

Boulder County Bats: A one-year survey

Oversite Agencies: *City of Boulder Open Space and Mountain Parks, Boulder County Open Space.*

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INTRODUCTION

The ecological uniqueness of Boulder County lies in its physiography. The Continental Divide lies farthest east at this latitude and the foothills of the Rockies, folded like an accordion, are compressed along a steep east to west gradient. A linear transect from the lowlands to highlands of the County ascends an elevational cline of more than 3,200 feet in less than 10 miles. Habitats range from grassland to shrubland to Ponderosa pine to Douglas fir to saxicoline brush, all inundated with finger-like projections of riparian woodland paralleling cascading drainages surging with snowmelt. This diversity of habitats and myriad interfaces accompanies a high diversity of mammal associates, each making a living under an umbrella of highly complex community interactions.

The diversity of bats is impressive here. Boulder County boast residence for 10 out of 18 species occurring statewide. Two other species may also be present sporadically in the area. Because roost sites are one of the most important ecological limiting factor in bats (Armstrong, 1972; Armstrong et al., 1994; Adams, 1990), the high diversity here suggest a unique assortment of usable day and night roosts. In addition, due to the recent listing of six out of the 10 Boulder County species as Federal Category 2, studies concerning the status of bat populations in the area are critical. An annual Bat Trend Survey initiated by the Colorado Bat Society in 1990 shows an alarming downhill trend in population numbers throughout the state over the past five years (Armstrong et al, 1994, Armstrong et al, 1995; Hall, 1995). This is particularly concerning in light of research supporting bats to be highly important components in the balance of ecosystems. At one end of the spectrum they act as voracious and unmatched predators on night-flying insects (many of which are human pest-species) and on the other, they represent important prey to higher level carnivorous animals thereby providing an important link in complex food webs. In addition, because bats form large colonies in caverns devoid of sunlight, they are keystone species that drive cave and abandoned mine ecosystems by acting as conduits of

energy flow from the outside. Large piles of guano deposited by historic colonies of bats support up to several hundred species of co-evolved organisms.

Although some studies and analyses have included data on bat populations resident in Boulder County (Adams, 1988; 1990; Armstrong 1972; Armstrong et al., 1994; Fitzgerald et al., 1994), no studies to date have rigorously quantified bat species abundance and distribution. The data herein constitute the first year of what we hope will be a multi-year survey of the population status of Boulder County bats.

METHODS

Bats were captured in Japanese mist nets stretched usually over a pond or other water source. Nets were erected approximated 20-30 minutes before dark. Number of nets set varied per location depending upon P.I.'s strategy. Captured individuals were distinguished by species, weighed, sexed, checked for reproductive condition and overall health (ectoparasites, etc.), and released. No individuals were marked or collected during this study.

RESULTS

A total of 20 nights of trapping were achieved representing 880 net nights (net nights = no. of nights x number of nets set per night). A total of 125 individuals were captured between the months of June and September. At some sites bats were present, but none were captured usually due to weather conditions such as high winds. Table 1 shows raw data for all bats captured. Table 2 shows specific locality information for all sites trapped.

Highest number of captured individuals (Fig. 1) was at the Stockton Cabin (SC) site ($n = 49$). Second highest was Shanahan Pond ($n = 34$). Number of species captured varied per site (Fig. 1). The site with the highest species number was Shanahan Pond (SHR) from which seven species were documented. At three other sites, Pollywag (POL), Stockton Cabin, and Bear Creek (BC), between five and six species were captured.

Of the 125 bats caught, almost 62% (77/125) were males (Fig. 2). In addition, only six juveniles and subadults were captured (4.8% of captures). Five of these six young of the year were captured at a single site, Stockton Cabin. The only other young captured was at the Bear Creek site. At several sites lactating or postlactating solitary females were captured (Table 1). A maternity colony of Townsend's big-eared bat (*Plecotus townsendii*) was located during a day search of Harmon cave (sec 12, T1S, R71W) near Bear Canyon .

DISCUSSION

Netting of bats (as well as volunteer efforts in locating bat hotspots) throughout the months of June, July, and August gave a small glimpse into the habits and status of Boulder County's bat populations. Of the ten expected species present in the Front Range, all but one were represented by capture data. The good news thus far is the confirmed presence of populations of the bat species expected to occur in Boulder County. As predicted, diversity of species was greater in the foothills than the plains. This is most likely due to the foothills providing a diversity of roost sites absent in homogeneous grassland habitats. In addition to population information gleaned from capture data, a maternity site for Townsend's big-eared bat (*Plecotus townsendii*) and either a bachelor or maternity colony (undetermined) of big brown bats (*Eptesicus fuscus*) were located at Harmon cave during a daytime search. This is only known maternity colony for *P. townsendii* in Boulder County and is, therefore, a critical site.

Data collected during 1995 also raise some concerns. In particular, the absence of females from the capture data. Of all sites netted this year, Stockton Cabin was the only one showing any indication of locally breeding females. At this site, however, pregnant, lactating and post-lactating females of only three species (*M. ciliolabrum*, *M. volans* and *E. fuscus*) were captured with regularity. At all other sites, males mostly were captured and females were rare, appearing occasionally as solitary individuals. Members of maternity colonies tend to forage and drink as a group and consequently one expects to

catch many reproductive females of a species when in proximity to a maternity site. Therefore, even though we were able to document species presence, we were unsuccessful in documenting foraging maternity colonies. Even more perplexing and concerning than the lack of females in the 1995 data set, was the inability to document a maternity colony of fringed myotis (*Myotis thysanodes*) that was present at the Lindsay site in summer 1994. Currently, the colony status of this Category 2 species is unclear, but efforts should be made to ascertain its status in the near future.

RECOMMENDATIONS FOR FUTURE RESEARCH

Future Research Needs.--Although the 1995 census gave insight into the species presence in Boulder County, little or nothing is known concerning day/night roost site usage, patterns of reproduction, location of maternity sites, overall distribution, and hibernation. Even though **general** localities of several bachelor colonies of bats representing several species were located, the study should be expanded to include intensive netting of foraging sites where maternity colonies may be located. In addition, more effort in locating potential cave or mine sites housing Townsend's big-eared bats and other rock-roosting species is needed. Furthermore, locating actual sites of maternity and hibernation is badly needed. A study design incorporating radio tracking of marked bats to find day/night, maternity, and hibernation sites is essential in understanding the ecology of the species utilizing the area. Maternity and hibernation sites are particularly vulnerable to human disturbance and data concerning their locations are paramount in management plans and conservation efforts.

Management Recommendations.--Because Boulder's open space and park systems are high-use areas, a management plan is essential to protect habitats used by bats. Unfortunately, too little is currently known to build an effective plan. Some initial steps, however, should be taken to ensure minimal disturbance in areas currently known to support high diversity. 1) So far we do know that certain water sources are used for foraging and drinking. These areas should be kept as undisturbed as possible and water

pools should not be further humanly manipulated. 2) The Colorado Division of Wildlife should be contacted concerning the *Plecotus* colony at Harmon cave, as this site needs immediate protection. It is easily accessible to human disturbance and is at high risk of extirpation. 3) Because many areas in Boulder County are heavily used by rock climbers, disturbance to maternity and hibernation sites located in rock crevices may be effecting and is of real concern. Maternity and hibernation sites need to be located with use of radio transmitters to assess the risk to bat populations due climber's impacts. 4) Further daytime investigation of rock cavities is recommended in areas where bats have been known to roost historically.

There are no data to suggest that the City of Boulder needs to modify or elaborate its wildlands (i.e. placing of bat houses, etc.) for bats. There are, however, many critical questions that need answers before effective measures for the management of bats can be considered. Clearly, the challenge facing a growing Boulder in forthcoming years will be to maintain what appears to be excellent bat habitat with foresight in supporting further bat studies today in order to build subsequent management plans which take bats into important consideration for the future.

LITERATURE CITED

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Table 1.--Raw capture data for 1995 census of Boulder County bats. *Ml* = *Myotis lucifugus*, *Mc* = *Myotis ciliolabrum*, *Me* = *Myotis evotis*, *Mt* = *Myotis thysanodes*, *Mv* = *Myotis volans*, *Lc* = *Lasiurus cinereus*, *Ln* = *Lasionycterus noctivagans*, *Ef* = *Eptesicus fuscus*, *Pt* = *Plecotus townsendii*. *F* = female, *M* = male, *A* = adult, *SA* = subadult, *J* = juvenile, *L* = lactating, *NL* = nonlactating, *PL* = postlactating, *P* = pregnant, *NP* = nonpregnant, *S* = scrotal, *NS* = nonscrotal, *SC* = Stockton Cabin, *ABB* = Abbey Pond, *WR* = White Rocks, *SHR* = Shanahan Ridge Pond, *LIN* = Lindsay, *Scn* = Schnieder Pond, *POL* = Pollywag Pond, *BC* = Bear Creek, *WHA* = North of Whales

1	SPECIES	DATE	SEX	AGE	WGT.	R-COND	SITE
2	Ml	12 JUNE	F	A	ND	NL	SC
3	Ml	21 JUNE	F	A	ND	P	POL
4	Ml	27 JUNE	F	A	9.0	P	POL
5	Ml	8 JULY	M	A	7.2	NS	ABB
6	Ml	12 JULY	F	A	7.8	L	SC
7	Ml	12 JULY	F	A	7.6	L	SC
8	Ml	12 JULY	M	A	7.4	NS	SC
9	Ml	12 JULY	F	A	7.6	NL	SC
10	Ml	12 JULY	F	A	7.2	NL	SC
11	Ml	12 JULY	M	A	6.5	NS	SC
12	Ml	12 JULY	F	SA	7.8	NL	SC
13	Ml	12 JULY	F	A	7.5	L	SC
14	Ml	12 JULY	F	A	8.0	L	SC
15	Ml	12 JULY	F	A	4.7	L	SC
16	Ml	12 JULY	M	SA	7.4	NS	SC
17	Ml	12 JULY	M	A	6.2	NS	SC
18	Ml	12 JULY	F	A	7.3	PL	SC
19	Ml	12 JULY	M	A	8.0	NS	SC
20	Ml	29 JULY	M	A	6.8	S	SHR
21	Ml	29 JULY	F	A	7.5	NLNP	SHR
22	Ml	29 JULY	M	A	8.4	S	SHR
23	Ml	29 JULY	M	A	7.8	S	SHR
24	Ml	29 JULY	M	A	8.6	NS	SHR
25	Ml	17 AUG	F	A	9.5	P, L	WHA
26	Ml	21 AUG	F	A	8.2	NL	SC
27	Ml	21 AUG	M	A	7.0	S	SC
28	Ml	26 AUG	M	A	8.0	NS	ABB
29	Ml	26 AUG	M	A	5.0	NS	ABB
30	Mc	12 JUNE	F	A	ND	ND	SC
31	Mc	12 JUNE	M	A	ND	ND	SC
32	Mc	27 JUNE	M	A	8.0	NS	POL
33	Mc	27 JUNE	M	A	8.0	NS	POL
34	Mc	29 JULY	M	A	5.0	NS	SHR
35	Mc	29 JULY	F	A	6.1	L NP	SHR
36	Mc	16 AUG	F	J	4.5	NLNP	BC
37	Mc	16 AUG	F	SA	5.5	NLNP	BC
38	Mc	21 AUG	F	A	4.4	NLNP	SC
39	Me	12 JUNE	M	A	ND	ND	SC
40	Me	12 JUNE	M	A	ND	ND	SC

41	Me	12 JUNE	M	A	ND	ND	SC
42	Me	12 JUNE	F	A	ND	ND	SC
43	Me	13 JUNE	F	A	ND	P	SHR
44	Me	12 JULY	M	A	ND	NS	SC
45	Me	12 JULY	M	A	5.5	NS	SC
46	Me	12 JULY	M	A	6.0	NS	SC
47	Me	12 JULY	M	A	7.2	NS	SC
48	Me	12 JULY	M	A	5.9	NS	SC
49	Me	12 JULY	M	A	6.8	NS	SC
50	Me	12 JULY	M	A	6.4	S	SC
51	Me	12 JULY	M	A	7.0	ND	SC
52	Me	12 JULY	M	A	5.7	NS	SC
53	Me	16 AUG	M	A	6.5	ND	BC
54	Me	21 AUG	M	A	8.4	S	SC
55	Mt	27 JUNE	M	A	5.3	NS	POL
56	Mt	8 JULY	F	A	9.6	P	ABB
57	Mt	12 JULY	M	SA	6.4	NS	SC
58	Mt	12 JULY	M	A	8.0	S	SC
59	Mt	12 JULY	M	A	7.0	NS	SC
60	Mt	29 JULY	M	A	7.2	S	SHR
61	Mt	29 JULY	M	A	7.6	S	SHR
62	Mt	29 JULY	F	A	9.0	L	SHR
63	Mt	16 AUG	F	A	8.5	L	BC
64	Mt	16 AUG	F	A	8.0	L	BC
65	Mt	16 AUG	F	A	8.0	L	BC
66	Mt	16 AUG	M	A	7.2	S	BC
67	Mt	26 AUG	M	A	9.0	ND	ABB
68	Mv	12 JUNE	F	A	ND	ND	SC
69	Mv	12 JUNE	M	A	ND	ND	SC
70	Mv	20 JUNE	M	A	9.0	NS	SCN
71	Mv	20 JUNE	F	A	9.2	P	SCN
72	Mv	12 JULY	M	A	7.2	NS	SC
73	Mv	12 JULY	M	A	6.8	NS	SC
74	Mv	12 JULY	M	A	8.1	NS	SC
75	Mv	12 JULY	M	SA	6.2	NS	SC
76	Mv	12 JULY	F	A	7.0	PL	SC
77	Mv	12 JULY	F	A	10.3	P	SC
78	Mv	12 JULY	M	A	5.5	NS	SC
79	Mv	12 JULY	M	A	7.4	NS	SC
80	Mv	16 AUG	M	A	5.1	NS	BC

81	Mv	21 AUG	F	A	8.1	NL	SC
82	Mv	26 AUG	F	A	ND	PL	ABB
83	Lc	19 JUNE	M	A	30.0	NS	WR
84	Lc	29 JULY	F	A	27.0	NLNP	SHR
85	Ln	27 JUNE	M	A	9.6	NS	POL
86	Ef	13 JUNE	M	A	ND	NS	SHR
87	Ef	13 JUNE	M	A	12.0	S	SHR
88	Ef	13 JUNE	F	A	ND	P	SHR
89	Ef	13 JUNE	M	A	18.0	NS	SHR
90	Ef	13 JUNE	M	A	15.8	S	SHR
91	Ef	13 JUNE	M	A	ND	S	SHR
92	Ef	13 JUNE	M	A	ND	NS	SHR
93	Ef	13 JUNE	M	A	ND	NS	SHR
94	Ef	13 JUNE	F	A	19.8	P	SHR
95	Ef	14 JUNE	M	A	12.0	NS	LIN
96	Ef	20 JUNE	M	A	18.2	NS	SCN
97	Ef	27 JUNE	M	A	15.8	S	POL
98	Ef	27 JUNE	M	A	16.4	NS	POL
99	Ef	8 JULY	M	A	14.2	NS	ABB
100	Ef	8 JULY	F	A	21.0	P	ABB
101	Ef	8 JULY	F	A	19.8	P	ABB
102	Ef	8 JULY	M	A	16.8	NS	ABB
103	Ef	8 JULY	M	A	16.0	S	ABB
104	Ef	8 JULY	M	A	16.0	S	ABB
105	Ef	8 JULY	M	A	13.4	S	ABB
106	Ef	8 JULY	M	A	ND	S	ABB
107	Ef	8 JULY	F	A	ND	P	ABB
108	Ef	12 JULY	M	A	16.2	S	ABB
109	Ef	12 JULY	ND	ND	ND	ND	ABB
110	Ef	12 JULY	M	A	14.5	S	ABB
111	Ef	29 JULY	M	A	14.2	S	SHR
112	Ef	29 JULY	F	A	17.3	L P	SHR
113	Ef	29 JULY	M	A	20.9	S	SHR
114	Ef	29 JULY	M	A	19.0	S	SHR
115	Ef	29 JULY	M	A	22.0	S	SHR
116	Ef	29 JULY	M	A	15.4	S	SHR
117	Ef	29 JULY	F	A	19.0	NL	SHR
118	Ef	29 JULY	F	A	23.0	L	SHR
119	Ef	16 AUG	F	A	14.5	NLNP	BC
120	Ef	16 AUG	ND	ND	ND	ND	BC
121	Ef	17 AUG	F	A	17.5	NLNP	WHA
122	Ef	17 AUG	M	A	17.0	S	WHA
123	Ef	26 AUG	M	A	24.0	NS	ABB
124	Ef	26 AUG	F	A	20.0	ND	ABB
125	Ef	26 AUG	F	A	13.5	ND	ABB
126	Pt	29 JULY	F	A	ND	NLNP	SHR

Table 2.--*Localities of net sites for 1995 census, all in Boulder County.*

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- Stockton Cabin Pool:** intersection of Mesa trail and Shadow canyon trail.
Sec. 24, T1S, R71W
- Shanahan Pond:** intersection of the middle and north fork of Shanahan Ridge trail.
Sec. 18, T1S, R70W
- Lindsay Pond:** south end of Dowdy Draw and just north of water diversion pipe.
Sec. 31, T1S, R70W
- White Rocks:** north of Valmont Rd. and east of 95th ave. at white rock outcrop on Ertl property, approximately 8 m west of obvious large deep depression about 3 m in diameter, currently housing barn owl nest.
Sec. 18, T1N, R69W
- Schneider Pond:** northwest of intersection of US 36 and Longhorn Rd. Approximately 1.5 mi. up ravine leading to Old Stage Rd.
Sec. 1, T1N, R71W
- Pollywog Pond:** southwest of first right angle bend in south fork of Shanahan trail from Hardscrabble Dr. access.
Sec. 18, T1S, R70 W
- Eagle Pond:** from Eagle trailhead approximately 1.5 mi west to Eagle trail south.
Sec. 5, T1N, R70W
- Abbey Pond:** from Hardscrabble Dr. access into Shanahan, take casual path due west.
Sec. 24, T1S, R71W
- Marshal Mesa:** mine reclamation site, just northwest of cliff-face on East Rudd property.
Sec. 21, T1S, R70W
- Bear Creek Pool:** junction of Mesa trail and Bear Creek.
Sec. 12, T1S, R71W
- North of Whales Trail:** Eldorado Canyon State Park
T1S, R71W
- Boulder Clouny Fairgrounds:** Cattail Lake, Longmont
Sec. 9, NW1/4, T2N, R69W
- Frontier Lakes:** Hygene
Sec. 30 NE 1/4, R70W, T3N
- Hall Ranch:** Lyons, Stockpond west of John Hall home
Sec. 24, T3N, R71W
-

FIGURE LEGENDS

Figure 1. Plot of numbers of individuals captured per species against net sites. MI = *Myotis lucifugus*, Mc = *Myotis ciliolabrum*, Mt = *Myotis thysanodes*, Me = *Myotis evotis*, Mv = *Myotis volans*, Ln = *Lasionycteris noctivagans*, Lc = *Lasiurus cinereus*, Pt = *Plecotus townsendii*, Ef = *Eptesicus fuscus*. SC = Stockton Cabin, SHR = Shanahan, LIN = Lindsay, WR = White Rocks, SCH = Schnieder, POL = Pollywag, BC = Bear Creek, WHA = North of Whales, ABB = Abbey. Where symbols overlap for MI and Pt, Pt is indicated. Where symbols overlap for Mc and Ef, Ef is indicated.

Figure 2. Plot of number of males versus females captured per net site. Site symbols as in Figure 1.



