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BEHAVIOR OF NESTING LEWIS' WOODPECKERS IN THE LARAMIE RANGE, SOUTHEASTERN WYOMING

ABSTRACT

Little data exist on the behavior of nesting Lewis' Woodpeckers (*Melanerpes lewis*), particularly in areas where it is not a year long resident. We examined behavioral characteristics of this migratory bird that nested in clumps of ponderosa pine (*Pinus ponderosa*) in southeastern Wyoming during the 1993-1994 breeding seasons. We divided the breeding season into three periods defined as prenesting, incubation, and nestling. We found period difference ($P < 0.05$) in foraging behavior, time spent out of sight of the nest, time spent in the nest cavity, and perching. Birds spent more time foraging and perching during the nestling period as opposed to the incubation period ($P < 0.05$). We found no significant time of day differences. Period effects were found for vegetation gleaning (1993) and hawking (1994). Eleven of the 30 nests active in 1993 were reused in 1994.

Key words: Lewis' Woodpecker, *Melanerpes lewis*, behavior, habitat, incubation, foraging

INTRODUCTION

Lewis' woodpeckers are cavity nesters that either excavate a new nest cavity, reuse the same cavity from the previous season, or use a natural or deserted cavity of another woodpecker (Bock 1970, Harju 1978, Bent 1992). The birds frequently utilize snags or partially living trees that are left after a forest fire (Linder and Anderson 1997). The pair is monogamous with both sexes assisting in the incubation of the eggs (Ehrlich et al. 1988). The young are fledged 28-34 days after hatching (Bock 1970, Ehrlich et al. 1988). In the northern part of their range (this study) Lewis' woodpeckers are seasonally migratory. They are territorial during the breeding season and are intolerant of conspecifics as well as other potential

competitors (Bock et al. 1971, Hadow 1973).

This species has a unique foraging strategy compared to most other woodpeckers (Bent 1992). They spend 60-76 percent of their time catching insects on the wing (hawking), with the remainder spent primarily gleaning the ground and in brush. Only a small proportion of time is spent gleaning and probing snags (Jackman 1975, Sousa 1982, Raphael and White 1984). These behavior patterns may be an adaptation to burned habitats in which the birds nest.

Initial seasonal behavior changes had not been previously quantified for this species which was migratory in this portion of its range. This paper quantifies behavioral characteristics of Lewis' woodpeckers during the breeding season in the northern part of their range where such information is generally lacking. We used time budget analysis to quantify changes in behavioral patterns throughout the day

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and through the breeding season as young fledged. We also documented the incidence of territoriality and reuse of nesting cavities during the two year study.

STUDY AREA

The study area, which contained scattered clumps of ponderosa pine, was located in the Laramie Range of southeastern Wyoming. Two large sites known to support Lewis' woodpeckers were selected. Both sites contained large burns of greater than 1250 ha. Fires eliminated much of the tree canopy and ground cover in some sections while leaving other tracts undisturbed.

The Tunnel Road Area (42° 0'N, 105° 30'E), encompassing 6216 ha, ranged in elevation from 1890 m to 2347 m; approximately twenty-one percent had been burned (1295 ha) in 1974. The Palmer Canyon Area (42° 07'N, 105° 22'E) encompassed 3885 ha with elevations of 1615 m to 2412 m. Approximately forty-one percent of this site had been burned (1590 ha) in 1986.

The average annual precipitation in the study area was 18.8 cm. The average summer temperature was approximately 47° C and ranged from 28.8° C in May to 57.6° C in July.

METHODS

Nest Search Strategy

Fieldwork spanned the time birds arrived in early May to late August in both 1993 and 1994. A systematic (transect) search of each area was conducted by vehicle or foot using 1:24,000 United States Geological Survey (USGS) topographic maps as a guide. Nest searches could be conducted during all daylight hours due to the Lewis' woodpeckers conspicuous and distinctive behavior.

Once located, an adult woodpecker was continuously observed for 40 minutes or until it entered a cavity. If we were unable to locate a potential nest

cavity within 40 minutes, we marked the area on a topographic map and returned to survey it at a later date. We assumed nests to be active if we saw an adult feeding, excavating, or remaining in the cavity for longer than two minutes, or heard the sounds of young. We flagged confirmed nests and plotted them on maps for periodic revisits.

Behavioral Observations

During 1993, we chose every fifth nest found, for a total of five confirmed active nests, to make behavioral observations. For each sampling period, we continuously watched a nest for one to three hours. When practical, we recorded the type and length of all behavior patterns for both adults (Table 1). During 1993, we recorded a total of 115 observation hours.

Table 1. Behavior patterns recorded for Lewis' woodpeckers in southeastern Wyoming.

Major	Foraging
Foraging	Vegetation Gleaning
Perching	Ground Gleaning
In Nest	Hawking
Copulation	Chiseling
Out of View	Direct Flight
Territory	
Perching	Territorial
On Nest Tree	Intraspecific
Nearby Tree	Interspecific
Looking into Nest	Calling
Exiting Nest	Drumming

During 1994, we selected every sixth active nest found to observe for a total of four. We also watched two of the nests observed in 1993, to provide a source of comparison between years. We spent a total of 206 hours observing behavior in 1994 in a manner similar to 1993. During 1994, however, we made one hour observations at varying times and were offset by one time period each sampling day. For example, if we observed a particular nest at 0800 one day, it would be observed at 0930 the

next day. We documented nest site reuse in the second field season by relocating all previously occupied nests to determine whether those sites were reoccupied.

Analysis

We quantified behavioral changes among periods in the breeding season, times of day, and years from data gathered from behavioral observations on five nests in 1993 and six nests in 1994. During the breeding season, we defined three periods: prenesting (15 May - 10 Jun.), incubation (10 Jun. - 10 Jul.), and nestling (11 Jul. - 10 Sep.). We divided the time of day into morning from 0600 - 1100, mid-day from 1100 - 1500 and afternoon from 1500 - 2000. We used this information to quantify the percent of time woodpeckers engaged in specific behavioral patterns. We classified behaviors into the following categories: foraging, perching, in nest, out of view, copulation, and territoriality (first level) (Table 1). We broke foraging, perching, and territoriality down further into second level behaviors (Table 1). Time spent in the nest included such behaviors as excavation, incubation, and feeding during early stages of the nestling period.

MANOVA was used for repeated measures (SAS 1985) to determine whether first level categories of behaviors differed across seasons, across times of day within seasons, or across times of day between seasons. We then evaluated the percent time foraging, percent time perching, and percent time spent in territorial behaviors. This level of analysis showed the percentage of individual behaviors that made up the first level categories for differences across years, seasons, and times of day. We used alpha levels at $P < 0.05$ and mean values (percent of time) for both levels of analysis. In the 1993 field season, we did not obtain any observations for the prenesting period. Thus we only used the periods of incubation and nestling/fledgling in the analysis.

RESULTS

There were no time of day effects or time of day between periods ($P > 0.05$) for the first level behavior classifications of Lewis' woodpeckers (Table 2). We found effects ($P < 0.05$) in time spent foraging, time spent in the nest cavity, out of sight of the nest cavity, and perching between periods during both years (Table 3). Percent time spent in the nest cavity and out of sight of the nest tree were higher ($P < 0.05$) in the incubation and nestling periods. In 1994, percent time perching was ($P < 0.05$) higher in the prenesting period.

Time of day effects in individual foraging behaviors were not significant ($P > 0.05$), but we found some differences between periods (Table 4). Vegetation gleaning was higher ($P < 0.05$) in the 1993 incubation season. Hawking in 1994 was lower ($P = 0.013$) in the nesting period while direct flight was higher ($P < 0.05$) during foraging in the 1994 nestling period.

We found no time of day effects ($P < 0.05$) for individual perching behaviors out of total percent time perching. One significant period by time of day ($P < 0.05$) interaction occurred for perching away from nest tree in 1994. In 1993, time spent looking in the nest cavity was higher ($P < 0.05$) in the incubation period, and in 1994, it was higher in both the prenesting and incubation period than in the nestling period. Time spent in the nest cavity in preparation for exit was higher ($P < 0.05$) in the incubation period than in either the prenesting or nestling period during both years.

There were no time of day effects ($P < 0.05$) or period by time of day interactions appeared for percent time spent in territorial behaviors out of total time spent in territorial activities, but we documented one seasonal effect. In 1994, calling represented a higher ($P < 0.05$) percent of the total time in territorial behaviors in the prenesting and nestling seasons than in the incubation season.

Table 2. Percent of time spent in each behavior classification by Lewis' woodpeckers near nests.

Year	Behavior type	Prenesting			Incubation			Nestling		
		Morn	Midday	Afternoon	Morn	Midday	Afternoon	Morn	Midday	Afternoon
1993	Foraging	—	—	—	4	5	6	9	9	13
	Perching	—	—	—	12	23	19	24	28	31
	In Nest	—	—	—	33	27	24	10	5	3
	Feeding	—	—	—	0	0	0	1	1	2
	Copulation	—	—	—	0	0	0	0	0	0
	Out of Sight	—	—	—	51	44	49	55	56	51
	Territory	—	—	—	1	0	1	1	1	1
1994	Foraging	3	6	4	4	4	4	9	10	11
	Perching	24	27	28	15	20	14	22	23	22
	In Nest	27	24	22	40	36	37	6	7	6
	Feeding	0	0	0	0	0	0	1	1	1
	Copulation	0	0	0	0	0	0	0	0	0
	Out of Sight	43	42	45	41	40	44	61	59	59
	Territory	3	1	1	0	0	0	2	1	1

Table 3. Percent time spent in primary behavior type during prenesting, incubation and nestling periods in 1993 and 1994.

	1993		
	Prenesting	Incubation	Nestling
Foraging*		5	10
Perching*		18	28
In Nest*		28	6
Copulation		<1	0
Out of View*		48	54
Territory		1	1

	1994		
	Prenesting	Incubation	Nestling
Foraging*	5	4	10
Perching*	26	16	22
In Nest*	24	38	6
Copulation	<1	<1	0
Out of View*	44	41	59
Territory	1	<1	1

* Significant at $P < 0.05$.

Table 4. Percent of time spent in foraging activities by Lewis' woodpeckers during prenesting, incubation and nestling periods in 1993 and 1994.

	1993		
	Prenesting	Incubation	Nestling
Vegetation Gleaning*		10	2
Ground Gleaning		10	7
Hawking		26	31
Chiseling		18	30
Direct Flight		36	30

	1994		
	Prenesting	Incubation	Nestling
Vegetation Gleaning	0	1	<1
Ground Gleaning	6	7	14
Hawking*	56	52	22
Chiseling	22	22	17
Direct Flight*	16	8	47

* Significant at $P < 0.05$.

DISCUSSION

Behavioral patterns did not differ throughout the day during any period in the breeding season. In southeastern Wyoming, several behavioral differences in Lewis' woodpeckers corresponded with breeding periods. Time spent in the nest varied from 23 percent during the prenesting period to a maximum of 40 percent during incubation with a minimum of seven percent during the nestling period.

As expected for adults feeding young, percent time spent foraging increased in the nestling period. There were differences in time spent gleaning vegetation in 1993 and direct flight foraging in 1994. The reasons remain unclear, but we speculate that variability in insect availability between periods of the breeding season and between years contributed to these differences. We would expect woodpeckers to spend more time gleaning and hawking during years of low insect availability. Decreased availability of flying insects during the incubation period of 1993 may have resulted in more time spent gleaning vegetation for terrestrial insects. Direct flight foraging, involving prolonged flights, probably would increase when flying insects are abundant.

The woodpeckers we observed spent an average of 62 percent of their foraging time flycatching, either hawking or direct flight. In 1994, percent time flycatching out of total percent time foraging was 72 percent in the prenesting period, 60 percent in the incubation period, and 69 percent in the nestling/fledgling period. These values were within a range reported by Bock (1970) and Jackman (1975) although they did not distinguish between breeding periods or behaviors that made up "flycatching." Others have reported that foraging time also was spent gleaning on the ground and in brush, while only a small proportion of time was spent gleaning and probing snags

(Sousa 1982, Raphael and White 1984). Bock (1970) reported that Lewis' woodpeckers spent 32 percent of their foraging time gleaning on the ground and in vegetation. Our results from 1993 indicated that they spent 20 percent of their time gleaning the ground and vegetation during incubation and nine percent in the nestling period. In 1994 these behaviors occupied six percent of the prenesting period, eight percent in the incubation period, and 14 percent in the nestling period. Bock (1970) also reported that 10 percent of their foraging time was in bark gleaning, whereas we did not observe bark gleaning as a frequent foraging behavior. We observed frequent use of food stores in or near nest trees. Chiseling was rarely associated with bark gleaning and was mainly associated with food stores near nests.

Our 1994 data suggested that the woodpeckers spent more time perching during the prenesting and nestling periods than in the incubation period. They spent more time out of sight of the nest during the nestling period than in the prenesting or incubation periods. We suspect food demands of the nestlings resulted in increased foraging time over a larger foraging area.

Several studies have suggested that territorial behavior should increase during times of low food abundance and high area competition accompanied by a greater risk of cuckoldry and predation (Biermann and Robertson 1981, Knight and Temple 1986, and Moller 1990). Our data are insufficient to support this idea, but insect abundance in the Laramie Range seemingly increased with time throughout the nesting period. Such an increase suggests that higher competition for food should have occurred in the prenesting period. Competition for nesting areas and the risk of cuckoldry also should have increased during the prenesting period when adults were establishing

territories. This idea holds that territoriality would again increase due to increased parental investment and the probability of predation as nestlings near fledging (Boucher 1977, Andersson et al. 1980). Bock et al. (1971) reported that drumming only occurred during the prenesting period. We also observed drumming during the nestling/fledgling period.

Bock (1970) suggested that Lewis' woodpecker show strong nest fidelity and his banding studies showed evidence for permanent pair bonds and nest site fidelity for individual pairs. Eleven of the 30 (36%) active nests in 1993 were used in 1994. We do not know if the same pairs reoccupied these nests in consecutive years as our birds were not banded.

In summary, our results indicated that the Lewis' Woodpecker migrated into southeastern Wyoming in early to mid-May and begin prenesting activities. We found that the birds' different behavior patterns were similar throughout the day during each period (prenesting incubation and nestling). Foraging and perching near or inside the nest, as well as out of view of the nest varied by period. In 1993 the birds spent more time gleaning in the vegetation during the incubation period. In 1994, hawking declined in the nesting period while flying directly to the nest increased. Observed variation of behavioral patterns depended on food availability.

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