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BEHAVIORAL ECOLOGY OF GREY EAGLE-BUZZARDS, *GERANOAETUS MELANOLEUCUS*, IN CENTRAL CHILE[1]

JAIME E. JIMÉNEZ AND FABIAN M. JAKSIĆ
Departamento de Ecología, Universidad Católica de Chile, Casilla 114-D, Santiago, Chile

Abstract. Throughout 1 year we observed the behavioral ecology of Grey Eagle-Buzzards (*Geranoaetus melanoleucus*) in central Chile. The eagles' activity period was bimodal, with peaks in mid-morning and mid-afternoon. During the day they spent most of their time flying (except during winter), extensively soaring in thermal and wind updrafts, rarely using flapping flight. Eagles appeared to select specific physiographic features that favored the presence of updrafts, particularly north- and west-facing slopes and ridge tops. Use of these features apparently was unrelated to prey abundance or vegetative cover. Prey were primarily large-sized small mammals, and secondarily reptiles and birds. Although aggressive, eagles were attacked by a number of species of other raptors. Comparison of the behavioral ecology of eagles and of Nearctic buteonines demonstrated some marked differences, particularly in activity time and habitat use. These differences appear to be related to weather conditions prevailing in montane vs. lowland terrain.

Key words: Time budget; flight modes; habitat use; weather conditions; prey abundance; diet; aggression.

INTRODUCTION

The Grey Eagle-Buzzard, *Geranoaetus melanoleucus,* is a buteonine hawk that occurs in South America from Colombia south to the Tierra del Fuego Archipelago, on both sides of the Andes and in the lowlands eastward to Brazil, Uruguay, and Argentina (Johnson 1965, Brown and Amadon 1968, Humphrey et al. 1970, Short 1975, Meyer de Schauensee 1982, Amadon 1982, Belton 1984, Vuilleumier 1985). Aside from anecdotal accounts (Housse 1926, 1945; Goodall et al. 1957; Johnson 1965; Barros 1967; Vigil 1973), the species is relatively little studied (Schlatter et al. 1980, Jaksić et al. 1981, Schoonmaker 1984, Jaksić and Jiménez 1986). Here we report on the ecology and behavior of the Grey Eagle-Buzzard, based on a 1-year study in montane habitats in central Chile. Because of the obvious advantage of long-range visibility, most studies on the behavioral ecology of buteonine hawks have been conducted in flat or rolling terrain (e.g., Wakeley 1978, Baker and Brooks 1981, Bechard 1982, Bildstein 1987). Our study, together with that of Barnard (1986, 1987), provides information on how buteonine hawks behave in mountainous terrain.

MATERIAL AND METHODS

STUDY SITE

San Carlos de Apoquindo (33°23′S, 70°31′W) is a rugged area of 835 ha 20 km E of Santiago in the foothills of the Andes, with elevations ranging from 1,050 to 1,915 m and slopes up to 47° (Table 1). The complex physiography includes both flat areas and numerous ridges dissected by deep ravines that carry water during the winter and spring months. The climate is Mediterranean, with an annual mean rainfall of 400 mm concentrated during the cool winter months and followed by seven to eight dry months with relatively high temperatures. The wind blows up from the valley (from the west) toward the mountains during the day; at night winds blow in the opposite direction. The vegetation is dominated by evergreen shrubs, and its physiognomy changes according to topography and orientation (Table 1).

RAPTOR SPECIES

Grey Eagle-Buzzards in Chile are assigned by taxonomists to the subspecies *Geranoaetus melanoleucus australis* (Amadon 1982); below we refer to them simply as eagles. Other raptors at the site included *Buteo polyosoma* (Red-backed Buzzard), *Parabuteo unicinctus* (Harris' Hawk), *Falco sparverius* (American Kestrel), *Falco peregrinus cassini* (Austral Peregrine Falcon), *Milvago chimango* (Chimango Caracara), *Phalcoboenus megalopterus* (Andean Caracara), and *Vultur gryphus* (Andean Condor). All but the latter two species are residents in the area.

BEHAVIORAL OBSERVATIONS

We stationed ourselves on top of a hill (1,266 m elevation) near the center of the study site. We

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TABLE 1. Habitat features of the 835-ha San Carlos study site. Cover values are the arithmetic mean of nine transects of 20 m each.

Features	Flatland	Ravine	Ridge top	North slope	South slope	East slope	West slope
Percent of area	9.5	7.0	18.5	25.7	19.2	6.6	13.5
Elevation (m)	1,050–1,200	1,250–1,350	1,250–1,915	1,100–1,800	1,075–1,575	1,170–1,730	1,200–1,825
Slope (degrees)	7–22	7–41	0–9	28–47	10–41	21–44	20–44
Tree cover (%)	50.9	80.6	1.3	19.9	65.2	4.4	11.5
Shrub cover (%)	12.6	3.9	59.1	26.4	7.9	46.6	50.1
Grass cover (%)	18.7	9.3	13.5	28.2	20.0	0.0	4.4
Bare ground (%)	15.6	5.1	24.7	22.9	6.0	36.1	22.9
Rocky ground (%)	2.2	1.1	1.4	2.6	0.9	12.9	11.1

used Altmann's (1974) "focal-animal sampling" technique, provided with 10 × 25 binoculars, and recorded our observations on a tape recorder. For each eagle we recorded (1) time of observation and duration, (2) activity type, using Walter's (1983) actigram, and (3) habitat beneath bird (see below). The recordings were later played back in the laboratory, where observations were timed to a precision of 1.0 sec.

Observations were made every other week between 1 August 1984 and 1 August 1985. This time span encompassed four biological seasons: spring (1 August–30 October), when courtship, pair formation, nest construction, and mating occur; summer (1 November–31 January), when egg laying, incubation, development of young, and nest abandonment occur; fall (1 February–30 April), when juveniles fledge and attain independence from their parents; adult pairs do not dissolve. Winter (1 May–31 July) encompasses the nonbreeding period. Observations were made from sunrise to sunset. For purposes of quantification, the day was arbitrarily divided into six equal time intervals; because the study site shows marked seasonality, day length differed among seasons. The following are seasonal average times of sunrise and sunset: 08:19, 18:34 (spring); 06:40, 19:49 (summer); 07:26, 18:48 (fall); and 07:57, 18:03 (winter). We obtained a total of 5,558 min of data.

We recorded how much time eagles spent in the following activities: (1) thermal soaring, characterized by the eagle soaring in circles on thermal updrafts; (2) wind soaring, characterized by the eagle moving in a straight line parallel to ridge crests, presumably using updrafts produced by the west wind; (3) cruising, a deliberate flapping flight; (4) hovering, a stationary flight wherein eagles face into wind updrafts and control their position with wing beats and tail movements; (5) harassing, a deliberate flight toward another bird, sometimes stooping with talons extended (here we recorded species of the victim); (6) perching, in a tree, in a shrub, on a boulder, or on the ground; (7) miscellaneous behaviors.

HABITAT USE

We recognized seven habitat types (Table 1): flatlands, ravines, ridge tops, and slopes (east-, west-, south-, and north-facing). We mapped these habitats and calculated their surface areas (slope-corrected) with a digital planimeter from a high-resolution aerial photograph. During winter, we described the vegetational physiognomy of each habitat type with nine linear transects of 20 m each, measuring the cover represented by trees, shrubs, herbs, bare ground, and rocks (Table 1). We used traps to estimate the abundance of small mammals (the main prey of eagles) in each habitat type. During 14 consecutive days and 14 intervening nights, from 20 July to 2 August 1985 (austral winter) we trapped small mammals on the four mountain slopes, at the summit, and at a ravine. All six trapping grids had a 7 × 7 configuration with one trap per station (49 traps per grid), alternating one Sherman live with one Victor kill trap over both rows and columns, with stations separated by 7 m. For the flatland we used information provided by Iriarte et al. (1989), who trapped small mammals simultaneously, behind our observation post.

DIET

We searched for regurgitated pellets and prey remains under perches and in two abandoned and three active nests at the study area. Prey were identified by standard procedures (Marti 1987).

STATISTICAL PROCEDURES

For activities quantified on an interval scale, such as time, we used one- or two-way ANOVAs for unequal sample sizes (Sokal and Rohlf 1981, p. 210, p. 360), with PROC GLM in SAS (1985). For a-posteriori contrasts, we used the Student-Newman-Keuls test (SAS 1985, p. 444). For activities quantified on a nominal scale, such as abundance of prey in different habitat types, we used the G statistic (Sokal and Rohlf 1981, p. 695).

RESULTS

DAILY ACTIVITY

Activity levels, which differed among intervals of the day ($F = 8.97$, $P < 0.0001$), did not vary with season ($F = 1.46$, $P > 0.22$). Throughout the day, eagle activity was highest during interval 2 (mid-morning), followed by intervals 3 (noon) and 5 (mid-afternoon) (SNK a-posteriori test, all P's < 0.05). Intervals 1, 4, and 6 (early morning, early afternoon, and late afternoon, respectively) demonstrated very low activity. Early morning and late afternoon, when the eagles were less active, were the least windy periods and few thermal updrafts existed. Similarly, during early afternoon a lull in the wind conditions also occurred. Eagles thus displayed a bimodal activity period, with most of their activity concentrated in mid-morning and noon, with a secondary peak in mid-afternoon.

SEASONAL ACTIVITY

The overall level of activity differed among seasons ($F = 3.92$, $P < 0.01$), because of low activity levels during summer (SNK a-posteriori test, $P < 0.05$). Thermal soaring was a pervasive activity throughout the year, ranging from a summer high of 50% to a winter low of 36% (Table 2). Eagles perched from 52% (winter) to 13% (summer) of the time. Wind soaring ranked third in importance, accounting for a high of 32% (summer) to a low of 11% (winter) of the time. The remaining activity categories (Table 2) accounted for less than 7% of the daily activity period of the eagles.

HABITAT USE

Activity levels, which differed among habitat types ($F = 50.36$, $P < 0.0001$), remained consistent among seasons. If eagles used habitat in proportion to relative availability in the study area (Table 1), activity levels should have followed the sequence north-facing slope > south-facing slope > ridge top > west-facing slope > flatland > ravine > east-facing slope. In fact, activity levels on north-facing slopes and ridge tops were significantly higher than those on west-facing slopes (SNK a-posteriori test, $P < 0.05$), which in turn were used more than ravines, and east- and south-facing slopes, which did not differ statistically among themselves. Activity in flatlands was significantly lower than in all other habitat types.

The amount of perching in different habitat types was not related to relative availability ($G = 156.6$, df = 6, $P < 0.001$). In 35% of 155 sightings the birds were perched on west-facing slopes, 34% were on north-facing slopes, and 17% on ridge tops; eagles were rarely seen perching on flatlands, ravines, and south- or east-facing slopes (14% combined total). Perches were not used homogeneously ($G = 193.7$, df = 8, $P < 0.001$). In decreasing order, perches used were standing dead bromeliads (28%), boulders (25%), standing dead trees (21%), live trees of *Quillaja saponaria* (20%), columnar cacti (3%), live trees of *Kageneckia oblonga* (2%), and of *Lithraea caustica* (1%). All perches shared one trait: they seemed to offer good visibility to perching eagles.

Throughout the year, eagles flew more often

TABLE 2. Absolute (min) and relative (%) time spent by Grey Eagle-Buzzards in different activities in San Carlos, during four biological seasons. Absolute figures are mean per observation day ± 2 SE (days observed).

Activities	Spring August–October	Summer November–January	Fall February–April	Winter May–July
Thermal soaring	68.8 ± 25.0 (15)	36.1 ± 10.4 (12)	42.7 ± 15.1 (6)	91.1 ± 56.9 (6)
% time	40.5	49.5	42.8	35.6
Wind soaring	29.9 ± 14.6 (15)	23.3 ± 11.8 (12)	29.9 ± 16.3 (6)	26.9 ± 18.7 (6)
% time	17.6	32.0	30.0	10.5
Perching	66.1 ± 35.6 (15)	9.1 ± 5.9 (12)	23.8 ± 15.5 (6)	133.7 ± 95.6 (6)
% time	38.9	12.5	23.8	52.3
Cruising	1.2 ± 0.7 (15)	1.4 ± 0.8 (12)	0.7 ± 0.4 (6)	1.5 ± 1.1 (6)
% time	0.7	1.9	0.7	0.6
Hovering	0.1 ± 0.2 (15)	0.2 ± 0.5 (12)	0.1 ± 0.2 (6)	0.0 ± 0.0 (6)
% time	0.1	0.3	0.1	0.0
Harassing[1]	0.9 ± 0.8 (15)	1.2 ± 0.9 (12)	0.9 ± 1.0 (6)	0.1 ± 0.1 (6)
% time	0.5	1.6	0.9	0.1
Other	3.0 ± 1.3 (15)	1.6 ± 1.4 (12)	1.7 ± 2.2 (6)	2.4 ± 2.4 (6)
% time	1.7	2.2	1.7	0.9
Total time	170.0 ± 58.2 (15)	72.9 ± 23.0 (12)	99.8 ± 38.9 (6)	255.7 ± 167.3 (6)

[1] See Table 6.

over north-facing slopes (from a high of 37% in spring to a low of 28% in winter), ridge tops (from 30% in fall to 14% in winter), and west-facing slopes (from 29% in winter to 11% in summer), than over other habitats (Table 3). These three habitat types accounted for 26%, 19%, and 14%, respectively, of the total study area (Table 1), but eagles used them out of proportion to their area. North-facing slopes and ridge tops received more direct solar radiation, and probably generated more thermal drafts. West-facing slopes received radiation from the setting sun, and were swept by the prevailing westerly wind. Eagles flew infrequently over south-facing slopes (from 11% in summer to 2% in fall), which were the second most common type of slope in the area; they received relatively low amounts of incident radiation and were sheltered from prevailing winds.

We examined the possibility that eagles concentrated their flight activities over areas with greatest prey abundance, rather than over areas with favorable air conditions. Trapping results

TABLE 3. Absolute (min) and relative (%) time spent by Grey Eagle-Buzzards in seven habitat types in San Carlos, during four biological seasons. Absolute figures are mean per observation day ± 2 SE (days observed).

Habitat types	Spring August–October	Summer November–January	Fall February–April	Winter May–July
Flatland	0.2 ± 0.4 (15)	0.8 ± 0.5 (12)	0.7 ± 0.4 (6)	0.3 ± 0.0 (6)
% time	0.1	1.1	0.7	0.1
Ravine	11.3 ± 8.8 (15)	6.7 ± 4.8 (12)	3.0 ± 3.3 (6)	3.7 ± 3.8 (6)
% time	6.6	9.2	3.0	1.4
Ridge top	42.7 ± 17.7 (15)	21.2 ± 9.4 (12)	29.5 ± 18.2 (6)	35.8 ± 23.1 (6)
% time	25.1	29.1	29.6	14.1
North slope	63.1 ± 37.1 (15)	22.2 ± 10.1 (12)	34.3 ± 21.6 (6)	71.4 ± 72.1 (6)
% time	37.2	30.4	34.4	27.9
South slope	4.6 ± 4.1 (15)	7.9 ± 7.4 (12)	2.0 ± 1.6 (6)	7.8 ± 13.1 (6)
% time	2.7	10.8	2.0	3.1
East slope	10.0 ± 5.3 (15)	5.8 ± 4.4 (12)	11.9 ± 10.7 (6)	63.7 ± 31.8 (6)
% time	5.9	8.0	11.9	24.9
West slope	38.1 ± 27.1 (15)	8.3 ± 3.7 (12)	18.4 ± 11.6 (6)	73.0 ± 72.1 (6)
% time	22.4	11.4	18.4	28.5
Total time	170.0 ± 58.3 (15)	72.9 ± 23.2 (12)	99.8 ± 38.9 (6)	255.7 ± 167.6 (6)

for the winter season (Table 4) demonstrated significant heterogeneities both between species abundances of small mammals and habitat types. The leaf-eared mouse (*Phyllotis darwini*) and the mouse-opossum (*Marmosa elegans*) were the most abundant species, particularly in ravines, on south-facing slopes, and on flatlands. The third most abundant species was the degu rat (*Octodon degus*), scarce everywhere except on east- and west-facing slopes. The least abundant species was the chinchilla rat (*Abrocoma bennetti*), trapped only on east-facing slopes. The introduced European rabbit (*Oryctolagus cuniculus*) was also present at the site, but the traps used were not adequate for their capture (Iriarte et al. 1989). We observed them to be most abundant on east- and west-facing slopes.

Overall, north- and west-facing slopes and ridge tops had lower prey densities than other areas (accounting for about 5%, 10%, and 4%, respectively, of the total prey captured, Table 4). Prey were most dense in ravines, on flatlands, and on east- and south-facing slopes (accounting for about 22%, 21%, 19%, and 19%, respectively, of the total prey captured, Table 4). Eagles, however, did not prey indiscriminately on available small mammals. In the neighboring locality of La Dehesa, Schlatter et al. (1980) demonstrated that eagles preyed essentially on degu rats (58% of the prey by number), European rabbits (19%), and chinchilla rats (8%). Our diet analyses (Table 5) agree well with those of Schlatter et al. (1980). Consequently, an attempt to relate eagle activity to prey abundance should perhaps consider only actual prey in their diet, not potential prey supply levels.

A comparison of winter activity data (Table 3) with the abundance of degu and chinchilla rats in different habitat types (Table 4) demonstrates that eagles spent ca. 46% of their time in habitats where those prey species were almost absent. They spent ca. 29% of their time on west-facing slopes where degu rat abundance was about 18 individuals/ha, and ca. 25% of their time on east-facing slopes, where combined degu and chinchilla rat abundance was about 35 individuals/ha.

The possibility remains that eagles cued in on areas with sparse vegetative cover rather than on areas with high prey abundance (Baker and Brooks 1981, Bechard 1982). Indexing the degree of vegetational sparseness by the combined cover of grass and bare ground (Table 1), the habitats

TABLE 4. Density (in numbers/hectare) of small mammals in seven habitat types of San Carlos, during winter. *P* is the probability that there is homogeneity along rows or columns, tested by the *G* statistic (low densities were pooled to obtain expected cell values >5.0).

Habitat types	*Octodon degus*	*Akodon olivaceus*	*Akodon longipilis*	*Oryzomys longicaudatus*	*Phyllotis darwini*	*Marmosa elegans*	*P*	*Abrocoma bennetti*	Total
Flatland	4.1	12.0	4.1	24.2	20.2	12.0	<0.001	0.0	76.6
Ravine	0.0	2.9	11.7	2.9	41.1	23.5	<0.001	0.0	82.1
Ridge top	0.0	4.0	0.0	2.0	6.0	4.0	>0.50	0.0	16.0
North slope	2.0	0.0	2.0	8.0	6.0	2.0	>0.10	0.0	20.0
South slope	4.1	2.0	16.3	6.1	26.5	14.3	<0.001	0.0	69.3
East slope	33.3	2.0	3.9	0.0	19.6	9.8	<0.001	2.0	70.6
West slope	17.6	1.9	1.9	0.0	9.8	7.8	<0.001	0.0	39.0
Total	61.1	24.8	39.9	43.2	129.2	73.4	—	2.0	373.6
P	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	—	—	—

TABLE 5. Prey of Grey Eagle-Buzzards in San Carlos, based on prey remains and pellets found in and under nests; undated = likely accumulated from December 1984 to October 1985. Integer numbers are the absolute numerical representation of each prey item; numbers in parentheses are the percent numerical representation of major prey classes. Prey weights in grams, based on literature sources cited in the text.

Prey	Weight	November 1984	November 1985	Undated
Mammals	—	(75.0)	(64.3)	(73.3)
Rodentia				
Abrocoma bennetti (Bennett's chinchilla rat)	231	0	2	2
Octodon degus (Fence degu rat)	184	3	11	7
Phyllotis darwini (Darwin's leaf-eared mouse)	62	0	1	0
Lagomorpha				
Oryctolagus cuniculus (European rabbit)	1,300	1	7	1
Marsupialia				
Marmosa elegans (mouse opossum)	30	0	1	0
Mammals unidentified	—	2	5	1
Birds	—	(12.5)	(16.7)	(6.7)
Tinamiformes				
Nothoprocta perdicaria (Chilean Tinamou)	400	0	0	1
Columbiformes				
Metriopelia melanoptera (Black-winged Ground-Dove)	125	0	3	0
Piciformes				
Colaptes pitius (Chilean Flicker)	100	0	1	0
Passeriformes				
Sturnella loyca (Greater Red-breasted Meadowlark)	110	0	1	0
Schelorchilus albicollis (White-throated Tapaculo)	60	0	1	0
Fringillid unidentified	—	0	1	0
Birds unidentified	—	1	0	0
Reptiles	—	(12.5)	(19.0)	(20.0)
Sauria				
Liolaemus sp. (unidentified lizard)	15	0	2	0
Callopistes palluma (Chilean racerunner)	65	1	2	0
Serpentes				
Philodryas chamissonis (long-tailed snake)	150	0	4	3
Total number of prey	—	8	42	15

with the most sparse vegetation were north-facing slopes (51% sparse), followed at about the same index values (34%–38%) by ridge tops, east-facing slopes, and flatlands. West- and south-facing slopes came next (26%–27%). As noted above, east-facing slopes and flatlands were seldom used by eagles, whereas west-facing slopes were frequently visited by them, unlike south-facing slopes. These data indicate that relative habitat use by eagles is not linked closely with relative amounts of sparse vegetation in different habitat types. Thus, overall it appears that eagles cued in on habitat types due to updrafts rather than prey density or vulnerability as reflected in the degree of vegetational sparseness.

DIET

As previously documented in nearby La Dehesa (Schlatter et al. 1980), we found that eagles on our study site mainly ate mammals (nearly 70% of their prey, Table 5), especially the three largest mammals in the area, the degu, the chinchilla rat, and the European rabbit. These three species were the only diurnal or crepuscular prey on the site (Iriarte et al. 1989). Birds accounted for some 12% of total prey and were among the largest birds on the study site. Reptiles accounted for the remaining 18% of the prey, more than half being the long-tailed snake (*Philodryas chamissonis*).

AGGRESSION

Aggressive encounters (harassment) comprised less than 2% of the eagles' time (Table 2), but might have been important in determining patterns of habitat use. Eagles originated about 40% of all observed attacks, while Red-backed Buzzards originated about 43% of the attacks (Table 6). Harris' Hawks ranked third in initiated aggressive encounters, with about 10% of the at-

TABLE 6. Number of times aggressive interactions were observed between different raptors in San Carlos, yearly totals. Column headers are the initials of the species names listed in rows.

	Harasser								
Harassed	*G.m.*	*B.p.*	*P.u.*	*F.s.*	*F.p.*	*M.c.*	*P.m.*	*V.g.*	Total
Geranoaetus melanoleucus (Grey Eagle-Buzzard)	25	29	4	2	1	1	0	0	62
Buteo polyosoma (Red-backed Buzzard)	16	24	6	1	0	1	0	0	48
Parabuteo unicinctus (Harris' Hawk)	4	0	3	0	0	0	0	0	7
Falco sparverius (American Kestrel)	2	0	0	0	0	0	0	0	2
Falco peregrinus cassini (Austral Peregrine Falcon)	1	0	0	0	0	0	0	0	1
Milvago chimango (Chimango Caracara)	1	0	0	0	0	1	0	0	2
Phalcoboenus megalopterus (Andean Caracara)	0	0	0	0	1	0	0	0	1
Vultur gryphus (Andean Condor)	0	0	0	0	1	0	0	0	1
Total	49	53	13	3	3	3	0	0	124
% conspecific interactions	51.0	45.3	23.1	0.0	0.0	33.3	0.0	0.0	—

tacks; the remaining five species accounted for about 7% of all attacks (Table 6). Eagles, however, were the most common victims of attacks (50% of all attacks), followed by Red-backed Buzzards (38% of the attacks). Harris' Hawks were victims of about 6% of the attacks, as were the remaining five species of raptors. The relative importance of intra- and interspecific harassment may be assessed by computing the percentage of conspecific harassments received (Table 6). Eagles were about as frequently harassed by conspecifics as by other species. Red-backed Buzzards and Harris' Hawks were more frequently harassed by other species than by conspecifics. Overall, eagles on our study site were aggressive birds, equally so toward conspecifics and other species, and were disproportionately victimized by other raptors in turn.

DISCUSSION

Our findings can be compared to those reported by Bildstein (1987) for the buteonine hawks *Buteo jamaicensis* (Red-tailed Hawk) and *B. lagopus* (Rough-legged Hawk) in south-central Ohio, who addressed similar questions as ours. Reference is also made to the more restricted studies of Wakeley (1978) on *B. regalis* (Ferruginous Hawk) in Idaho, of Baker and Brooks (1981) on sympatric *B. jamaicensis* and *B. lagopus* in Ontario, and of Bechard (1982) on *B. swainsoni* (Swainson's Hawk) in Washington.

The two wintering buteonines studied by Bildstein (1987) showed a unimodal distribution of activity times, from a low at 08:00–11:00 to peak activity at 17:00–18:00. In contrast, the eagles we studied showed a bimodal activity period, peaking mid-morning and mid-afternoon. Whereas we noted eagles to be essentially soarers, the two buteonines in Ohio hunted mainly from perches (nearly 60% of the first sightings were of perching birds) vs. only 14% of the first sightings of soarers. Bildstein (1987) noted that weather was important in determining the type of flight behavior. In general, the eagles we studied also tended to be active at time periods when thermals and wind drafts were strongest, and to spend more time perching in winter, when rain, weak solar radiation, and low wind levels impeded normal soaring flight, as did the two buteonines in Ohio.

As did eagles, the two buteonines studied by Bildstein (1987) used certain types of habitat disproportionately. Unlike eagles, buteonines shifted their use of habitat depending on whether they were flying or perching. Also, whereas Rough-legged Hawks used flat terrain extensively and Red-tailed Hawks used primarily terrain of average slope, eagles used very steep slopes. Perch use by buteonines in Ohio also differed from that of eagles, although this may simply reflect the higher frequency of man-made structures in Bildstein's (1987) study site. Whereas buteonines in Ohio perched most often on fences and fence posts, utility lines and poles, and high voltage powerline stanchions, we never observed eagles to do so, despite the presence of said structures on our site.

Wakeley (1978), Baker and Brooks (1981), and Bechard (1982), all concurred that the buteonines they studied cued in on vegetative cover rather than on prey abundance. They convincingly showed that buteonines hunted disproportionately in sparsely vegetated areas, rather than on areas densely populated by prey. They argued that densely vegetated patches that support high densities of prey are less profitable than patches with lower densities of prey but that afford higher visibility to the hunting buteonines. In Chile, there was no correlation between prey abundance in different habitat types and eagle activity in those habitats, nor was there correlation between vegetative cover and corresponding eagle activity. Rejection of these two hypotheses led us to propose that eagle activity is related to the magnitude of updrafts in different habitat types, a factor not present in the North American studies, which were conducted in relatively flat or rolling terrain.

Buteonines in Ohio (Bildstein 1987) scavenged more than did eagles in Chile. The former preyed on comparatively smaller mammals and took rabbits only as carrion. Buteonines always ate their prey on a perch, never on the wing as we sometimes noted in the case of eagles. Otherwise, manipulation of prey on perches did not differ greatly.

Bildstein (1987) found that 80% of the agonistic encounters he witnessed in Ohio did not involve prey, and that in 60% of these preyless interactions the victim was perched. In our case, all agonistic encounters were preyless and on the wing. All encounters appeared to be attempts to chase away other hunting raptors.

Although of much more restricted scope, the study of Barnard (1986) offers the only topographic setting comparable to ours. She showed that Jackal Buzzards (*Buteo rufofuscus*) in a montane habitat of South Africa used ridges preferentially relative to their availability, and that this behavior was related to the heavy use that Jackal Buzzards made of updrafts to remain airborne.

It appears, then, that although there are some points of similarity between Nearctic buteonine hawks and our Neotropical buteonine eagle, some marked differences exist in activity patterns and habitat use. They do not seem to be "species induced" and may be attributed to the prevailing weather conditions (particularly to the presence of updrafts) in montane habitats as contrasted to flat terrains.

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