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Project Report: Faunal Survey of the bats at the Oak Lake Research Station

Section I— Project Overview

Investigators performed faunal censuses of the bats at: 1) Oak Lake Research Station - SDSU, 2) several State Recreational areas in Brookings County, and 3) several city parks in Brookings, South Dakota. Investigators captured bats throughout the summer using mist-nets stretched over ponds, streams, and walking trails. Captured individuals were identified to species, weighed, sexed, checked for reproductive condition and overall health (ectoparasites, etc.). Several healthy individual Big Brown bats were radio-tagged and tracked to locate roosts and to document home ranges. This first season was utilized primarily to train four students in basic capture and census methodology, two of which will return to assist in a regional census during the 2001 field season.

Section II—Initial Objectives & Re-Direction of Project

Initially, this project had four objectives: (1) to document which species are present at the Station; (2) to gather data concerning the natural history of each species; (3) to identify maternity roosts; and (4) to document water-use patterns, home ranges, and foraging behavior. Despite the wealth of habitat, roosting opportunities, and abundant insect prey, there were no bats observed at the station until August 23rd, and then only a single female Red bat (*Lasiurus borealis*) was acoustically identified and eventually mist-netted.

Due to this surprising lack of bat activity at the Station, and in order to provide necessary training for the subsequent field season, efforts were re-directed into a survey of potential habitats that were known to support bat populations throughout Brookings County (City of Brookings: Conservation Park, Hillcrest Park, McCrory Gardens & Arboretum - SDSU, Pioneer Park, Rotary Park, Sexauer Park; Brookings County: Newton Hills State Park, Oakwood State Park).

Section III—Training efforts

Two undergraduate (Susan Wolfe, Jon Appino), and two graduate students (Vicki Swier, Pat Beauzay) were trained in the following field census methods: a) mist netting and field identification, b) radio-tracking, and d) acoustic sampling techniques.

III-a Mist nets—Students were shown how to evaluate various habitats for the best strategy to be used in setting out their mist-nets. Each student was trained how to erect nets over ponds, streams, roads and walking trails at a variety of heights ranging from 2-6 meters off of the ground. Students were trained to: 1) remove tangled bats from the nets, 2) identify captured animals to species, 3) weigh, sex, and checked for reproductive condition, 4) collect ectoparasites, 5) record data, and 6) to follow appropriate release methods for each species.

III-b Radio-tracking—Four bats (3 *Eptesicus fuscus*; 1 *Lasiurus borealis*) were outfitted with Holohil LB-2 radio transmitters. These transmitters were the smallest currently available (0.04 grams, just under the 5% transmitter/body mass rule) and had an active life of 3 weeks (Holohil guaranteed two weeks). Transmitters were attached to the bat's dorsal fur using surgical skin-glue that disintegrates 4 weeks after application.

Eight transmitters were purchased, four were activated, whereas the remaining four have been returned to Holohil to have new batteries installed for re-use next season. Communications Specialists AR-1000 Receivers were used to track radio-tagged individuals around the Oak Lake Field Station as well around the City of Brookings.

III-c Acoustic sampling—Three different types of bat-detector were field tested in 2000: Titley ANABAT II, Petterson D-100, and Stag BATBOX III. The simple tunable detectors (Stag, Petterson) were quite capable of detecting and discerning between the ultrasonic frequencies of the two predominant species in the region, Red and Big Brown bats, as verified by mist-net captures. The ANABAT arrived from Australia late in the season (August 25th) and was only employed a small number of times.

Section IV—Results and Discussion

IV-a Captures—Little or no information concerning bats was available for Eastern South Dakota, let alone Brookings County. Presumably, seven species of bats are present in the region: Silver-haired, Big Brown, Little Brown, Hoary, and Red bats, plus the Western small-footed and Northern long-eared *Myotis*. An additional three species may very well be present, albeit unreported due to limited sampling efforts in the region: Eastern Pipistrelle, Indiana and Evening bats (Appendix 2).

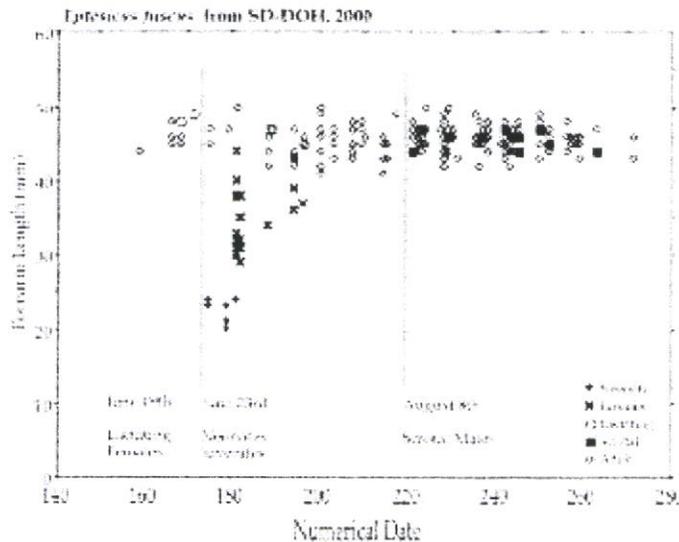
Whereas roost sites and water resources are important ecological limiting factors to bats (Adams, 1990; Armstrong, 1972, 1994; Fenton, 1997) both are clearly abundant throughout Brookings County and do not effect local foci of bat activity. Indeed, 148 net-nights and 320 man-hours later, we had captured only 8 bats (3 Big Brown bats - *Eptesicus fuscus*, and 5 Red bats - *Lasiurus borealis*; i.e., 0.05 bats per net per night - BNN; Appendix 3).

Though somewhat humiliating for the PI (15 years in this line of research), this underwhelming success was made even more ridiculous by the observation that the South Dakota Department of Health (east-river) was able to secure 243 Big Brown bats in the same period of time with considerably less effort.

IV-b DOH "Captures"—Certainly, the wealth of DOH material underlines the extraordinary value of the DOH personnel and their colleagues in the identification and archival of voucher specimens throughout the State. Much to the chagrin of the PI, Exterminators and Animal Control Officers in Sioux Falls were able to demonstrate 4 species of bat, whereas the PI (using 'tried and true' technology) was only able to demonstrate 2 species!

As of September 30th, 310 bats had been submitted to the South Dakota Department of Health (entire State) for rabies testing in 2000 (*pers. comm.* Lon Kightlinger, SD-DOH, Pierre). Of these, only eight tested positive for the Rabies virus (2.5%) Certainly a low value by CDC standards, but nevertheless significantly greater than the incidence of rabies in wild-caught animals (<0.5%). On October 15th, the PI had received 251 rabies negative carcasses from the Animal Disease Research & Diagnostic laboratory (ADRDL, SDSU) for species identification.

Of the 251 ADRDL specimens, 243 were Big Brown bats (*Eptesicus fuscus*) collected from Sioux Falls, 3 were Hoary bats (*Lasiurus cinereus*), 4 were Red bats (*Lasiurus borealis*), and a single unidentifiable species of *Myotis* was also present in the sample. It is unknown how many of these vouchers were included in Kightlinger's DOH report and the complete analysis of these vouchers must await the final year-end report from the DOH.



In lieu of actual field-data, the PI began the process of identifying reproductive patterns in Big Brown bats in eastern South Dakota by documenting several life-history events based upon the DOH 2000 voucher specimens from Sioux Falls (see above figure). Several important landmarks should be noted: (1) Lactating females first appeared on June 19th and were collected through July 14th; (2) Neonates and juveniles were first noted on June 23rd; (3) Scrotal males made their first appearance on August 8th and were submitted for testing through September. These dates reflect the day the animals were actually turned in for testing, as such, they lag behind the actual date of appearance by a week or more.

In summary, as of November 2000, SD-DOH and SDSU Museum vouchers exist for 4 species of bat in eastern South Dakota:

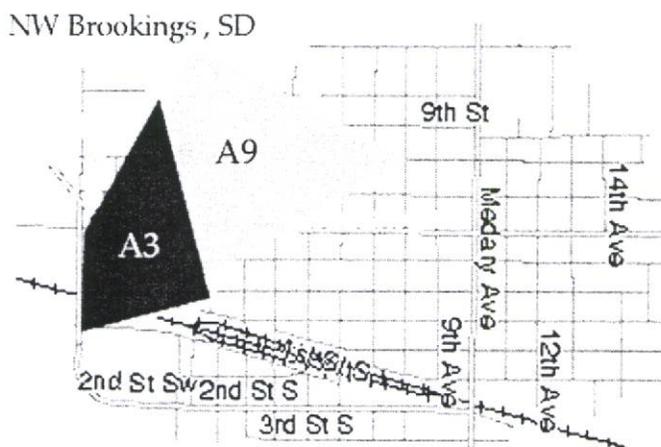
- Lasiurus borealis*Red bat
- Lasiurus cinereus*Hoary bat
- Eptesicus fuscus*Big Brown bat
- Myotis lucifugus*Little Brown bat

IV-c Radio-tracking—The radio-tagged Red bat was never re-located at, nor within a two-mile radius of the Station. This is not surprising given the nature of this bat's great foraging range. In Brookings, students drove street-wise grid-patterns each evening until tagged animals were re-located and then subsequently followed. The third tagged bat (*Eptesicus*) was never relocated despite rather extensive efforts to locate the animal.

Movement patterns of two individual Big Brown bats (A3, A9) were documented to determine foraging range and habitat use via triangulated signals recorded at two stations (Sexauer and Pioneer City Parks), coordinated by FM 2-way radios. Both tagged bats lived in man-made structures: A3 in the eaves of a finished garage situated at the edge of Pioneer Park; A9 in the crawl-space/attic of a two-story home in a wooded neighborhood between two large city parks, Pioneer and Sexauer.

Each bat averaged ~60 minutes of foraging time, evenly divided between Pioneer and Sexauer city Parks. Bats foraged between 20-50 feet above the ground (visual observation)

in open clearings among mature cottonwood and oak trees. On a single evening, heavy fog reduced foraging times to 40 minutes for both animals. One bat, A3, foraged for 90 minutes one evening, 20 minutes at each park and then another 20 minutes out of range of the two tracking stations, i.e., the range of A3 (16 city blocks) may be more similar to that of A9 (36 city blocks: 1/4 square mile; see map).



Tag / Species	Location	Results
A3 <i>Eptesicus</i>	Pioneer Park, Brookings	16 tracking nights
A5 <i>Eptesicus</i>	Pioneer Park, Brookings	Never found
A7 <i>Lasiurus</i>	Oak Lake Field Station	Never found
A9 <i>Eptesicus</i>	Home: 716 8th St., Brookings	11 tracking nights

IV-d Acoustic sampling—Clearly, mist-netting is poorly suited for sampling diffuse populations such as those found around Brookings and Sioux Falls, let alone for the observation/identification of habitat utilization. Though acoustic sampling methods are problematic and controversial, they do permit tentative species identification and estimation of animal activity/habitat-use patterns with a significant decrease in man-hours (and frustration) in situations such as we have found in Brookings.Co., and will become the survey method of choice in future field seasons (see below: *Future Directions*).

Tunable bat-detectors were able to distinguish between Red and Big Brown bats at the following locations (City of Brookings: Hillcrest Park, McCrory Gardens & Arboretum - SDSU, Pioneer Park, Rotary Park, and Sexauer Park) and proved to be reliable instruments that supported visual observations of foraging big Brown and Red bats.

Future efforts will be shifted towards a greater reliance on acoustic sampling methods. Currently, the ANABAT system is the premier acoustic sampling system available and consists of a highly sensitive microphone and sound-activated tape recorders. As bats fly through a habitat, the system turns itself on and records the animals echolocation calls. The acoustic information can be immediately downloaded to a lap-top computer where an 'acoustic-fingerprint' of the recorded animal can be analyzed and identified to species.

Due to the late arrival of GFP Grant monies, and delays in receiving the unit from Titley Electronics, the ANABAT system was not available to record echolocation calls in 2000.

Vicki Swier (entering Masters student) spent considerable time at the 30th Annual North American Symposium on Bat Research (NASBR; 9/27-30, 2000), talking with several research teams that utilize the ANABAT system in their own work. In this manner, she received an appreciable post-hoc training/understanding of the use of this unit and will have the system fully operational in preparation for her project that begins April, 2001 (See below: *Future Directions*).

IV-e Timetable—The timetable of Bat activity that was presented in the initial proposal was based on data borrowed from Dr. Ken Geluso's work at a more southern latitude in Fontanelle Forest, near Omaha NE.. Weather (and University exam schedules) precluded survey efforts until mid-May. Despite our negligible data, most dates differ predictably from those recorded near Omaha, that is, bats are starting things later, and ending them earlier in Brookings than in Omaha.

<u>Milestones</u>	<u>Predicted</u>	<u>DOH</u>	<u>Actual</u>
Project starting date	4.16		5.10
Census efforts		6.07 - 9.27	5.10 - 10.05
Report submitted			11.15
Enter region?	4.16 - 4.30		5.14
Pregnant females	5.07 - 6.04		
Lactating	5.28 - 7.30	6.19 - 7.14	
Neonates	6.25 - 7.30	6.23 - 6.27	6.14
Juveniles	6.25 - 9.10	6.29 - 7.14	
Scrotal males	8.01 - 10.10	8.08 - 9.19	8.22
Exit region?	9.17 - 11.22		11.05

Section V—Future Directions

The faunal survey of bat species in eastern South Dakota will continue during the 2001 season, albeit in the guise of a Masters Thesis project performed by Vicki Swier. In short, Ms. Swier's project will be the logical extension of our efforts (and her training) in 2000, but extended into several State Parks and Recreation areas in the eastern half of the State. She will capture bats throughout the summer using mist nets and will augment this data with acoustical surveys, primarily with the aid of ANATBAT system hardware.

Ms. Swier will be assisted by the PI, Patrick Beauzay, and Susan Wolfe during the 2001 field season. Captured individuals will be identified to species, weighed, sexed, checked for reproductive condition and overall health (ectoparasites, etc.) following guidelines laid out in the South Dakota Game Fish and Parks document: "*Bat Sampling and Collection Protocol Guidelines and Requirements*". Life history information on each species will be recorded as time permits: time of first arrival at each site, duration of lactation, appearance of first volant juveniles, and time of departure from each site.

One of the primary goals of her Masters Thesis will be to generate distributional maps detailing spatial and temporal habitat use among the resident species in the region. It is unlikely that her data will deviate significantly from those collected by investigators in adjacent states, but the significance of her extensive survey lies in that it will be the first data collected in the eastern half of the state since Findley's census of Clay County in 1956.

Appendix 1. South Dakota State Scientific Collection and Salvage Permit: #49.

Appendix 2. Species list for South Dakota—The Natural Heritage database lists South Dakota bats as follows: (S1) Extremely rare; (S2) Rare; (S3) Very rare - restricted range; (S4) Common; (S5) Very common.

Bats expected in eastern South Dakota (Brookings County Vouchers = Bold Face)

<i>Eptesicus fuscus pallidus</i>	Big brown bat	S5
<i>Lasionycteris noctivagans</i>	Silver-haired bat	S4
<i>Lasiurus borealis borealis</i>	Red bat	S5
<i>Lasiurus cinereus cinereus</i>	Hoary bat	S5 ?
<i>Myotis ciliolabrum subulatus</i>	Western small-footed Myotis	S5 ?
<i>Myotis lucifugus carissima</i>	Little brown Myotis	S5 ?
<i>Myotis septentrionalis</i>	Northern long-eared Myotis	S3

Species with possible occurrence in southeast South Dakota (No vouchers for SD)

<i>Myotis sodalis</i>	Indiana bat	S1 ?
<i>Nycticeius humeralis</i>	Evening bat	S1 ?
<i>Pipistrellus subflavus</i>	Eastern Pipistrelle	S1 ?

Appendix 3a. Summer 2000, Capture Data for Brookings County:

Species	Date	Sex	FA	Mass	Radio	Status
<i>E. fuscus</i>	8.22	male	44.5	17.3 g	[A5]	young adult
	8.22	male	45.5	17.8 g	[A3]	scrotal
	8.27	male	45.0	18.0 g	[A9]	
<i>L. borealis</i>	6.14	female	41.5	12.9 g		adult, non-lact.
	6.14	female	—	—		adult, lact., w/neonate
	7.17	female	40.0	7.5 g		adult
	8.23	female	38.0	15.4	[A7]	young adult
	8.26	female	41.0	10.5 g		juvenile

Appendix 3b. Summer 2000, SD-DOH Data (Adults only):

Species	n	Sex	FA	Mass
<i>E. fuscus</i>	133	male	44.7	12.5 g
	81	female	44.8	13.1 g
<i>L. borealis</i>	1	male	18.0	4.9 g
	3	female	31.0	7.4 g
<i>L. cinereus</i>	1	male	41.5	14.2 g
	2	female	56.0	15.6 g
<i>Myotis spp.</i>	1	?	?	?

Appendix 4. Census activity in Brookings County.

Date	Tech	Location	Nets	Date	Tech	Location	Nets
5.14	N	Sexauer Park	8	7.28	N/A	Rotary Park	4
5.21	N/A	Oak Lake FS	8	7.29	A	Oak Lake FS	0
5.25	N/V	Oakwood SP	9	7.30	N/A	Arboretum SDSU	4
5.30	A	Sexauer Park	0	8.14	A/V	Oak Lake FS	0
5.31	A	Conservation Park	0	8.15	N/A	5th St. @ Sherwood	5
6.01	A	Sexauer Park	0	8.21	N/A	Rotary Park	8
6.06	N/A	Sexauer Park	6	8.22	N/A	Pioneer Park	8
6.08	N/A	1108 22nd Ave. N.	3	8.23	R	109 4th	0
6.10	A	Oak Lake FS	0	8.23	N/A	Oak Lake FS	6
6.11	N/A	McCrary Gardens	0	8.24	R	Pioneer Park	0
6.12	N/A	Arboretum SDSU	8	8.24	N/A	Sexauer Park	7
6.13	A	Hillcrest Park	0	8.25	R	109 4th	0
6.13	A	Oak Lake FS	0	8.26	R	109 4th	0
6.17	N/A	McCrary Gardens	8	8.26	R	716 8th	0
6.18	N/A	1108 22nd Ave. N.	3	8.26	N/A	McCrary Gardens	7
6.22	N/A	Newton Hills SP	4	8.27	N	716 8th	1
6.22	A	Oak Lake FS	0	8.27	N/A	Hillcrest Park	9
6.26	A	Conservation Park	0	8.28	R	Oak Lake FS	0
6.27	A	Oak Lake FS	0	8.29	R	716 8th	0
6.29	N/A	Newton Hills SP	8	8.29	R	Sexauer	0
6.30	N/A	Arboretum SDSU	5	8.29	R	Pioneer	0
7.04	A	Rotary Park	0	8.30	R	716 8th	0
7.07	A	Oak Lake FS	0	8.30	R	Sexauer	0
7.09	A	Oak Lake FS	0	8.30	R	Pioneer	0
7.13	N/A	Rotary Park	4	8.31	R	Pioneer	0
7.15	A	Rotary Park	0	8.31	R	Sexauer	0
7.16	A	Golf Course	0	9.02	N/R	Pioneer	3
7.16	A	Oak Lake FS	0	9.02	R	Sexauer	3
7.17	N/A	Rotary Park	3	9.06	R	109 4th/716 8th	0
7.21	N	McCrary Gardens	4	9.07	NRA	Pioneer	2
7.22	A	Golf Course	0	9.19	R	109 4th/716 8th	0

[N = Mist-netting, A = Acoustic Sampling, R = Radiotracking]

Appendix 5. 2000 Budget (Actual expenses)

ANABAT system.....	\$1500.00	(1)	.....1500.00
Avinet 12 meter mist nets	\$ 94.25	(2)	.....188.50
Avinet 6 meter mist nets	\$ 58.25	(4)	.....233.00
Avinet 9 meter mist nets	\$ 76.00	(2)	.....152.00
Avinet canopy net (nylon 18' x 7' x 1.25').....	\$ 85.00	(2)	.....170.00
Chest waders.....	\$ 45.00	(2)	.....90.00
Fuel/Oil (~1500 miles @ \$ 0.29/mi.)	406.00	(1)	.....406.00
Head lamps/batteries.....	\$ 38.00	(1)	.....140.00
Holohil (BD-2) radio transmitters.....	\$ 145.00	(8)	.....1160.00
Hughes Plastic Wing-bands.....	\$ 129.00	(1)	.....129.00
Motorola FR-50 2-Way radios	\$ 51.00	(1)	.....102.00
Pesola spring-scales	\$32.00	(2)	.....64.00
Poles (12' electrical conduit)	\$ 10.00	(6 pr.)	.....120.00
Radio antennae (Holohil).....	\$ 90.00	(2)	.....180.00
Radio receivers (CSI R-1000)	\$ 559.00	(2)	.....1118.00
Skin-bond glue.....	\$ 30.00	(1)	.....30.00
Sony Laptop computer (for ANABAT).....	\$ 2200.00	(1)	.....\$ 2200.00
Supplies (rope, photography, hardware)	\$ 200.00	(1)	.....200.00
Wind-meter / Psychrometer	\$ 145.00	(1)	.....145.00
TOTAL			\$ 8327.50
SD-GF&P Grant 2000			5000.00
PI out-of-pocket expenses			3327.50