Landbird Inventory for Devil's Postpile National Monument

Final Report

Rodney B. Siegel and Robert L. Wilkerson
with collaboration from Sacha K. Heath

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

April 7, 2004

Cooperative Agreement
H9471011196

Table of Contents

List of Tables

List of Figures

Summary

In June of 2003 The Institute for Bird Populations (IBP) conducted a breeding season inventory of the landbirds of Devil's Postpile National Monument. The goals of the inventory were to characterize the composition of the breeding landbird community at the park, and to estimate park-wide density for a large suite of species. These data will serve as baseline information for assessing future changes in species-specific abundance and community composition in the park, and will provide important information for the design of a long-term landbird monitoring program.

Using field and analytical techniques consistent with those implemented in the other parks of the network, we conducted variable circular-plot point counts at 42 stations arrayed along a systematic grid covering the entire park. We documented the presence of 59 bird species in the Monument. Forty-seven of these were detected during at least one point count, while the remaining 12 were recorded only at times other than during point counts. We also conducted detailed habitat assessments at each of the survey points.

In this report we tabulate the number of times each species was detected during point counts, the percent of point count stations at which we detected each species, and the apparent Monument-wide density, unadjusted for detectability, of each species. We provide maps indicating locations of point count stations where each species was and was not detected. Finally, we use analytical techniques based on distance sampling to model species-specific detectability and to produce Monument-wide density estimates, corrected for detectability, for 39 of the forty-seven species detected during point counts. Detectability models, which require larger numbers of detections than we could amass at Devil's Postpile National Monument alone, are based on point count data from our survey at Devil's Postpile, pooled with point count data fom forested habitats at Sequoia and Kings Canyon National Parks.

Acknowledgments

We are grateful to our field crew, N. Clipperton and S. Dolrenry, for collecting the data. We also thank D. Dulen, R. Mazur, and L. Mutch, for logistic help, J. Akin for assistance developing our vegetation sampling protocol, and B. Rolph for assisting with the administration of our NPS contract. This is Contribution No. 239 of The Institute for Bird Populations.

Introduction

Reported declines of many birds breeding in North America have stimulated interest in avian population trends and mechanisms driving those trends (DeSante and George 1994). The North American Breeding Bird Survey suggests that many landbird populations in the Sierra Nevada appear to be declining (Siegel and DeSante 1999; Sauer et al. 2003), and data from the national parks are particularly important for teasing out possible causes. Birds are particularly well-suited to serve as indicators of ecological change (Furness et al. 1993), so landbird inventory and monitoring efforts in the national parks not only assess the status of local bird populations, they may also provide insight into broader ecological changes.

Although small, Devil's Postpile provides important habitat for many breeding, migrating, and wintering landbird species. Situated 2,300 m above sea level on the western slope of the Sierra Nevada, the Monument is dominated by Red Fir and Lodgepole Pine forest, but also contains dry as well as wet meadows, and substantial riparian vegetation along the San Joaquin River and its tributaries.

Until recently the Monument's avifauna received little if any systematic study. In the last few years, however, Parker and Parker (2001) compiled a bird species list for the Monument, and Gates and Heath (2003) established a Monitoring Avian Productivity and Survivorship (MAPS) station (DeSante et al. 2003) to monitor demography of birds utilizing Soda Springs Meadow and the riparian habitats along the San Joaquin River and Red's Meadow Creek within the Monument.

While ecological pressures affecting riparian bird species in California have received considerable attention in recent years (Manley and Davidson 1993; Siegel and DeSante 1999; Riparian Habitat Joint Venture 2004), birds occupying upland habitats throughout the Sierra also face substantial threats and changes. Potential stressors throughout the Sierra include not only increasing urbanization with its concomitant increases in land conversion and facilitation of Brown-headed Cowbird parasitism, but also long-term shifts in habitat composition and structure resulting from historical fire suppression (Hejl 1994; Chang 1996; Gruell 2001), projected climate change (Lenihan et al. 2003), and recent decisions by the USDA Forest Service to step up timber harvest and forest thinning efforts. Thus, a need still existed to systematically assess and describe the bird community utilizing upland as well as riparian areas of the Monument and to produce quantitative, Monument-wide estimates of density for species inhabiting the Monument. Such estimates could then serve as baselines for monitoring future ecological changes within the Monument and assessing the affects of future management actions on bird populations, and as benchmarks for comparison with more heavily managed areas outside of the NPS system.

We designed this inventory project to determine Monument-wide density of landbirds during the breeding season at Devil's Postpile National Monument, across upland as well as riparian habitats, using methods consistent with those employed in other NPS units across the Sierra Nevada Network (Siegel and DeSante 2002; Siegel and Wilkerson 2004), and beyond (Siegel et al. 2002; Siegel et al. 2004; Siegel et al. 2004b).

Methods

Sampling Strategy

The comparatively small size (approximately 320 ha) of Devil's Postpile National Monument made sample design for this project relatively simple. Beginning with a randomly selected starting point, we defined a systematic grid of point count stations, 250 m apart, covering the length and breadth of the park. In order to facilitate collaboration and integration with existing bird study efforts in the Monument, we discarded several grid points that fell within Soda Springs Meadow and the riparian areas along the San Joaquin River, and replaced them with five existing survey points where point counts are being conducted in conjunction with operation of the Monument's MAPS station (Gates and Heath 2003). This yielded 42 points arrayed in a nearly regular grid across the length and breadth of the park. We provide coordinates of all point count stations in Table 1.

Field Methods

Conducting Point Counts. We conducted all fieldwork between June 7 and June 13 of 2003. We used five-minute variable circular plot (VCP) point counts (Fancy and Sauer 2000, Siegel 2000) coupled with detailed habitat descriptions of each point count location as our primary means of surveying birds. VCP point counts entailed recording the horizontal distance, estimated to the nearest meter, to every bird seen or heard during the point count.

Observers located pre-selected starting points in the field with topographic maps and a hand-held GPS unit. Observers flagged the points as they conducted the counts, and then returned later in the day to sample vegetation. Point counts began within ten minutes of local sunrise, and continued until 3.5 hours after local sunrise. 'Flyovers'— defined as birds that flew over the top of the vegetation canopy, never touched down in the observer's field of view, and did not appear to be foraging, displaying, or behaving in any other way that might suggest a link to the habitat below— were tallied separately from other bird detections. Birds thought to have been recorded previously at another point were marked accordingly on the data forms. Observers recorded whether each bird was initially detected during the first three minutes or last two minutes of the point count, in order to improve comparability with data from the Breeding Bird Survey (BBS) which utilizes three-minute counts. They also recorded whether each bird was initially detected visually or aurally, and whether the bird sang at any time during the count. While at Devil's Postpile National Monument, crew members compiled lists of all bird species they detected in the park, even species that were only detected at times other than during point counts.

Sampling Vegetation at Bird Survey Points. Vegetation descriptions at each point entailed collecting detailed data on vegetation structure and composition, as well as physiographic features, within a circular 40-m radius plot (covering 0.5 ha) centered on the point count station. We also classified each point to the plant community alliance or association, using the National Vegetation Classification Standard (NVCS), with draft modifications for local application by personnel at Sequoia and Kings Canyon National Parks (Jennifer Akin, personal communication). We will submit databases containing our detailed habitat information as well

as point count data to the NPS when we submit similar (but much more extensive) databases resulting from our work in 2003 and 2004 at Sequoia and Kings Canyon National Parks.

Crew Training and Testing

At the beginning of the field season, we provided our field crew (who spent most of the field season working at Sequoia and Kings Canyon National Parks) with an intensive two-week training program. We trained our crew members, who had prior experience birding and conducting biological fieldwork, in visual and aural bird identification, distance estimation, plant identification, orienteering, backcountry safety, and project protocols. Crew members honed their bird identification skills by spending days in the field birding and practicing point counts with experienced trainers, and then reviewing at night with the aid of field guides, taped songs and calls, and an instructional CD-ROM. At the end of the two-week training period, we gave crew members a rigorous exam involving the identification of approximately 100 taped songs and calls (some of them grouped together in rapid succession to produce 'simulated point counts') as well as 30-40 photographic images (generally of rarer species or less obvious female plumages). Crew members had to pass the exam before they were permitted to conduct point counts. Passing the exam, which required a near-perfect score, ensured that observers could competently identify by sight and sound all species expected to occur in central and southern Sierra Nevada.

Data Analysis

All data were entered into DBASE databases, which we then checked for errors using an array of automated and manual data verification routines.

For each species detected during point counts, we calculated the average number of detections per point, and the percentage of points where the species was detected, using all detections at any distance from the observer. For each species we also calculated the apparent density, uncorrected for detectability, as

$$\frac{(d_{50}/42)}{0.7854},$$

where d_{50} is the total number of birds detected within 50 m of the observer, 42 is the total number of points sampled, and 0.7854 is the portion of a hectare covered by a 50-m radius circle

However, the effective detection radius for birds during point counts has been shown to vary across habitats and between species (Burnham 1981; Barker and Sauer 1995; Buckland et al. 2001). Some species vocalize much more loudly than others, so detectability corrections should be performed on a species-by-species basis. We used the computer program DISTANCE 4.1 Release 2 (Thomas et al. 2003) to correct for detectability and to produce estimates of absolute density.

Distance-sampling experts generally advise that at least 60-80 detections are necessary for reliably modeling the relationship between detection probability and distance from the observer (Buckland et al. 2001). Our data set comprised only 42 points; not surprisingly, we were unable to amass 60 detections for *any* species at Devil's Postpile. For the purpose of modeling detection probability, we therefore pooled our Devil's Postpile point count results with data from 647 point counts that we conducted in forested habitats at Sequoia and Kings Canyon National Parks during the same field season. The two projects shared the same point count protocol, and moreover, our Devil's Postpile crew members were also part of the crew at Sequoia and Kings Canyon, where they spent the balance of the field season.

We used DISTANCE to fit detection functions for each species with at least 60 detections in the pooled data set containing data from our 2003 field seasons at both Devil's Postpile and Sequoia and Kings Canyon. Because of our relatively large sample size at Sequoia and Kings Canyon, we amassed at least 60 detections for 22 of the 47 bird species we detected during point counts at Devil's Postpile. We set the data filter to truncate the largest 10% of observations (Buckland et al. 2001), and then fit models using the half-normal key function and both the cosine and polynomial series expansions. We used the Akaike Information Criterion (AIC) to select among models with different forms and numbers of expansion terms (Akaike 1973; Burnham and Anderson 1998). We then applied the species-specific detection function obtained from the pooled data set to just the Devil's Postpile point count results, yielding Monument-wide estimates of absolute density, taking into account species-specific variation in detectability.

For each of the remaining 25 species detected during points at Devil's Postpile, even our pooled data set contained fewer than sixty detections. We dealt with two of these species, Hairy Woodpecker and White-headed Woodpecker, by fitting a single detectability model to pooled distance estimates from *both* species, and then applying that model to produce separate density estimates for the two species. In order to estimate the density for as many as possible of the 23 remaining species detected during point counts, we matched each of them with a 'surrogate' species—another species that was detected at least 60 times, and whose detectability function would likely be similar to that of the rarer species, had we been able to model it. Species were matched using our professional judgment of the acoustic properties of their vocalizations, and their usual singing behavior. We paid particular attention to song volume, song pitch, and the species' usual singing location (e.g. high in the canopy, or down in the understory). For the rarer species, we then estimated absolute density by fitting the uniform key function with no adjustment terms in DISTANCE, and used 'borrowed' estimates of detection probability and detection probability variance from the surrogate species as multipliers (Thomas et al. 2002). We were unable to satisfactorily match a few of the rarer species at Devil's Postpile with suitable surrogate species, and consequently did not estimate their absolute density.

Scientific names of all bird species listed in this report are provided in Appendix A, and sample field forms are provided in Appendix B.

Results and Discussion

Habitat Assessments

We determined the dominant vegetation alliance at each survey point (Fig. 1). Jeffrey Pine Woodland was the most common alliance (14 points), followed by Lodgepole Pine Forest (11 points), Red Fir Forest (9 points), Mountain Whitethorn Shrubland (5 points), Aspen Forest (2 points), and Non-vegetated Rock (1 point). In addition to the two Aspen Forest points, six of the 40 points classified as upland habitat types were also described as having substantial riparian inclusions (Fig. 2).

Bird Species Detected in the Park

We documented the presence of 59 bird species in the Monument (Table 2), seven of which—Virginia Rail, Vaux's Swift, White-throated Swift, Anna's Hummingbird, Rock Wren, Common Yellowthroat, and Red-winged Blackbird— had not been previously documented by either Parker and Parker (2001) or Gates and Heath (2003). We detected 47 species during at least one point count, while the remaining 12 were recorded only at times other than during point counts (Table 2). A complete list of all bird species documented to occur in the park, including results from this study as well as Parker and Parker (2001) and Gates and Heath (2003) is provided in Appendix A.

Birds Detected During Point Counts

For each species detected during point counts, Table 3 presents

a) the number of detections (excluding flyovers),
b) the percentage of points at which the species was detected at any distance, and
c) the 'unadjusted density' of each species (based only on the number of detections within 50 m of the observer, and incorporating no correction for detectability).

For 39 of the species, Table 3 also provides

d) the adjusted density estimate, which takes into account species-specific variation in detectability, and
e) the coefficient of variation, degrees of freedom, and 95% confidence interval associated with each adjusted density estimate.

Surrogate species for the detectabity models used in estimating density are indicated in Table 4.

Locations of point count stations where we did and did not detect each species are indicated in Figures 3-14.

The presence of numerous riparian-affiliated species at Devil's Postpile clearly underscores the importance of the Monument's riparian habitats. However it is also interesting to note that of the ten most abundant bird species in the park (based on adjusted density estimates from Table 2), only two of them, MacGillivray's Warbler and Warbling Vireo, can really be considered to have a strong riparian affinity. The other eight species—Brown Creeper, Dark-eyed Junco, Mountain Chickadee, Yellow-rumped Warbler, Fox Sparrow, Golden-crowned Kinglet, Western Wood-Pewee, and Cassin's Finch—are all upland-associated species, though most of them can of course occur in riparian habitats as well. This suggests that the value of the Monument's upland habitats to landbirds should not be underestimated. It is also notable that the eleventh most abundant species is Olive-sided Flycatcher, a species of increasing conservation concern throughout the montane West (Altman and Sallabanks 2000; Meehan and George 2003). The presence of a relatively high density of this species alone warrants paying continued attention to birds in the Monument's upland habitats.

Literature Cited

Akaike, H. 1973. Information theory as an extension of the maximum likelihood principle. Pages 267-281 *in* B. N. Petrov and F. Csaki [eds.], Second international symposium on information theory Akademiai Kiado, Budapest.

Altman, B. and R. Sallabanks. 2000. Olive-sided Flycatcher (*Contopus cooperi*). *In* The Birds of North America, no. 502 (A. Poole and F. Gill, Eds.). The Birds of North America, Inc., Philadelphia.

Barker, R. J. and J. R. Sauer. 1995. Statistical aspects of point count sampling, p. 125-130. *In* C.J. Ralph, J.R. Sauer and S. Droege [eds.], Monitoring bird populations by point counts, USDA Forest Service, Pacific Southwest Research Station, Gen. Tech. Rep. PSW-GTR.

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

Burnham, K. P. 1981. Summarizing remarks: environmental influences. Studies in Avian Biology 6:324-325.

Burnham, K. P., and D. R. Anderson. 1998. Model Selection and Inference: a Practical Information-Theoretic Approach. Springer, New York.

Chang, C. 1996. Ecosystem response to fire and variations in fire regimes. Pp. 1071-1100 *in* Sierra Nevada ecosystem project, final report to Congress, Vol. II: assessments and scientific basis for management options. Wildland Resources Center Report No. 37, Univ. of California, Davis.

DeSante, D. F., K. M. Burton, P. Velez, and D. Froehlich. 2003. MAPS Manual: 2003 Protocol. The Institute for Bird Populations, Point Reyes Station, CA.

DeSante, D.F. and L. George. 1994. Population trends in the landbirds of western North America. Pg. 173-190 *in* Jehl, J.R. Jr. and N.K. Johnson, eds. A century of avifaunal change in western North America. Studies in Avian Biology No. 15.

Fancy, S. G. and J. R. Sauer. 2000. Recommended methods for inventory and monitoring of biological resources in national parks. National Park Service Inventory and Monitoring Program.

Furness, R.W., J.J.D. Greenwood, and P.J. Jarvis. 1993. Can birds be used to monitor the environment? Pg. 1-41 *in* Furness, R.W., and J.J.D. Greenwood, eds. Birds as monitors of environmental change. Chapman and Hall, London, 356 pp.

Gates, H. R. and S. K. Heath. 2003. Bird monitoring, habitat assessment and visitor

education in montane meadow and riparian habitats of Devil's Postpile National Monument: results from the 2002 and 2003 field season. PRBO Conservation Science.

Gruell, G. E. 2001. Fire in Sierra Nevada forests: a photographic interpretation of ecological change since 1849. Mountain Press, Missoula, Montana.

Hejl, S. J. 1994. Human induced changes in bird populations in coniferous forests in western North America during the past 100 years. Studies in Avian Biology 15:232-246.

Lenihan, J. M., R. Drapek, D. Bachelet, and R. P. Neilson. 2003. Climate change effects on vegetation distribution, carbon, and fire in California. Ecological Applications 13:1667-1681.

Manley, P. and. C. Davidson. 1993. A risk analysis of neotropical migrant birds in California. USFS report, Region 5, San Francisco.

Meehan, T. D. and T. L. George. 2003. Short-term effects of moderate- to high-severity wildfire on a disturbance-dependent flycatcher in northwest California. Auk 120:1102-1113.

Parker, J. and D. Parker. 2001. Summary of bird observations at Devil's Postpile and vicinity. A report to Devil's Postpile National Monument.

Riparian Habitat Joint Venture. 2004. Version 2.0. The riparian bird conservation plan: a strategy for reversing the decline of riparian associated birds in California. California Partners in Flight.

Sauer, J.R., J.E. Hines, and J. Fallon. 2003. The North American breeding bird survey, results and analysis 1966-2002. Version 2003.1. USGS Patuxent Wildlife Research Center, Laurel, MD.

Siegel, R. B. 2000. Methods for monitoring landbirds: a review commissioned by Seattle City Light's Wildlife Research Advisory Committee. USDI Technical Report NPS/NRNOCA/NRTR/00-03.

Siegel, R. B. and D. F. DeSante. 1999. Draft avian conservation plan for the Sierra Nevada Bioregion: conservation priorities and strategies for safeguarding Sierra bird populations. The Institute for Bird Populations, Point Reyes Station, CA.

Siegel, R. B. and D. F. DeSante. 2002. Avian inventory of Yosemite National Park (1998-2000). The Institute for Bird Populations, Point Reyes Station, CA.

Siegel, R. B. and R. L. Wilkerson. 2004. Landbird inventory of Sequoia and Kings

Canyon National Parks: first annual progress report. The Institute for Bird Populations, Point Reyes Station, CA.

Siegel, R. B., R. L. Wilkerson, and S. Hall. 2004. Landbird inventory for Olympic National Park (2002-2003). The Institute for Bird Populations, Point Reyes Station, CA.

Siegel, R. B., R. L. Wilkerson, R. C. Kuntz II, J. and J. F. McLaughlin. 2004b. Landbird inventory for North Cascades National Park Service Complex. The Institute for Bird Populations, Point Reyes Station, CA.

Siegel, R. B., R. L. Wilkerson, H. K. Pedersen, and R. C. Kuntz II. 2002. Landbird inventory of San Juan Island National Historical Park. Technical Report NPS D 73 of the National Park Service.

Thomas, L., J. L. Laake, S. Strindberg, F. F. C. Marques, S. T. Buckland, D. L. Borchers, D. R. Anderson, K. P. Burnham, S. L. Hedley, and J. H. Pollard and J. R. B. Bishop. 2003. Distance 4.1 Release 2. Research Unit for Wildlife Populations Assessment, University of St. Andrews, UK. http://www.ruwpa.st-and.ac.uk/distance/

Table 1. Coordinates of landbird inventory point count stations in Devil's Postpile National Monument. All points are in Zone 11S and the datum is NAD27.

Point Count Station	Easting	Northing
DP01	315662	4166834
DP02	315666	4166581
DP03	315656	4166320
DP04	315688	4166100
DP05	315650	4165830
DP06	315663	4165575
DP07	315669	4165325
DP08	315663	4165080
DP09	315665	4164830
DP10	315662	4164580
DP11	315665	4164328
DP12	315663	4164084
DP13	315661	4163840
DP14	315664	4163582
DP15	315656	4163328
DP16	315662	4163084
DP17	315912	4166834
DP18	315916	4166584
DP19	315914	4166334
DP20	315912	4166034
DP21	315912	4165836
DP22	315912	4165584
DP23	315914	4165334
DP24	315912	4165084
DP25	315915	4164833
DP26	315911	4164585
DP27	315915	4164334
DP28	315909	4164081
DP29	315910	4163834
DP30	315914	4163595
DP31	315908	4163092
DP32	316162	4166834
DP33	316162	4166334
DP34	316162	4166084
DP35	316162	4165834
DP36	316162	4165584
DP37	316082	4162935
SH03	316169	4166497
SH10	316183	4164981
SH11	316216	4164793
SH12	316183	4164551
SH13	316177	4164303

Table 2. All bird species detected in Devil's Postpile National Monument during the 2003 landbird inventory. Asterisks indicate species that were documented by our crew members but were never detected during point counts.

1. Mallard*
2. Common Merganser*
3. Red-tailed Hawk*
4. Golden Eagle*
5. American Kestrel
6. Mountain Quail
7. Virginia Rail
8. Spotted Sandpiper
9. Mourning Dove
10. Vaux's Swift*
11. White-throated Swift*
12. Anna's Hummingbird
13. Calliope Hummingbird*
14. Red-breasted Sapsucker
15. Downy Woodpecker
16. Hairy Woodpecker
17. White-headed Woodpecker
18. Black-backed Woodpecker*
19. Northern Flicker
20. Olive-sided Flycatcher
21. Western Wood-Pewee
22. Dusky Flycatcher
23. Warbling Vireo
24. Steller's Jay
25. Clark's Nutcracker
26. Common Raven*
27. Violet-green Swallow
28. Cliff Swallow*
29. Mountain Chickadee
30. Red-breasted Nuthatch
31. White-breasted Nuthatch
32. Brown Creeper
33. Rock Wren
34. House Wren
35. American Dipper*
36. Golden-crowned Kinglet
37. Mountain Bluebird
38. Townsend's Solitaire
39. American Robin
40. Nashville Warbler
41. Yellow-rumped Warbler
42. Hermit Warbler
43. MacGillivray's Warbler
44. Common Yellowthroat
45. Wilson's Warbler
46. Western Tanager
47. Green-tailed Towhee
48. Fox Sparrow
49. Song Sparrow
50. Lincoln's Sparrow
51. White-crowned Sparrow
52. Dark-eyed Junco
53. Red-winged Blackbird
54. Brewer's Blackbird
55. Brown-headed Cowbird*
56. Purple Finch
57. Cassin's Finch
58. Pine Siskin
59. Evening Grosbeak

Table 3. Results from 42 point counts at Devil's Postpile National Monument. An entry of '--' for the Adjusted Density Estimate indicates a species for which we did not model detectability or identify a suitable 'surrogate' species.

Species[1]	No. of Non-flyover Detections[2]	Percent of Points with Detections[3]	Unadjusted Density (birds/ha)[4]	Adjusted Density[5]				
				Estimate (birds/ha)	CV	df	Lower 95% C.I.	Upper 95% C.I.
American Kestrel	1	2.4	0.00	**--**				
Mountain Quail	13	31.0	0.00	**0.06**	36.3	114	0.03	0.12
Virginia Rail	1	2.4	0.00	**--**				
Spotted Sandpiper	2	2.4	0.00	**--**				
Mourning Dove	1	2.4	0.00	**--**				
Anna's Hummingbird	1	2.4	0.03	**--**				
Red-breasted Sapsucker	2	4.8	0.06	**--**				
Downy Woodpecker	1	2.4	0.03	**0.09**	101.7	41	0.02	0.52
Hairy Woodpecker	4	9.5	0.12	**0.10**	51.6	41	0.04	0.27
White-headed Woodpecker	3	7.1	0.06	**0.07**	59.3	41	0.02	0.22
Northern Flicker	5	9.5	0.03	**0.04**	55.4	55	0.01	0.11
Olive-sided Flycatcher	14	31.0	0.12	**0.18**	31.6	80	0.10	0.34
Western Wood-Pewee	22	47.6	0.30	**0.33**	24.3	88	0.21	0.54
Dusky Flycatcher	2	4.8	0.06	**0.06**	73.6	50	0.02	0.22
Warbling Vireo	15	33.3	0.18	**0.29**	29.9	44	0.16	0.53
Steller's Jay	11	26.2	0.06	**0.11**	34.8	56	0.06	0.23
Clark's Nutcracker	3	7.1	0.00	**0.03**	78.1	105	0.01	0.12
Violet-green Swallow	1	2.4	0.03	**--**				
Mountain Chickadee	34	57.1	0.55	**0.58**	34.2	278	0.30	1.11
Red-breasted Nuthatch	13	26.2	0.06	**0.08**	149.7	257	0.01	0.66
White-breasted Nuthatch	6	14.3	0.06	**0.08**	151.7	41	0.01	0.75
Brown Creeper	10	21.4	0.30	**0.63**	35.8	66	0.31	1.25
Rock Wren	4	9.5	0.09	**0.06**	51.4	41	0.02	0.15
House Wren	1	2.4	0.03	**0.03**	100.1	41	0.01	0.18
Golden-crowned Kinglet	5	11.9	0.15	**0.34**	45.3	53	0.14	0.80
Mountain Bluebird	5	11.9	0.09	**0.08**	44.5	41	0.03	0.19
Townsend's Solitaire	9	19.0	0.06	**0.10**	43.6	73	0.05	0.24
American Robin	8	16.7	0.21	**0.18**	62.2	168	0.06	0.56
Nashville Warbler	2	4.8	0.06	**0.06**	85.9	87	0.01	0.28

Table 3, continued

Species[1]	No. of Non-flyover Detections[2]	Percent of Points with Detections[3]	Unadjusted Density (birds/ha)[4]	Adjusted Density[5]				
				Estimate (birds/ha)	CV	df	Lower 95% C.I.	Upper 95% C.I.
Yellow-rumped Warbler	25	40.5	0.45	**0.52**	28.1	67	0.30	0.91
Hermit Warbler	1	2.4	0.03	**0.03**	101.6	44	0.01	0.18
MacGillivray's Warbler	12	26.2	0.27	**0.31**	34.3	43	0.16	0.61
Common Yellowthroat	1	2.4	0.00	**0.03**	100.1	41	<0.01	0.14
Wilson's Warbler	2	4.8	0.03	**0.04**	100.1	41	0.01	0.20
Western Tanager	3	7.1	0.09	**0.07**	57.6	45	0.02	0.21
Green-tailed Towhee	1	2.4	0.03	**0.04**	113.3	41	0.01	0.23
Fox Sparrow	16	19.0	0.21	**0.37**	65.4	204	0.12	1.21
Song Sparrow	7	14.3	0.00	**0.09**	40.9	41	0.04	0.19
Lincoln's Sparrow	2	4.8	0.03	**0.04**	72.1	41	0.01	0.16
White-crowned Sparrow	4	7.1	0.00	**0.07**	80.2	41	0.02	0.28
Dark-eyed Junco	20	33.3	0.42	**0.59**	33.1	81	0.31	1.11
Red-winged Blackbird	1	2.4	0.00	**0.02**	101.0	41	<0.01	0.09
Brewer's Blackbird	5	7.1	0.06	**0.11**	79.8	41	0.03	0.44
Purple Finch	1	2.4	0.03	**0.03**	101.3	41	0.01	0.17
Cassin's Finch	8	16.7	0.18	**0.26**	40.2	57	0.12	0.56
Pine Siskin	2	4.8	0.06	**0.06**	101.3	41	0.01	0.35
Evening Grosbeak	1	2.4	0.00	**--**				

[1] Includes all species detected during point counts.
[2] Number of individual birds detected at any distance during point counts, excluding flyovers.
[3] Percent of points where the species was detected, including flyovers.
[4] Based on number of detections within 50 m of the observer, with no adjustment for detectability.
[5] Estimates and statistics calculated using the software Distance 4.1 Release 2 (Thomas et al. 2003). See Methods for details.

Table 4. Source of detectability models for all species for which we estimated absolute or 'adjusted' density at Devil's Postpile National Monument. 'Self' indicates species for which we amassed at least 60 detections (pooling data with observations we collected in forested habitats at Sequoia and Kings Canyon National Parks during the same field season) and were able to model detectability without using data from 'surrogate' species. For species that were detected less frequently, we modeled detectability using data from a more frequently encountered 'surrogate' species, as indicated.

Species	Source of Detectability Model
Mountain Quail	self
Downy Woodpecker	Hairy Woodpecker + White-headed Woodpecker
Hairy Woodpecker	Hairy Woodpecker + White-headed Woodpecker
White-headed Woodpecker	Hairy Woodpecker + White-headed Woodpecker
Northern Flicker	self
Olive-sided Flycatcher	self
Western Wood-Pewee	self
Dusky Flycatcher	self
Warbling Vireo	self
Steller's Jay	self
Clark's Nutcracker	self
Mountain Chickadee	self
Red-breasted Nuthatch	self
White-breasted Nuthatch	Red-breasted Nuthatch
Brown Creeper	self
Rock Wren	Dark-eyed Junco
House Wren	MacGillivray's Warbler
Golden-crowned Kinglet	self
Mountain Bluebird	Yellow-rumped Warbler
Townsend's Solitaire	self
American Robin	self
Nashville Warbler	self
Yellow-rumped Warbler	self
Hermit Warbler	self
MacGillivray's Warbler	self
Common Yellowthroat	MacGillivray's Warbler
Wilson's Warbler	MacGillivray's Warbler
Western Tanager	self
Green-tailed Towhee	Fox Sparrow
Fox Sparrow	self
Song Sparrow	Warbling Vireo
Lincoln's Sparrow	Dark-eyed Junco
White-crowned Sparrow	Fox Sparrow
Dark-eyed Junco	self
Red-winged Blackbird	Western Wood-Pewee
Brewer's Blackbird	Western Wood-Pewee
Purple Finch	Cassin's Finch

Table 4, continued

Species	Source of Detectability Model
Cassin's Finch	self
Pine Siskin	Cassin’s Finch

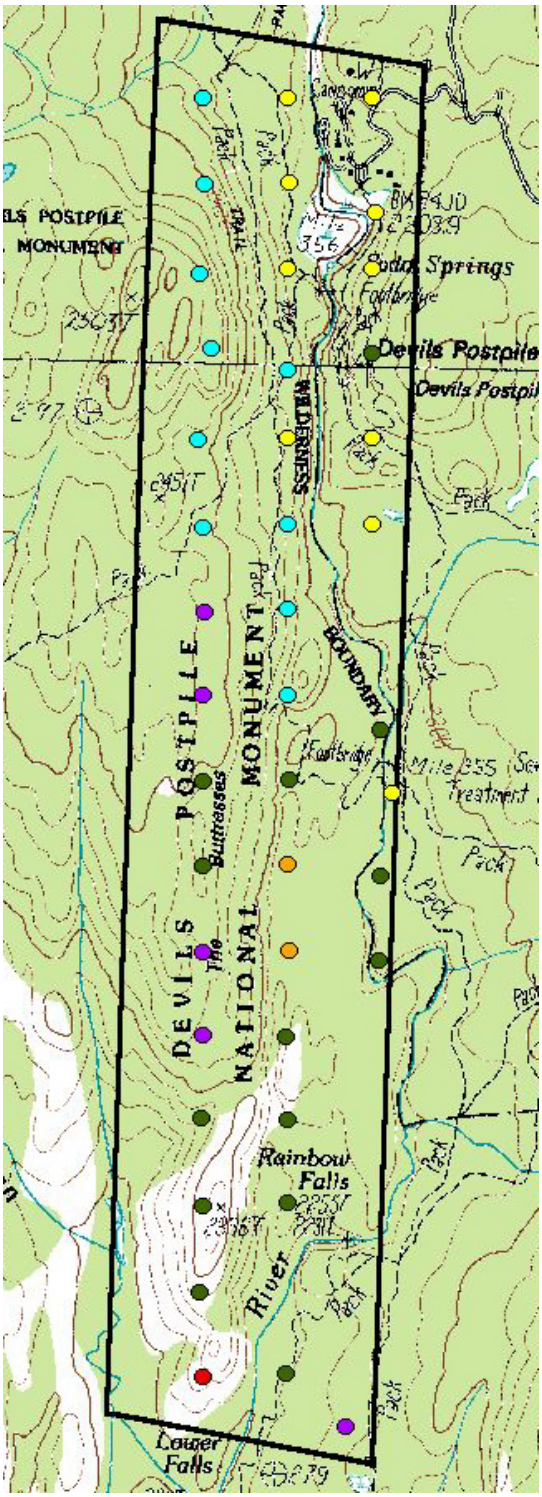

Figure 1. Locations of point count stations sampled during the June 2003 landbird inventory of Devil's Postpile National Monument. Each point was classified on the ground by habitat alliance (see text for source of alliance classifications): Non-vegetated Rock (red), Aspen Forest (orange), Lodgepole Pine Forest (yellow), Jeffrey Pine Woodland (dark green) Red Fir Forest (light blue), and Mountain Whitethorn Shrubland (purple).

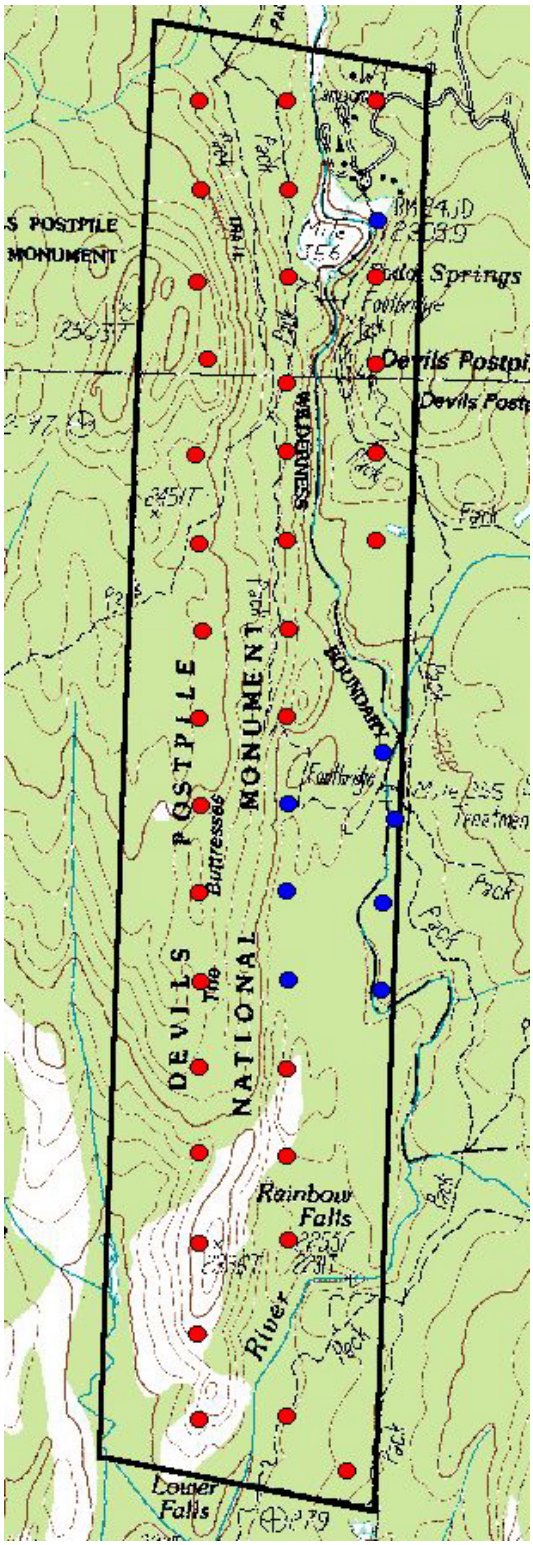

Figure 2. Landbird inventory point count stations with riparian inclusions (blue dots) and without riparian inclusions (red dots).

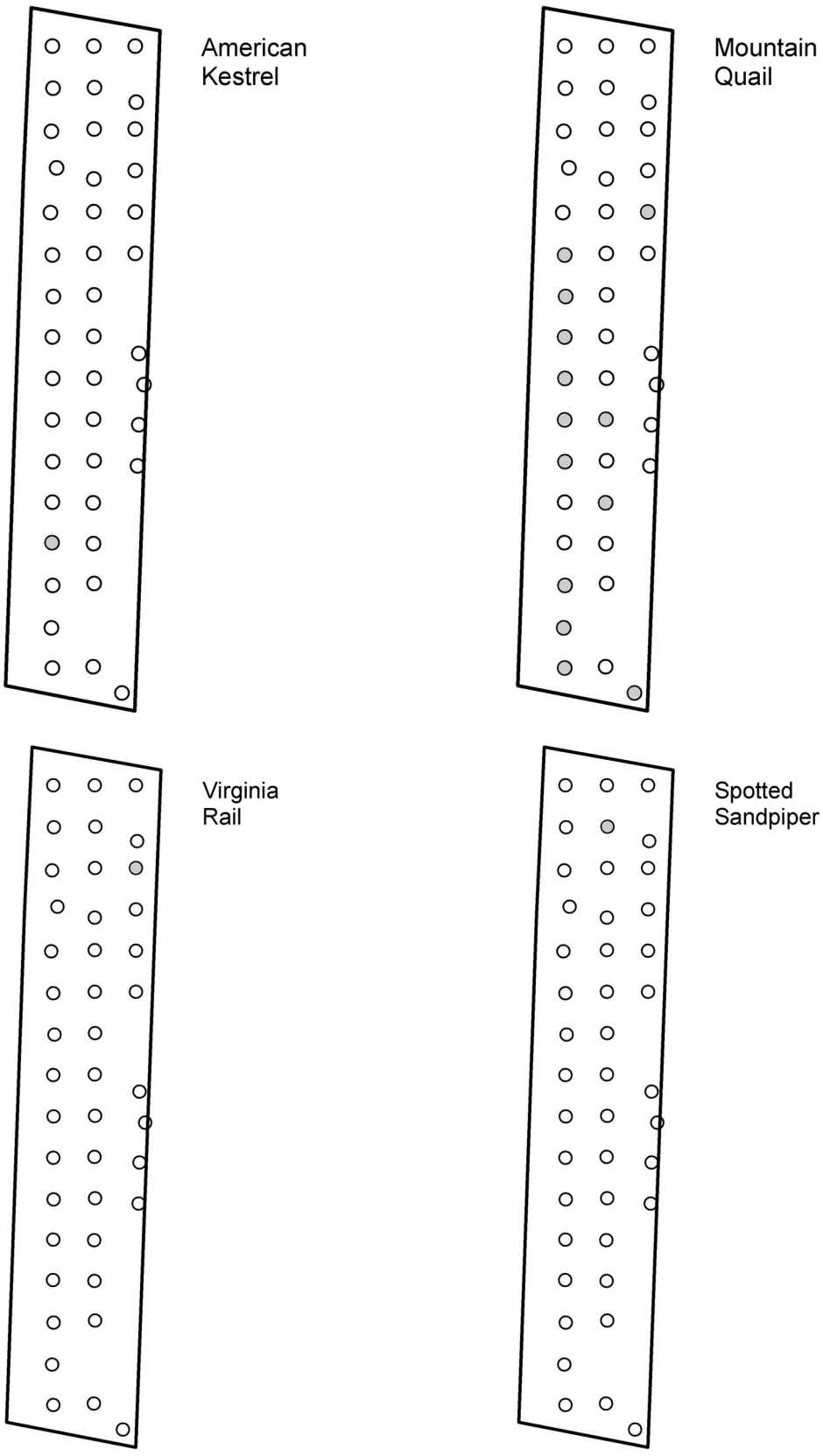

Figure 3. Landbird inventory points where American Kestrel, Mountain Quail, Virginia Rail, and Spotted Sandpiper were detected at a distance greater than 50 m (gray dots) or less than 50 m black dots). White dots indicate the survey points where the species was not detected.

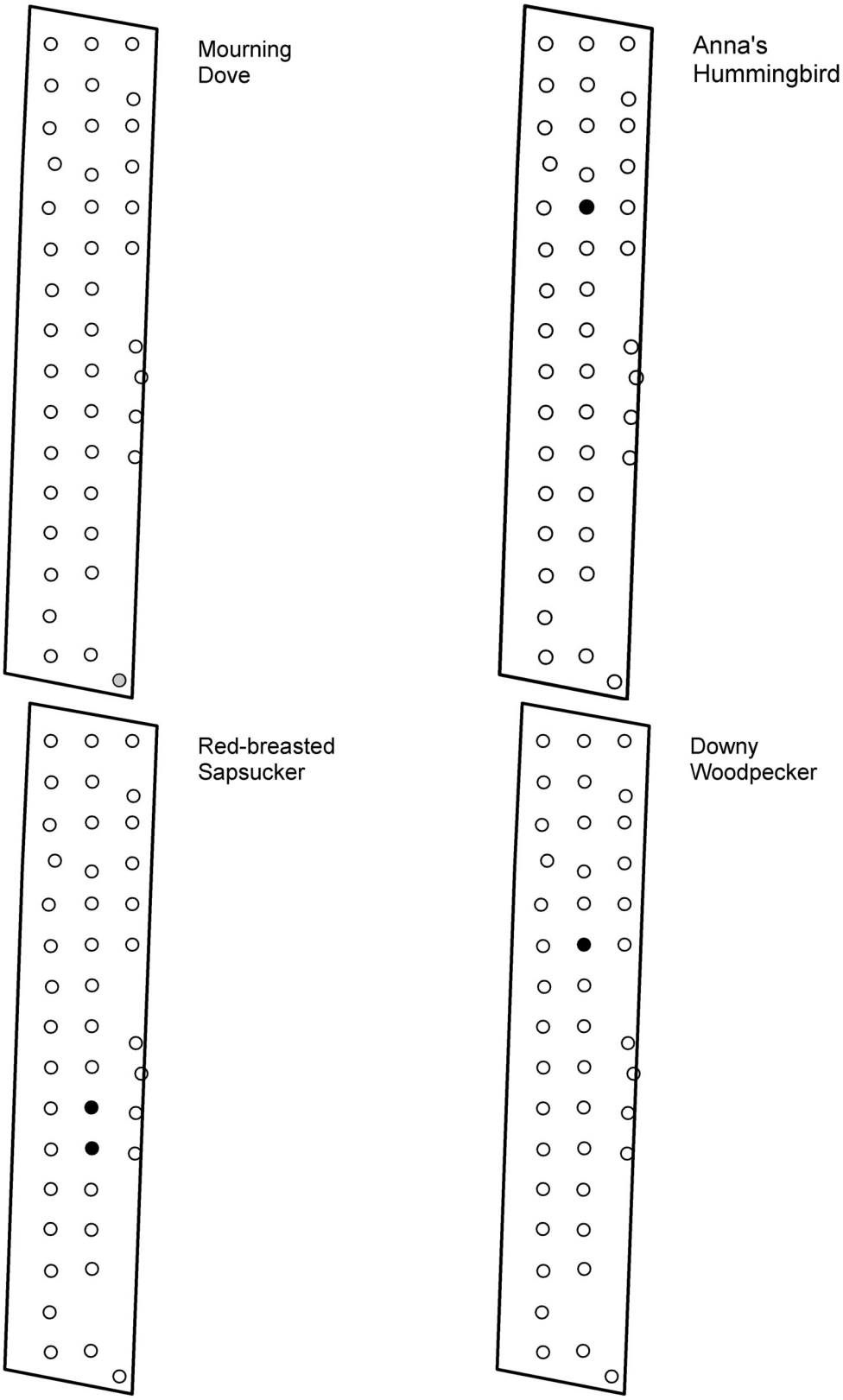

Figure 4. Landbird inventory points where Mourning Dove, Anna's Hummingbird, Red-breasted Sapsucker, and Downy Woodpecker were detected at a distance greater than 50 m (gray dots) or less than 50 m (black dots). White dots indicate the survey points where the species was not detected.

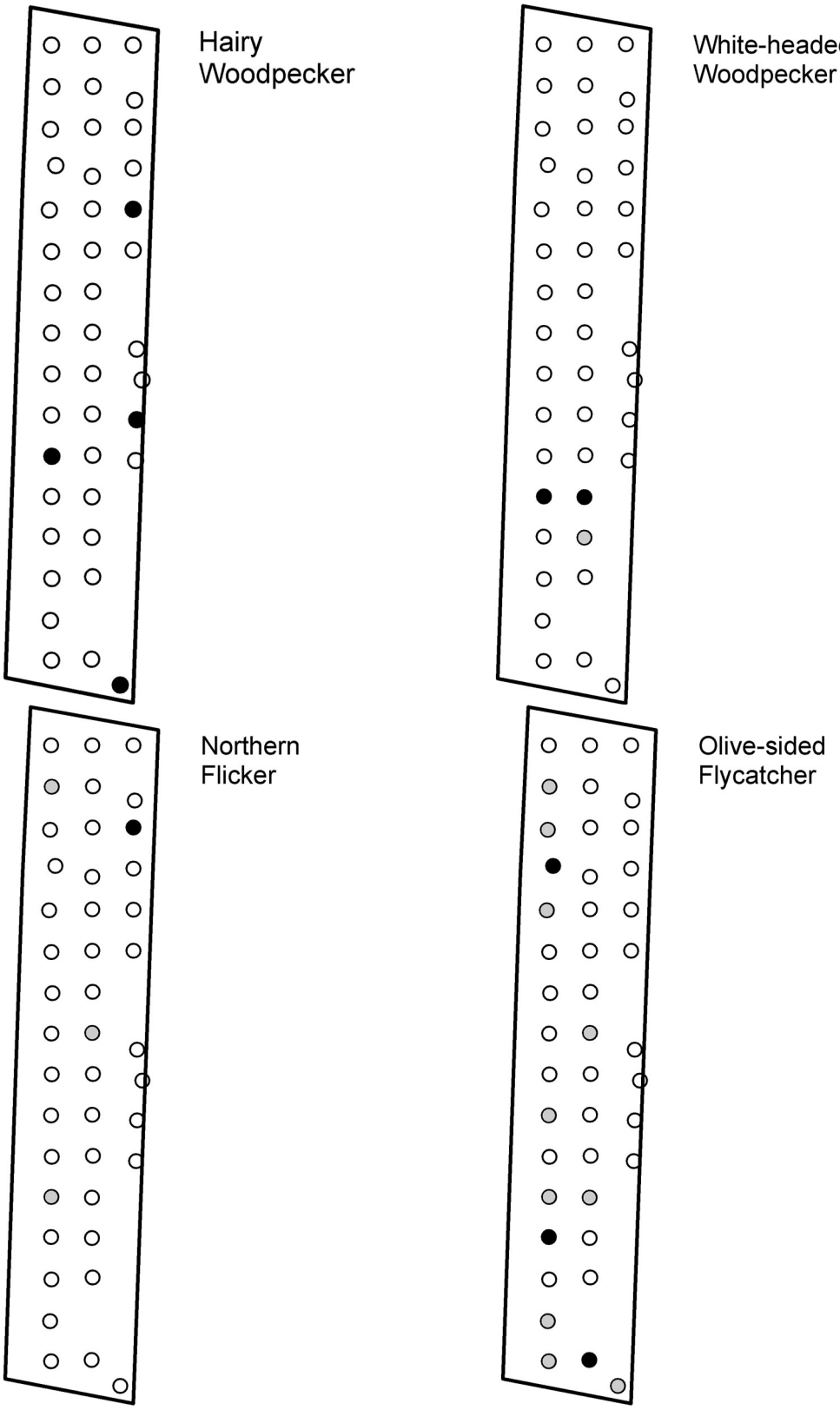

Figure 5. Landbird inventory points where Hairy Woodpecker, White-headed Woodpecker, Northern Flicker, and Olive-sided Flycatcher were detected at a distance greater than 50 m (gray dots) or less than 50 m (black dots). White dots indicate the survey points where the species was not detected.

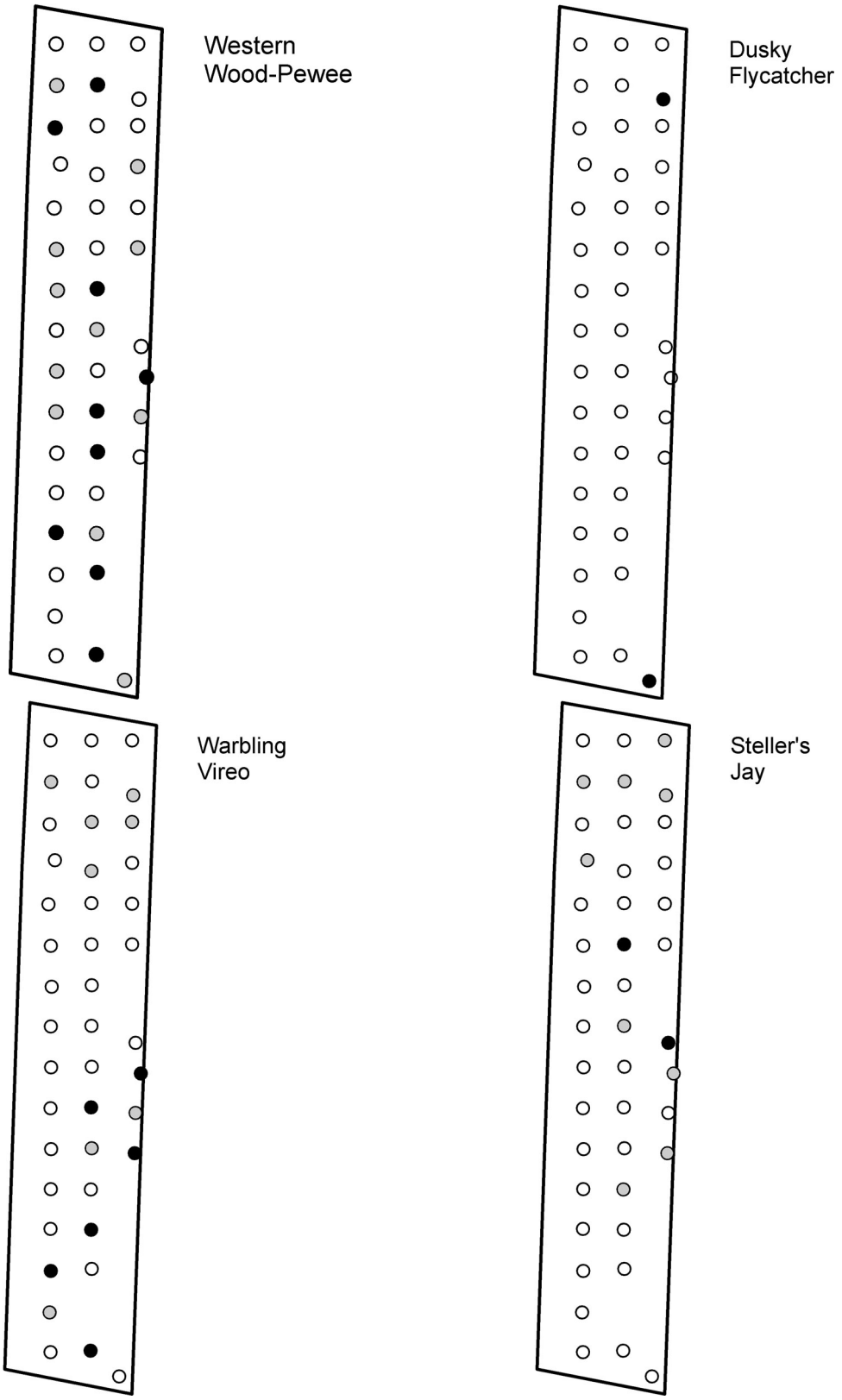

Figure 6. Landbird inventory points where Western Wood-Pewee, Dusky Flycatcher, Warbling Vireo, and Steller's Jay were detected at a distance greater than 50 m (gray dots) or less than 50 m (black dots). White dots indicate the survey points where the species was not detected.

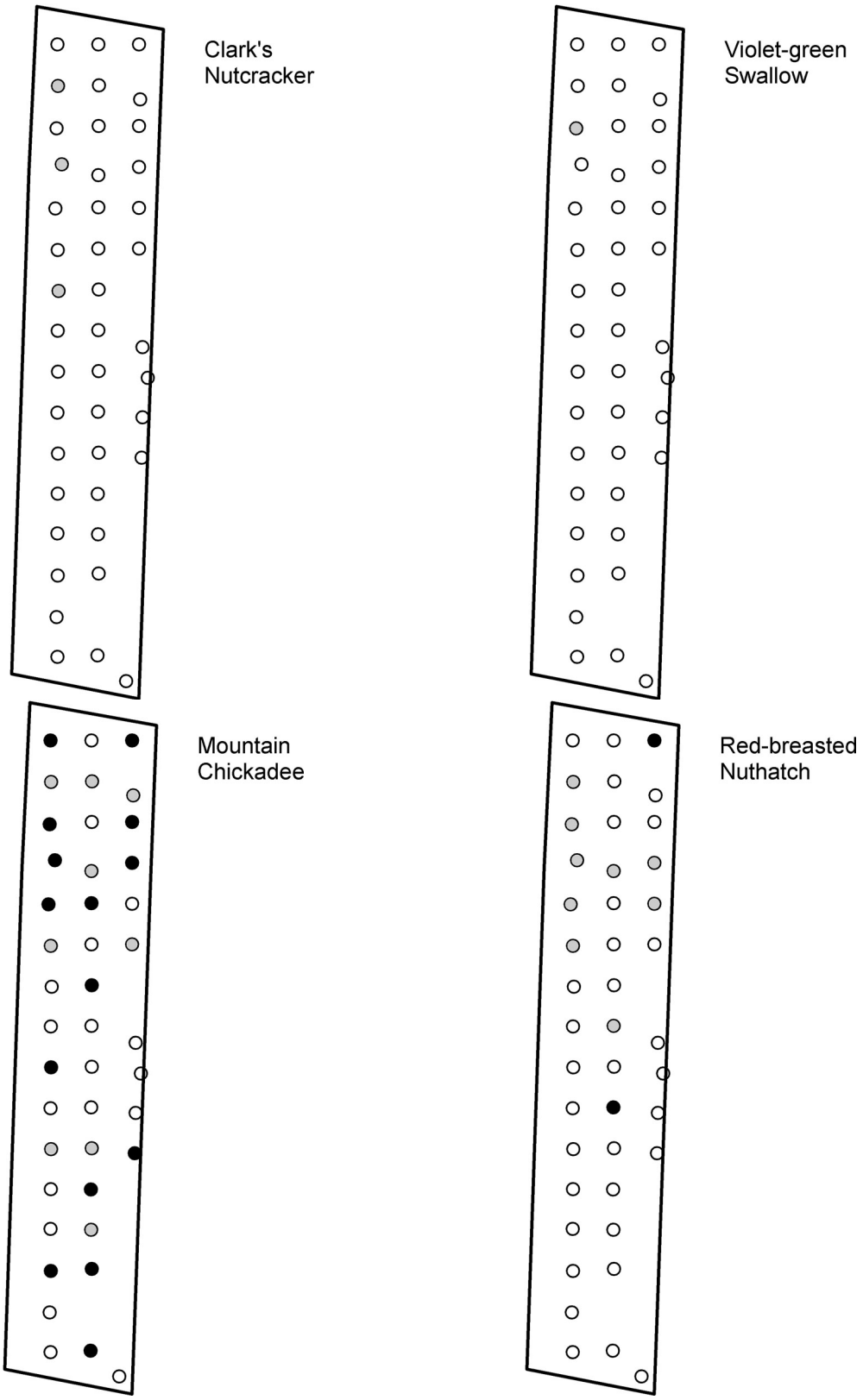

Figure 7. Landbird inventory points where Clark's Nutcracker, Violet-green Swallow, Mountain Chickadee, and Red-breasted Nuthatch were detected at a distance greater than 50 m (gray dots) or less than 50 m (black dots). White dots indicate the survey points where the species was not detected.

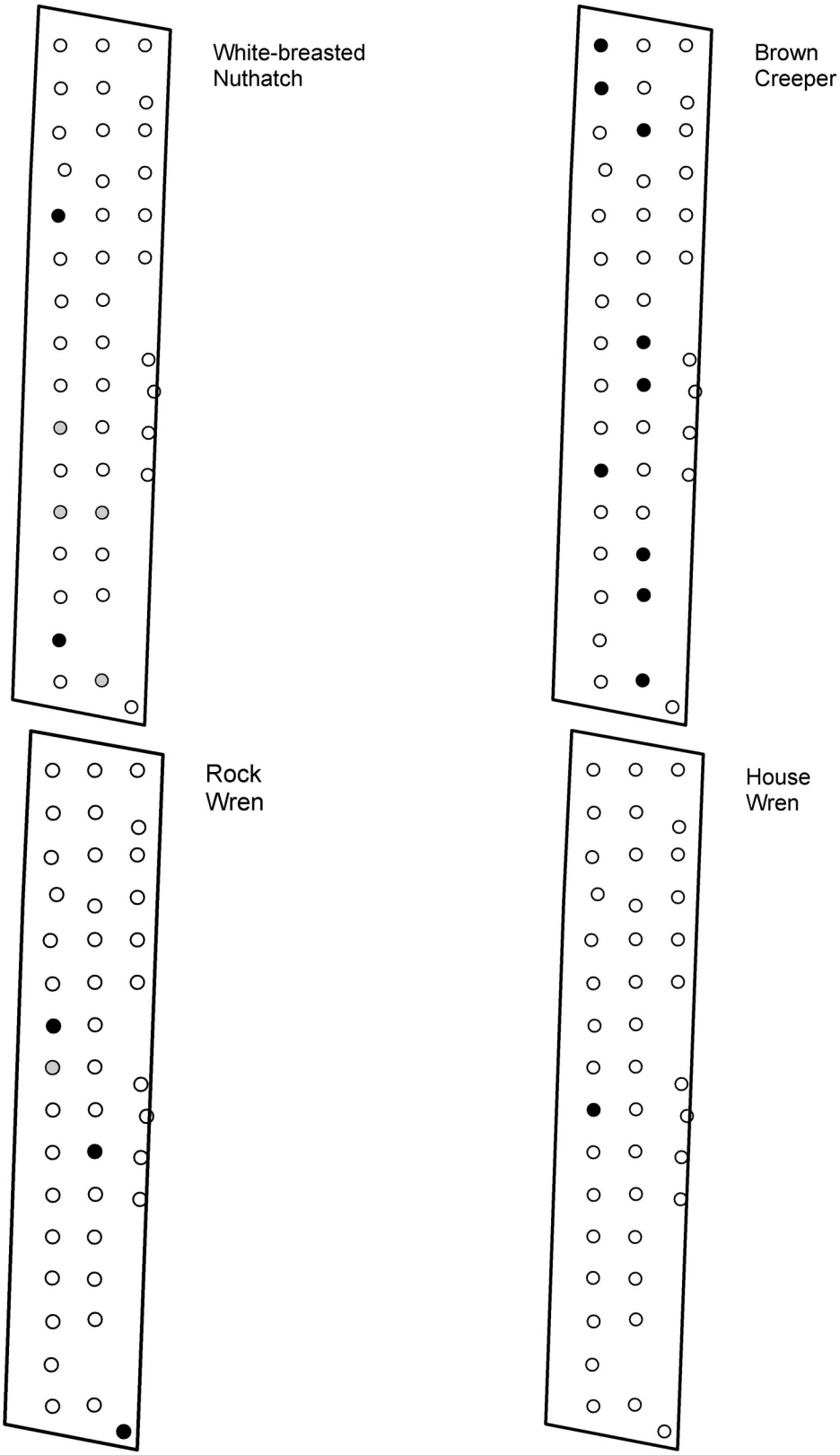

Figure 8. Landbird inventory points where White-breasted Nuthatch, Brown Creeper, Rock Wren, and House Wren were detected at a distance greater than 50 m (gray dots) or less than 50 m (black dots). White dots indicate the survey points where the species was not detected.

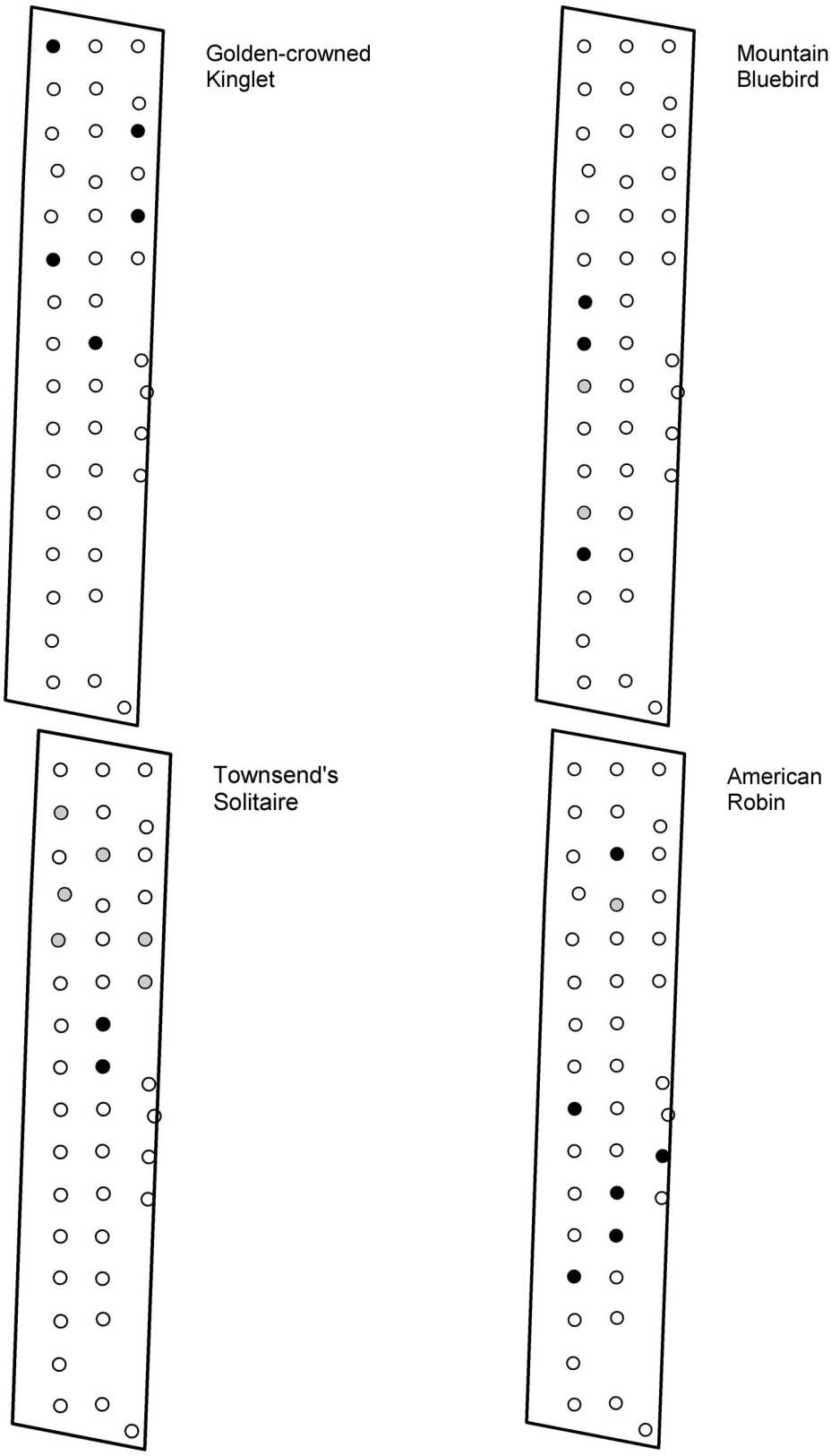

Figure 9. Landbird inventory points where Golden-crowned Kinglet, Mountain Bluebird, Townsend's Solitaire, and American Robin were detected at a distance greater than 50 m (gray dots) or less than 50 m (black dots). White dots indicate the survey points where the species was not detected.

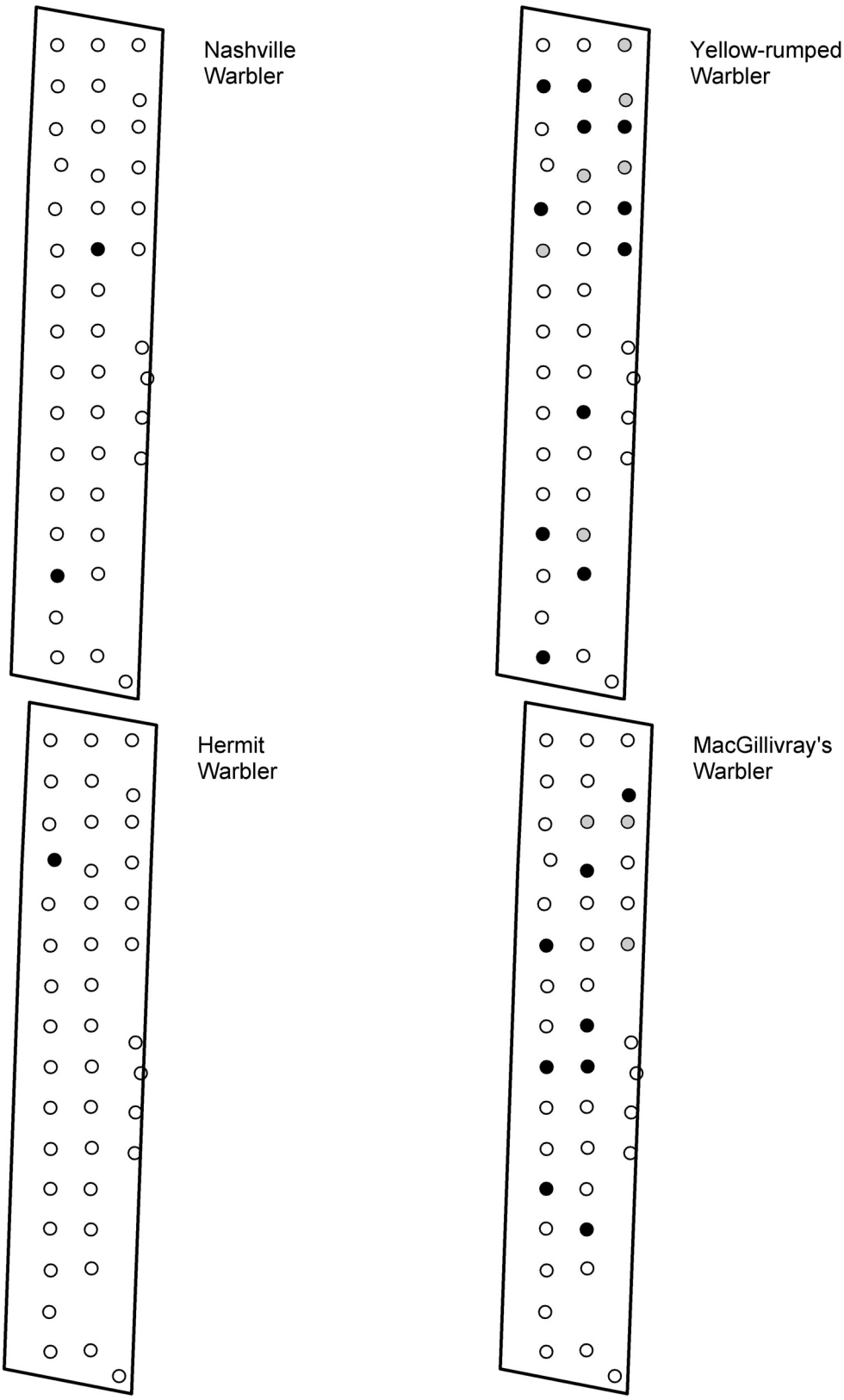

Figure 10. Landbird inventory points where Nashville Warbler, Yellow-rumped Warbler, Hermit Warbler, and MacGillivray's Warbler were detected at a distance greater than 50 m (gray dots) or less than 50 m (black dots). White dots indicate the survey points where the species was not detected.

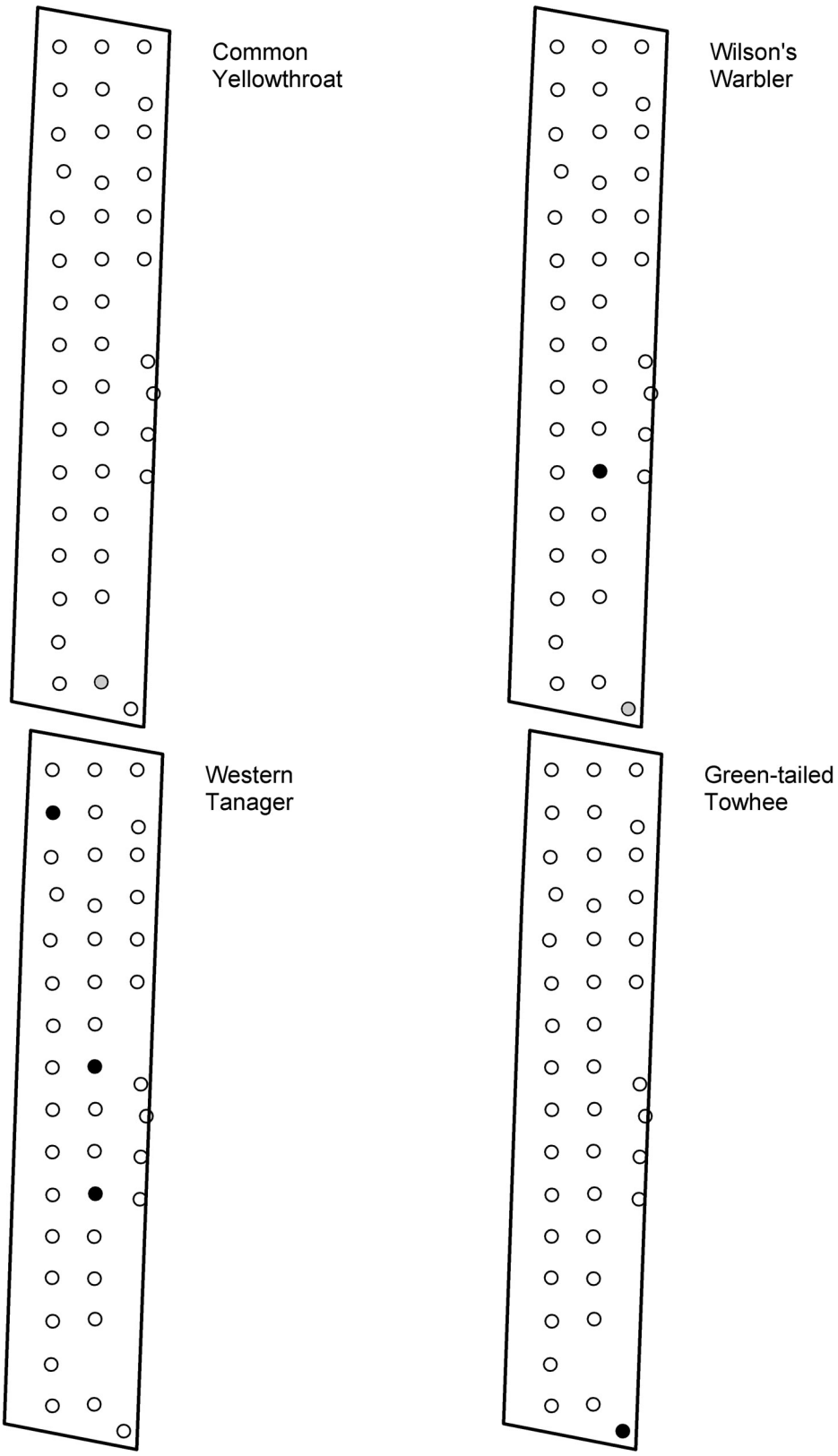

Figure 11. Landbird inventory points where Common Yellowthroat, Wilson's Warbler, Western Tanager, and Green-tailed Towhee were detected at a distance greater than 50 m (gray dots) or less than 50 m (black dots). White dots indicate the survey points where the species was not detected.

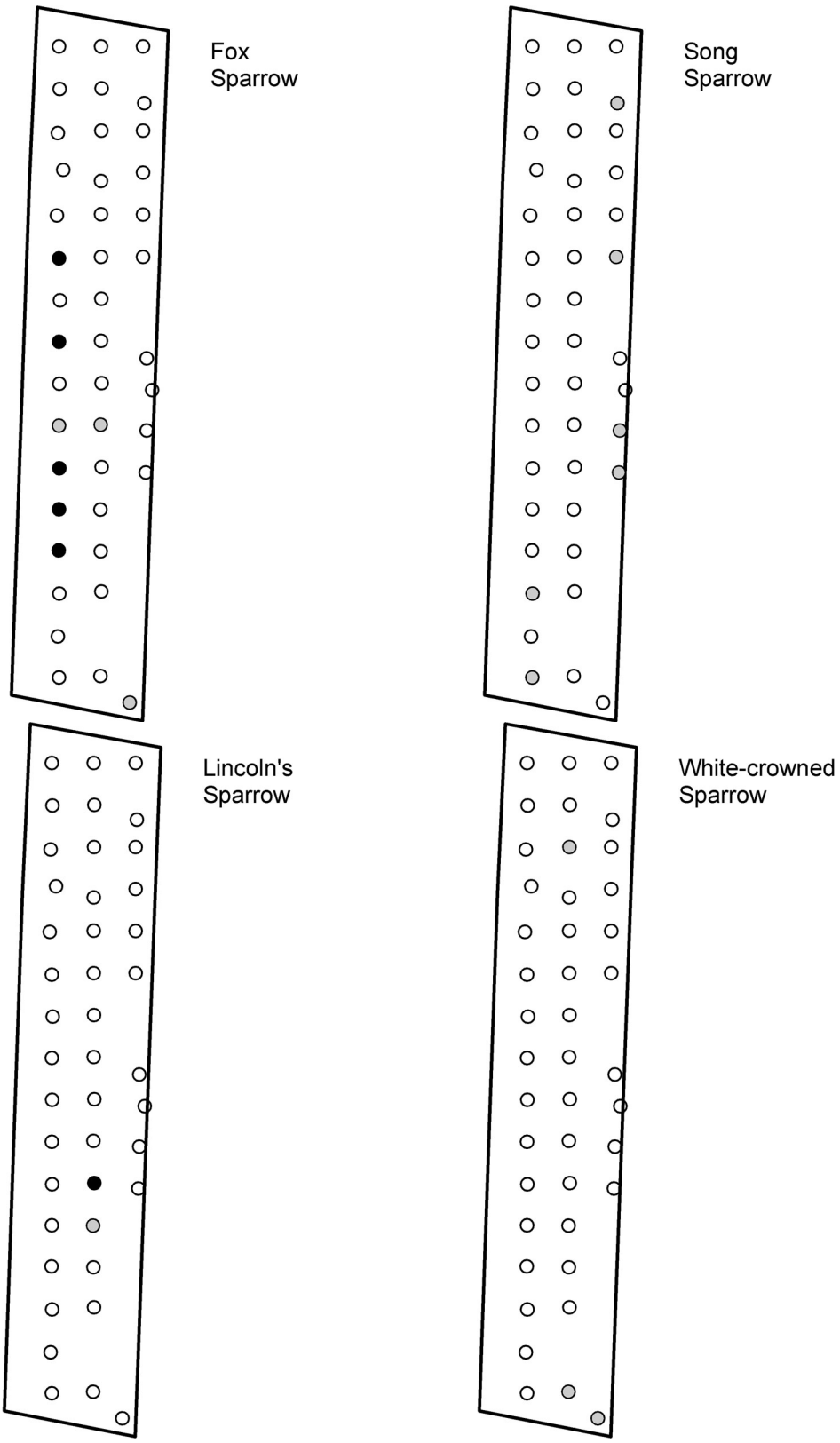

Figure 12. Landbird inventory points where Fox Sparrow, Song Sparrow, Lincoln's Sparrow, and White-crowned Sparrow were detected at a distance greater than 50 m (gray dots) or less than 50 m (black dots). White dots indicate the survey points where the species was not detected.

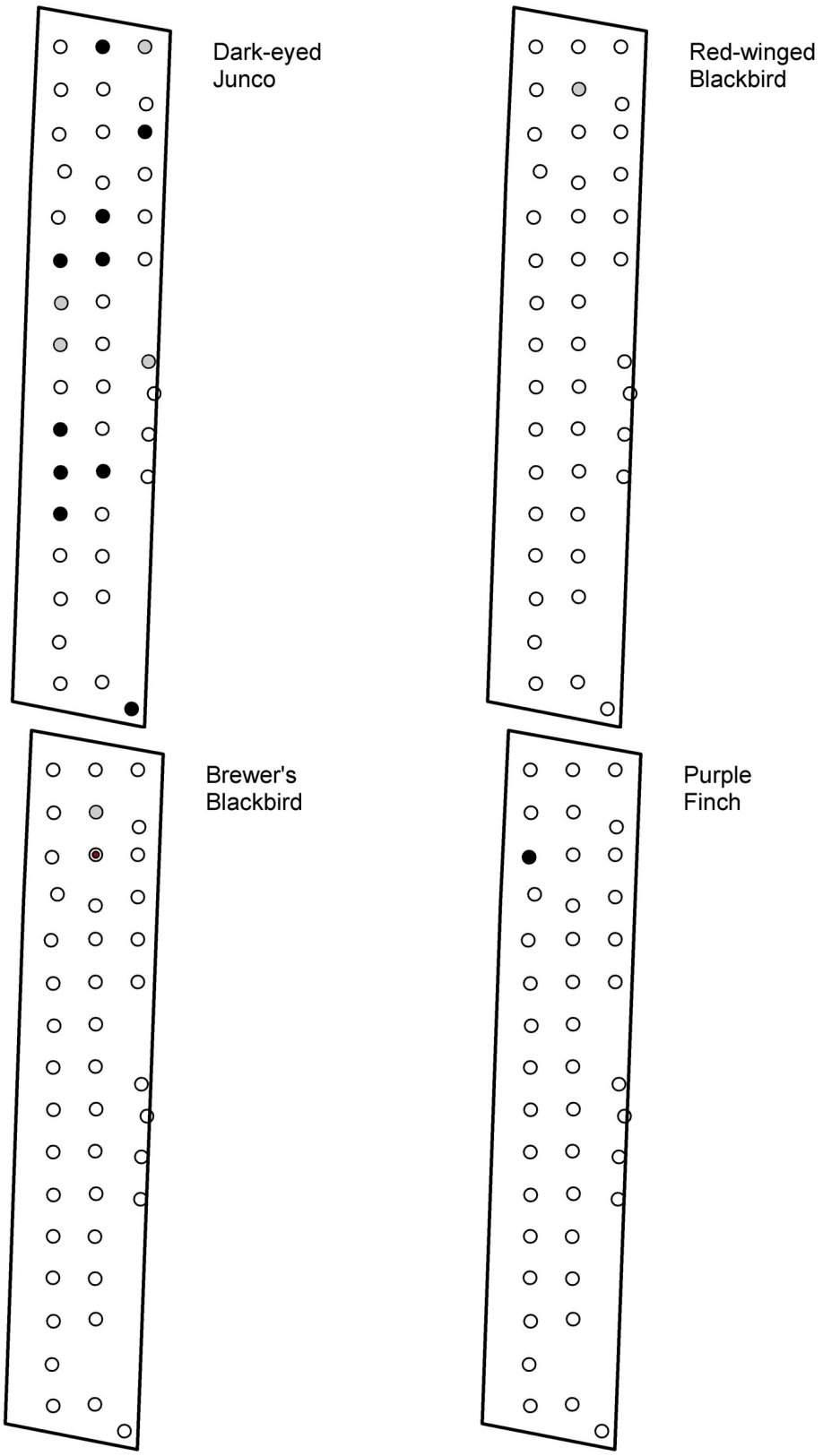

Figure 13. Landbird inventory points where Dark-eyed Junco, Red-winged Blackbird, Brewer's Blackbird, and Purple Finch were detected at a distance greater than 50 m (gray dots) or less than 50 m (black dots). White dots indicate the survey points where the species was not detected.

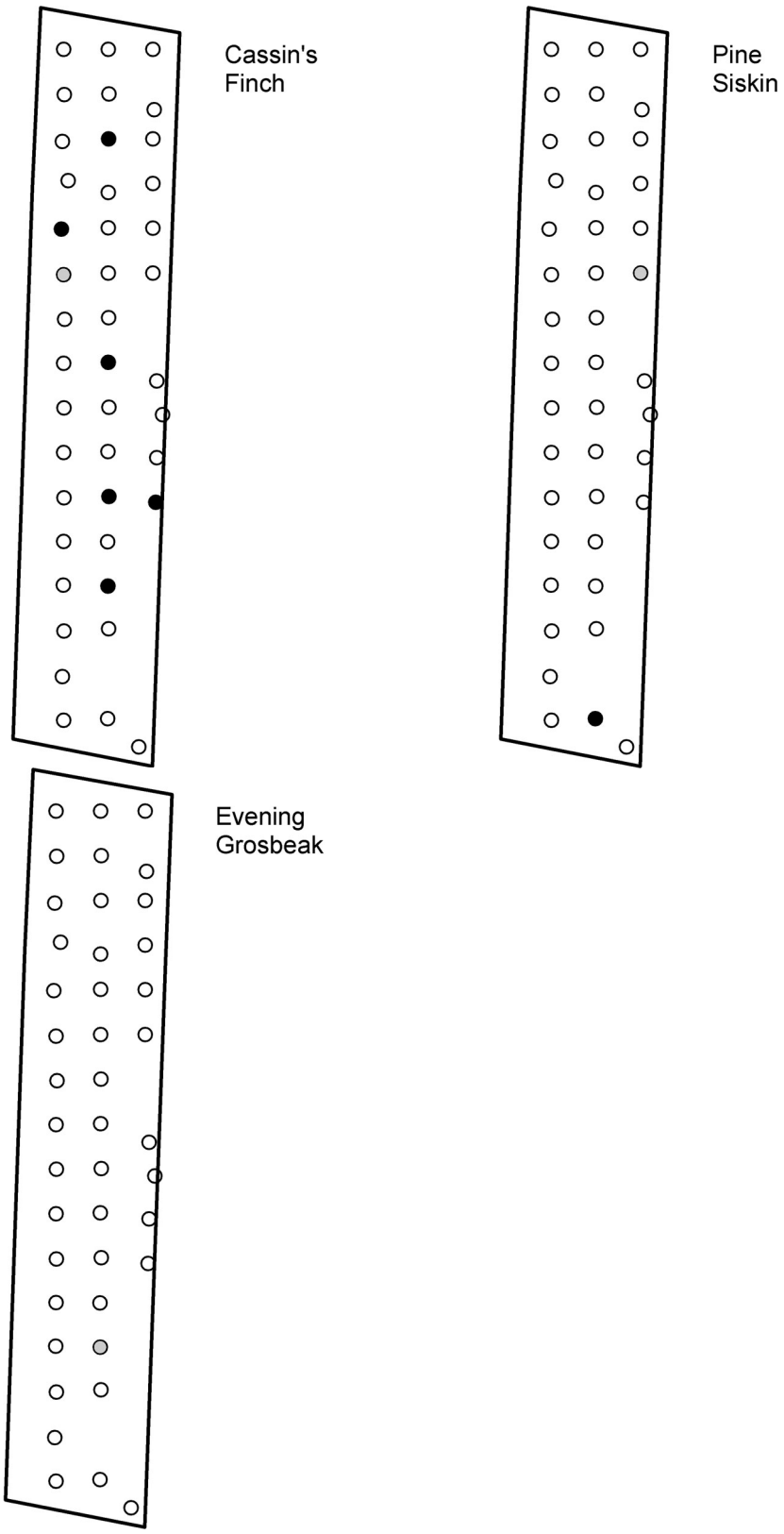

Figure 14. Landbird inventory points where Cassin's Finch, Pine Siskin, and Evening Grosbeak were detected at a distance greater than 50 m (gray dots) or less than 50 m (black dots). White dots indicate the survey points where the species was not detected.

Appendix A. Bird species documented to occur at Devil's Postpile National Monument, including species observed during our 2003 landbird inventory, as well as species detected by Gates and Heath (2003) and Parker and Parker (2001). Species in bold were detected during our 2003 landbird inventory.

Common Name	Scientific Name
1. Mallard	***Anas platyrhynchos***
2. Common Merganser	***Mergus merganser***
3. Bald Eagle	*Haliaeetus leucocephalus*
4. Cooper's Hawk	*Accipiter cooperii*
5. Northern Goshawk	*Accipiter gentilis*
6. Red-tailed Hawk	***Buteo jamaicensis***
7. Golden Eagle	***Aquila chrysaetos***
8. American Kestrel	***Falco sparverius***
9. Mountain Quail	***Oreortyx pictus***
10. Virginia Rail	***Rallus limicola***
11. Spotted Sandpiper	***Actitis macularia***
12. California Gull	*Larus californicus*
13. Mourning Dove	***Zenaida macroura***
14. Great Horned Owl	*Bubo virginianus*
15. Black Swift	*Cypseloid niger*
16. Vaux's Swift	***Chaetura vauxi***
17. White-throated Swift	***Aeronautes saxatalis***
18. Anna's Hummingbird	***Calypte anna***
19. Calliope Hummingbird	***Stellula calliope***
20. Rufous Hummingbird	*Selasphorus rufus*
21. Belted Kingfisher	*Ceryle alcyon*
22. Lewis's Woodpecker	*Melanerpes lewis*
23. Williamson's Sapsucker	*Sphyrapicus thyroideus*
24. Red-breasted Sapsucker	***Sphyrapicus ruber***
25. Downy Woodpecker	***Picoides pubescens***
26. Hairy Woodpecker	***Picoides villosus***
27. White-headed Woodpecker	***Picoides albolarvatus***
28. Black-backed Woodpecker	***Picoides arcticus***
29. Northern Flicker	***Colaptes auratus***
30. Olive-sided Flycatcher	***Contopus cooperi***
31. Western Wood-Pewee	***Contopus sordidulus***
32. Willow Flycatcher	*Empidonax traillii*
33. Hammond's Flycatcher	*Empidonax hammondii*
34. Gray Flycatcher	*Empidonax wrightii*
35. Dusky Flycatcher	***Empidonax oberholseri***
36. Cassin's Vireo	*Vireo cassinii*
37. Warbling Vireo	***Vireo gilvus***
38. Steller's Jay	***Cyanocitta stelleri***
39. Clark's Nutcracker	***Nucifraga columbiana***
40. Common Raven	***Corvus corax***

Appendix A, continued

Common Name	Scientific Name
41. Tree Swallow	*Tachycineta bicolor*
42. Violet-green Swallow	***Tachycineta thalassina***
43. Cliff Swallow	***Petrochelidon pyrrhonota***
44. Mountain Chickadee	***Poecile gambeli***
45. Red-breasted Nuthatch	***Sitta canadensis***
46. White-breasted Nuthatch	***Sitta carolinensis***
47. Brown Creeper	***Certhia americana***
48. Rock Wren	***Salpinctes obsoletus***
49. House Wren	***Troglodytes aedon***
50. American Dipper	***Cinclus mexicanus***
51. Golden-crowned Kinglet	***Regulus satrapa***
52. Mountain Bluebird	***Sialia currucoides***
53. Townsend's Solitaire	***Myadestes townsendi***
54. Hermit Thrush	*Catharus guttatus*
55. American Robin	***Turdus migratorius***
56. Orange-crowned Warbler	*Vermivora celata*
57. Nashville Warbler	***Vermivora ruficapilla***
58. Yellow Warbler	*Dendroica petechia*
59. Yellow-rumped Warbler	***Dendroica coronata***
60. Hermit Warbler	***Dendroica occidentalis***
61. MacGillivray's Warbler	***Oporornis tolmiei***
62. Common Yellowthroat	***Geothlypis trichas***
63. Wilson's Warbler	***Wilsonia pusilla***
64. Western Tanager	***Piranga ludoviciana***
65. Green-tailed Towhee	***Pipilo chlorurus***
66. Spotted Towhee	*Pipilo maculatus*
67. Chipping Sparrow	*Spizella passerina*
68. Brewer's Sparrow	*Spizella breweri*
69. Black-throated Sparrow	*Amphispiza bilineata*
70. Fox Sparrow	***Passerella iliaca***
71. Song Sparrow	***Melospiza melodia***
72. Lincoln's Sparrow	***Melospiza lincolnii***
73. White-crowned Sparrow	***Zonotrichia leucophrys***
74. Dark-eyed Junco	***Junco hyemalis***
75. Black-headed Grosbeak	*Pheucticus melanocephalus*
76. Lazuli Bunting	*Passerina amoena*
77. Red-winged Blackbird	***Agelaius phoeniceus***
78. Brewer's Blackbird	***Euphagus cyanocephalus***
79. Brown-headed Cowbird	***Molothrus ater***
80. Pine Grosbeak	*Pinicola enucleator*
81. Purple Finch	***Carpodacus purpureus***
82. Cassin's Finch	***Carpodacus cassinii***
83. Red Crossbill	*Loxia curvirostra*
84. Pine Siskin	***Carduelis pinus***

Appendix A, continued

Common Name	Scientific Name
85. Lesser Goldfinch	*Carduelis psaltria*
86. Evening Grosbeak	***Coccothraustes vespertinus***

Appendix B: Field Forms

DEVIL'S POSTPILE NATIONAL MONUMENT BIRD INVENTORY DAILY JOURNAL

Transect:_____ Quad:_____ Date:_____/____/_____ Bird Obs.:_____ Veg. Obs.:_____

Transect Turning Points

Point number:_____ New direction:_____

Explanation:_____

_____

Point number:_____ New direction:_____

Explanation:_____

_____

Point number:_____ New direction:_____

Explanation:_____

_____

Point number:_____ New direction:_____

Explanation:_____

_____

Transect notes (describe transect route including crossing creeks/rivers and vegetation types encountered):

_____

_____

_____

_____

_____

Weather:_____

_____

_____

_____

Vegetation phenology and natural history observations (include interesting avian encounters/observations; please record unusual bird sightings here and on the Rare Bird Report Form):

_____

_____

_____

_____

_____

Other:_____

_____

_____

Devil's Postpile National Monument 2003 VCP Point Count Form

Transect_________ Date____/____/____ Observer______ Weather____

Starting Northing								
Starting Easting								

Starting Direction:______ Offset (Y, N):____

Ending Northing								
Ending Easting								

Protocol (**n**ormal, **r**estrict. hab, **t**rail, **m**ixed—on & offtrail, **d**eliberate):______

Pt. #	New Dir.

Notes:
____
____

Pt	N[1]	Start Time	Species	Dist.	Flyover (count)	Seen First	Ever Sang	I[2]

Pt	N[1]	Start Time	Species	Dist.	Flyover (count)	Seen First	Ever Sang	I[2]

[1]Noise: 1=*no noise*; 2=*gentle babbling brook noise*, probably not missing birds; 3=*babbling creek noise*, might be missing some high-pitched songs/calls of distant birds; 4=*rushing creek noise*, detection radius is probably substantially reduced; 5=*roaring creek/river noise*, probably detecting only the closest/loudest birds.

[2]Interval: 3=first detected during first three minutes of point count; 2=first detected during last two minutes of point count.

IBP's Devil's Postpile National Monument Point Count Vegetation Form—side 1
(adapted from SEKI'S Vegetation Accuracy Assessment Field Form)

Point ___ ___ ___ ___ ___ ___ Plot code* SEKI-AA. Hab _____ Hab2 **_____

1 Field prov. cmmty. name_____1Field PI code_____

2 Field prov. cmmty. name**_____ 2Field PI code**_____

State CA Park SEQUOIA AND KINGS CANYON NP Park site name _____

Quad name* _____(USGS 7.5 min.) Quad code* _____

(USE NAD27) Zone 11 S. Plot UTM X __ __ __ __ __ __ E Plot UTM Y __ __ __ __ __ __ __ N Error: +/- _____ m

Loc. Source_____ Survey date (MM/DD/YY): _____/_____/_____ Veg obs: _____ Bird obs: _____

Elevation _____ ft ./ m Slope _____deg. Aspect _____ deg.

**office use only; **optional field*

Topographic Position (*circle one*): Lower 1/3 Mid 1/3 Upper 1/3 Ridge Top Canyon Bottom

Landform _____ Microtopography (*circle one*): Concave Convex Undulating Flat

Soil Moisture (1-3) _____ Standing H2O(sq.-m)_____ Running H2O(1-5)_____ Snags >20cm dbh (a=0, b=1-5, c=6+)_____

Plot/Vegetation Description (*include description of unvegetated cover*):

Ground cover (0.1m or less)	
Type	Cover
snow	%
water	%
rock	%
bare soil/mud/sand	%
litter	%
downed wood	%
grass	%
sedge	%
forb	%
fern	%
shrub	%
tree	%
other1 (specify)	%
other2 (specifiy)	%
other3 (specify)	%
TOTAL	**100%**

Representative of Polygon: ____ Yes, ____ No (*If no, comments required below)* Other Habs within 100m:_____, _____

Additional Comments:

IBP's Devil's Postpile National Monument Point Count Vegetation Form—side 2
(adapted from SEKI'S Vegetation Accuracy Assessment Field Form)

Point_____

VEGETATION DESCRIPTION

Leaf Phenology (dominant stratum)	**Leaf Type (of dominant stratum)**	**Physiognomic class**
Trees and Shrubs	__Broad-leaved	__Forest
__Evergreen	__Needle-leaved	__Woodland
__Cold-deciduous	__Mixed broad-leaved/ Needle leaved	__Shrubland
__Drought-deciduous	__Microphyllous	__Dwarf Shrubland
__Mixed evergreen-cold deciduous	__Graminoid	__Herbaceous
__Mixed evergreen - drought deciduous	__Forb	__Nonvascular
Herbs	__Pteridophyte	__Sparsely Vegetated
__ Annual		
__Perennial		

	% Cover	Height (m)	% Cover	Dominant species
T1 Emergent				
T2 Canopy ☐				
T3 Sub-canopy				
S1 Tall shrub ☐				
S2 Short shrub				
S3 Dwarf-shrub				
H Herbaceous				
N Non-Vascular				
V Vine/liana				
E Epiphyte				

Devil's Postpile National Monument Point Count Densiometer Readings

Transect:_____ Date:_____ Observer:_____

Note: Please record the number of OPEN quarter-squares!!!

Point 1			
North: _____/96	East: _____/96	South: _____/96	West: _____/96

Point 2			
North: _____/96	East: _____/96	South: _____/96	West: _____/96

Point 3			
North: _____/96	East: _____/96	South: _____/96	West: _____/96

Point 4			
North: _____/96	East: _____/96	South: _____/96	West: _____/96

Point 5			
North: _____/96	East: _____/96	South: _____/96	West: _____/96

Point 6			
North: _____/96	East: _____/96	South: _____/96	West: _____/96

Point 7			
North: _____/96	East: _____/96	South: _____/96	West: _____/96

Point 8			
North: _____/96	East: _____/96	South: _____/96	West: _____/96

Point 9			
North: _____/96	East: _____/96	South: _____/96	West: _____/96

Point 10			
North: _____/96	East: _____/96	South: _____/96	West: _____/96

Point 11			
North: _____/96	East: _____/96	South: _____/96	West: _____/96

Point 12			
North: _____/96	East: _____/96	South: _____/96	West: _____/96

Point 13			
North: _____/96	East: _____/96	South: _____/96	West: _____/96

Point 14			
North: _____/96	East: _____/96	South: _____/96	West: _____/96

Devil's Postpile National Monument Rare Bird Report Form

Obs.:	Species:	Date: / /2003	Qty:	Northing: __ __ __ __ __ __ __	Easting: __ __ __ __ __ __	Time:
Transect and point, if detected during a point count:						
Description (include diagnostic plumage and vocalization details used to identify the individual, sex, #'s, and any nest sightings or behavior indicative of nesting):						

Obs.:	Species:	Date: / /2003	Qty:	Northing: __ __ __ __ __ __ __	Easting: __ __ __ __ __ __	Time:
Transect and point, if detected during a point count:						
Description (include diagnostic plumage and vocalization details used to identify the individual, sex, #'s, and any nest or behavior indicative of nesting):						

Obs.:	Species:	Date: / /2003	Qty:	Northing: __ __ __ __ __ __ __	Easting: __ __ __ __ __ __	Time:
Transect and point, if detected during a point count:						
Description (include diagnostic plumage and vocalization details used to identify the individual, sex, #'s, and any nest sightings or behavior indicative of nesting):						

Hitlist:

All Grebe spp.
All Waterfowl
Merganser spp.
TUVU
WTKI, OSPR
BAEA
NOHA
RSHA, SWHA
SSHA, COHA
NOGO, RTHA
GOEA
AMKE, MERL
PEFA
WTPT
VIRA
Shorebird spp.
All Gull spp.
GRRO
All Owl spp.
CONI, COPO
All Swift Spp.
BEKI
LEWO, WISA
NUWO, BBWO
WIFL, GRFL
WEWP
WEKI
PHAI
AMCR, CLNU
HOLA
WBNU
OATI
MAWR
RCKI
BGGN
NOMO
AMPI
CEDW, LOSH
COYE, YBCH
CATH, GTTO
CALT, RCSP
SAGS, BCSP
SAVS, GRSP
BRSP, VESP
BTSP, LASP
WEME, YHBL
BUOR,
GCRF
PIGR
LAGO
HOFI

Or anything you even suspect may be unusual or outside its normal range.