munication in the form of male and female songs, at times perhaps analogous to the duets of various tropical and subtropical oscine species, could be advantageous for pair-bond maintenance, reproductive synchronization and for keeping the male and female aware of each other's location. Because one female sang as I approached her nest, the songs may also serve an aggressive or defensive function. Miller's (1931) observations of Bullock's Oriole females singing while chasing and excluding conspecific females from their territories supports this idea; in fact, Miller (1931) considered female oriole songs to be true territorial songs. Detailed behavioral studies of orioles and other species are required to adequately elucidate the phenomenon of female singing.

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Department of Biological Sciences, Wayne State University, Detroit, Michigan 48202. Received 17 December 1981. Final acceptance 12 July 1982.

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MORNING VERSUS EVENING DETECTABILITY OF SOUTHEAST ALASKAN BIRDS

WINIFRED B. KESSLER

AND

KATHLEEN A. MILNE

Many avian ecological studies require estimation of either absolute or relative population densities (Kendeigh 1944). These estimates are influenced by the detectability of the birds under a particular set of environmental conditions (Emlen 1971). Birds of most species are most active in the early morning during the breeding season (Robbins and Van Velzen 1970). Therefore, counts are generally conducted within a few hours after sunrise, when birds are assumed to be most detectable (International Bird Census Committee 1970). We report here a study that we conducted in order to test that assumption and thereby strengthen census procedures for landbirds.

While sampling populations of forest birds in southeastern Alaska, we noticed that individuals of certain species were territorially active (singing and chasing interlopers) during the evening. This suggested that our morning counts might be biased by the lower detectability of these birds at that time of day. We therefore designed procedures to test for differences in results between morning and evening sampling periods.

This study was incidental to an investigation by the senior author on the effects of logging on forest birds (Kessler 1979, 1980). Birds were censused from late May to mid-July in 1978 and 1979 on Kosciusko and Prince of Wales islands (55–56°N, 133°W). Seventy-eight 300-m transects were established in a variety of successional and old-growth habitats within western hemlock-Sitka spruce (*Tsuga heterophylla-Picea sitchensis*) forest communities (Viereck and Dyrness 1980). Each transect received four morning and four evening visits distributed throughout the sampling period. Direction of travel and transect order were reversed with each morning and evening visit. Morning and evening counts began 0.5 h after sunrise (approximately 04:00 on 15 June) and 2.5 h before sunset (approximately 21:30 on 15 June), respectively, and lasted 2 to 3 h. All birds detected within 40 m of the transect were recorded.

For our test, morning and evening detections were summed by species for each transect. We omitted species detected fewer than 10 times altogether. Paired *t*-tests were used to determine if differences between morning and evening detections were significantly different from zero (Steel and Torrie 1960). Data were normalized by a square root transformation (Sokal and Rohlf 1969).

Data for 1978 and 1979 are presented separately (Table 1) because different plots were censused in each year. The 1979 plots, unlike those censused in 1978, were riparian. We believe that major differences between years in species recorded resulted from the different habitats represented in each year.

Morning and evening detections differed significantly in paired *t*-tests for eight and nine species in 1978 and 1979, respectively. The Chestnut-backed Chickadee, Winter Wren, Orange-crowned Warbler, and Townsend's Warbler were more detectable in the morning in both years. The Rufous Hummingbird, Yellow-bellied Sapsucker, Fox Sparrow, and Lincoln's Sparrow had greater morning detectability for the one year the sample size was large enough for analysis. In contrast, Hermit Thrushes were detected significantly more often in evening than in morning counts. For other thrushes, we found no differences in detectability between morning and evening counts.

The Dark-eyed Junco, Golden-crowned Kinglet, and Western Flycatcher yielded significantly different detectabilities for only one of the two years. Sample size of Western Flycatchers was small in 1978. We do not know why detectability of juncos and kinglets differed between years. Analysis of variance (Steel and Torrie 1960) conducted on the normalized junco data indicated that the difference between morning and evening counts varied significantly ($P < 0.005$) among types of habitat. However, comparison among habitats by Duncan's multiple range test (Steel and Torrie 1960) yielded no patterns to help us explain this result. For kinglets, morning and evening detectability did not differ significantly among habitats.

TABLE 1. Number of morning and evening bird detections and significance levels of paired t-tests conducted on the difference.

Species	1978			1979		
	Morning	Evening	Signif. of t	Morning	Evening	Signif. of t
Rufous Hummingbird (*Selasphorus rufus*)				21	10	$P < .04$
Yellow-bellied Sapsucker (*Sphyrapicus varius*)				37	17	.001
Hairy Woodpecker (*Picoides villosus*)				9	8	NS
Western Flycatcher (*Empidonax difficilis*)	19	13	NS	163	67	.0001
Tree Swallow (*Iridoprocne bicolor*)	10	15	NS	35	40	NS
Steller's Jay (*Cyanocitta stelleri*)	28	23	NS	13	13	NS
Chestnut-backed Chickadee (*Parus rufescens*)	104	50	$P < .02$	88	37	.0001
Winter Wren (*Troglodytes troglodytes*)	444	212	.0001	108	44	.002
American Robin (*Turdus migratorius*)	9	13	NS	22	17	NS
Varied Thrush (*Ixoreus naevius*)	84	85	NS	35	37	NS
Hermit Thrush (*Catharus guttatus*)	74	142	.005	26	51	.0006
Swainson's Thrush (*Catharus ustulatus*)	50	66	NS	25	20	NS
Golden-crowned Kinglet (*Regulus satrapa*)	74	29	.001	97	67	NS
Orange-crowned Warbler (*Vermivora celata*)	190	79	.002	66	38	.05
Townsend's Warbler (*Dendroica townsendi*)	122	48	.002	55	15	.0001
Pine Siskin (*Carduelis pinus*)				29	22	NS
Dark-eyed Junco (*Junco hyemalis*)	166	106	.004	116	123	NS
Fox Sparrow (*Passerella iliaca*)	109	52	.02			
Lincoln's Sparrow (*Melospiza lincolnii*)				49	22	.005

Two approaches exist to avoid time-of-day bias. Dawson (1981) suggested that when only an index to abundance is desired, mid-day counts may be employed to avoid maximum fluctuations in individual species' detectabilities, thereby providing more precise results. More commonly, however, observers attempt to standardize the time-of-day influence by restricting counts to the early morning period of maximum activity (Johnson 1981).

Our results indicate that for at least one species, the Hermit Thrush, counting only in the early morning would have under-represented the population. Similarly, Robbins (1981b) found an evening rather than a morning peak of detectability for the Wood Thrush (*Hylocichla mustelina*). Such findings suggest that times of peak detectability should be determined for each species before the count periods are established. We agree with Robbins (1981a, b) that census procedures should accommodate species that do not have an early-morning peak of activity. One approach is to add sampling periods that conform to the activity patterns of these species. Alternatively, census data may be adjusted to correct time-of-day biases.

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