# The Effect of Time Period on Point Count Methodology for Monitoring Breeding Birds

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**Abstract**—The traditional time period to survey breeding birds in low elevation forests of western Montana is from the middle of May through early July. There are some bird species, however, that begin their breeding cycle before these surveys begin and, therefore, may not be as vocal or active during the traditional survey period. To study the impact of survey timing on our understanding of the breeding bird community, we undertook a two year study of breeding birds in old-growth ponderosa pine (*Pinus ponderosa*) habitat in western Montana in 1996 and 1997. We chose eight sites and sampled each site with a transect of 5 points, 200 meters apart using standard bird point count methodology (Ralph and others 1995). Observers visited each site a total of ten times each year from mid- to late April until the end of June and recorded the number of each species seen or heard at each point on the transect. Over the two years, a total of 52 species and 6,730 individuals were detected within 100 meters of the counting points. The highest numbers of individuals and species were generally detected during the traditional survey period, confirming this time period as the best for surveying breeding birds in this habitat in western Montana. However, some resident and short distance migratory species were detected more frequently during the first five visits, indicating that they may be underrepresented in point count surveys beginning in mid-May. We also demonstrate that the use of habitat by flocking species may not be represented accurately in a single year's survey.

Controversies about National Forest management have underscored the need for better information on local animal and plant populations. Because they are more visible and therefore more familiar than other animal groups, birds have figured prominently in recent public debates over forest management policies. The existence of large nationwide surveys such as the Breeding Bird Survey (Robbins and others 1986), and numerous regional and statewide surveys, give biologists and managers important large-scale information about the status of avian populations. However, data from these large-scale surveys do not meet the increasing need for avian population trend and habitat association information at local and regional scales. Additional monitoring needs exist on a local level, where land managers require more specific information about species distributions, critical habitats, and the effects of management activities (Howe and others 1995).

Point counts are a widely used, relatively standardized method to sample bird populations for estimating densities in local areas, determining trends in populations over local and regional areas, assessing habitat preferences, and other scientific and population monitoring purposes (Johnson 1995; Ralph and others 1995). Moreover, point counts are well suited for avian population monitoring programs because they are straightforward methodologically and permit sampling at numerous geographic sites (Wolf and others 1995). Point counts depend on the observers' ability to detect and identify birds that are present in an area by sight and sound (song, call, or drum), because the majority of the detections of birds in forested habitats are made by sounds alone.

It is the hope of biologists that data recorded using the point count methodology is strongly correlated with the actual population of birds in the study area (Johnson 1995). Invariably, however, there are birds present at point count locations that are not detected, and this proportion of undetected birds is unknown and variable (Barker and Sauer 1995). This leads directly to the idea of detection probability, or the probability that a specific bird will be detected on a particular point count. This probability of detection varies by species, habitat, time of year, and a host of environmental factors, including temperature, weather, etc. (Ralph and Scott 1981). This greatly complicates comparisons of point count values between species, habitats, and even sites within a habitat. Therefore, biologists, seeking to minimize the effects of the variable probabilities of detection, have sought to limit census periods to times of "acceptable" field conditions (Burnham 1981) that are comparable between sites.

Somewhat overlooked in the literature on point count methodology is the influence of limiting the time period in which counts are conducted on the final results (but see Anderson and others 1981; Best 1981; Ralph 1981; and Skirven 1981). The optimal period for detecting species is when they are most vocal, usually when they are establishing and defending breeding territories, because many species are relatively quiet during incubation and nestling periods. Most local biologists and managers schedule point count surveys to take advantage of the best local time period for the majority of the breeding bird activity, meaning that they must wait for migratory birds to arrive. Hence, the typical breeding bird point count survey in this habitat in Montana begins in mid- to late May and ends by early July. However, some nonmigratory or short distance migrant species may be missed or underestimated by surveys that target the migratory species because the less migratory species establish territories and breed before long

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distance migrants return. This group of species includes a number of sensitive species such as forest owls (e.g., Northern Pygmy-owl; see table 1 for scientific names), woodpeckers, and other cavity nesters. Because many of these species are sensitive to habitat changes such as logging in National Forests of the Northwest (Hejl 1994; Hejl and others 1995), understanding these sampling biases is critical for effective forest management.

**Table 1**—Species observed in old-growth ponderosa pine categorized by detection frequency. More frequent early indicates this species was detected more frequently during the early visits than the traditional survey visits. More frequent later indicates more detections during the traditional survey period than earlier. Migration status, R = Residents, B = short distance migrants, and A = long distance migrants (follows Hejl and others 1995).

| Species | | More frequent early | | More frequent later | | No difference | | Migration |
|---|---|---|---|---|---|---|---|---|
| Common Name | Scientific Name | 1996 | 1997 | 1996 | 1997 | 1996 | 1997 | status |
| Cooper's Hawk | *Accipiter cooperii* | | X | | | X | | B |
| Red-tailed Hawk | *Buteo jamaicensis* | | | X | X | | | B |
| American Kestrel | *Falco sparverius* | | | X | | | | B |
| Blue Grouse | *Dendragapus obscurus* | | X | X | | | | R |
| Ruffed Grouse | *Bonasa umbellus* | X | X | | | | | R |
| Northern Pygmy-Owl | *Glaucidium gnoma* | | | | | | X | R |
| White-throated Swift | *Aeronautes saxatalis* | | | | X | | | A |
| Calliope Hummingbird | *Stellula calliope* | | | | X | | | A |
| Red-naped Sapsucker | *Sphyrapicus nuchalis* | X | X | | | | | B |
| Williamson's Sapsucker | *Sphyrapicus thyroideus* | X | | | X | | | B |
| Hairy Woodpecker | *Picoides villosus* | | | | | X | X | R |
| Three-toed Woodpecker | *Picoides tridactylus* | | X | X | | | | R |
| Black-backed Woodpecker | *Picoides arcticus* | | | | | | X | R |
| Northern Flicker | *Colaptes auratus* | | | X | X | | | B |
| Pileated Woodpecker | *Dryocopus pileatus* | | | X | | | X | R |
| Olive-sided Flycatcher | *Contopus cooperi* | | | X | | | | A |
| Hammond's Flycatcher | *Empidonax hammondii* | | | X | X | | | A |
| Dusky Flycatcher | *Empidonax oberholseri* | | | X | X | | | A |
| Gray Jay | *Perisoreus canadensis* | | | X | X | | | R |
| Steller's Jay | *Cyanocitta stelleri* | X | | | X | | | R |
| Clark's Nutcracker | *Nucifraga columbiana* | X | | | X | | | R |
| Common Raven | *Corvus corax* | X | | | | | X | R |
| Black-capped Chickadee | *Poecile atricapillus* | | | | | X | X | R |
| Mountain Chickadee | *Poecile gambeli* | | | | | X | X | R |
| Chestnut-backed Chickadee | *Poecile rufescens* | | | | X | | | R |
| Red-breasted Nuthatch | *Sitta canadensis* | | | | | X | X | R |
| White-breasted Nuthatch | *Sitta carolinensis* | | | | X | X | | R |
| Brown Creeper | *Certhia americana* | | | X | X | | | B |
| Winter Wren | *Troglodytes troglodytes* | X | | | | | X | R |
| Golden-crowned Kinglet | *Regulus satrapa* | X | | | X | | | R |
| Ruby-crowned Kinglet | *Regulus calendula* | | X | X | | | | B |
| Townsend's Solitaire | *Myadestes townsendi* | | | | | X | X | B |
| Swainson's Thrush | *Catharus ustulatus* | | | X | X | | | A |
| Hermit Thrush | *Catharus guttatus* | | | X | | | X | B |
| American Robin | *Turdus migratorius* | | | | | X | X | B |
| Varied Thrush | *Ixoreus naevius* | X | X | | | | | R |
| Cassin's Vireo | *Vireo cassinii* | | | X | X | | | A |
| Warbling Vireo | *Vireo gilvus* | | | X | X | | | A |
| Orange-crowned Warbler | *Vermivora celata* | X | | | | | | A |
| Yellow Warbler | *Dendroica petechia* | | | X | | | | A |
| Yellow-rumped Warbler | *Dendroica coronata* | | | X | X | | | B |
| Townsend's Warbler | *Dendroica townsendi* | | | X | | | X | A |
| MacGillivray's Warbler | *Oporornis tolmiei* | | | X | X | | | A |
| Western Tanager | *Piranga ludoviciana* | | | X | X | | | A |
| Black-headed Grosbeak | *Pheucticus melanocephalus* | | | X | X | | | A |
| Lazuli Bunting | *Passerina amoena* | | | | X | | | A |
| Chipping Sparrow | *Spizella passerina* | | | X | X | | | A |
| Song Sparrow | *Melospiza melodia* | | X | | | | | B |
| Dark-eyed Junco | *Junco hyemalis* | | | | | X | X | B |
| Cassin's Finch | *Carpodacus cassinii* | | | | X | X | | B |
| Red Crossbill | *Loxia curvirostra* | | | | X | X | | R |
| Pine Siskin | *Carduelis pinus* | | | | X | X | | B |
| Evening Grosbeak | *Coccothraustes vespertinus* | | | | X | X | | R |

This paper reports the results of a study in which point count surveys of birds in old-growth ponderosa pine (*Pinus ponderosa*) habitat began five weeks prior to the traditional point count survey in western Montana and continued through the traditional survey time period, which is completed by early July. The main objective was to determine the phenology of detection (when birds begin to call and end calling) over a breeding season. Other objectives included determining the number of visits needed to get an accurate assessment of species composition and relative abundances, and determining the probability of detection for species in this habitat in order to make sample size recommendations for future surveys in this habitat (Hejl and Thompson, in preparation).

## Methods

Eight study sites were selected in old-growth ponderosa pine stands on the Bitterroot and Lolo National Forests in western Montana between 1,236 m and 1,649 m in elevation. Sites were at least 8 hectares in size and 200 meters wide, dominated by relatively undisturbed, homogeneous stands of ponderosa pine with old-growth characteristics (Hejl and Woods 1991). One transect was established at each study site, and consisted of 5 points located 200 m apart and at least 100 m from any large habitat discontinuity or stand edge. The bird community was sampled on these sites during the spring and summer of 1996 and 1997.

Two experienced bird watchers conducted bird point counts at 7 to 10 day intervals from April 15 until June 28 in 1996 and from April 21 until June 26 in 1997, resulting in 10 visits each year to each site. The observers differed between years. Point counts were completed at all study sites prior to beginning another survey cycle. The first five visits of each year will hereafter be referred to as the early survey period and the last five visits as the traditional survey period. The term "visit" represents one observer going to a site and recording information on a particular day. "Survey cycle" will refer to all visits to study sites during a particular 7 to 10 day period.

Observers conducted bird counts from one-half hour after dawn to 11:00 a.m. and each point was sampled for 10 minutes. Observers recorded all birds detected (seen, heard or flushed) while at a point. Information was recorded for each individual bird only once at each point, at the time and distance it was first noted. Data recorded included species, approximate distance from the observer (≤25 m, 26-50 m, 51-75 m, 76-100 m, >100m), sex (if known), breeding evidence, flock size, time interval during which the bird was noted (0-3 min., 3-5 min., 5-10 min), if the bird was a "repeat" sighting from an earlier point on the transect, and if the bird appeared to be "using" the habitat. Observers also separately recorded birds seen or heard while traveling to, from, and between points.

We conducted analyses using count data of birds within 100 m of the observer, excluding repeat sightings of individual birds. The number of species detected, number of individuals detected, species proportions, and other summary statistics were determined and summarized by point, site, visit, and year. Excluded from the analyses were observations that could not be verified at the species level, but were recorded by the observers as unknowns (for example, unknown woodpecker or unknown flycatcher).

## Results

Over the two-year study, a total of 53 species were detected: 46 species and 4,408 individuals in 1996, and 49 species and 2,322 individuals in 1997. The total number of species detected per visit ranged from 20 to 34 in 1996 and from 18 to 35 in 1997. The total number of individuals detected per visit ranged from 352 to 551 in 1996 and from 125 to 342 in 1997. The primary reason for the higher counts in 1996 was the very large number of individuals of flocking species such as Red Crossbills, Pine Siskins and Evening Grosbeaks encountered in the early weeks of the survey. Excluding counts for these three species, 2,409 individuals were detected in 1996, very similar to the 1997 totals.

There were six species common enough to have been detected in each survey cycle of both years: Hairy Woodpecker, Mountain Chickadee, Red-breasted Nuthatch, Townsend's Solitaire, American Robin, and Dark-eyed Junco. Four species (American Kestrel, Olive-sided Flycatcher, Orange-crowned Warbler, and Yellow Warbler) uncommon in this habitat were detected in 1996 but not in 1997. Seven additional uncommon species (Northern Pygmy-owl, White-throated Swift, Calliope Hummingbird, Black-backed Woodpecker, Chestnut-backed Chickadee, Lazuli Bunting, and Song Sparrow) were detected in 1997 but not in 1996. In each year there were five species detected only once, and a total of eight species seen only once during the entire study.

For the first perspective of differences between early and traditional survey times, we looked at species detected in the early period only or detected in the traditional period only. In 1996, there were two species detected in the early survey period but not in the traditional survey period (Orange-crowned Warbler, Winter Wren) and 10 species detected in the traditional survey period but not earlier (table 1). In 1997, five species were detected in the early survey period but not in the traditional survey period (Blue Grouse, Cooper's Hawk, Red-tailed Hawk, Song Sparrow, and Three-toed Woodpecker) and nine species detected in the traditional survey period but not earlier.

As the next step, we summarized the frequency of detections by counting the number of times a species was detected in one survey period compared to the other survey period. Frequency data from 1996 show 10 species were detected more frequently in the early survey period, 23 detected more frequently in the traditional survey period, and 13 were detected with equal frequency in both survey periods (table 1). In 1997, there were nine species detected more frequently in the early survey period, 26 detected more frequently in the traditional period and 14 detected with equal frequency in both survey periods. In summary, 15 different species were detected more frequently in the early survey period in at least one year. Three species, the Ruffed Grouse, Red-naped Sapsucker, and Varied Thrush were detected more frequently in the early count period in both years of the study.

Looking at the frequency of detections at each site individually, in 1996 there was an average of 3.5 species (range 1 to 8) over the eight sites that were detected in the early

period, but not detected in the traditional survey period. The species most often detected only in the early count period were Ruffed Grouse (4 sites), Clark's Nutcracker (3 sites), and Varied Thrush (3 sites). In 1997, there was an average of 4.9 species (range 2-8) per site detected in the early period but not detected in the traditional survey period. These species included Northern Flicker (3 sites), Winter Wren (3 sites), and the Ruby-crowned Kinglet (5 sites).

## Discussion

Most species in ponderosa pine old-growth forests of western Montana were best detected during the traditional survey period, but some species were detected more often in the period just prior to the time of traditional breeding bird surveys. All of the earlier species are permanent residents or short-distance migrants that begin breeding activity earlier than long-distance migrants. Ruffed Grouse, Red-naped Sapsucker and the Varied Thrush were detected more often in the early counts in both years of the study and 12 others were detected more often in early counts in at least one year. Some of these 12 other species are uncommon in this habitat, for example, Cooper's Hawk, Winter Wren, Orange-crowned Warbler, and the Song Sparrow. Other species detected more often early in 1996 were common species such as the Stellar's Jay, Clark's Nutcracker, and Common Raven. This indicates that if the goal of the point count surveys is to determine which species are present in this habitat, then the traditional survey period is satisfactory for most species. However, if the goal is to attempt to link the number of individuals of a particular species detected to the density of that species in this habitat, or alternatively, to assess the importance of the habitat to a particular species, then limiting survey counts to the traditional survey period can lead to erroneous conclusions.

Many of the species that are detected more often in the early survey period are species of special concern because of potential negative effects of logging (Hejl 1994; Hejl and others 1995). Resident woodpeckers, in particular, are of concern to management because of their use of large snags (dead trees) for nesting and feeding sites. The Red-naped Sapsucker, Williamson's Sapsucker and Three-toed Woodpecker are difficult to detect using traditional point count methodology. Our results suggest that this may be because they establish territories early and begin breeding early; moreover, they occur at low population levels. In fact, Hejl and Woods (1991) noted few Red-naped Sapsuckers on these same study sites in 1989 to 1991 when they conducted a study comparing bird presence and abundance in old-growth and second-growth stands. We do not know if the birds were present but missed due to sampling during the traditional time period, or if few were present in those years. Based on our results, we recommend that scientists or managers with particular interest in these species should consider including early season samples in their surveys.

Comparing the species abundances between years, it is clear that Red Crossbills, Pine Siskins and Evening Grosbeaks made up a large percentage of the individuals detected in the early weeks of 1996. In 1997, the abundances of these species were not substantially different than other species. This exemplifies why studies carried out over multiple years are necessary. A study based only on data from 1996 might conclude that Red Crossbills, Pine Siskins and Evening Grosbeaks are quite abundant in this habitat. Conversely the 1997 data suggest that these species were no more or less abundant than several other species in this habitat. However, using data from both field seasons and including the early season data of the survey, it is clear that these species may utilize this habitat heavily at certain times and in certain years, and not as heavily at other times. These results indicate that old-growth ponderosa pine may be an important breeding and foraging habitat for these species during certain years. Therefore, the addition of early season counts to multiple-year surveys improves our ability to derive good estimates of these species for use in management plans and scientific studies.

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