–	–	–	–	16	–	–	–	–
MORA	Alt3	Medium	4048	–	–	–	13	–	–	–	–	12	–	–	–	–
MORA	Alt3	High	4029	–	–	–	14	–	–	–	–	14	–	–	–	–
MORA	Alt3	High	4030	–	–	–	12	–	–	–	–	15	–	–	–	–
MORA	Alt3	High	4032	–	–	–	15	–	–	–	–	15	–	–	–	–
MORA	Alt3	High	4033	–	–	–	18	–	–	–	–	19	–	–	–	–
MORA	Alt4	Low	4021	–	–	–	–	12	–	–	–	–	13	–	–	–
MORA	Alt4	Low	4022	–	–	–	–	17	–	–	–	–	17	–	–	–
MORA	Alt4	Medium	4057	–	–	–	–	10	–	–	–	–	14	–	–	–
MORA	Alt4	Medium	4060	–	–	–	–	24	–	–	–	–	24	–	–	–
MORA	Alt4	Medium	4061	–	–	–	–	15	–	–	–	–	17	–	–	–
MORA	Alt4	Medium	4065	–	–	–	–	13	–	–	–	–	15	–	–	–
MORA	Alt4	High	4035	–	–	–	–	12	–	–	–	–	14	–	–	–
MORA	Alt4	High	4036	–	–	–	–	14	–	–	–	–	16	–	–	–
MORA	Alt4	High	4039	–	–	–	–	11	–	–	–	–	13	–	–	–
MORA	Alt4	High	4043	–	–	–	–	18	–	–	–	–	19	–	–	–

Park	Panel	Elevation class	Transect	Number of points surveyed												
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018
MORA	Alt5	Low	4024	–	–	–	–	–	25	–	–	–	–	25	–	–
MORA	Alt5	Low	4025	–	–	–	–	–	9	–	–	–	–	15	–	–
MORA	Alt5	Medium	4068	–	–	–	–	–	9	–	–	–	–	15	–	–
MORA	Alt5	Medium	4073	–	–	–	–	–	13	–	–	–	–	19	–	–
MORA	Alt5	Medium	4074	–	–	–	–	–	13	–	–	–	–	15	–	–
MORA	Alt5	Medium	4076	–	–	–	–	–	15	–	–	–	–	17	–	–
MORA	Alt5	High	4045	–	–	–	–	–	12	–	–	–	–	21	–	–
MORA	Alt5	High	4046	–	–	–	–	–	10	–	–	–	–	13	–	–
MORA	Alt5	High	4052	–	–	–	–	–	12	–	–	–	–	16	–	–
MORA	Alt5	High	4055	–	–	–	–	–	–	–	–	–	–	0	–	–
MORA	Alt5	High	4083	–	–	–	–	–	–	–	–	–	–	18	–	–
MORA	Alt6	Low	4031	–	–	–	–	–	–	10	–	–	–	–	13	–
MORA	Alt6	Low	4034	–	–	–	–	–	–	10	–	–	–	–	12	–
MORA	Alt6	Medium	4077	–	–	–	–	–	–	12	–	–	–	–	18	–
MORA	Alt6	Medium	4078	–	–	–	–	–	–	9	–	–	–	–	22	–
MORA	Alt6	Medium	4081	–	–	–	–	–	–	10	–	–	–	–	19	–
MORA	Alt6	Medium	4084	–	–	–	–	–	–	–	–	–	–	–	17	–
MORA	Alt6	High	4058	–	–	–	–	–	–	–	–	–	–	–	19	–
MORA	Alt6	High	4062	–	–	–	–	–	–	–	–	–	–	–	19	–
MORA	Alt6	High	4064	–	–	–	–	–	–	10	–	–	–	–	15	–
MORA	Alt6	High	4067	–	–	–	–	–	–	13	–	–	–	–	17	–

Park	Panel	Elevation class	Transect	Number of points surveyed												
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018
NOCA	Ann1	Low	1013	12	11	14	12	11	9	13	15	15	15	–	15	15
NOCA	Ann1	Low	1017	13	12	9	12	12	12	13	14	14	15	14	15	15
NOCA	Ann1	Low	1020	15	12	13	15	16	12	16	17	17	18	18	17	17
NOCA	Ann1	Low	1023	18	19	19	20	21	20	21	21	21	21	22	22	22
NOCA	Ann1	Medium	1015	12	16	17	17	15	15	16	17	17	19	18	19	18
NOCA	Ann1	Medium	1018	16	21	21	23	22	25	25	23	25	25	24	25	25
NOCA	Ann1	Medium	1022	13	13	11	13	14	13	14	15	15	17	16	18	16
NOCA	Ann1	Medium	1024	9	10	11	12	10	11	10	13	13	13	14	14	15
NOCA	Ann1	High	1014	15	19	19	–	20	–	–	20	21	21	22	22	23
NOCA	Ann1	High	1016	14	15	14	16	15	14	15	17	17	17	17	17	16
NOCA	Ann1	High	1019	12	12	10	12	12	12	12	13	13	13	14	–	14
NOCA	Ann1	High	1021	18	21	22	23	22	19	17	24	24	24	24	23	24
NOCA	Alt2	Low	1001	–	–	11	–	–	–	–	13	–	–	–	–	13
NOCA	Alt2	Low	1005	–	–	13	–	–	–	–	15	–	–	–	–	15
NOCA	Alt2	Low	1006	–	–	10	–	–	–	–	12	–	–	–	–	12
NOCA	Alt2	Low	1010	–	–	12	–	–	–	–	16	–	–	–	–	16
NOCA	Alt2	Medium	1003	–	–	12	–	–	–	–	15	–	–	–	–	15
NOCA	Alt2	Medium	1004	–	–	13	–	–	–	–	14	–	–	–	–	15
NOCA	Alt2	Medium	1009	–	–	–	–	–	–	–	16	–	–	–	–	17
NOCA	Alt2	Medium	1011	–	–	19	–	–	–	–	19	–	–	–	–	20
NOCA	Alt2	High	1002	–	–	18	–	–	–	–	20	–	–	–	–	20

Park	Panel	Elevation class	Transect	Number of points surveyed												
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018
NOCA	Alt2	High	1007	–	–	13	–	–	–	–	14	–	–	–	–	15
NOCA	Alt2	High	1008	–	–	–	–	–	–	–	14	–	–	–	–	14
NOCA	Alt2	High	1012	–	–	15	–	–	–	–	19	–	–	–	–	18
NOCA	Alt3	Low	1027	–	–	–	13	–	–	–	–	16	–	–	–	–
NOCA	Alt3	Low	1028	–	–	–	13	–	–	–	–	14	–	–	–	–
NOCA	Alt3	Low	1029	–	–	–	13	–	–	–	–	15	–	–	–	–
NOCA	Alt3	Low	1034	–	–	–	13	–	–	–	–	14	–	–	–	–
NOCA	Alt3	Medium	1025	–	–	–	15	–	–	–	–	15	–	–	–	–
NOCA	Alt3	Medium	1026	–	–	–	14	–	–	–	–	15	–	–	–	–
NOCA	Alt3	Medium	1057	–	–	–	–	–	–	–	–	13	–	–	–	–
NOCA	Alt3	Medium	1031	–	–	–	19	–	–	–	–	20	–	–	–	–
NOCA	Alt3	High	1032	–	–	–	–	–	–	–	–	13	–	–	–	–
NOCA	Alt3	High	1037	–	–	–	–	–	–	–	–	20	–	–	–	–
NOCA	Alt3	High	1039	–	–	–	20	–	–	–	–	20	–	–	–	–
NOCA	Alt3	High	1040	–	–	–	21	–	–	–	–	19	–	–	–	–
NOCA	Alt4	Low	1036	–	–	–	–	20	–	–	–	–	25	–	–	–
NOCA	Alt4	Low	1054	–	–	–	–	11	–	–	–	–	16	–	–	–
NOCA	Alt4	Low	1061	–	–	–	–	10	–	–	–	–	13	–	–	–
NOCA	Alt4	Low	1122	–	–	–	–	–	–	–	–	–	22	–	–	–
NOCA	Alt4	Medium	1033	–	–	–	–	20	–	–	–	–	23	–	–	–
NOCA	Alt4	Medium	1035	–	–	–	–	16	–	–	–	–	18	–	–	–

Park	Panel	Elevation class	Transect	Number of points surveyed												
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018
NOCA	Alt4	Medium	1038	–	–	–	–	13	–	–	–	–	18	–	–	–
NOCA	Alt4	Medium	1041	–	–	–	–	14	–	–	–	–	17	–	–	–
NOCA	Alt4	High	1048	–	–	–	–	11	–	–	–	–	13	–	–	–
NOCA	Alt4	High	1049	–	–	–	–	12	–	–	–	–	17	–	–	–
NOCA	Alt4	High	1050	–	–	–	–	13	–	–	–	–	16	–	–	–
NOCA	Alt4	High	1052	–	–	–	–	11	–	–	–	–	13	–	–	–
NOCA	Alt5	Low	1062	–	–	–	–	–	8	–	–	–	–	11	–	–
NOCA	Alt5	Low	1063	–	–	–	–	–	9	–	–	–	–	16	–	–
NOCA	Alt5	Low	1065	–	–	–	–	–	11	–	–	–	–	13	–	–
NOCA	Alt5	Low	1067	–	–	–	–	–	8	–	–	–	–	13	–	–
NOCA	Alt5	Medium	1042	–	–	–	–	–	15	–	–	–	–	17	–	–
NOCA	Alt5	Medium	1043	–	–	–	–	–	9	–	–	–	–	13	–	–
NOCA	Alt5	Medium	1044	–	–	–	–	–	11	–	–	–	–	15	–	–
NOCA	Alt5	Medium	1045	–	–	–	–	–	10	–	–	–	–	10	–	–
NOCA	Alt5	High	1055	–	–	–	–	–	13	–	–	–	–	16	–	–
NOCA	Alt5	High	1058	–	–	–	–	–	–	–	–	–	–	18	–	–
NOCA	Alt5	High	1060	–	–	–	–	–	9	–	–	–	–	14	–	–
NOCA	Alt5	High	1064	–	–	–	–	–	–	–	–	–	–	–	–	–
NOCA	Alt6	Low	1068	–	–	–	–	–	–	13	–	–	–	–	15	–
NOCA	Alt6	Low	1070	–	–	–	–	–	–	12	–	–	–	–	14	–
NOCA	Alt6	Low	1074	–	–	–	–	–	–	14	–	–	–	–	18	–

Park	Panel	Elevation class	Transect	Number of points surveyed												
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018
NOCA	Alt6	Low	1075	–	–	–	–	–	–	11	–	–	–	–	16	–
NOCA	Alt6	Medium	1047	–	–	–	–	–	–	13	–	–	–	–	15	–
NOCA	Alt6	Medium	1051	–	–	–	–	–	–	11	–	–	–	–	12	–
NOCA	Alt6	Medium	1053	–	–	–	–	–	–	13	–	–	–	–	19	–
NOCA	Alt6	Medium	1056	–	–	–	–	–	–	13	–	–	–	–	14	–
NOCA	Alt6	High	1072	–	–	–	–	–	–	–	–	–	–	–	9	–
NOCA	Alt6	High	1088	–	–	–	–	–	–	12	–	–	–	–	13	–
NOCA	Alt6	High	1090	–	–	–	–	–	–	–	–	–	–	–	16	–
NOCA	Alt6	High	1092	–	–	–	–	–	–	14	–	–	–	–	14	–
OLYM	Ann1	Low	3001	11	10	8	10	11	12	12	13	12	13	13	14	13
OLYM	Ann1	Low	3121	11	15	17	17	17	14	17	15	17	17	19	19	18
OLYM	Ann1	Low	3126	9	10	11	13	13	13	15	15	15	14	15	16	16
OLYM	Ann1	Low	3134	16	16	18	18	18	18	19	19	19	19	18	20	20
OLYM	Ann1	Medium	3122	14	12	14	–	16	16	–	16	17	18	18	–	18
OLYM	Ann1	Medium	3123	10	10	12	14	14	15	15	15	15	16	17	16	16
OLYM	Ann1	Medium	3130	9	9	8	9	9	9	9	10	10	10	10	10	10
OLYM	Ann1	Medium	3200	–	–	22	23	21	23	22	23	23	22	23	23	23
OLYM	Ann1	High	3124	9	10	10	11	11	11	11	12	12	13	14	14	13
OLYM	Ann1	High	3125	9	11	13	13	14	15	11	14	12	15	15	15	15
OLYM	Ann1	High	3127	7	9	13	15	14	15	15	15	15	15	16	15	16
OLYM	Ann1	High	3128	10	11	11	11	10	11	12	13	12	14	14	14	14

Park	Panel	Elevation class	Transect	Number of points surveyed												
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018
OLYM	Alt2	Low	3138	–	–	10	–	–	–	–	12	–	–	–	–	13
OLYM	Alt2	Low	3142	–	–	14	–	–	–	–	14	–	–	–	–	16
OLYM	Alt2	Low	3144	–	–	13	–	–	–	–	13	–	–	–	–	14
OLYM	Alt2	Low	3145	–	–	13	–	–	–	–	14	–	–	–	–	14
OLYM	Alt2	Medium	3133	–	–	8	–	–	–	–	16	–	–	–	–	16
OLYM	Alt2	Medium	3135	–	–	11	–	–	–	–	13	–	–	–	–	13
OLYM	Alt2	Medium	3137	–	–	10	–	–	–	–	11	–	–	–	–	11
OLYM	Alt2	Medium	3141	–	–	14	–	–	–	–	15	–	–	–	–	15
OLYM	Alt2	High	3132	–	–	19	–	–	–	–	19	–	–	–	–	18
OLYM	Alt2	High	3136	–	–	11	–	–	–	–	11	–	–	–	–	14
OLYM	Alt2	High	3139	–	–	16	–	–	–	–	13	–	–	–	–	16
OLYM	Alt2	High	3140	–	–	–	–	–	–	–	12	–	–	–	–	13
OLYM	Alt3	Low	3146	–	–	–	15	–	–	–	–	15	–	–	–	–
OLYM	Alt3	Low	3149	–	–	–	10	–	–	–	–	12	–	–	–	–
OLYM	Alt3	Low	3151	–	–	–	12	–	–	–	–	17	–	–	–	–
OLYM	Alt3	Low	3153	–	–	–	11	–	–	–	–	16	–	–	–	–
OLYM	Alt3	Medium	3143	–	–	–	10	–	–	–	–	11	–	–	–	–
OLYM	Alt3	Medium	3150	–	–	–	11	–	–	–	–	12	–	–	–	–
OLYM	Alt3	Medium	3152	–	–	–	11	–	–	–	–	13	–	–	–	–
OLYM	Alt3	Medium	3154	–	–	–	15	–	–	–	–	16	–	–	–	–
OLYM	Alt3	High	3147	–	–	–	19	–	–	–	–	19	–	–	–	–

Park	Panel	Elevation class	Transect	Number of points surveyed												
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018
OLYM	Alt3	High	3148	–	–	–	14	–	–	–	–	16	–	–	–	–
OLYM	Alt3	High	3156	–	–	–	10	–	–	–	–	11	–	–	–	–
OLYM	Alt3	High	3157	–	–	–	11	–	–	–	–	12	–	–	–	–
OLYM	Alt4	Low	3155	–	–	–	–	10	–	–	–	–	12	–	–	–
OLYM	Alt4	Low	3159	–	–	–	–	11	–	–	–	–	12	–	–	–
OLYM	Alt4	Low	3161	–	–	–	–	11	–	–	–	–	12	–	–	–
OLYM	Alt4	Low	3163	–	–	–	–	15	–	–	–	–	15	–	–	–
OLYM	Alt4	Medium	3160	–	–	–	–	10	–	–	–	–	12	–	–	–
OLYM	Alt4	Medium	3167	–	–	–	–	11	–	–	–	–	14	–	–	–
OLYM	Alt4	Medium	3168	–	–	–	–	10	–	–	–	–	15	–	–	–
OLYM	Alt4	Medium	3174	–	–	–	–	14	–	–	–	–	15	–	–	–
OLYM	Alt4	High	3158	–	–	–	–	14	–	–	–	–	18	–	–	–
OLYM	Alt4	High	3164	–	–	–	–	14	–	–	–	–	17	–	–	–
OLYM	Alt4	High	3171	–	–	–	–	12	–	–	–	–	15	–	–	–
OLYM	Alt4	High	3173	–	–	–	–	–	–	–	–	–	12	–	–	–
OLYM	Alt5	Low	3165	–	–	–	–	–	10	–	–	–	–	12	–	–
OLYM	Alt5	Low	3166	–	–	–	–	–	12	–	–	–	–	15	–	–
OLYM	Alt5	Low	3169	–	–	–	–	–	8	–	–	–	–	13	–	–
OLYM	Alt5	Low	3170	–	–	–	–	–	11	–	–	–	–	11	–	–
OLYM	Alt5	Medium	3178	–	–	–	–	–	11	–	–	–	–	14	–	–
OLYM	Alt5	Medium	3183	–	–	–	–	–	13	–	–	–	–	15	–	–

Park	Panel	Elevation class	Transect	Number of points surveyed												
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2018
OLYM	Alt5	Medium	3184	–	–	–	–	–	16	–	–	–	–	20	–	–
OLYM	Alt5	Medium	3185	–	–	–	–	–	9	–	–	–	–	11	–	–
OLYM	Alt5	High	3175	–	–	–	–	–	12	–	–	–	–	15	–	–
OLYM	Alt5	High	3179	–	–	–	–	–	16	–	–	–	–	19	–	–
OLYM	Alt5	High	3180	–	–	–	–	–	16	–	–	–	–	19	–	–
OLYM	Alt5	High	3188	–	–	–	–	–	12	–	–	–	–	18	–	–
OLYM	Alt6	Low	3172	–	–	–	–	–	–	14	–	–	–	–	14	–
OLYM	Alt6	Low	3177	–	–	–	–	–	–	10	–	–	–	–	10	–
OLYM	Alt6	Low	3181	–	–	–	–	–	–	16	–	–	–	–	16	–
OLYM	Alt6	Low	3182	–	–	–	–	–	–	16	–	–	–	–	18	–
OLYM	Alt6	Medium	3187	–	–	–	–	–	–	20	–	–	–	–	21	–
OLYM	Alt6	Medium	3190	–	–	–	–	–	–	14	–	–	–	–	15	–
OLYM	Alt6	Medium	3195	–	–	–	–	–	–	12	–	–	–	–	13	–
OLYM	Alt6	Medium	3198	–	–	–	–	–	–	11	–	–	–	–	13	–
OLYM	Alt6	High	3189	–	–	–	–	–	–	16	–	–	–	–	16	–
OLYM	Alt6	High	3191	–	–	–	–	–	–	15	–	–	–	–	16	–
OLYM	Alt6	High	3192	–	–	–	–	–	–	14	–	–	–	–	15	–
OLYM	Alt6	High	3196	–	–	–	–	–	–	15	–	–	–	–	18	–

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