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ILLINOIS NATURAL HISTORY SURVEY

CENTER FOR WILDLIFE ECOLOGY

Cooperative Furbearer Research
Illinois Raccoon Investigations

W-104-R-6

Final Report

by
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Illinois Natural History Survey

1 July 1993 through 30 June 1995

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Table 1. Minimum number of raccoons known present in spring and fall for all 4 study areas 1990-1993. (F = Fall and S = Spring).

	S 1990	F 1990	S 1991	F 1991	S 1992	F 1992	S 1993	F 1993	Mean # F	Mean # S	Mean Density Km^2 F	Mean Density Km^2 S
					Main Study Area (23.0 Km^2)							
Min. # Known Alive	124	129	92	171	86	89	58	71	90	115	5	4
					Siloam Springs State Park (6.1 Km^2)							
Min. # Known Alive	60	146	81	96	122	66	37	31	85	75	14	12
					Richardson Wildlife Foundation (6.58 Km^2)							
Min. # Known Alive	–	37	–	61	–	83	–	98	63	–	10	–
					Amboy Area (2.78 Km^2)							
Min. # Known Alive	–	18	–	35	–	64	–	74	48	–	17	–

Table 2. Sex and age of raccoons livetrapped on all study areas, fall 1989-fall 1993 (M = male and F = female).

	Adults		Yearlings		Juveniles	
	M	F	M	F	M	F
			Main Study Area			
Fall 1989	16	6	1	1	12	9
Spr 1990	25	16	19	11	--	--
Fall 1990	9	7	7	5	13	10
Spr 1991	14	13	5	3	--	--
Fall 1991	17	5	4	4	14	9
Spr 1992	21	29	13	16	--	--
Fall 1992	10	10	7	7	18	14
Spr 1993	8	8	11	6	--	--
Fall 1993	14	10	8	3	16	20
Males Per 100 Females						
Fall	174		135		118	
Spr	103		113		--	
			Siloam Springs State Park			
Spr 1990	5	9	2	5	--	--
Fall 1990	12	21 [a]	4	9 [a]	21	26
Spr 1991	25	14	16	9	--	--
Fall 1991	18	14 [a]	8	7 [a]	7	12
Spr 1992	30	12	3	10	--	--
Fall 1992	4	16 [a]	1	8 [a]	3	8
Spr 1993	11	2	4	5	--	--
Fall 1993	12	4	4	0	7	5

Continued.

Table 2. Page 2.

	Adults M	Adults F	Yearlings M	Yearlings F	Juveniles M	Juveniles F
Males Per 100 Females						
Fall	84		71		75	
Spr	191		83		--	
			Richardson Foundation			
Fall 1990	5 [a]	8	4 [a]	3	7	10
Spr 1991	6	6	5	6	1	2
Fall 1991	4 [a]	3	1 [a]	3	17	4
Fall 1992	2 [a]	3	5 [a]	0	16	16
Fall 1993	14	8	7	5	12	14
Males per 100 Females						
Fall	114		155		118	
			Amboy Area			
Fall 1990	5	3	1	1	4	4
Spr 1991	2	5	8	1	--	--
Fall 1991	2	3	4	2	10	2
Fall 1992	4	4	11	3	11	4
Fall 1993	10	6	3	2	3	6
Males Per 100 Females						
Fall	131		238		175	

[a] Raccoons removed from the study areas.

Table 3. Age structure of livetrapped raccoons from tooth cementum annuli.

Age Years	Fall 1989		Spring 1990		Fall 1990		Spring 1991		Fall 1991		Spring 1992		Fall 1992		Spring 1993		Fall 1993		TOTAL Fall		TOTAL Spring	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Main Study Area																						
<1	12	9	--	--	13	10	--	--	14	9	--	--	21	18	--	--	16	20	76	66	--	--
1	7	1	22	5	9	2	9	2	11	0	19	20	11	17	8	9	9	2	47	22	58	36
2	6	3	14	11	2	4	4	5	6	0	6	3	14	6	14	8	6	5	34	18	38	27
3	1	1	4	8	3	4	4	4	0	1	3	4	2	3	5	3	3	2	9	11	16	19
4	1	1	1	0	0	1	2	4	0	1	2	7	4	4	0	1	1	1	6	8	5	12
≥5	1	0	0	1	0	0	0	1	0	1	3	10	4	6	3	4	3	2	8	9	6	16
Adult	0	1	1	1	1	1	1	1	0	1	0	1	1	1	0	1	1	0	3	4	2	4
Siloam Springs State Park																						
<1	--	--	--	--	21	26	--	--	7	12	--	--	4	8	--	--	6	6	38	52	--	--
1	--	--	2	4	3	10	17	7	10	9	4	13	4	7	3	5	4	0	21	26	26	29
2	--	--	1	1	3	3	9	2	5	2	4	10	12	12	0	1	1	2	21	19	14	14
3	--	--	3	1	1	4	5	2	6	2	3	41	1	3	8	1	5	0	13	9	19	8
4	--	--	0	1	1	1	3	2	2	3	6	1	2	1	3	0	0	1	5	6	12	4
≥5	--	--	1	6	5	11	4	8	2	4	7	7	6	7	7	1	4	1	17	23	19	22
Adult	--	--	0	1	3	3	3	0	2	0	1	2	0	0	0	0	1	0	6	3	4	3

Age Years	Fall 1989		Spring 1990		Fall 1990		Spring 1991		Fall 1991		Fall 1992		Fall 1993		TOTAL Fall	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Richardson Foundation																
<1	--	--	--	--	7	10	1	2	16	5	16	16	13	13	52	44
1	--	--	--	--	3	3	3	7	2	4	7	4	5	6	17	17
2	--	--	--	--	2	1	3	2	1	1	6	4	6	2	15	8
3	--	--	--	--	1	4	0	0	1	0	0	2	1	2	3	8
4	--	--	--	--	1	1	0	1	0	0	0	0	0	2	1	3
≥5	--	--	--	--	1	3	0	3	0	0	0	2	0	2	1	7
Adult	--	--	--	--	0	0	2	2	1	0	5	0	7	0	13	0
Amboy Area																
<1	--	--	--	--	4	4	--	--	10	2	11	4	3	6	28	16
1	--	--	--	--	1	1	8	1	4	2	12	6	3	2	20	11
2	--	--	--	--	0	2	0	1	0	0	4	2	5	3	9	7
3	--	--	--	--	4	0	1	0	1	0	2	1	2	0	9	1
4	--	--	--	--	1	0	1	0	1	0	2	0	1	1	5	1
≥5	--	--	--	--	0	1	0	1	0	0	0	2	1	1	1	4
Adult	--	--	--	--	--	--	0	2	0	1	1	3	1	1	2	5

Table 4. Breeding frequencies of raccoons in west-central Illinois, 1990-93.

Breeding Age	Perardi Bros.[a] N	Perardi Bros.[a] Percent With Placental Scars	Main Study Area N	Main Study Area Percent Nursing	Siloam Springs N	Siloam Springs Percent Nursing
			1990			
Yearling	15	67	11	55	5	60
≥ 2 years	18	100	15	93	9	89
			1991			
Yearling	12	33	3	33	7	0
≥ 2 years	13	100	13	92	14	79
			1992			
Yearling	2	50	21	43	14	14
≥ 2 years	4	75	25	80	19	63
			1993			
Yearling	3	33	6	50	3	0
≥ 2 years	18	100	7	86	4	100
			1990-93			
Yearling	32	50	41	46	29	17
≥ 2 years	53	98	60	87	46	76

[a] Data provided by Dr. G.C. Sanderson, INHS.

Table 5. Dispersal rates for marked raccoons in west-central Illinois, 1989-1993.

Age	Sex	No. of Raccoons	No. Dispersing	Percent Dispersing
Ad	M	71	10	14
	F	57	3	5
Yearl.	M	30	10	33
	F	24	1	4
Juv	M	16	5	31
	F	12	3	25

Table 6. Known causes of death for marked raccoons on the Main and Siloam Springs study areas, 1989-93.

	Females				Males				Grand
	Juv	Yearl	Adult	Total	Juv	Yearl	Adult	Total	Total
				MAIN STUDY AREA					
Harvest	11	9	17	37	11	15	27	53	90
Highway	3	2	3	8	--	3	7	10	18
Disease	--	1	8	9	--	1	6	7	16
Dog	--	--	1	1	--	--	3	3	4
Misc	--	--	--	--	--	--	2	2	2
				SILOAM SPRINGS STATE PARK					
Disease	2	1	5	8	--	2	6	8	16
Harvest[a]	2	1	--	3	1	2	3	6	9
Highway	--	1	--	1	--	1	6	7	8
Dog	--	--	--	--	--	2	2	4	4

[a] Raccoons harvested from SSSP ranged off the Park as raccoon hunting and trapping was banned on the Park.

Table 7. Survival rates calculated from resident radio-marked raccoons in west-central Illinois.

Site	Age	Sex	No. Raccoons	Seasonal Survival				
				Breed	Parturition	Summer	Fall	Annual
SSSP	Juv	Female	11	0.87	--	1.00	0.82	0.72
		Male	7	1.00	--	1.00	0.85	0.85
MSA		Female	7	1.00	--	1.00	1.00	1.00
		Male	8	1.00	--	1.00	0.86	0.86
SSSP	Yearl	Female	7	1.00	1.00	1.00	0.83	0.83
		Male	9	1.00	--	0.61	1.00	0.61
MSA		Female	9	1.00	0.84	1.00	0.76	0.64
		Male	9	1.00	--	1.00	0.49	0.49
SSSP	Adult	Female	10	1.00	0.88	0.86	0.42	0.32
		Male	18	0.91	--	0.93	0.76	0.64
MSA		Female	31	0.92	0.89	0.93	0.85	0.65
		Male	25	0.83	--	0.78	0.85	0.55

Table 8. Seasonal and annual recovery rates for raccoons marked on the Main Study Area, west-central Illinois.

				Recovery Rates		
Season	Age	Sex	Year	S	S.E.	N
Fall (Nov-Dec)	Juvenile	Male	1989	0.23	0.07	13
			1990	0.25	0.07	12
			1991	0.40	0.09	15
			1992	0.21	0.05	19
		Female	1989	0.22	0.07	9
			1990	0.44	0.13	9
			1991	0.69	0.11	13
			1992	0.29	0.08	17
Winter (Jan-15 Mar)		Male	1990	1.00	---	3
			1991	1.00	---	4
			1992	0.67	0.19	6
			1993	1.00	--	3
		Female	1990	1.00	--	2
			1991	1.00	--	3
			1992	1.00	--	9
			1993	1.00	--	5
Spring-Summer (16 Mar-Oct)	Yearl.	Male	1990	0.32	0.06	22
			1991	0.53	0.10	15
			1992	0.38	0.06	24
Partur- (16 Mar-15 Jun)	Yearl.	Female	1990	0.63	0.14	8
			1991	0.88	0.13	8
			1992	0.56	0.08	25
Summer	Yearl.	Female	1990	1.00	--	5

Table 8. Page 2.

(16 June-			1991	0.80	--	4
Oct)			1992	0.93	0.08	14
Fall	Yearl.	Male	1989	0.86	0.13	7
			1990	0.36	0.09	14
			1991	0.47	0.09	17
			1992	0.25	0.11	12
		Female	1989	NO DATA		
			1990	1.00	--	8
			1991	1.00	--	4
			1992	0.40	0.10	15
Winter	Yearl.	Male	1990	0.83	0.13	6
			1991	1.00	--	4
			1992	0.86	0.12	7
			1993	NO DATA		
		Female	1990	NO DATA		
			1991	1.00	--	9
			1992	1.00	--	4
			1993	0.89	0.08	9
Annual	Yearl.	Male	1989-90	0.23		
			1990-91	0.19		
			1991-92	0.15		
		Female	1989-90	NO DATA		
			1990-91	0.84		
			1991-92	0.52		
Fall	Adult	Male	1989	0.50	0.14	8
			1990	0.84	0.08	19
			1991	0.68	0.09	19
			1992	0.30	0.07	23
		Female	1989	0.67	0.17	6
			1990	0.76	0.10	17
			1991	0.91	0.06	23
			1992	0.56	0.09	18
Winter	Adult	Male	1990	1.00	---	3

Table 8. Page 3.

		1991	0.88	0.08	16
		1992	0.92	0.07	13
		1993	1.00	----	9
	Female	1990	1.00	---	4
		1991	1.00	---	13
		1992	1.00	---	22
		1993	NO DATA		
Spring-	Male	1990	0.54	0.08	24
Summer		1991	0.68	0.09	19
		1992	0.58	0.08	26
Parturition	Female	1990	0.64	0.08	22
		1991	0.88	0.06	26
		1992	0.50	0.07	30
Summer	Female	1990	1.00	----	9
		1991	0.95	0.04	22
		1992	0.80	0.10	15
Annual	Male	1989-90	0.27		
		1990-91	0.50		
		1991-92	0.17		
	Female	1989-90	0.42		
		1990-91	0.64		
		1991-92	0.37		

Table 9. Seasonal and annual recovery rates for juvenile females and all male raccoons marked on the Siloam Springs State Park, 1990-93[a].

				Recovery Rate		
Season	Age	Sex	Year	S	S.E.	N
Fall	Juvenile	Male	1990	0.59	0.08	22
			1991	0.43	0.10	7
			1992	0.25	--	4
		Female	1990	0.42	0.06	26
			1991	0.38	0.09	13
			1992	0.38	0.10	8
Winter	Juvenile	Male	1991	1.00	---	13
			1992	0.66	--	3
		Female	1991	0.73	0.12	11
			1992	1.00	--	5
Summer	Yearling	Male	1991	0.75	0.09	20
			1992	NO DATA		
Fall	Yearling	Male	1990	1.00	--	3
			1991	0.78	0.08	26
			1992	NO DATA		
Winter	Yearling	Male	1991	1.00	---	3
			1992	1.00	--	13
Annual	Yearling	Male	1990-91	0.44		
			1991-92	0.28		
Summer	Adult	Male	1991	0.73	0.08	26
			1992	0.71	0.0	31
Fall	Adult	Male	1990	0.57	0.1	14
			1991	0.78	0.0	23
			1992	0.80	0.0	20

Table 9. Page 2.

Winter	Adult	Male	1991	1.00	--	9
			1992	1.00	--	18
			1993	0.93	0.07	15
Annual	Adult	Male	1990-91	0.42		
			1991-92	0.55		

a Because yearling and older females were removed at capture from SSSP in fall 1990, 91, and 92, recovery rates could not be calculated for females ≥1 year old.

Table 10. Seasonal home ranges (ha) for males and females radio tracked on the Main Study area and Siloam Springs State Park in west-central Illinois.

			Home Range (Ha)			
Season[a]	Sex	Age	N	Mean	S.E.	Range
1	M	Juv	6	59.9	15.2	16-115
		Yearl.		NO DATA		
		Adult	11	32.0	7.4	7-82
	F	Juv	8	26.6	4.9	7-47
		Yearl.		NO DATA		
		Adult	4	22.1	5.7	12-35
2	M	Juv		NO DATA		
		Yearl.	5	45.8	17.5	12-108
		Adult	7	33.8	6.8	11-71
	F	Juv	1	21.0	--	--
		Yearl.	5	13.1	2.3	7-20
		Adult	7	24.0	9.2	3-71
3	M	Juv		NO DATA		
		Yearl.	3	60.2	14.7	31-78
		Adult	18	54.3	6.0	16-109
	F	Juv		NO DATA		
		Yearl.	9	23.7	3.1	9-37
		Adult	14	51.6	12.1	15-186
4	M	Juv		NO DATA		
		Yearl.	2	37.0	13.0	24-50
		Adult	18	40.1	4.2	11-88
	F	Juv	1	43.0	--	--
		Yearl.	6	21.7	4.5	12-39
		Adult	10	44.1	7.4	17-90

[a] Season Dates: 1--1 Dec-March 15; 2--16 March-31 May; 3--1 June-15 September; 4--16 Sept-30 November.

Table 11. Movement (m/hour) between location of den used during daylight and last radio location taken 3-4 hours after sunset for raccoons ≥ 1 year old.

Site	Season[a]	Sex	No. Raccoons	No. Locations	Meters per Hour Mean	Meters per Hour S.E.
MSA	1	M	4	30	212.3	3.5
	1	F	3	34	276.6	4.3
	2	M	6	47	296.8	4.1
	2	F	7	30	260.2	5.2
	3	M	NO DATA			
	3	F	11	117	193.4	1.3
	4	M	4	10	372.8	14.2
		F	3	6	373.3	15.7
SSSP	1	M	3	31	103.0	1.5
		F	4	24	150.5	3.5
	2	M	7	37	143.5	3.5
		F	4	7	203.7	24.3
	3	M	NO DATA			
	3	F	6	51	134.7	2.5
	4	M	NO DATA			
		F	NO DATA			

[a] For seasonal boundaries (see Table 10).

Table 12. Pearson product moment correlations for selected weather values and the number of raccoons observed on the Busse and Siloam Springs spotlight routes.

	Independent Variables				
Dependent Variable	Air Temp.	Cloud Cover	Relative Humidity	Wind Dir.	Wind Speed
		BUSSE AREA (N = 18 nights)			
Raccoons	0.14	-0.22	-0.63	-0.27	-0.41
Significance	P=0.29	P=0.19	P=0.40	P=0.14	P=0.05
		SILOAM AREA (N = 12 days)			
Raccoons	0.17	0.65	0.29	0.32	0.76
Significance	P=0.29	P=0.01	P=0.18	P=0.15	P=0.002

Table 13. Summary of raccoon serology for each study area, 1989-1993.

Parameter	N	Mean	Standard Deviation	Ho:Normal	Ho:Equal Variance	Parametric	Non-parametric
Creatinine							
Total	458	0.88	0.26	p<0.01			NSignif
Main	283	0.86	0.23				
Park	175	0.91	0.3				
Blood Urea Nitrogen							
Total	458	21.2	12.8	p<0.01			p<0.01
Main	283	22.4	10.3				
Park	175	20.9	16.1				
Total Protein							
Total	458	7.3	0.83	p<0.01			NSignif
Main	283	7.2	0.75				
Park	178	7.4	0.93				
Albumin							
Total	458	3.4	0.4	NSignif	p<0.01	NSignif	
Main	283	3.5	0.4				
Park	178	3.3	0.4				
Calcium							
Total	458	8.1	0.78	NSignif	NSignif	NSignif	
Main	283	8.1	0.74				
Park	178	8.3	0.84				
Phosphorus							
Total	458	6.4	1.6	NSignif	NSignif	NSignif	
Main	283	6.3	1.6				
Park	178	6.4	1.5				
Sodium							
Total	456	149.8	7.7	p<0.01			p<0.01
Main	282	148.5	6.9				
Park	174	152	8.6				
Potassium							
Total	456	3.8	0.44	p<0.01			NSignif
Main	282	3.8	0.39				
Park	174	3.8	0.45				
Chloride							
Total	456	113.9	8.1	p<0.01			p<0.01
Main	282	112.5	6.97				
Park	174	116.1	9.3				

Parameter	N	Mean	Standard Deviation	Ho:Normal	Ho:Equal Variance	Parametric	Non-parametric
Magnesium							
Total	182	2.45	0.37	NSignif	p<0.01	NSignif	
Main	98	2.5	0.36				
Park	84	2.4	0.36				
Glucose							
Total	458	110	28.8	Nsignif	Nsignif	Nsignif	
Main	283	112	29.7				
Park	175	106	27.0				
Serum Alkaline Phosphatase							
Total	458	137	69.8	p<0.01			p<0.01
Main	283	145	77.3				
Park	175	124	53.3				
Serum Glutamic Pyruvic Transaminase							
Total	458	168	67.4	p<0.01			p<0.01
Main	283	175	69.9				
Park	175	156	61.1				
Serum Glutamic Oxalic Transaminase							
Total	458	242	143	p<0.01			NSignif
Main	283	252	150				
Park	175	278	128				
Cholesterol							
Total	456	185	51	p<0.01			p<0.01
Main	281	169	45				
Park	175	211	48				
Total Bilirubin							
Total	458	0.25	0.19	p<0.01			NSignif
Main	283	0.26	0.18				
Park	175	0.23	0.22				
Albumin-Globulin Ratio							
Total	458	0.93	0.26	p<0.01			p<0.01
Main	283	0.98	0.3				
Park	175	0.84	0.22				
Sodium-Potassium Ratio							
Total	455	39.5	4.7	NSignif	p<0.01	NSignif	
Main	281	39	4.5				
Park	174	40	5.0				

Parameter	N	Mean	Standard Deviation	Ho:Normal	Ho:Equal Variance	Parametric	Non-parametric
White Blood Cell Count (x1000)							
Total	494	13.3	5.2	p<0.01			NSignif
Main	283	13.5	5.5				
Park	211	12.9	4.7				
Hematocrit (percentage)							
Total	472	31	6.0	NSignif	NSignif	NSignif	
Main	282	31	6.3				
Park	210	31	5.5				
Absolute Number Segmented Neutrophils (x1000)							
Total	492	10.2	4.6	p<0.01			NSignif
Main	282	10.5	4.8				
Park	210	9.8	4.3				
Absolute Number Lymphocytes (x1000)							
Total	492	2.5	1.3	p<0.01			NSignif
Main	282	2.5	1.3				
Park	210	2.4	1.2				
Absolute Number Eosinophils (x10)							
Total	494	0.92	2.11	p<0.01			NSignif
Main	283	0.71	1.52				
Park	211	1.2	2.69				
Absolute Number Stabs (x100)							
Total	494	0.24	0.8	p<0.01			NSignif
Main	283	0.27	0.79				
Park	211	0.21	0.82				
Segmented Neutrophils (percentage)							
Total	492	75.6	0.1	p<0.01			NSignif
Main	282	76.1	0.1				
Park	210	74.8	0.1				
Lymphocytes (percentage)							
Total	492	19.8	0.1	p<0.01			NSignif
Main	282	19.7	0.09				
Park	210	19.9	0.1				

Table 14. Summary of raccoon serology for both sexes, 1989-1993.

Parameter	N	Mean	Standard Deviation	Ho:Normal	Ho:Equal Variance	Parametric	Non-parametric
Creatinine							
Total	457	0.88	0.26	p<0.01			NSignif
F (Female)	221	0.9	0.28				
M (Male)	236	0.87	0.24				
Blood Urea Nitrogen							
Total	457	21.8	12.8	p<0.01			NSignif
F	221	21.9	14.4				
M	236	21.8	11.1				
Total Protein							
Total	457	7.3	0.83	p<0.01			NSignif
F	221	7.3	0.87				
M	236	7.3	0.8				
Albumin							
Total	457	3.4	0.39	NSignif	p<0.01	NSignif	
F	221	3.36	0.42				
M	236	3.46	0.37				
Calcium							
Total	457	8.1	0.78	NSignif	NSignif	NSignif	
F	221	8.1	0.84				
M	236	8.1	0.73				
Phosphorus							
Total	457	6.3	1.6	NSignif	NSignif	NSignif	
F	221	6.3	1.76				
M	236	6.45	1.42				
Sodium							
Total	445	150	7.7	p<0.01			NSignif
F	221	150	8.3				
M	234	150	7.1				
Potassium							
Total	445	3.8	0.41	p<0.01			NSignif
F	221	3.8	0.4				
M	234	3.8	0.4				
Chloride							
Total	445	114	8.1	p<0.01			NSignif
F	221	115	9				
M	234	113	7.1				

Parameter	N	Mean	Standard Deviation	Ho:Normal	Ho:Equal Variance	Parametric	Non-parametric
Magnesium							
Total	182	2.45	0.37	NSignif	NSignif	NSignif	
F	88	2.46	0.38				
M	94	2.44	0.36				
Glucose							
Total	457	109	28.8	Nsignif	Nsignif	Nsignif	
F	221	107	28.1				
M	236	111	29.4				
Serum Alkaline Phosphatase							
Total	457	137	69.8	p<0.01			Nsignif
F	221	141	77.6				
M	236	133	61.6				
Serum Glutamic Pyruvic Transaminase							
Total	457	168	67.3	p<0.01			NSignif
F	221	164	65.3				
M	236	172	69.2				
Serum Glutamic Oxalic Transaminase							
Total	457	242	143	p<0.01			NSignif
F	221	247	158				
M	236	239	141				
Cholesterol							
Total	455	185.5	50.6	p<0.01			p<0.01
F	220	198.7	49.2				
M	235	173.3	48.8				
Total Bilirubin							
Total	457	0.25	0.19	p<0.01			NSignif
F	221	0.26	0.21				
M	236	0.25	0.17				
Albumin-Globulin Ratio							
Total	457	0.9	0.26	p<0.01			NSignif
F	221	0.9	0.26				
M	236	0.9	0.25				
Sodium-Potassium Ratio							
Total	454	39.5	4.7	NSignif	NSignif	NSignif	
F	221	39.6	4.8				
M	233	39.5	4.6				

Parameter	N	Mean	Standard Deviation	Ho:Normal	Ho:Equal Variance	Parametric	Non-parametric
White Blood Cell Count (x1000)							
Total	493	13.3	5.2	p<0.01			NSignif
F	236	13.1	5.1				
M	257	13.5	5.2				
Hematocrit (percentage)							
Total	471	31	5.9	NSignif	NSignif	NSignif	
F	225	31	5.8				
M	246	32	6				
Absolute Number Segmented Neutrophils (x1000)							
Total	491	10.2	4.6	p<0.01			NSignif
F	235	9.9	4.6				
M	256	10.4	4.7				
Absolute Number Lymphocytes (x1000)							
Total	491	2.4	1.3	p<0.01			NSignif
F	235	2.5	1.2				
M	256	2.4	1.3				
Absolute Number Eosinophils (x100)							
Total	493	0.92	2.1	p<0.01			p<0.01
F	236	1.21	2.6				
M	257	0.66	1.4				
Absolute Number Stabs (x100)							
Total	493	0.24	0.8	p<0.01			NSignif
F	236	0.23	0.81				
M	257	0.25	0.79				
Segmented Neutrophils (percentage)							
Total	491	75	10	p<0.01			NSignif
F	235	75	10				
M	256	76	11				
Lymphocytes (percentage)							
Total	491	19.7	10	p<0.01			NSignif
F	235	20	9				
M	256	19	10				

Table 15. Seasonal values for raccoon serology, 1989-1993.

Parameter	N	Mean	Standard Deviation	Ho:Normal	Ho:Equal Variance	Parametric	Non-parametric
Creatinine							
Total	458	0.88	0.26	p<0.01			NSignif
Spring(0)	143	0.84	0.2				
Fall(1)	315	0.9	0.3				
Blood Urea Nitrogen							
Total	458	21.8	12.8	p<0.01			p<0.01
Spring	143	24.4	10.1				
Fall	315	20.7	13.7				
Total Protein							p<0.01
Total	458	7.3	0.83	p<0.01			
Spring	143	7.6	0.73				
Fall	315	7.1	0.83				
Albumin							
Total	458	3.4	0.4	NSignif	p<0.01	NSignif	
Spring	143	3.2	0.35				
Fall	315	3.5	0.4				
Calcium							
Total	458	8.1	0.8	NSignif	p<0.01	p<0.01	
Spring	143	7.8	0.6				
Fall	315	8.3	0.8				
Phosphorus							
Total	458	6.4	1.6	NSignif	p<0.01	NSignif	
Spring	143	5.2	1.3				
Fall	315	6.8	1.4				
Sodium							
Total	456	150	7.7	p<0.01			NSignif
Spring	141	150	7.6				
Fall	315	150	7.8				
Potassium							
Total	456	3.8	0.4	p<0.01			NSignif
Spring	141	3.7	0.36				
Fall	315	3.9	0.43				
Chloride							
Total	456	114	8.1	p<0.01			NSignif
Spring	141	114	7.2				
Fall	315	114	8.5				

Parameter	N	Mean	Standard Deviation	Ho:Normal	Ho:Equal Variance	Parametric	Non-parametric
Magnesium							
Total	182	2.4	0.37	NSignif	NSignif	NSignif	
Spring	74	2.66	0.36				
Fall	108	2.3	0.3				
Glucose							
Total	458	110	29	Nsignif	NSignif	NSignif	
Spring	143	105	28.3				
Fall	315	111	29				
Serum Alkaline Phosphatase							
Total	458	137	70	p<0.01			NSignif
Spring	143	136	68				
Fall	315	137	71				
Serum Glutamic Pyruvic Transaminase							
Total	458	138	67.3	p<0.01			p<0.01
Spring	143	162	64.5				
Fall	315	171	68.5				
Serum Glutamic Oxalic Transaminase							
Total	458	242	143	p<0.01			p<0.01
Spring	143	282	140				
Fall	315	225	141				
Cholesterol							
Total	456	185	51	p<0.01			NSignif
Spring	142	189	55				
Fall	314	184	48.5				
Total Bilirubin							
Total	458	0.25	0.19	p<0.01			NSignif
Spring	143	0.23	0.13				
Fall	315	0.26	0.21				
Albumin-Globulin Ratio							
Total	458	0.9	0.26	p<0.01			p<0.01
Spring	143	0.76	0.15				
Fall	315	1	0.26				
Sodium-Potassium Ratio							
Total	455	39.5	4.72	NSignif	NSignif	NSignif	
Spring	140	40.3	4.05				
Fall	315	39.1	4.96				

Parameter	N	Mean	Standard Deviation	Ho:Normal	Ho:Equal Variance	Parametric	Non-parametric
White Blood Cell Count (x1000)							
Total	494	13.3	5.16	p<0.01			NSignif
Spring	227	13.7	5.6				
Fall	267	12.9	4.7				
Hematocrit (percentage)							
Total	472	31	5.9	NSignif	p<0.01	NSignif	
Spring	210	33	5				
Fall	262	30	6.4				
Absolute Number Segmented Neutrophils (x1000)							
Total	492	10.2	4.6	p<0.01			NSignif
Spring	225	10.8	4.9				
Fall	267	9.7	4.3				
Absolute Number Lymphocytes (x1000)							
Total	492	2.4	1.3	p<0.01			NSignif
Spring	225	2.3	1.3				
Fall	267	2.5	1.2				
Absolute Number Eosinophils (x100)							
Total	494	9.2	21.1	p<0.01			NSignif
Spring	227	8.5	16.6				
Fall	267	9.8	24.2				
Absolute Number Stabs (x100)							
Total	494	0.24	0.8	p<0.01			NSignif
Spring	227	0.25	0.8				
Fall	267	0.23	0.8				
Segmented Neutrophils (percentage)							
Total	492	75.5	10	p<0.01			p<0.01
Spring	225	77	9				
Fall	267	74	11				
Lymphocytes (percentage)							
Total	492	19.7	9.6	p<0.01			p<0.01
Spring	225	18	9				
Fall	267	21	10				

Table 16. Summary of raccoon serology by age class, 1989-1993.

Parameter	N	Mean	Standard Deviation	Ho:Normal	ANOVA	Non-parametric
Creatinine						
Total	458	0.88	0.26	p<0.01		NSignif
Juvenile	158	0.86	0.3			
Yearling	119	0.87	0.24			
Adult	181	0.91	0.23			
Blood Urea Nitrogen						
Total	458	21.8	12.8	p<0.01		NSignif
Juvenile	158	22	15.3			
Yearling	119	23	12			
Adult	181	21	11			
Total Protein						
Total	458	7.3	0.83	p<0.01		p<0.01
Juvenile	158	6.8	0.71			
Yearling	119	7.4	0.71			
Adult	181	7.7	0.77			
Albumin						
Total	458	3.4	0.4	NSignif	p<0.01	
Juvenile	158	3.6	0.34			
Yearling	119	3.4	0.34			
Adult	181	3.3	0.38			
Calcium						
Total	458	8.1	0.8	NSignif	p<0.01	
Juvenile	158	8.6	0.71			
Yearling	119	8	0.7			
Adult	181	7.8	0.64			
Phosphorus						
Total	458	6.4	1.6	NSignif	p<0.01	
Juvenile	158	7.6	1.2			
Yearling	119	5.9	1.3			
Adult	181	5.6	1.3			
Sodium						
Total	456	150	7.7	NSignif	NSignif	
Juvenile	158	150	6.7			
Yearling	118	149	7.9			
Adult	180	150	8.5			

Table 16. Page 2.

Parameter	N	Mean	Standard Deviation	Ho:Normal	ANOVA	Non-parametric
Potassium						
Total	456	3.8	0.4			
Juvenile	180	3.9	0.44	p<0.01		NSignif
Yearling	118	3.8	0.4			
Adult	158	3.8	0.37			
Chloride						
Total	456	114	8.1	NSignif	NSignif	
Juvenile	158	114	6.7			
Yearling	118	113	7.8			
Adult	180	113	9.3			
Magnesium						
Total	182	2.4	0.37	NSignif	NSignif	
Juvenile	50	2.2	0.3			
Yearling	48	2.6	0.3			
Adult	84	2.5	0.4			
Glucose						
Total	458	110	29	NSignif	p<0.01	
Juvenile	158	111	29.1			
Yearling	119	115	29.2			
Adult	181	104	27.5			
Serum Alkaline Phosphatase						
Total	458	137	70	p<0.01		p<0.01
Juvenile	158	166	76			
Yearling	119	135	63			
Adult	181	112	57			
Serum Glutamic Pyruvic Transaminase						
Total	458	138	67	p<0.01		p<0.01
Juvenile	158	187	78			
Yearling	119	170	68			
Adult	181	150	50			
Serum Glutamic Oxalic Transaminase						
Total	458	242	143	p<0.01		p<0.01
Juvenile	158	193	98			
Yearling	119	277	154			
Adult	181	262	156			

Parameter	N	Mean	Standard Deviation	Ho:Normal	ANOVA	Non-parametric
Cholesterol						
Total	456	185	51	p<0.01		NSignif
Juvenile	157	187	47			
Yearling	118	184	49			
Adult	181	185	54			
Total Bilirubin						
Total	458	0.25	0.19	p<0.01		NSignif
Juvenile	150	0.29	0.25			
Yearling	119	0.22	0.15			
Adult	181	0.24	0.15			
Albumin-Globulin Ratio						
Total	458	0.9	0.26	p<0.01		p<0.01
Juvenile	158	1.15	0.22			
Yearling	119	0.88	0.2			
Adult	181	0.76	0.17			
Sodium-Potassium Ratio						
Total	455	39.5	4.7	NSignif	NSignif	
Juvenile	158	38.8	4.8			
Yearling	117	40	4.7			
Adult	180	39.7	4.6			
White Blood Cell Count (x1000)						
Total	494	13.3	5.1	p<0.01		NSignif
Juvenile	126	12.3	4.4			
Yearling	160	14	2.9			
Adult	208	13.3	5			
Hematocrit (percentage)						
Total	472	31	5.9	NSignif	p<0.01	
Juvenile	124	27	5.3			
Yearling	151	31	5.4			
Adult	197	34	5.3			
Absolute Number Segmented Neutrophils (x1000)						
Total	492	10.2	4.6	p<0.01		NSignif
Juvenile	126	8.9	3.9			
Yearling	160	10.8	4.9			
Adult	206	10.6	4.6			

Parameter	N	Mean	Standard Deviation	Ho:Normal	ANOVA	Non-parametric
Absolute Number Lymphocytes (x1000)						
Total	492	2.4	1.3	p<0.01		NSignif
Juvenile	126	2.8	1.2			
Yearling	160	2.5	1.4			
Adult	206	2.1	1			
Absolute Number Eosinophils (x10)						
Total	494	9.2	2.1	p<0.01		p<0.01
Juvenile	126	5.2	1.1			
Yearling	160	9.3	2.3			
Adult	208	11.6	2.3			
Absolute Number Stabs (x10)						
Total	494	2.4	8	p<0.01		NSignif
Juvenile	126	2.2	6.2			
Yearling	160	2.2	8.6			
Adult	208	2.7	8.5			
Segmented Neutrophils (percentage)						
Total	492	75.5	10	p<0.01		p<0.01
Juvenile	126	71	11			
Yearling	160	76	10			
Adult	206	78	9.9			
Lymphocytes (percentage)						
Total	492	19.7	9.6	p<0.01		p<0.01
Juvenile	126	25	10			
Yearling	160	19	9			
Adult	206	17	8			

Table 17. Oral aerobic microbial flora isolated from raccoons in west-central Illinois.

Bacteria	No. Raccoons Isolated
Streptococcus sp.	27
Staphylococcus sp.	26
Bacillus sp.	26
Smooth E. coli	16
Proteus sp.	14
Rough E. coli	10
Pseudomonas sp.	09
Citrobacter sp.	08
Corynebacter sp.	08
Enterobacter sp.	08
Providencia sp.	08
Klebsiella sp.	07
Edwardsiella sp.	06
Micrococcus sp.	04
Actinobacter sp.	01
Aeromonas sp.	01

Table 18. Sex and age of raccoons captured on the 30-ha Jensen and Mason woodlots, 1989-1992. Nest structures were erected on the Jensen Woods at a density of 1 per ha (Ad = adult, Y = yearling, J = juvenile, F = female, M = male).

Nest Structures	Area	SEX AND AGE Ad M	Ad F	YM	YF	JM	JF	Total	Captures/ 100 Trap Nights	Density Per 100 ha
					FALL 1989					
Absent	Jensen	1	0	0	0	0	0	1	0.67	3
Absent	Mason	1	0	1	0	0	0	2	1.33	6
					SPRING 1990					
Present	Jensen	6	5	2	1	–	–	14	9.33	46
Absent	Mason	3	1	2	2	–	–	8	5.33	27
					FALL 1990					
Present	Jensen	0	1	1	1	2	3	8	3.81	27
Absent	Mason	0	1	1	3	0	1	6	2.85	20
					SPRING 1991					
Present	Jensen	2	1	0	0	–	–	3	1.43	10
Absent	Mason	2	2	0	1	–	–	5	2.38	17
					FALL 1991					
Present	Jensen	3	1	1	0	1	2	8	2.67	27
					SPRING 1992					
Present	Jensen	5	2	0	1	–	–	8	2.67	27
					FALL 1992					
Present	Jensen	2	2	1	1	1	1	8	2.67	27
					SPRING 1993					
Absent	Jensen	3	2	0	1	0	0	6	2.85	20

Table 19. Raccoon use of nesting structures on the Jensen Woods, 1990-93.

Date	No. of Boxes Checked	NO. OF BOXES Raccoon Use: Hair or Droppings	Raccoon Present	% Used
Spring 1990	30	10	0	33
Fall 1990	30	2	5 (3M, 2J)	23
Spring 1991	30	1	2 (1M, F & Yg)	10
Fall 1991	28	3	4 (2M, 2?)	25
Winter 1991-92	28	6	0	21
Winter 1992-93	28	5	8 (1M, 1F, 6 ?)	46

Table 20.

Den type selection of radio-marked raccoons by sex and season on the Main Study Area of the Western-Central Illinois site from Oct. 1989 to Dec. 1992.

DEN TYPE[a]	FEMALE SEASON[b] 1	2	3	4	TOTAL	MALE SEASON[c] 5	6	7	TOTAL	TOTAL
JUV.										
1	29	11	-	9	49	20	7	7	34	
2	-	-	-	2	2	2	-	6	8	
3	44	5	-	12	61	42	8	10	60	
4	-	-	-	-	-	-	-	-	-	
TOTAL	73	16	-	23	112	64	15	23	102	
YRL.										
1	-	7	22	-	29	-	8	-	8	
2	-	-	-	-	-	-	5	-	5	
3	-	6	17	-	23	-	-	-	-	
4	-	-	2	-	2	-	12	-	12	
TOTAL	-	13	41	-	54	-	25	-	25	
ADULT										
1	-	10	-	48	58	2	19	3	24	
2	-	-	10	-	10	-	5	1	6	
3	-	4	19	1	24	3	-	1	4	
4	-	-	1	-	1	2	5	4	11	
TOTAL	-	14	78	1	93	7	29	9	45	
ALL AGES										
1	29	28	70	9	136	22	34	10	66	202
2	-	-	10	2	12	2	10	7	19	31
3	44	15	36	13	108	45	8	11	64	172
4	-	-	3	-	3	2	17	4	23	26
TOTAL										431

[a]1-Tree Den, 2-Ground Burrow, 3-Building, 4-Other (usually ground nest).
[b]1=01 Jan.-15 Mar., 2=16 Mar.-15 Jun., 3=16 Jun.-31 Oct., 4=01 Nov.-31 Dec.
[c]5=01 Jan.-15 Mar., 6=16 Mar.-31 Oct., 7=01 Nov.-31 Dec.

APPENDIX 1. SUMMARY OF RACCOON CAPTURES IN WEST-CENTRAL ILLINOIS, 1989-1993

Date of and age at the original capture, sex, study area, and the age, date, and cause of mortality if known of all raccoons captured in the west-central portion of the Illinois raccoon study Oct 1989 - May 1994.

EAR TAG #		CAPTURE			STUDY	MORTALITY		
L	R	DATE	AGE	SEX	AREA	DATE	AGE	CAUSE
001	002	10/10/89	J	M	M			
003	004	10/11/89	J	M	M			
005	006	10/11/89	A	M	M	11/27/90	A	TRAPPED
007	008	10/11/89	A	M	M	02/12/91	A	UNKNOWN
009	010	10/11/89	J	F	M			
011	012	10/11/89	A	M	M	03/16/90	A	SHOT
013	014	10/11/89	J	F	M	11/21/89	Y	TRAPPED
015	018	10/14/89	J	M	M	11/07/92	A	SHOT
016	017	10/11/89	A	M	M	03/26/90	A	DOG
019	020	10/14/89	A	F	M	11/07/92	A	TRAPPED
021	022	10/14/89	J	F	M			
023	024	10/14/89	A	F	M			
025	026	10/15/89	J	M	M	11/21/89	J	TRAPPED
027	028	10/16/89	A	F	M			
029	030	10/17/89	J	M	M			
031	032	10/18/89	A	M	M			
033	034	10/18/89	A	M	M	02/16/91	A	DOG
035	036	10/19/89	J	M	M	11/15/90	Y	TRAPPED
037	038	10/19/89	A	F	M			
039	040	10/19/89	J	M	M			
041	042	10/20/89	J	M	M			
043	044	10/20/89	J	F	M	12/25/91	A	SHOT
045	046	10/23/89	J	F	M	11/28/89	J	TRAPPED
047	048	10/24/89	J	F	M	12/13/89	J	SHOT
050	051	10/25/89	A	M	M	11/16/89	A	SHOT
052	053	10/26/89	A	F	M	11/17/90	A	TRAPPED
054	055	10/27/89	J	F	M			
056	057	10/27/89	A	M	M	12/21/92	A	TRAPPED
058	059	10/27/89	J	M	M	11/19/89	J	SHOT
060	062	10/28/89	A	M	M	11/29/92	A	SHOT
064	067	10/29/89	J	F	M			
068	069	10/29/89	J	M	M	11/20/89	J	SHOT
070	071	10/30/89	A	M	P			
073	074	10/30/89	A	M	M	07/31/90	A	ROADKILL
076	077	10/31/89	J	M	M	11/16/89	A	SHOT
078	079	10/31/89	J	M	M			
080	081	11/01/89	A	M	M	12/21/89	A	SHOT
082	083	11/01/89	J	F	M			
084	085	11/02/89	A	F	M			
086	087	11/02/89	A	M	M	11/27/92	A	SHOT
088	089	11/03/89	A	M	M	11/19/89	A	SHOT
090	091	11/03/89	A	M	M	11/21/91	A	SHOT
092	093	11/04/90	J	M	M			
094	095	11/05/89	A	M	M			

EAR TAG # L	R	CAPTURE DATE	AGE	SEX	STUDY AREA	MORTALITY DATE	AGE	CAUSE
096	097	11/05/89	J	F	M	11/16/89	J	SHOT
104	105	04/10/90	A	M	M			
106	107	04/12/90	Y	M	M	12/12/90	Y	TRAPPED
108	109	04/12/90	Y	M	M			
110	111	04/13/90	A	F	M			
112	113	04/13/90	A	M	M			
114	115	04/13/90	A	F	M	12/10/90	A	SHOT
116	117	04/14/90	Y	M	M			
118	119	04/14/90	Y	F	M			
120	121	04/14/90	Y	M	M			
122	123	04/24/90	Y	M	M			
124	125	04/24/90	A	M	M	07/10/90	A	ELECTROCUTED
126	127	04/25/90	Y	F	M			
128	129	04/25/90	A	M	M			
130	131	04/25/90	A	M	M			
132	133	04/26/90	A	F	M	02/26/93	A	UNKNOWN
134	135	04/26/90	Y	M	M			
136	137	04/26/90	Y	M	M			
138	139	04/27/90	A	F	M			
140	141	04/27/90	A	M	M			
142	143	04/28/90	Y	F	M			
144	145	04/28/90	Y	M	M			
146	147	04/29/90	A	M	M	11/22/90	A	ROADKILL
148	149	05/01/90	A	F	M	10/04/91	A	UNKNOWN
150	151	05/01/90		F	M	04/28/92	A	UNKNOWN
152	153	05/01/90	Y	M	M			
154	155	05/02/90	A	F	M	06/01/91	A	DOG
156	157	05/02/90	Y	M	M			
158	159	05/02/90	A	M	M	06/11/91	A	UNKNOWN
160	161	05/02/90	A	M	M	08/06/90	A	UNKNOWN
162	163	05/03/90	A	F	M	11/14/90	A	TRAPPED
164	165	05/03/90	A	M	M			
168	169	05/04/90	A	M	M	08/20/90	A	NUISANCE
170	171	05/07/90	A	F	M			
172	173	05/07/90	Y	M	M	03/08/93	A	ROADKILL
174	175	05/07/90	Y	M	M	11/20/90	A	DISEASE
177	178	05/08/90	A	F	M			
179	180	05/08/90	Y	F	M			
181	182	05/10/90	A	F	M			
183	184	05/10/90	A	M	M			
185	186	05/10/90	Y	M	M			
187	188	05/11/90	A	F	M			
189	190	05/11/90	A	F	M			
191	192	05/11/90	Y	M	M			
193	194	05/12/90	Y	F	M			
195	196	05/14/90	Y	M	M	08/12/91	A	ROADKILL
197	198	05/15/90	A	M	M	11/16/92	A	SHOT
199	200	05/15/90	Y	M	M			
201	202	05/17/90	A	F	M	10/25/91	A	SHOT
203	204	05/17/90	A	F	M	11/15/91	A	SHOT

EAR TAG # L	R	CAPTURE DATE	AGE	SEX	STUDY AREA	MORTALITY DATE	AGE	CAUSE
205	206	05/18/90	A	M	M			
207	208	05/19/90	A	M	M	06/12/91	A	POISONED
209	210	05/19/90	A	M	M	11/15/90	A	SHOT
211	212	05/21/90	A	F	M	01/02/93	A	UNKNOWN
213	214	05/22/90	A	F	M			
215	216	05/22/90	Y	M	M			
217	218	05/23/90	A	F	M			
219	220	05/23/90	Y	M	M	01/15/92	A	TRAPPED
221	222	05/24/90	Y	M	M			
268	269	08/15/90	A	M	M			
270	271	08/15/90	J	F	M			
272	273	08/15/90	Y	F	M	02/15/92	A	UNKNOWN
274	275	08/15/90	J	F	M			
276	277	08/16/90	Y	M	M			
278	279	08/17/90	J	M	M			
280	283	08/17/90	A	M	M	11/11/93	A	TRAPPED
281	282	08/17/90	J	M	M			
284	285	08/18/90	J	M	M			
286	287	08/19/90	A	F	M	11/19/90	A	TRAPPED
288	289	08/19/90	J	M	M			
290	291	08/20/90	A	M	M	11/24/92	A	TRAPPED
293	294	08/21/90	A	F	M			
295	296	08/21/90	J	M	M			
297	298	08/21/90	J	F	M			
299	300	08/23/90	A	F	M	11/02/92	A	SHOT
301	302	04/10/90	A	F	P			
303	304	04/10/90	Y	M	P			
305	306	04/10/90	A	M	P			
307	308	04/11/90	A	M	P			
309	310	04/11/90	Y	F	P			
311	312	04/12/90	A	F	P			
313	314	04/12/90	Y	M	P			
315	316	04/12/90	A	F	P			
317	318	04/12/90	A	M	P			
319	320	04/12/90	A	M	P	11/01/91	A	UNKNOWN
321	322	05/11/90	Y	F	P			
323	324	05/25/90	A	F	P			
325	326	05/25/90	A	F	P			
327	328	05/25/90	A	F	P	08/29/91	A	REMOVED
329	330	05/25/90	A	F	P			
331	333	05/25/90	Y	F	P	04/26/91	A	CAPTURE
334	335	05/25/90	A	F	P			
336	337	05/25/90	A	F	P			
338	339	06/14/90	Y	F	P			
340	341	06/15/90	A	F	P	05/21/92	A	NUISANCE
343	344	09/05/90	A	M	P			
345	346	09/05/90	Y	M	P			
348	349	09/05/90	A	M	P			
350	359	09/05/90	J	M	P			
351	354	09/05/90	J	F	P			

EAR TAG # L	R	CAPTURE DATE	AGE	SEX	STUDY AREA	MORTALITY DATE	AGE	CAUSE
352	353	09/05/90	J	F	P			
355	356	09/05/90	J	F	P	09/25/92	A	REMOVED
357	358	09/05/90	J	F	P			
360	365	09/05/90	J	M	P	11/27/92	A	SHOT
361	362	09/05/90	J	M	P			
363	364	09/05/90	J	F	P	11/11/92	A	DISEASE
366	367	09/05/90	J	M	P	06/20/91	Y	UNKNOWN
368	369	09/05/90	J	M	P			
371	372	09/05/90	J	M	P			
374	375	09/05/90	J	M	P			
377	379	09/05/90	A	M	P			
380	381	09/06/90	J	F	P			
382	383	09/06/90	J	F	P	09/16/91	Y	REMOVED
384	385	09/07/90	J	F	P			
386	387	09/07/90	J	F	P	08/29/91	Y	REMOVED
388	389	09/07/90	J	F	P			
390	391	09/07/90	J	F	P	12/01/92	A	DISEASE
392	393	09/07/90	J	M	P	09/18/91	Y	DOG
394	395	09/07/90	J	M	P	06/14/91	Y	DOG
396	397	09/11/90	J	M	P	05/12/92	A	DOG
398	399	09/11/90	J	M	P	11/13/90	J	SHOT
401	401	08/24/90	Y	M	M			
402	402	08/25/90	J	M	M			
403	403	08/26/90	J	F	M			
404	404	08/27/90	J	M	M			
405	405	08/27/90	Y	F	M			
406	406	08/27/90	Y	M	M			
407	407	08/28/90	Y	M	M	11/25/90	Y	SHOT
408	408	08/29/90	Y	M	M	11/24/90	Y	TRAPPED
409	409	08/29/90	J	F	M	11/13/90	J	SHOT
410	410	08/29/90	J	F	M			
411	411	08/30/90	J	M	M			
419	419	10/30/90	J	M	M	11/14/90	J	TRAPPED
420	420	10/31/90	J	F	M	03/23/91	J	ROADKILL
421	421	11/01/90	A	F	M	11/13/90	A	SHOT
422	422	11/02/90	J	F	M	11/13/90	J	SHOT
423	423	11/02/90	J	F	M	06/13/92	A	UNKNOWN
424	424	11/02/90	Y	M	M			
425	425	11/05/90	J	M	M	03/07/93	A	UNKNOWN
426	426	11/05/90	Y	M	M			
427	427	11/05/90	J	M	M	11/24/91	Y	SHOT
428	428	11/06/90	J	M	M			
429	429	11/06/90	A	M	M			
430	430	11/07/90	J	M	M			
431	431	11/08/90	Y	M	M	11/13/90	Y	SHOT
432	432	12/01/90	J	F	M			
434	434	04/27/91	Y	M	M			
435	435	04/27/91	A	M	M			
436	436	04/28/91	Y	M	M			
437	437	04/28/91	Y	M	M			

EAR TAG # L	R	CAPTURE DATE	AGE	SEX	STUDY AREA	MORTALITY DATE	AGE	CAUSE
438	438	05/09/91	Y	M	M			
439	439	05/09/91	Y	M	M			
440	440	05/20/91	A	F	M			
441	441	05/20/91	Y	F	M	09/25/92	A	REMOVED
442	442	05/21/91	A	F	M			
443	443	05/22/91	Y	M	M			
444	444	05/23/91	A	F	M	05/27/92	A	NUISENCE
445	445	05/23/91	Y	M	M			
446	446	05/25/91	Y	M	M	11/01/91	Y	UNKNOWN
447	447	05/27/91	Y	M	M			
448	448	06/01/91	Y	M	M	01/11/94	A	ROADKILL
449	449	06/01/91	Y	F	M			
450	450	06/02/91	A	F	M			
451	451	06/05/91	A	F	M			
452	452	06/06/91	Y	M	M			
453	453	06/08/91	Y	F	M			
458	458	08/20/91	J	M	M	02/04/93	A	DISEASE
459	459	08/20/91	J	F	M	04/01/92	Y	ROADKILL
460	460	08/20/91	Y	M	M			
461	461	09/05/91	J	M	M	11/05/92	Y	SHOT
462	462	09/06/91	J	F	M			
463	463	09/08/91	J	M	M			
464	464	09/24/91	J	F	M			
465	465	09/25/91	A	M	M	12/??/92	A	SHOT
466	466	09/25/91	J	F	M	11/08/92	A	SHOT
467	467	09/25/91	J	F	M	11/08/93	A	TRAPPED
468	468	09/26/91	J	F	M	05/27/92	A	NUISANCE
469	469	09/26/91	A	M	M	11/10/93	A	SHOT
471	471	09/27/91	J	M	M			
472	472	09/27/91	J	M	M			
473	473	09/27/91	A	F	M			
474	474	09/28/91	J	M	M			
475	475	10/01/91	J	F	M			
476	476	10/01/91	Y	M	M			
477	477	10/01/91	Y	M	M	02/01/92	A	ROADKILL
478	478	10/01/91	A	M	M			
479	479	10/02/91	A	M	M			
480	480	10/02/91	J	M	M	01/08/92	J	SHOT
481	481	10/08/91	J	M	M			
482	482	10/09/91	J	F	M	06/13/92	A	ROADKILL
483	483	10/09/91	Y	M	M	11/15/91	A	SHOT
484	484	10/09/91	J	F	M	11/10/92	Y	SHOT
485	485	10/10/91	J	F	M			
486	486	10/10/91	J	F	M			
487	487	10/10/91	J	M	M	11/15/91	Y	SHOT
488	488	10/11/91	A	M	M			
489	489	10/11/91	Y	M	M			
490	490	10/15/91	A	M	M			
491	491	10/15/91	Y	M	M	12/20/91	A	SHOT
492	492	10/17/91	J	F	M			

EAR TAG # L	R	CAPTURE DATE	AGE	SEX	STUDY AREA	MORTALITY DATE	AGE	CAUSE
493	493	10/17/91	A	M	M			
501	501	09/11/90	J	M	P			
502	502	09/11/90	J	M	P			
503	503	09/12/90	J	M	P	01/05/92	Y	ROADKILL
504	504	09/12/90	J	M	P	11/11/92	A	SHOT
505	505	09/12/90	J	F	P			
506	506	09/12/90	J	F	P			
507	507	09/12/90	J	F	P	09/25/92	A	REMOVED
508	508	09/12/90	J	M	P			
509	509	09/12/90	A	M	P			
510	510	09/13/90	J	F	P	08/29/91	Y	REMOVED
511	511	09/13/90	J	M	P			
512	512	09/13/90	J	F	P			
513	513	09/18/90	J	F	P			
514	514	09/18/90	J	F	P			
515	515	09/18/90	J	F	P	09/30/92	A	REMOVED
516	516	09/18/90	J	M	P			
517	517	09/18/90	J	M	P			
518	518	09/18/90	J	F	P			
519	519	09/18/90	J	F	P			
520	520	09/18/90	A	M	P	11/21/90	A	ROADKILL
521	521	09/19/90	Y	M	P			
522	522	09/20/90	J	F	P			
523	523	09/20/90	A	M	P			
524	524	09/20/90	A	M	P			
525	525	10/25/90	J	F	P			
526	526	10/23/90	J	F	P	11/24/91	Y	TRAPPED
527	527	10/24/90	J	F	P	11/04/92	A	UNKNOWN
528	528	10/24/90	A	M	P	11/29/90	A	UNKNOWN
529	529	10/24/90	A	M	P			
530	530	10/26/90	J	M	P			
531	531	10/26/90	J	F	P	02/20/91	J	UNKNOWN
532	532	10/26/90	J	F	P	11/26/90	J	UNKNOWN
533	533	10/26/90	A	M	P			
534	534	04/08/91	A	M	P	05/20/91	A	ROADKILL
535	535	04/08/91	A	M	P	02/05/93	A	DISEASE
536	536	04/09/91	A	M	P	05/05/93	A	ROADKILL
537	537	04/10/91	A	M	P	12/01/91	A	TRAPPED
538	538	04/10/91	Y	M	P	03/26/92	A	ROADKILL
539	539	04/11/91	A	F	P	09/04/91	A	REMOVED
540	540	04/12/91	A	F	P			
541	541	04/12/91	Y	F	P	09/10/91	Y	REMOVED
542	542	04/12/91	A	M	P			
543	543	04/12/91	Y	M	P			
544	544	04/25/91	A	M	P			
545	545	04/25/91	Y	M	P			
546	546	04/25/91	Y	F	P	09/22/92	A	REMOVED
547	547	04/25/91	A	M	P			
548	548	04/25/91	A	M	P	03/21/92	A	DOG
549	549	04/25/91	A	M	M			

EAR TAG # L	R	CAPTURE DATE	AGE	SEX	STUDY AREA	MORTALITY DATE	AGE	CAUSE
550	550	04/26/91	A	F	P			
551	551	04/26/91	A	M	P			
552	552	04/26/91	A	M	P	08/15/92	A	UNKNOWN
553	553	04/30/91	A	F	P	09/10/91	A	REMOVED
554	554	04/30/91	A	M	P			
556	556	05/02/91	A	F	P			
557	557	05/02/91	A	M	P			
558	558	05/03/91	A	F	P	08/29 91	A	REMOVED
559	559	05/03/91	A	F	P	05/18/91	A	ROADKILL
560	560	05/03/91	Y	M	P			
561	561	05/06/91	A	F	P	09/28/92	A	REMOVED
562	562	05/06/91	Y	M	P			
563	563	05/07/91	Y	M	P			
564	564	05/07/91	A	M	P			
565	565	05/09/91	A	F	P	09/19/91	A	REMOVED
566	566	05/09/91	A	M	P			
567	567	08/28/91	J	F	P	01/03/93	A	UNKNOWN
568	568	08/29/91	J	F	P			
569	569	08/29/91	J	M	P			
570	570	08/29/91	J	F	P	12/28/91	J	SHOT
571	571	09/06/91	J	F	P			
572	572	09/09/91	J	M	P	10/02/92	Y	UNKNOWN
573	573	09/10/91	J	M	P			
574	574	09/10/91	J	M	P	11/05/92	Y	SHOT
575	575	09/11/91	J	F	P	07/23/93	A	UNKNOWN
576	576	09/11/91	J	F	P			
577	577	09/11/91	A	M	P			
578	578	09/13/91	J	F	P			
579	579	09/13/91	J	F	P	09/16/92	Y	REMOVED
580	580	09/17/91	J	M	P			
581	581	09/17/91	J	M	P			
582	582	09/17/91	A	M	P			
583	583	09/18/91	J	F	P			
584	584	09/19/91	J	F	P			
585	585	09/19/91	J	M	P			
586	586	09/19/91	Y	M	P			
587	587	09/20/91	J	F	P			
588	588	09/20/91	J	F	P			
589	589	10/23/91	A	M	P			
590	590	10/24/91	J	F	P	11/13/91	J	SHOT
591	591	04/14/92	A	M	P	05/13/93	A	ROADKILL
592	592	14/15/92	Y	F	P	09/29/92	Y	REMOVED
593	593	04/15/92	A	M	P			
594	594	04/17/92	Y	M	P			
595	595	04/20/92	Y	F	P			
596	596	04/20/92	A	F	P	09/29/92	A	REMOVED
597	597	04/20/92	Y	F	P			
598	598	04/21/92	A	F	P	10/16/92	A	UNKNOWN
600	600	10/17/91	J	M	M	11/21/91	J	SHOT
601	601	10/17/91	J	M	M			

EAR TAG #		CAPTURE			STUDY	MORTALITY		
L	R	DATE	AGE	SEX	AREA	DATE	AGE	CAUSE
602	602	10/18/91	J	M	M			
603	603	10/18/91	A	M	M	11/10/92	A	TRAPPED
604	604	10/18/91	A	F	M			
605	605	10/19/91	J	M	M	11/12/92	Y	TRAPPED
606	606	10/19/91	J	M	M			
607	607	10/20/91	J	F	M			
608	608	10/23/91	J	M	M			
609	609	05/19/92	Y	M	M	06/13/92	Y	ROADKILL
610	610	05/20/92	Y	F	M			
611	611	05/20/92	A	M	M			
612	612	05/20/92	A	M	M			
613	613	05/21/92	Y	M	M	11/11/92	Y	TRAPPED
614	614	05/21/92	Y	F	M			
615	615	05/22/92	Y	F	M			
616	616	05/22/92	A	M	M			
617	617	05/23/92	Y	M	M			
618	618	05/27/92	Y	F	M			
618	618	05/29/92	Y	F	M			
619	619	05/27/92	A	M	M			
620	620	05/27/92	A	M	M	08/01/93	A	DOG
621	621	05/27/92	Y	M	M	11/05/92	Y	SHOT
622	622	05/27/92	Y	M	M			
623	623	05/27/92	A	M	M			
624	624	05/27/92	Y	F	M	11/09/92	Y	SHOT
625	625	05/29/92	J	M	M			
626	626	05/29/92	J	M	M			
627	627	05/29/92	J	M	M			
628	628	05/29/92	Y	M	M			
629	629	05/29/92	A	M	M			
630	630	05/29/92	A	F	M	06/04/92	A	NUISANCE
631	631	05/29/92	A	F	M			
632	632	05/29/92	Y	M	M			
633	633	05/29/92	A	M	M			
634	634	05/30/92	Y	F	M			
635	635	06/01/92	Y	M	M	11/05/92	Y	SHOT
636	636	06/01/92	Y	F	M			
637	637	06/01/92	Y	F	M	09/26/92	Y	ROADKILL
638	638	06/02/92	A	F	M			
639	639	06/02/92	Y	F	M			
641	641	06/02/92	A	M	M	11/06/92	A	SHOT
642	642	06/02/92	A	M	M			
643	643	06/03/92	A	F	M			
644	644	06/03/92	Y	M	M			
645	645	06/04/92	A	F	M	05/15/93	A	ROADKILL
646	646	06/04/92	A	F	M			
647	647	06/06/92	A	F	M			
648	648	06/06/92	A	F	M			
649	649	06/09/92	Y	F	M	06/15/92	Y	TRAPPED
650	650	06/09/92	Y	M	M	11/07/92	Y	TRAPPED
651	651	06/09/92	A	M	M			

EAR TAG #		CAPTURE			STUDY	MORTALITY		
L	R	DATE	AGE	SEX	AREA	DATE	AGE	CAUSE
652	652	06/09/92	J	F	M	11/07/92	J	SHOT
653	653	05/10/92	J	M	M			
654	654	06/10/92	J	M	M			
655	655	06/10/92	A	F	M			
656	656	06/10/92	Y	F	M			
657	657	06/10/92	Y	F	M			
658	658	06/10/92	J	F	M			
659	659	06/11/92	Y	F	M			
660	660	06/11/92	A	F	M			
661	661	06/11/92	A	M	M	06/03/93	A	NUISANCE
662	662	06/11/92	Y	M	M			
663	663	06/12/92	A	M	M	11/09/92	A	TRAPPED
664	664	06/13/92	A	F	M			
665	665	06/13/92	A	F	M	11/03/92	A	SHOT
666	666	06/19/92	A	M	M			
667	667	06/22/92	A	F	M	03/16/93	A	DISEASE
668	668	06/22/92	Y	M	M			
670	670	06/24/92	A	M	M	03/16/93	A	REMOVED
671	671	09/01/92	A	M	P			
673	673	09/01/92	J	M	M			
674	674	09/01/92	J	F	M	11/23/92	J	ROADKILL
675	675	09/02/92	A	F	M			
676	676	09/03/92	J	F	M			
677	677	09/03/92	J	F	M	12/??/92	J	SHOT
678	678	09/03/92	A	F	M			
679	679	09/03/92	Y	F	M	11/02/92	Y	SHOT
680	680	09/04/92	J	M	M	09/04/92	J	CAPTURE
681	681	09/04/92	J	F	M			
682	682	09/09/92	Y	M	M			
683	683	09/09/92	J	M	M			
684	684	09/09/92	Y	M	M			
685	685	09/10/92	A	F	M			
686	686	09/10/92	Y	F	M			
687	687	09/10/92	J	F	M			
688	688	09/11/92	Y	M	M			
689	689	09/12/92	A	M	M	11/12/92	A	SHOT
690	690	09/13/92	A	M	M	12/18/92	A	TRAPPED
691	691	09/13/92	J	M	M			
692	692	10/06/92	A	M	M	05/12/93	A	ROADKILL
693	693	10/06/92	A	M	M	12/01/92	A	SHOT
694	694	10/06/92	A	M	M			
695	695	10/08/92	J	F	M	11/09/92	J	SHOT
696	696	10/08/92	A	M	M			
697	697	10/09/92	J	F	M			
698	698	10/09/92	Y	F	M	11/09/92	Y	SHOT
700	700	10/10/92	J	M	M			
701	701	04/22/92	Y	F	P			
702	702	04/22/92	A	M	P			
703	703	04/22/92	A	M	P	06/03/92	A	ROADKILL
704	704	04/22/92	A	M	P			

EAR TAG # L	R	CAPTURE DATE	AGE	SEX	STUDY AREA	MORTALITY DATE	AGE	CAUSE
705	705	04/22/92	A	F	P			
706	706	04/23/92	Y	M	P			
711	711	06/23/92	A	F	P			
712	712	06/24/92	A	F	P			
713	713	06/24/92	Y	F	P			
714	714	06/24/92	A	F	P	12/13/92	A	UNKNOWN
715	715	10/02/92	A	F	P	10/02/92	A	REMOVED
715	715	06/25/92	A	F	P	10/02/92	A	REMOVED
716	716	06/25/92	Y	F	P			
717	717	06/26/92	Y	F	P	10/01/92	Y	REMOVED
726	726	09/15/92	J	F	P			
727	727	09/15/92	J	M	P			
728	728	09/17/92	J	M	P			
729	729	09/17/92	J	F	P			
730	730	09/21/92	J	F	P			
731	731	09/22/92	A	M	P	11/04/92	A	DISEASE
732	732	09/22/92	Y	M	P			
733	733	09/24/92	J	F	P			
734	734	09/24/92	J	F	P			
735	735	09/28/92	J	F	P			
736	736	09/28/92	A	M	P			
737	737	09/29/92	J	M	P			
738	738	09/29/92	J	F	P			
740	740	10/02/92	J	F	P			
741	741	10/10/92	J	M	M			
742	742	10/13/92	J	F	M			
743	743	10/13/92	A	F	M	11/13/92	A	SHOT
744	744	10/13/92	A	F	M	11/06/92	A	TRAPPED
745	745	10/13/92	J	M	M	11/24/92	J	TRAPPED
746	746	10/13/92	J	F	M			
747	747	10/13/92	J	M	M	11/12/92	J	SHOT
748	748	10/14/92	J	M	M			
749	749	10/14/92	A	M	M			
750	750	10/15/92	A	F	M	11/09/93	A	TRAPPED
751	751	10/15/92	J	M	M			
752	752	10/15/92	J	M	M			
753	753	10/15/92	Y	F	M			
754	754	10/15/92	J	F	M	12/30/92	J	ROADKILL
756	756	10/16/92	A	M	M	11/12/92	A	SHOT
757	757	10/16/92	Y	F	M	04/28/93	A	ROADKILL
758	758	10/16/92	J	M	M			
759	759	10/16/92	A	M	M			
760	760	10/17/92	A	F	M			
761	761	10/17/92	J	F	M	04/12/93	Y	UNKNOWN
762	762	10/17/92	J	M	M	11/24/92	J	TRAPPED
763	763	10/17/92	J	M	M			
764	764	10/18/92	J	M	M			
765	765	10/18/92	J	F	M			
766	766	10/18/92	Y	M	M			
767	767	10/18/92	J	F	M	11/09/92	J	SHOT

EAR TAG #		CAPTURE			STUDY	MORTALITY		
L	R	DATE	AGE	SEX	AREA	DATE	AGE	CAUSE
768	768	10/19/92	J	M	M			
769	769	10/21/92	J	M	M			
770	770	10/25/92	Y	M	M	11/03/92	Y	SHOT
771	771	10/30/92	Y	M	M			
772	772	03/24/93	Y	M	P			
773	773	03/26/93	Y	M	P			
774	774	03/26/93	Y	F	P			
775	775	03/27/93	Y	F	P			
781	781	04/19/93	Y	M	P			
782	782	04/01/93	A	M	P			
783	783	04/21/93	A	F	P			
784	784	08/21/93	A	F	P			
785	785	08/21/93	Y	M	P			
786	786	08/21/93	J	M	P			
787	787	08/21/93	J	M	P			
788	788	08/21/93	J	F	P			
789	789	08/22/93	J	F	P			
790	790	08/22/93	Y	F	P			
791	791	08/24/93	J	M	P			
792	792	09/13/93	J	M	P			
793	793	09/13/93	Y	F	P			
794	794	09/21/93	J	M	P			
795	795	09/21/93	A	F	P			
796	796	09/21/93	J	F	P			
797	797	09/22/93	A	M	P			
798	798	09/22/93	A	M	P			
799	799	09/22/93	A	M	P			
800	800	04/23/93	Y	F	M			
801	801	04/25/93	Y	M	M			
802	802	04/27/93	A	M	M	04/27/93	A	CAPTURE
803	803	04/30/93	Y	M	M			
804	804	05/01/93	A	M	M			
805	805	05/02/93	A	M	M			
806	806	05/03/93	Y	M	M			
807	807	05/04/93	A	F	M			
808	808	05/04/93	Y	F	M			
810	810	05/04/93	A	M	M			
811	811	05/07/93	Y	M	M			
812	812	05/11/93	Y	M	M			
813	813	05/11/93	Y	M	M			
814	814	05/12/93	A	F	M			
815	815	05/12/93	Y	M	M			
816	816	05/13/93	Y	M	M	11/11/93	Y	SHOT
817	817	05/13/93	A	M	M			
818	818	05/13/93	Y	M	M			
819	819	05/14/93	Y	F	M			
820	820	05/14/93	A	M	M	05/14/93	A	CAPTURE
821	821	05/19/93	A	F	M			
822	822	05/19/93	A	M	M			
823	823	09/01/93	Y	M	M			

EAR TAG # L	EAR TAG # R	CAPTURE DATE	CAPTURE AGE	SEX	STUDY AREA	MORTALITY DATE	MORTALITY AGE	MORTALITY CAUSE
824	824	09/02/93	J	M	M	09/02/93	J	CAPTURE
825	825	09/06/93	A	M	M			
826	826	09/07/93	J	M	M			
827	827	09/09/93	J	M	M			
828	828	09/09/93	J	M	M			
829	829	09/03/93	J	M	M			
830	830	09/10/93	A	F	M			
831	831	09/10/93	J	M	M			
832	832	09/10/93	J	M	M			
833	833	09/11/93	J	F	M			
834	834	09/15/93	A	M	P			
835	835	09/23/93	J	F	M			
836	836	09/24/93	J	M	M			
837	837	09/28/93	J	F	M			
838	838	09/28/93	J	F	M			
839	839	09/28/93	J	F	M			
840	840	09/29/93	J	F	M			
841	841	09/29/93	J	M	M			
842	842	09/30/93	Y	M	M			
843	843	09/30/93	Y	M	M	09/30/93	Y	CAPTURE
844	844	09/30/93	J	M	M			
845	845	10/01/93	J	F	M			
846	846	10/01/93	J	F	M			
847	847	10/01/93	J	M	M			
848	848	10/05/93	J	M	M			
849	849	10/05/93	J	F	M			
850	850	10/05/93	J	F	M			
851	851	10/05/93	J	F	M			
852	852	10/05/93	J	F	M			
853	853	10/05/93	Y	M	M			
854	854	10/05/93	A	M	M			
855	855	10/06/93	Y	M	M			
856	856	10/06/93	J	M	M			
857	857	10/06/93	A	F	M			
858	858	10/06/93	J	M	M			
859	859	10/07/93	A	M	M			
860	860	10/07/93	J	F	M	11/11/93	J	SHOT
861	861	10/07/93	J	F	M			
862	862	10/08/93	J	M	M	10/08/93	J	CAPTURE
863	863	10/08/93	J	F	M			
864	864	10/11/93	A	M	M			
865	865	10/11/93	J	F	M			
866	866	10/11/93	J	F	M			
867	867	10/12/93	Y	M	M			
870	870	10/12/93	Y	M	M			
871	871	10/12/93	A	M	M			
872	872	10/13/93	J	F	M			
873	873	10/13/93	A	M	M			
874	874	10/14/93	Y	M	M			
875	875	10/15/93	J	F	M	11/11/93	J	SHOT

EAR TAG #		CAPTURE			STUDY	MORTALITY		
L	R	DATE	AGE	SEX	AREA	DATE	AGE	CAUSE
876	876	09/24/93	J	M	P			
877	877	09/24/93	J	F	P			
878	878	09/24/93	A	M	P			
879	879	09/25/93	A	M	P			
880	880	09/25/93	A	M	P			

APPENDIX 2. SUMMARY OF RACCOON CAPTURES IN LEE COUNTY, ILLINOIS, 1990-1993

APPENDIX 2.

Fate of all raccoons captured on the Richardson Wildlife Foundation and the Amboy Area, Lee County, Illinois, 1990-1993.

Ear Tag No.	Sex	Age	Capture Dates	Fate After Capture
		RICHARDSON WILDLIFE FOUNDATION		
1001	M	Juv	8-21-90	Unknown
1002	F	2 years	8-22-90	"
1003	F	3 years	8-23-90	
			6-04-91	"
1004	M	Yearling	8-23-90	
			5-29-91	Steel Trapped Nov 1992
1005	F	Yearling	8-24-90	Unknown
1006	F	7 years	8-24-90	"
1007	F	Juv	8-24-90	"
1008	F	Juv	8-21-91	"
1009	F	Juv	8-24-90	
			6-04-91	"
1010	F	5 years	8-28-90	
			5-30-91	Steel Trapped Nov 1993
1011	F	4 years	8-29-90	
			6-06-91	Unknown
1012	F	Juv	8-29-90	"
1013	F	Juv	8-29-90	Disease May 1992

1014	M	Juv	8-29-90	
			6-13-92	Unknown
1015	F	Juv	8-29-90	
			10-03-90	
			10-05-90	
			8-01-91	Unknown
1016	M	Juv	8-30-90	
			10-11-90	Dispersed 26 Km NNE-Road Kill
				May 1993
1017	M	Juv	8-30-90	Unknown
1018	F	Yearling	8-30-90	"
1019	F	Juv	8-30-90	"
1020	M	Juv	8-30-90	"
1022	F	Juv	8-31-90	"
1023	F	Juv	9-05-90	"
1024	F	3 years	9-06-90	"
1040	F	Juv	10-02-90	Disease Nov 1990
1042	M	Juv	10-02-90	Unknown
1043	F	Yearling	10-03-90	
			9-09-93	Unknown
1044	F	3 years	10-03-90	
			10-10-90	Unknown
1048	M	Juv	10-10-90	"
1049	F	7 years	8-31-90	
			10-10-90	
			5-31-91	Disease May 1993
				(aged 10 years)

1050	F	3 years	10-10-90	Road Kill Feb 1991
---	M	Yearling	8-23-90	Removed to Green River Area
---	M	4 years	8-24-90	" " " " "
---	M	5 years	8-28-90	" " " " "
---	M	2 years	8-30-90	"
---	M	Yearling	10-03-90	"
---	M	2 years	10-04-90	"
---	M	3 years	10-09-90	"
1041	M	2 years	5-22-91	
			8-13-92	Removed to Green River Area
1052	M	Yearling	5-22-91	
			3-19-92	Removed to Green River Area
1054	F	2 years	5-24-91	
			6-14-91	
			9-10-92	
			8-11-93	Unknown
1055	F	Yearling	5-22-91	
			3-19-93	Unknown
1056	M	2 years	5-22-90	Killed & Tested for Rabies
1057	F	Yearling	5-22-91	Unknown
1058	F	Yearling	5-30-91	"
1059	M	2 years	5-31-91	"
1060	F	Adult	5-31-91	"
1064	F	Juv	6-18-91	"
			7-30-91	Disease May 1992
1065	M	Adult	6-06-91	Ear Tag Only Found March 1992

1066	M	Yearling	6-11-91	
			3-19-93	Unknown
1067	M	Adult	6-12-91	
			8-04-92	Removed to Green River Area
1068	F	Juv	6-18-91	
			9-10-91	Unknown
1070	F	Adult	6-18-91	Killed by Dog Dec 1991
1078	M	Juv	6-19-91	Unknown
1082	M	Adult	7-30-91	"
1099	F	Juv	8-08-91	"
1151	M	Juv	7-31-91	
			8-06-91	Disease Feb 1992
1152	M	Juv	7-30-91	Unknown
1153	M	Juv	7-30-91	"
1154	M	Juv	7-31-91	"
1155	F	Juv	7-31-91	
			8-15-91	
			9-13-91	Unknown
1156	F	2 years	8-01-91	"
1157	M	Juv	8-06-91	
			8-16-91	Unknown
1158	M	Juv	8-07-91	Disease Feb 1992
1159	F	Juv	8-07-91	
			8-20-91	Unknown
1160	M	Juv	8-07-91	
			9-11-91	Unknown

1161	M	Juv	8-07-91	
			8-15-91	
			9-05-91	Unknown
1162	M	Juv	8-09-91	"
1163	M	Juv	8-15-91	"
1164	M	Juv	8-16-91	"
1165	M	Juv	8-16-91	"
1166	M	Juv	8-20-91	
			7-22-92	
			7-21-93	Steel trapped Nov 1993
1167	M	Juv	8-20-91	Unknown
1169	M	Juv	8-23-91	"
1182	M	Juv	9-12-91	"
1186	F	Yearling	9-05-91	"
---	M	Yearling	7-30-91	Removed to Green River Area
--	M	2 years	8-06-91	"
---	M	3 years	8-23-91	"
---	M	Yearlings	3-18-92	"
1185	F	2 years	3-19-92	"
---	M	Adult	3-19-92	Removed to Green River Area
---	M	Adult	3-20-92	Removed to Green River Area
1186	F	Yearling	3-24-92	Unknown
1187	F	"	3-26-92	Unknown
---	M	"	3-27-92	Removed to Green River Area
1142	M	Yearling	7-21-92	Steel trapped Nov 1993
1143	M	Juv	7-21-92	Unknown

1146	M	Juv	8-13-92	Unknown
1148	F	Juv	7-21-92	"
1149	M	Juv	7-21-92	"
1168	F	Juv	7-21-92	"
1201	M	Juv	7-21-92	
			8-13-92	Unknown
1202	F	Juv	7-21-92	
			7-21-93	Unknown
1203	F	Juv	7-22-92	"
1204	F	Juv	7-22-92	
			8-11-92	Unknown
1205	F	Juv	7-22-92	"
1206	F	Juv	7-23-92	"
1207	M	Juv	7-23-92	"
1208	M	Juv	7-23-92	"
1209	F	5 years	7-24-92	"
1210	F	Juv	7-24-92	
			9-11-92	Unknown
---	M	Yearling	7-28-92	Removed to Green River Area
1211	F	Juv	7-28-92	Unknown
1212	F	Juv	7-28-92	
			3-23-93	Unknown
1213	M	Juv	7-28-92	"
1214	M	Juv	7-29-92	"
1215	M	Juv	7-30-92	"
1216	F	Juv	7-31-92	"

1217	F	Juv	7-31-92	Unknown
--	M	2 years	8-04-92	Removed to Green River Area
--	M	Yearling	8-04-92	"
1218	M	Juv	8-04-92	Steel Trapped Nov 1993
1220	F	2 years	8-06-92	"
1221	F	Juv	8-07-92	
			9-15-93	Steel Trapped Nov 1993
---	M	2 years	8-11-92	Removed to Green River Area
1222	F	Juv	8-13-92	Unknown
1223	M	Juv	8-14-92	Steel Trapped Nov 1992
1224	F	Juv	8-14-92	Unknown
1236	M	Juv	9-01-92	Road Kill Oct 1992
1237	F	Juv	9-01-92	Unknown
1238	M	Juv	9-04-92	"
---	M	Adult	9-04-92	Removed to Green River Area
---	M	Adult	9-09-92	"
---	M	Yearling	9-09-92	"
1239	M	Juv	9-10-92	Unknown
1240	M	Juv	9-10-92	"
1241	M	Juv	9-10-92	"
1242	M	Yearling	3-16-93	"
1243	M	Yearling	3-17-93	"
			9-15-93	"
1244	M	Yearling	3-17-93	"
1245	M	Yearling	3-19-93	"
1246	M	Yearling	3-19-93	"

1247	M	Adult	3-23-93	Disease April 1993
1250	M	Yearling	3-24-93	Unknown
1249	M	Adult	3-24-93	
			8-10-93	Steel Trapped Nov 1993
1248	M	Adult	3-24-93	"
1199	M	Adult	3-25-93	
			7-23-93	
			8-06-93	Unknown
1519	M	Juv	7-20-93	"
1520	F	Juv	7-20-93	"
1521	M	Juv	7-20-93	"
1522	F	Juv	7-20-93	"
1523	F	3 years	7-20-93	"
1524	F	Juv	7-21-93	Unknown
1525	M	Juv	7-21-93	"
1526	F	Yearling	7-21-93	"
1527	F	Juv	7-22-93	
			7-30-93	Steel Trapped Nov 1993
1528	M	Juv	7-22-93	Unknown
1529	F	Juv	7-22-93	"
1530	F	Juv	7-23-93	"
1531	F	Juv	7-23-93	"
1532	M	Juv	7-23-93	"
1533	F	Juv	7-27-93	Road Kill Sept 1993
1534	F	Juv	7-27-93	Unknown
1535	F	Juv	8-04-93	"
1536	F	Juv	8-06-93	Road Kill Dec 1993

1538	F	2 years	8-10-93	Unknown
1539	M	Adult	8-11-93	"
1540	M	Juv	8-11-93	"
1542	M	2 years	8-12-93	"
1541	F	Juv	8-13-93	"
1543	M	Juv	8-13-93	"
1544	M	2 years	8-13-93	"
1551	F	Juv	9-08-93	"
1552	M	Juv	9-10-93	"
1553	F	2 years	9-10-93	"
1554	M	Juv	9-10-93	Steel Trapped Nov 1993
1555	M	2 years	9-14-93	Unknown
1556	M	Adult	9-14-93	"
1557	M	Adult	9-15-93	"
1558	F	Yearling	9-17-93	"
1559	M	Juv	9-21-93	"
1560	M	Juv	9-21-93	"
1561	F	2 years	9-23-93	"
1562	M	Juv	9-23-93	"
1565	M	2 years	9-23-93	Steel Trapped Nov 1993
1566	F	Juv	9-24-93	Unknown
			AMBOY AREA	
1025	F	Juv	9-11-90	Unknown
1026	F	Juv	9-12-90	"
1027	F	10 years	9-12-90	
			6-16-92	
			6-17-92	Unknown

1028	F	2 years	9-18-90	Unknown
1029	F	Yearling	9-19-90	"
1030	M	3 years	9-19-90	
			9-04-91	Unknown
1031	M	Juv	9-20-90	Road Kill 11-17-90
1032	M	4 years	9-25-90	
			10-11-90	Killed by Dog Nov 1990
1033	M	Juv	9-25-90	Unknown
1034	F	Juv	9-25-90	Shot Nov 1991
1035	M	Juv	9-26-90	Shot Nov 1990
1036	F	2 years	9-26-90	Shot Nov 1990
1037	M	3 years	9-26-90	Unknown
1038	M	Yearling	9-26-90	
			7-09-93	
			7-13-93	Unknown
1039	M	3 years	9-28-90	"
1045	F	Juv	10-03-90	Steel Trapped Nov 1990
1046	M	3 years	10-04-90	Shot Nov 1990
1047	M	Juv	10-09-90	
			6-18-91	Shot Nov 1991
1073	M	Yearling	6-18-91	Unknown
1075	F	5 years	6-18-91	
			6-23-92	Shot Nov 1992
1061	M	Yearling	6-18-91	
			6-21-91	
			7-02-91	Unknown

1079	M	Yearling	6-19-91	
			6-25-91	Shot Nov 1991
1062	F	Adult	6-19-91	
			6-30-93	Unknown
1083	M	3 years	6-21-91	Disease June 1993
1084	M	Yearling	6-19-91	Shot Nov 1991
1086	M	Yearling	6-21-91	Unknown
1071	M	Yearling	6-25-91	"
1090	F	Adult	6-25-91	Shot Nov 1991
1091	F	2 years	6-25-91	Unknown
1093	M	Yearling	6-26-91	"
1094	F	Juv	7-02-91	"
1095	M	Juv	7-02-91	"
1096	M	Juv	7-02-91	"
1097	M	Juv	7-02-91	"
1170	M	Juv	8-27-91	"
1171	M	Juv	8-28-91	"
1172	M	Yearling	8-29-91	"
			9-05-91	Unknown
1173	M	Juv	8-29-91	"
1174	M	Juv	8-30-91	
			9-09-91	Disease Sept 1991
1175	F	Yearling	8-30-91	Unknown
1176	F	Juv	9-04-91	
			9-11-91	
			7-08-93	
			8-18-93	Unknown

1179	M	Juv	9-06-91	Unknown
1180	M	Juv	9-06-91	"
1181	M	3 years	9-11-91	
			6-18-92	
			6-30-92	Unknown
1183	M	Juv	9-13-91	
1188	F	Yearling	6-16-92	
			7-01-92	Shot Nov 1992
1189	M	3 years	6-16-92	Unknown
1190	F	Yearling	6-16-92	"
1191	M	2 years	6-16-92	"
1193	M	Yearling	6-16-92	"
1194	M	Yearling	6-16-92	
			6-23-92	
			7-02-92	Unknown
1196	M	Yearling	6-17-92	Shot Nov 1992
1197	M	Yearling	6-18-92	Unknown
1198	F	2 years	6-18-92	"
1199	F	Adult	6-18-92	"
1200	F	Yearling	6-19-92	"
1102	F	Yearling	6-23-92	"
1103	M	Yearling	6-23-92	"
1106	M	2 years	6-23-92	"
1110	F	3 years	6-24-92	
			7-07-93	Unknown
1112	M	Yearling	6-24-92	
			7-07-92	Unknown

1116	M	2 years	6-24-92	
			8-21-92	Unknown
1118	M	Yearling	6-25-92	"
1121	F	Yearling	6-26-92	"
1124	M	Yearling	6-26-92	"
1125	M	Yearling	6-26-92	
			7-01-93	Unknown
1129	M	Adult	6-26-92	
			8-28-92	Unknown
1108	M	Juv	6-30-92	"
1115	M	Juv	6-30-92	"
1132	M	Yearling	7-02-92	
			8-27-93	Unknown
1136	M	Yearling	7-03-92	"
1139	F	2 years	7-07-92	
			8-19-92	Unknown
1181	M	Juv	7-07-92	Unknown
1128	F	Adult	7-09-92	"
1130	M	Juv	7-09-92	"
1134	M	Juv	7-09-92	"
1225	M	Juv	8-18-92	"
1226	F	Juv	8-19-92	"
1227	M	Juv	8-19-92	"
1228	M	Juv	8-21-92	"
1229	F	Juv	8-21-92	"
1230	M	2 years	8-25-92	"
1231	M	Juv	8-25-92	"

1232	F	Juv	8-25-92	"
1233	F	Juv	8-25-92	"
1234	M	Juv	8-26-92	"
1235	M	Juv	8-27-92	"
1501	M	3 years	6-22-93	Unknown
1502	F	Yearling	6-22-93	"
1503	M	Adult	6-22-93	"
			7-01-93	"
1504	M	3 years	6-25-93	"
1505	M	2 years	6-29-93	"
1506	F	Juv	6-29-93	"
1507	M	2 years	7-01-93	Shot Nov 1993
1508	F	2 years	7-07-93	Unknown
1509	M	Yearling	7-07-93	"
1510	M	Juv	7-07-93	"
1511	M	Yearling	7-07-93	"
1512	F	Juv	7-07-93	"
1514	F	Juv	7-13-93	"
1515	F	Juv	7-14-93	"
1516	F	Yearling	7-15-93	"
1517	M	Yearling	7-16-93	"
1518	M	2 years	7-16-93	"
1545	M	Juv	8-17-93	"
1546	F	Juv	8-20-93	"
1547	F	2 years	8-24-93	"
1548	M	Juv	8-25-93	"
1549	F	5 years	8-31-93	"
1550	F	Juv	9-01-93	Unknown

APPENDIX 3. NOTES ON THE LIFE HISTORY OF OPOSSUMS IN WEST-CENTRAL ILLINOIS

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Notes on the Life History of Opossums in West-Central Illinois

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ABSTRACT

Opossums (*Didelphis virginiana*) were captured and marked in west-central Illinois from fall 1989 through fall 1993. Females predominated in spring and fall for birth year and after birth year captures. The highest minimum density was 7.7 opossums per 100 ha in spring 1993. Eighty-eight percent (N = 42) of after-birth year females were carrying pouched young when captured in the spring and averaged 9.9 ± 0.5 young. Annual survival of marked opossums was low on the study area, with only 5 of 182 (1 male, 4 females) recaptured 1 year after initial capture. Opossums were captured more often than expected in oak-hickory stands and old fields and less than expected in crop fields, assuming a opossum distribution similar to our trap distribution.

INTRODUCTION

The opossum is present throughout Illinois, and aspects of its life history have been reported from northwest (Verts 1963), east-central (Sanderson 1961, Holmes and Sanderson 1965), and southern (Stieglitz and Klimstra 1962) Illinois.

These notes on the life history attributes of the Virginia opossum in west-central Illinois were collected incidentally when investigating the ecology and life history of the raccoon (*Procyon lotor*) from fall 1989 through fall 1993. Our purpose was to provide some additional information concerning opossum life history in Illinois.

METHODS

We livetrapped opossums during fall (Aug-Oct) and spring (Apr-Jun) from fall 1989 to fall 1993. For fall 1989 and spring 1990, the study area included 3,222 ha of the Purpus and Wells Creek watersheds in Brown County, west-central Illinois. Subsequently, the study area comprised only the 2,310 ha within the Wells Creek watershed. These study areas averaged 59% agricultural fields, 23% oak-hickory woodland, 12% pasture, 4% shrub-old field, and 1% ponds; the remainder was in farmsteads (<1%) and Conservation Reserve lands.

Opossums were livetrapped using box traps baited with sardines (Sanderson 1961). Traps were not placed in a grid pattern but were placed in locations thought to maximize captures of raccoons. During each trapping period, trapping was begun at the north end of the watershed and progressively moved south along the watershed, with traps set in a given location for 2-5 days before being moved to a new site. This trapping pattern allowed us to trap throughout a large area but minimized recaptures of both species within trapping periods.

Captured opossums were sexed, aged as either birth year (BY) or after birth year (ABY), weighed to the nearest 0.1 kg, ear-tagged, examined for pouched young (if female), and released at the trap site.

Sex and age ratios were tested for differences using Chi-square analysis. Sex differences in body weights and movements between and within trapping periods were examined using 1-way ANOVA. Habitat preferences were determined with Chi-square analysis using total trap nights within each habitat as the proportion of each habitat available and the total captures within each type as the observed use of each habitat.

RESULTS AND DISCUSSION

Populations

Females predominated in our captures ($P<0.05$) (Table 1). Spring captures of ABY opossums averaged 68% female. Fall captures averaged 62% and 58% female for ABY and BY captures, respectively (Table 1). Based on other studies, livetrapped samples are biased toward females (Holmes and Sanderson 1965, Petrides 1949) whereas ratios derived from hunting and trapping are biased toward males (Reynolds 1945, Hamilton 1958). Females apparently are more susceptible to livetraps than are males (Holmes and Sanderson 1965, Blumenthal and Kirkland 1976). We sexed only a few young while they were still in the pouch (N = 26) and found nearly a 50:50 ratio (12 F:14 M). Pouched young averaged 51% male in New York (Hamilton 1958) and a 50:50 sex ratio for pouched young in east-central Illinois (Sanderson 1961) and south-central Pennsylvania (Blumenthal and Kirkland 1976).

The highest relative density of opossums (including young in the pouch) occurred in spring 1993, when 179 were captured on 2310 ha (7.7/100 ha). Seidensticker et al. (1987) estimated an average density of 3.9 opossums per 100 ha on a wooded site in Virginia. Other estimates have been 14 per 100 ha in New York (Van druff 1971), 13 per 100 ha in Kansas (Fitch and Sandidge 1953), 2 per 100 ha in Iowa (Wiseman and Hendrickson 1953), and 6 per 100 ha in Texas (Lay 1942). Holmes and Sanderson (1965),using after-weaning recoveries of young marked in the pouch, estimated between 223 and 634 opossums per mi^2 in east-central Illinois. These estimates may be inflated because of extensive dispersal from the study area by females with pouched young (Gillette 1980), but Holmes and Sanderson (1965) livetrapped up to 29 opossums per 100 ha. Our estimates of opossum densities were probably conservative compared to previous studies because other studies used higher trap densities set specifically for opossums.

Body Weights

In the fall, the average weight (mean ± S.E.) of ABY males (3.02 ± 0.11 kg, N = 43) was significantly greater (F = 7.07, df 1,78, P<0.01) than that of ABY females (2.6 ± 0.09 kg, N = 37). Males captured in the spring averaged 3.02 ± 0.15 kg. Female weights in the spring were biased by the presence of pouched young and were not indicative of female body mass. Male opossums are larger on average than females throughout their range (Hamilton 1958, Blumenthal and Kirkland 1976).

Reproduction

Spring breeding rates for ABY females averaged 88% (N = 42). Only 40% of the ABY females captured between late August and mid-October gave indication they had bred during the present year but fall examination is not a good indicator of the average breeding rate in opossums (Seidensticker et al. 1987). The breeding period extends from February through June in the Midwest (Petrides 1949, Reynolds 1945) with peaks in February and again in May because many females conceive 2 litters per year. Our trapping methodology did not provide data concerning the number of marked females conceiving multiple litters per year.

Pouched young were present with captured females from 10 April until 11 June. Twenty litters averaged 9.9 ± 0.5 young, with a range of 7 to 14, slightly larger than the 7.9 young per litter (N = 85 females) reported for east-central Illinois (Holmes and Sanderson (1965). Other average litter sizes reported include 8.9 in Missouri (Reynolds 1945), 8.6 in Nebraska (Reynolds 1952), 8.6 in New York (Hamilton 1958), and 8.2 in Oregon (Hopkins and Forbes 1979). Our recaptures were not frequent enough to estimate mortality rates for pouched young, reported to be <25% for most females (Llwellyn and Dale 1964, Sanderson 1961).

Recovery Rates

Recapture rates of marked opossums were low in west-central Illinois for both the fall-to-spring and spring-to-fall intervals. For the fall-to-spring period, we recaptured none of 43 BY males, 2 of 30 BY females (6.7%), 1 of 61 ABY males (1.6%), and 8 of 48 ABY females (16.7%). For the spring-to-fall interval for ABY opossums only, we recaptured 5 of 25 males (25%) and 11 of 54 females (29%). Only 5 of 182 marked opossums (1 male, 4 females, 1.6%) were captured 1 year after initial capture. Seidensticker et al.(1987) found the number of females livetrapped after their birth year was more constant than the number of males livetrapped after their birth year, which was indicative of a lower dispersal rate for females.

In Virginia, maximum longevity was only 28 and 24 months for females and males, respectively, and only 8% of marked females survived into a second breeding season at age 24 months (Seidensticker et al. 1987). In east-central Illinois, Holmes and Sanderson (1965) found that only 5.0% of adult opossums were recaptured the year after initial tagging. Van Druff (1971) estimated an average winter carryover of 9.2% in New York. Gillette (1980) found that no adults present on a Wisconsin study area in 1971 survived to breed in 1972. Llewellyn and Dale (1964) captured only 6 of 224 opossums (2.6%) 1 year or more after initial tagging in Maryland. Fitch and Sandidge (1953) recaptured only 4 of 106 tagged opossums the year following marking in Kansas. Verts (1963) found the maximum elapsed time between the first and last capture for any individual opossum was only 80 days in northwest Illinois.

Petrides (1949) calculated an average life expectancy from birth of 1.3 years for the opossum, with a 4.8-year turnover in the population. Llewellyn and Dale (1964) argued that Petrides' estimates were too high.

Movements

Our limited trapping program was not designed to assess home range size or to monitor daily activity. However, recaptures of previously marked individuals provided some indication of movements within and between trapping periods. For BY opossums within a fall trapping period, male movements averaged 186 ± 32 m (N = 33) and female movements averaged 201 ± 40 m (N = 21) between recaptures (P>0.10). After birth-year male movements averaged 264 ± 51 m in the fall (N = 21) and 404 ± 207 m in the spring (N = 6)(P>0.10). After birth-year female movements averaged 345 ± 98 m (N = 33) in the fall and 269 ± 46 m in the spring (N = 30) (P>0.10). Movements between trapping periods were larger than within-period movements for both sexes. Fall-to-spring movements for juvenile females averaged 815 ± 356 m (N = 5); too few juvenile males were recaptured to estimate movements. For ABY opossums, male movements averaged 1,076 ± 247 m (N = 7) and female movements averaged 510 ± 251 m (N = 20) between recaptures in consecutive trapping periods (P>0.05). The longest known movement of a marked opossum was 5.2 km for an ABY female.

Opossums have been described as nomads with no fixed abode (Reynolds 1945). However, Gillette (1980) using radio marked individuals, found that home range boundaries were quite flexible, but that ABY opossums of both sexes remained within definable home ranges for months at a time. He also found that BY young gradually moved away from their mother after weaning and that dispersal movements stopped with the advent of cold weather (Gillette 1980).

Several studies have demonstrated that dispersal is extensive among both BY and ABY opossums during the growing season (Gillette 1980, Fitch and Shirer 1970). Apparently, females disperse with pouched young. Such movements facilitate repopulation of depleted habitats and may be a contributing factor in the recent northward extension of their continental range (Gillette 1980).

Holmes and Sanderson (1965) found the average movement between recaptures in successive nights to be 228 m for BY opossums, 88 m for ABY females, and 162 m for ABY males. Other studies found the mean distance between captures to be 527 m (Verts 1963), 403 m (Wiseman and Hendrickson 1950), 445 m (Lay 1942), and 249 m (Fitch and Sandidge 1953). However, unrestricted nocturnal movements may be considerably greater because Seidensticker et al. (1987) found that radio marked opossums moved an average of >1,100 m per night throughout the year in Virginia. Gillette (1980) also followed radio marked opossums in Wisconsin and found nightly foraging movements during nonwinter months to average 946 m for males and 413 m for females. After-birth-year home ranges averaged 108 ha for males and 451 ha for females (Gillette 1980). Ryser (1992) found that home ranges of male opossums in Florida overlapped 5-7 females and that males regularly moved over a well-defined area checking on the reproductive status of these females.

Habitat

Because traps were set to maximize captures of raccoons, our opossum captures may not be a true reflection of habitat selection by Illinois opossums. In all overstory types, traps were generally set along waterways to capture raccoons so captures reflect relative use of waterways within each habitat type. We used trap nights (1 trap set for 1 night) per habitat type as a measure of habitat availability. We found growing season captures to be more common than expected in oak-hickory and old field habitats and less frequent than expected in croplands (Table 2). Reynolds (1945) found that opossums in Missouri favored mixed age class forest along small streams, similar to the habitat favored in west-central Illinois and considered water to be an essential component of opossum home ranges. Llewellyn and Dale (1964) reported that opossums in Maryland were found primarily in low, dense woodlands near water but avoided crop fields and dry upland woods.

CONCLUSIONS

As noted by Seidensticker et al. (1987), the opossum is about as far toward the r side of the r/K strategies of the survival continuum as mammalian morphology and physiology make possible. Observations in west-central Illinois are consistent with an r-selected life history strategy, e.g., a short gestation, large litters with minimal parental care, rapid onset of puberty in both sexes, and high mortality rates. Low survival and high dispersal rates are normal for this species, with populations dominated by individuals < 2 years old (Seidensticker et al. 1987, Llewellyn and Dale 1964) In west-central Illinois, as elsewhere, opossum numbers fluctuate annually on the basis of resource availability (Seidensticker et al. 1987). At present, human exploitation is not an important mortality factor because of low pelt prices.

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Table 1. Sex and age of opossums captured in west-central Illinois 1989-93.

Season	Birth Year		After Birth Year		
	Male	Female	Male	Female	Total
Fall 1989	11	25	9	11	56
Spring 1990	--	-	5	11	16
Fall 1990	19	23	8	10	60
Spring 1991	-	-	4	8	12
Fall 1991	5	6	11	19	41
Spring 1992	-	-	3	18	21
Fall 1992	8	7	2	8	25
Spring 1993	-	-	13	17	30
Fall 1993	8	8	9	21	46
Total Spring	-	-	25	54	79
Fall	51	69	39	69	228

Table 2. Frequency of opossum captures during the growing season in west-central Illinois.

Habitat	Proportion Available[a]	Total Captures	Expected Captures	Chi-Square Values	P Values
Mature Oak Hickory	0.347	194	153	11.18	0.001
Crops	0.307	108	135	5.43	0.05
Pasture	0.103	34	45	2.83	NS[b]
Upland shrub	0.077	44	34	3.02	NS
Farmstead	0.054	19	24	0.9	NS
Ponds	0.034	11	15	1.1	NS
Successional Forest	0.027	7	12	2.0	NS
Old field	0.022	16	10	4.13	0.05
Grassland	0.011	1	5	3.05	NS
Fallow (CRP)[c]	0.009	4	4	0.002	NS

[a] Proportion of trap nights in each habitat.
[b] NS = Not significant.
[c] CRP = Conservation reserve program.

APPENDIX 4. SOME ASPECTS OF RACCOON LIFE HISTORY IN LEE COUNTY, ILLINOIS

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Some Aspects Of Raccoon Life History In Lee County, Illinois

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ABSTRACT

Raccoons (*Procyon lotor*) were livetrapped and marked during summers 1990-1993, in mixed wetland, forest, and agricultural habitats on 2 sites, the 656-ha Richardson Wildlife Foundation (RWF) and the 297-ha Amboy area (AA) in Lee County, northcentral Illinois. Males predominated in captures of juveniles through 2 years of age, but females dominated older age classes. Estimated fall densities ranged from 7.5 to 18 raccoons per 100 ha. Yearling female breeding rates averaged 40% (range 25-50%); older females averaged 83% (range 50-100%). The age structure of females indicated that yearling breeding contributed only about 20% of the production of young on both study areas. Annual recovery rates (sum of death and dispersal) for sexes combined were 0.57 and 0.18 for juveniles and 0.61 and 0.66 for adults on the RWF during 1990-1991 and 1991-1992, respectively. For AA raccoons, adult recovery rates were 0.64 for 1990-1991; for juveniles, they were 0.53 and 0.42 for 1990-1991 and 1991-1992, respectively. During the growing season, raccoons were most abundant in water associated habitats. They avoided grasslands, restored and native prairies as well as corn and soybean fields. Current exploitation levels on both study areas were below the threshold of sustainability postulated for raccoons in the Midwest and raccoon numbers increased during our study. Low pelt prices have reduced human exploitation, and annual postweaning survival exceeded 60% during our study.

INTRODUCTION

There have been few studies of raccoon populations in Illinois. Sanderson and Hubert (1981) reported on the demographic characteristics of raccoons harvested by hunters and trappers in Illinois. They found that sex ratios of harvested raccoons favored males, that juveniles made up about two-thirds of the harvest, and that parous females averaged about 3.5 young per litter. Based on these data collected over 25 years (1955-1980), they concluded there had been little demographic change in the raccoon population in Illinois during that interval. Ellis (1964) used radio tracking to investigate home range and movements of 7 raccoons in east-central Illinois woodlots. Home ranges averaged 55 ha in a 600 ha woodlot and 68 ha in a 24 ha woodlot.

We studied raccoon population dynamics and summer habitat selection of raccoons from the fall of 1990 until the early fall of 1993 using livetrapping on 2 sites in Lee County, Illinois. Our objectives were to (1) investigate current raccoon exploitation rates in northern Illinois and; (2) contribute to life history data base of raccoons in Illinois.

METHODS

Both study areas were privately owned. The 656-ha Richardson Wildlife Foundation (RWF) was a refuge from hunting, but 1 person trapped in 1992 and 1993. Habitat composition on the RWF was 60% cropland (corn, soybeans, sunflowers, forage crops), 16% restored prairie, 13% early successional woodland, 10% wetland, and 2% miscellaneous cover (buildings, roads, etc.). The 297-ha Amboy Area (AA), open each year to both hunting and trapping, was comprised of 51% woodland, 24% pasture, 12% cropland, 6% wetland, 5% miscellaneous cover, and 2% restored prairie.

Raccoons were livetrapped during 2- to 3-week periods on each study area during August-October 1990 and June-September 1991-1993. We also livetrapped for 8-day periods in March 1992 and 1993 on the RWF. Traps were set throughout each site in habitats likely to harbor raccoons during 1990 and 1991 at densities of 1 trap per 25 ha (RWF) and 1 trap per 10 ha (AA). In 1992 and 1993 traps were set in proportion to the available habitat at densities of 1 trap per 14 ha (RWF) and 1 per 10 ha (AA). Captured raccoons were weighed to the nearest 0.1 kg and immobilized using ketamine hydochloride (100 mg/ml, 0.1 cc per 0.45 kg of body weight). Raccoons were then sexed, examined for external parasites and injuries, examined for breeding activity (females pregnant or lactating, males if penis extrusible [Sanderson 1961]), ear tagged with serial-numbered plastic tags, and released after recovery at the trap site. A lower first premolar was extracted from all raccoons ≥1 year for aging using tooth cementum (Grau et al. 1970).

We estimated raccoon numbers each year using the software package CAPTURE (Rexstad and Burnham 1991). Because we made only a few recaptures each trapping period, we used estimators that assume capture probabilities vary by behavioral response to capture (Mb) and by individual animal as well as behavioral response to capture (Mbh). These estimators use the number of unmarked animals captured and do not require large numbers of recaptures to compute a population estimate (Rexstad and Burnham 1991).

We attempted to simulate the effect of fall harvests of males on the subsequent population dynamics of raccoons by removing captured yearling and adult males from the RWF in fall 1990 (N = 7), 1991 (N = 3), and 1992 (N = 14). These males were transported 33 km away to the Green River Conservation area and immediately released.

Raccoon captures were compared among sexes, ages, areas, and years using a contingency table analysis and likelihood ratio chi-square tests assuming that the response rates are the same in each sample (SAS Institute 1994). Seasonal changes in weight were compared for males only (female weights affected by pregnancy and the metabolic demands of nursing young) among areas, ages (yearling vs. adult), and years using analysis of variance (ANOVA). Monthly comparisons of changes in mean weight were made using Tukey-Kramer HSD tests (SAS Institute 1994).

Adult female breeding rates were estimated each year based on whether females were pregnant (palpated fetuses), nursing, or anestrous. Chi-square tests with one degree of freedom were used to compare breeding rates of adults and yearlings, and capture sites.

Grids in both areas were arranged as 1-ha blocks, and each block was assigned a habitat type based on the dominant (≥50%) vegetation present. In both 1992 and 1993, traps were apportioned over each study area using random grid numbers to place traps (maximum number of traps used = 48 on RWF and 28 on AA) according to habitat availability. Chi-square analysis with one degree of freedom was used to compare expected captures based on habitat availability with actual captures in each habitat type.

Annual recovery rates on each study area (combined death and dispersal, September-September) were calculated for juveniles and raccoons ≥1 year, sexes combined, for 1990 and 1991 using the program JOLLY.AGE (Pollock et al. 1990). Sample sizes were too small to separate the sexes on each area. Male raccoons removed from the RWF were not used in the calculation of adult recovery on the RWF. Two X two chi-square tests of independence was used to compare recovery rates among years and age classes.

RESULTS AND DISCUSSION

Population Characteristics

There were 176 and 111 raccoons captured and released on the RWF and AA, respectively. Males predominated in captures on the AA but not on RWF (likelihood ratio chi-square = 12.9, df = 1, P = 0.0003) (Fig. 1). Combining areas, males predominated among juveniles and yearlings and females among adults (likelihood ratio chi-square = 4.6, df = 2, P = 0.09). Sex ratios did not differ among years on either area but we captured proportionally more adults on the AA (likelihood ratio chi-square = 8.1, df = 2, P = 0.02). Combining areas, adults were more common in our captures in 1992 and 1993 compared with 1990 and 1991 (likelihood ratio chi-square = 20.6, df = 6, P = 0.002). More juvenile males were captured on the RWF than on the AA after we removed older males from the RWF, but yearling males were proportionally more abundant on the AA (Fig. 1). The oldest females captured were 10 and 7 years old and the oldest males captured were 5 and 4 years old on the RWF and AA, respectively.

The mean number of raccoons captured/traps set each summer was also used as an index to raccoon abundance on each area. Mean captures per trap set were nearly identical on both areas, averaging 0.041 on the AA and 0.0405 on the RWF (one way ANOVA = 0.0018, df = 1, P = 0.96). However, calculated estimates of raccoon numbers using software program CAPTURE indicated that raccoons were more abundant on the AA, even though raccoons were hunted and trapped on the area (Table 1).

Breeding

Breeding rates for yearling females for both areas combined averaged 40% (N = 20), ranging from 25% (1990, N = 4) to 50% (1992, N = 6). Adult female breeding rates averaged 83% (N = 36), with a range of 50% (1992, N = 2) to 100% (1990, N = 9), and did not differ significantly (P>0.05) among years. Yearlings accounted for about 37% of the females ≥1 year old captured on both study areas. With a lower breeding rate compared with adults, yearlings contributed less to the total breeding effort in Lee County than in areas where yearlings constitute a higher proportion of the female population (Fiero and Verts 1986). Using the age structure of captured females to estimate potential production of young indicates that yearlings in an average year would contribute only about 20% of the young produced on the study areas during our study.

Stuewer (1943) reported that 53% of yearling females bred in 1 year in Michigan. Fritzell et al. (1985) reported yearling breeding rates between 38% to 77% for raccoons in Missouri and Illinois over a 3-year period, with pregnancy rates greater in Illinois. Adult females averaged a 95% breeding rate in Illinois and 81% in Missouri (range 68-96%) (Fritzell et al. 1985). Yearlings averaged a 62% breeding rate and adults 91% for a 3-year period in Iowa (Glueck 1985). Payne and Root (1986) found that 32% of the yearling females and 91% of the adults bred in southwestern Wisconsin over a 2-year period.

Movements

Movements between trapping periods were noted for 9 raccoons, 8 juveniles and 1 adult. Three juveniles and an adult moved <900 m between the capture site and site of recovery, and a juvenile male moved 5 km NE of the RWF, all within 1 year of capture. A juvenile male dispersed 26 km north of the RWF and was killed on the highway 2 years after capture. Another juvenile male dispersed 41 km SW of the RWF and was killed on the highway 16 months after capture. Two juveniles, a male and female, dispersed 2.5 km from the AA and RWF, respectively, both within 2 months of capture.

Body Weights

Raccoons were weighed at first capture during March (RWF only) and May through September (both areas). Combining data from both study areas, adult male body weights were similar among years ($F = 1.6$, $df = 3$, $P = 0.16$) and areas ($F = 0.004$, $df = 1$, $P = 0.99$). Body weights (mean ± S.E.) of adult males, areas and years combined, were significantly heavier ($F = 3.8$, $df = 6$, $P = 0.004$) in September (7.2 ± 0.31 kg, N = 9) compared with March (5.7 ± 0.35 kg, N = 7, RWF only), June (6.4 ± 0.29 kg, N = 11), and July (6.2 ± 0.42 kg, N = 5). Adult male weights did not differ among June , July, and August (6.9 ± 0.26 kg, N = 13) captures. Yearling males gained weight ($F = 4.9$, $df = 6$, $P = 0.008$) between March (4.7 ± 0.27 kg, N = 8) and June (5.5 ± 0.18 kg, N = 18) and July (5.4 ± 0.27 kg, N = 8).

Lipid deposition and weight gain occurs in temperate raccoons from mid-July until December (Lotze and Anderson 1979, Hanni and Millar 1993, Mech et al. 1968, Zeveloff and Doerr 1985). Sanderson and Hubert (1981) found November-December males from north-central Illinois to average 8.8 kg for adults and 5.4 kg for juveniles, while adult females averaged 7.6 kg for parous females and 7.5 kg for nulliparous females, significantly lighter than males in late fall (Sanderson and Hubert 1981).

Recovery Rates

Recovery rates were the product of deaths and dispersals on each area. The annual juvenile recovery rate (proportion recovered on the study area = 0.57) of RWF raccoons was comparable to the adult recovery rate (0.61) for 1990-1991, but the juvenile recovery rate was lower than the adult tag recovery in 1991-1992 (juvenile = 0.18, adult = 0.66, (2X2 chi-square test, $X^2 = 3.67$, $P<0.05$). The juvenile recovery rate of AA raccoons was 0.53

for 1990-1991 and 0.42 for 1991-1992. The tag recovery of 0.64 for adults on the AA for 1990-1991 did not differ from the juvenile tag recovery, but recaptures were too few to calculate an adult recovery rate for 1991-1992.

Juvenile tag recovery did not differ between areas for 1990-1991 or 1991-1992, even though the juvenile recovery rate was considerably higher on the AA than on the RWF for 1991-92, 0.42 vs. 0.18 ($X^2 = 1.2$, df = 1, $P = 0.30$). There was no indication that removal of older males significantly improved recruitment of juvenile and yearling raccoons into the RWF population. Sanderson (1987), using productivity and sex-age data collected from Illinois hunters and trappers for 1981-1984, estimated juvenile male annual survival at 0.28. Annual survival of after-birth-year males (0.58) exceeded that of after-birth-year females (0.42) (Sanderson 1987). Annual survival of adult raccoons averaged 0.68 for 2 areas in an epizootic rabies area in Pennsylvania (Brown et al. 1990).

All but 7 of 24 known deaths of raccoons marked on the RWF were human induced; 11 raccoons were trapped, 5 were killed by vehicles, 7 died of disease, and 1 was killed by a farm dog. There were 17 known deaths reported for raccoons marked on the AA; and only 2 of these were natural deaths. Twelve were shot by hunters, 2 died of disease, and 1 each died because of trapping, a highway accident, and a farm dog. Trapping accounted for 45% of the deaths among RWF raccoons, and hunting and trapping combined accounted for 76% of the deaths among AA raccoons. Hasbrouck et al. (1992) reported hunting and trapping accounted for 71% of the deaths of raccoons in Iowa.

Habitat Selection

During the growing seasons of 1992 and 1993, water-associated habitats, particularly emergent wetlands, attracted raccoons on both study areas. On the RWF in summer raccoons were captured more often in upland forest and around ponds and wetlands and less often in sunflower fields, soybeans, hayfields, and prairies (Table 2). On the AA, raccoons avoided pastures and corn fields and were captured more often in wet forest, and around ponds, wetlands, and marshes (Table 2).

CONCLUSIONS

Our estimates of 7-18 raccoons per 100 ha on each area fall within reported densities in North America. Raccoons averaged 10 per 100 ha in upland hardwoods in Virginia (Hallett et al. 1991) whereas Kennedy et al. (1991) estimated 13 raccoons per 100 ha of lowland forest in Tennessee. Conner and Labisky (1985) estimated 12 raccoons per 100 ha for a site in northern Florida. The highest published densities of raccoons were 167 raccoons removed from 41 ha on a lowland site in Missouri (Twitchell and Dill 1949) and 1 raccoon per 0.3 ha in an area of mixed agriculture and forest in Quebec (Riverst and Bergeron 1981).

Based upon age-specific life expectancy estimates and population age structure, longevity of raccoons in Lee County, Illinois, was <3 years. Females currently outlive males on our study areas. Although not presented here because of low sample size, male recovery rates were lower than females on both study areas, a reflection of higher dispersal rates for males (Nixon et al. 1993) as well as a higher probability of capture by hunters and trappers (Sanderson and Hubert 1981). Polygonous mating also often results in a higher mortality of males as a result of longer and more frequent seasonal movements in inclement winter weather and conflicts with other males. Sexual dimorphism in size favoring males (Sanderson 1987) and female-biased sex ratios in adult age classes are often characteristic of a polygnous mating system (Ritke and Kennedy 1993).

Raccoons were more abundant in summer on the AA area apparently in response to the greater amount of wetland associated habitats present on the area. Wetand habitat covered nearly 20% of the AA compared to only 9% of the RWF (Table 2) and these additional areas attracted more raccoons. Leberg and Kennedy (1988) found that raccoon densities were highest in bottomland deciduous forests in west Tennessee and that wetland habitats supported more females and young than upland habitats. Fritzell (1978a) observed that raccoons favored wetland-associated habitats in spring and summer in North Dakota. Glueck (1985) found lowland forest to be the favored habitat for raccoons in Iowa, with the use of upland forest being important only in the fall. Leberg and Kennedy (1988) found juveniles more abundant in bottomland habitat and attributed this difference to habitat -specific reproduction, with more young produced in wetlands. We found juveniles more abundant on the RWF, although wetland associated habitats were more abundant on the AA (Table 2).

There is conflicting evidence for territorial behavior among male raccoons. Fritzell (1978b) reported territorial behavior among males in North Dakota, but Johnson (1970) in Alabama and Allsbrooks and Kennedy (1987) in Tennessee reported overlapping ranges. We found that both sexes had some sharing of ranges during the summer months. Fifty-four of 98 males (55%) were captured in the same trap or within the same hectare as another male during the same summer. Of these captures, 6 were of 2 yearlings, 12 were of an adult and a yearling, and 12 were of 2 adults. For 69 females, only 20 (29%) were captured in the same trap or hectare as another female during the same summer of trapping. Of these captures, 3 were of 2 yearlings, 5 were of an adult and a yearling, and only 2 were of 2 adults. These capture rates were different (Fisher's exact test $P = 0.0009$) between the sexes and suggest that females may be less tolerant of same sex conspecifics than males, at least during the litter-rearing period in summer. Females may also be more tolerant of yearling females than of older females within their postpartum ranges. These yearlings may also have been related to the adult female and shared portions of her range, although philopatry has not been specifically reported for the raccoon. Indeed, both sexes may mutually avoid one other during the summer (Mech et al. 1966, Johnson 1970). Fritzell (1978b) found extensive summer range overlap among parous females in North Dakota, but these females avoided contact with other raccoons except for their young. Twitchell and Dill (1949) removed more than 100 raccoons from dens in Missouri and found males more likely to den with others (32/40, 80%) than were females (28/60, 47%).

Apparently our male removals from RWF were too small (average = 8 per year) to affect male recruitment from resident young or immigrants, based on a between-area comparison of recovery rates of males marked as juveniles and the recruitment rates of yearlings after male removals (total captures of yearlings). The proportion of males captured each year did not differ between areas either before or after male removal from RWF, ranging between 40% (RWF 1990) and 74% (AA 1991).

Total known losses of captured males from the RWF (assuming the males removed each year were tagged and in the population each fall) totaled 43% (7/16), 17% (4/23), and 49% (18/37) for 1990, 1991, and 1992, respectively. Numbers of trap-susceptible males were not affected by these losses, and annual recovery rates of adults averaged about 60% on both areas during 1990-1991. Clark et al. (1989) estimated a maximum sustainable potential harvest of 41% of preharvest numbers for raccoons in Iowa. Sanderson (1987) estimated sustainable harvest levels ranging from 49% to 59% of the total population for 3 levels of fecundity for raccoons in west-central Illinois. However, harvests of juveniles could be considerably higher than these levels, up to 76% for males and up to 60% for females in high-fecundity populations. Sustainable harvest levels for adults were considerably lower, between 29% and 33% for males and 46% and 54% for females (Sanderson 1987). Known losses of males exceeded these levels for 1990 and 1992, but recruitment of males was sufficient to sustain the male population.

These data were collected at a time of low pelt prices and reduced harvests compared to the long-term mean for raccoon harvests in Illinois (Bluett and Hubert 1992). The low harvests and generally mild winters allowed raccoon numbers to increase during the study on both study areas. Postweaning annual mortality levels appear to be <40% from all causes, based on recoveries of marked raccoons in northern (this study) and west-central Illinois (Nixon et al. 1993).

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Figure 1. Sex and age of raccoons captured on the Richardson Wildlife Foundation (RWF) and the Amboy Area (AA), Lee County, Illinois, 1990-1993.

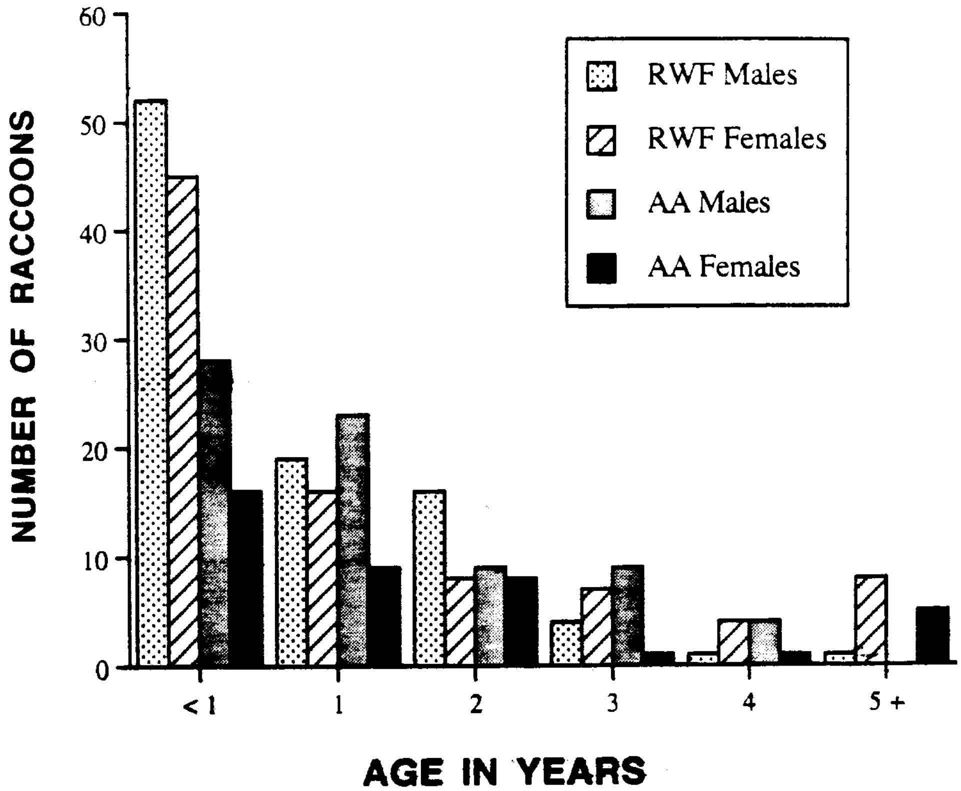

Table 1. Estimated number of raccoons present in late summer on the Richardson Wildlife Foundation (RWF) and Amboy Area (AA), Lee County, Illinois, 1990-1992.

		Capture Estimates				
Year	Area	Mb[a]	95% Conf. Interval	Mbh[b]	95% Conf. Interval	Aver. No. Per 100 Ha
1990	RWF	49	39-93	40	37-67	7
	AA	28	19-93	18	–	8
1991	RWF	28	26-42	28	26-42	4
	AA	38	30-77	36	28-67	12
1992	RWF	42	36-68	42	36-68	6
	AA	51	41-70	55	44-81	18

[a] Mb = Model where capture probabilities change due to behavioral response from first capture (Pollock et al. 1990).
[b] Mbh = Model where heterogeneity of capture probabilities are found and capture probabilities change with capture history.

Table 2. Observed and expected raccoon captures on the Richardson Wildlife Foundation and Amboy Area with traps set in proportion to habitat availability during summer-early fall 1992 and 1993. P-Values are for one degree of freedom.

Habitat type	Proportion available	Observed captures	Expected captures	Chi-square values	P value
		RICHARDSON WILDLIFE FOUNDATION			
Corn	0.28	29	31.8	1.2	0.30
Grasses	0.14	2	16.0	16.6	0.0005
Prairie	0.14	6	15.3	8.1	0.005
Soybeans	0.09	1	9.6	9.7	0.005
Forest	0.06	21	7.0	28.6	0.0005
Pines	0.06	9	7.0	0.7	0.40
Ponds	0.04	15	4.9	18.9	0.0005
Oats	0.04	0	4.6	5.1	0.025
Wetlands	0.04	28	4.5	125.6	0.0005
Sunflowers	0.03	0	3.2	3.9	0.05
Buildings	0.01	0	1.2	1.6	0.30
Wet forest	0.01	1	1.1	1.4	0.30
		AMBOY AREA			
Pasture	0.24	5	11.1	5.1	0.05
Pines	0.18	5	8.5	2.1	0.20
Wet forest	0.14	17	6.7	17.5	0.0005
Bur Oak	0.13	5	6.2	0.4	0.60
Corn	0.07	0	3.4	3.9	0.05
Soybeans	0.04	0	2.0	2.3	0.20
Succ. forest	0.04	1	1.8	0.5	0.50
Ponds	0.04	5	1.7	6.4	0.025
Prairie	0.02	0	0.9	1.0	0.40
Oats	0.02	0	0.7	0.8	0.40
Wetlands	0.01	5	0.6	25.4	0.0005
Marsh	0.01	3	0.5	12.5	0.0005

APPENDIX 5. PERIODONTAL AND DENTAL LESIONS IN RACCOONS (*PROCYON LOTOR*) FROM A FARMING AND A RECREATIONAL AREA IN WEST-CENTRAL ILLINOIS.

Running Heading: HUNGERFORD ET AL. - DENTAL HEALTH IN ILLINOIS RACCOONS

Title: Periodontal and Dental Lesions in Raccoons (Procyon lotor) from a Farming and a Recreational Area in West-Central Illinois

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ABSTRACT

Dental health was evaluated in two populations of raccoons (Procyon lotor) in western Illinois; one from a rural agricultural area with low human density and the other from a nearby state park with heavy human and raccoon use. From 1989 through 1993, 300 raccoons were live-trapped in the agricultural area and 246 raccoons were live-trapped in the park. After immobilization with tiletamine+zolazepam, all raccoons were weighed, measured, aged and tagged. Oral health was assessed with quantitative measures derived from human periodontal epidemiology: gingival index, gap junction depth, calculi index and tooth wear. Raccoons from the park were significantly older and smaller, but not thinner, than raccoons from the farmed area. Gingival and periodontal indices, tooth wear, tooth loss and caries increased significantly from juveniles to yearlings to adults. There were no seasonal or sex differences between raccoons in dental indices. Animals with high scores for one oral measure tended to have high values for all indices. Dental health was generally good for juveniles and yearlings from both sites. Among adults, periodontal indices and the prevalence of caries were significantly higher in the park, but prevalence of broken or missing teeth was similar for both populations. There was no association between body condition and a higher dental score or more missing or broken teeth. Few studies have examined gingivitis, periodontal disease, tooth loss or caries in free-ranging wildlife, but risk patterns for these maladies seem to differ between wild species, humans and domestic animals. Quantitative assessment of oral health may be a valuable addition to measurement of human-induced effects on wild populations.

KEY WORDS: Raccoon, Procyon lotor, teeth, periodontal disease, veterinary dentistry

INTRODUCTION

The raccoon (Procyon lotor) is widely distributed throughout North America (Kaufmann, 1982) and has also been introduced into Europe (Fatullaevich-Aliev and Sanderson, 1966). The natural diet of this opportunistic omnivore includes plant material, crayfish and insects, but raccoons have also adapted to human environments and food sources (Hoffmeister, 1989). For example, suburban raccoons will utilize human garbage even when a traditionally preferred food source, such as corn, is closer to their denning areas (Slate, 1985). This ability of raccoons to exploit human modified habitats can enhance urban appreciation of wildlife, but may have negative effects on human well-being by increasing the potential for bites, disease transmission and property or crop destruction. Use of human resources may also have both positive and negative consequences for raccoons.

Increased levels of dental disease, in a variety of animal species, have been attributed to artificial diets. Dental caries and periodontal disease were both more prevalent in captive primates and other mammals than in their wild counterparts of similar ages (Robinson, 1979). Increased dental disease in wild chimpanzees was associated with use of farm crops and refuse heaps (Jones and Cave, 1960). Prevalence of periodontal disease and caries in bears varied greatly between two different study areas, although the cause was unknown (Manville, 1992). Dental disease has been related to factors such as age, hygiene, general nutrition, specific dietary imbalances and food consistency (Hamp et. al., 1984; Vosburgh et al., 1982). No studies have compared effects among adjacent wild populations differing in levels of exposure to human food refuse.

As part of a study of raccoon ecology and health in western Illinois, dental disease was evaluated in two populations of raccoons; one from a rural agricultural area with low human density and the other from a nearby state recreational area offering raccoons access to human food and garbage. The objective of this study was to compare raccoon dental health between these two populations and to assess relationships between the presence of gingival, dental and periodontal lesions and raccoon age, sex and body size.

MATERIALS AND METHODS

Noncontiguous sites with close geographic proximity were selected to minimize potential differences in raccoon populations, such as genetics, climate or ecology, not related to human activities. The rural agricultural study site was a 2,310 ha forested/extensively farmed area (AG; 39°57' N, 90°53' W) with 59% row crops, 15% pasture/forage and 25% shrub forest. Minimum raccoon density was estimated to be 4.5 raccoons/km^2 (Nixon et al., 1994). Cattle, horses, swine and sheep were grazed within the study area. Raccoons had continual access to livestock feeds, garbage from individual farm households and other trash piles, throughout the year. Human contact occurred through raccoon feeding and denning, as well as hunting and trapping. The public recreation area was a nearby 644 ha state park (SP; 39°53' N, 90°56' W) with a substantial raccoon and nuisance raccoon population, estimated to be at least 13.5 raccoons/km^2 (Nixon et al., 1994). Land cover was 75% oak-hickory forest, 6% row crops and 11% pasture/forage. Public attendance at this park was approximately 205,000 visits per year, almost entirely from late spring through early fall. During times of heavy use, the contact potential between raccoons and campers was extensive, with reports of raccoons eating garbage from bags and cans, food left on picnic tables, in tents or in trailers and accepting food from campers' hands. Raccoons also chewed on coolers and opened containers that were not strapped shut (L. Hungerford, unpublished survey data, 1990). Raccoons in the park had access to abundant human food wastes, spring-to-fall, but not during other months.

Raccoons were live-trapped in both study sites during the spring (March to June) and fall (August to October) from 1989 through 1993. Each animal was sedated with tiletamine+zolazepam (Telazol®, Fort Dodge Laboratories, Inc., Fort Dodge, Iowa 50501) given intramuscularly at 5mg/kg and weighed, measured and given a thorough physical examination. The oral cavity was examined and photographed. A premolar was extracted from animals >1 year old to confirm age. Numbered, rotatable ear tags were placed as permanent identification and some animals received radio collars. Following recovery from sedation in a dark, quiet area, raccoons were released at the site of capture.

Five indices were used to assess oral health (Table 1). All were modified from measures developed for human and domestic animal dental epidemiology (Spolsky, 1990). Gingival Index (GI) quantified the redness and friability of the gingiva. Attachment Loss (AL) measured the distance between the cemento-enamel junction and the bottom of the periodontal pocket between the gingiva and the tooth. Measurements were made using a Williams round single end periodontal probe (Henry Schein, Inc., 5 Harbor Park Dr., Port Washington, New York, USA, 11050) and averaged for all teeth excluding the canine teeth. Canine Attachment Loss (CAL) was measured as an average of the pocket depth for all canine teeth. Calculi Index (CI) graded the amount of calculus on the teeth. Tooth wear was categorized as light, moderate or severe in each animal. Major injuries to the mouth, damage to or loss of teeth and presence of dental caries were separately recorded on each field sheet using a diagram of the upper and lower raccoon dentition (dental formula - 2 x (3/3, 1/1, 4/4, 2/2)=40).

Animals were classified into age groups based on appearance, tooth eruption and body weight (Nixon et al., 1994). Ages were grouped as juveniles (< 1 year old), yearlings (≥ 1 but < 2 years old) or adults (≥ 2 years old). Classifications were confirmed based on cementum annuli of a first premolar from animals one year and older (Grau et al. 1970). Adults were subclassified into age groups based on cementum annuli. To assess variation in thinness between animals, an index of body condition was computed as the ratio of the animal's actual weight to an "ideal" weight. This reference weight was calculated for each animal based on its length using the relationship $Weight_{kg} = 80*(Length_{cm})^{2.7}$ developed by Radinsky (1978).

The complete database contained information on all captures for each raccoon. For raccoons captured more than once, one record was randomly selected from among those with complete dental information. Potentially confounding effects of age, sex and size were assessed between the total AG and SP populations and between the adults in both populations. Dental indices and proportions of animals with either damaged teeth or dental caries were compared among age groups and then between sites, controlling for age. Mean dental scores were graphed. Because juveniles and many yearlings lacked complete permanent dentition, subsequent analyses included only adults. Dental scores for adults were compared between sites, controlling for age. Adults with different levels of dental lesions were compared for differences in weight, length and thinness. The proportion of animals with broken teeth and with dental caries were examined for relationships with the other dental health indices.

Analyses of population and health data were performed using a statistical package for a DOS-based PC running Windows (SAS version 6.10, 1995, SAS Institute Inc., SAS Circle, Box 8000, Cary, North Carolina, 27512-8000, USA). Fishers exact test was used when both dependent and independent variables were dichotomous (Fleiss, 1981). Cochran-Mantel-Haenszel chi-square statistics were used for other categorical data to test for differences between rows (CMH; Fleiss, 1981) or for trend across rows (BD; Breslow and Day, 1980) controlling for categorical confounding variables. The distributions of continuous data were tested for normality and homogeneity of variance. Analysis of variance (ANOVA; Zar, 1984) was used when assumptions were met. A Wilcoxon test, or Friedman's test to correct for confounders, (Zar, 1984) was used in other cases. Because of the number of comparisons made, a cut-off value of $p<0.01$ was used to establish statistical significance.

RESULTS

In the agricultural area, data were collected on 300 raccoons, of which 183 were captured in the spring and 117 in the fall. There were 176 males and 124 females composed of 105 juveniles, 97 yearlings and 98 adults. In the recreational area, 246 raccoons were examined, of which 158 were captured in the spring and 88 in the fall. There were 102 males and 144 females composed of 69 juveniles, 60 yearlings and 117 adults.

The age distribution and physical size of raccoons differed between sites, but the sex ratio did not. The sample of raccoons from the recreational area contained more adults and fewer juveniles (CMH, $p=0.002$) and the adults were slightly older in the park than the farmed area (SP median=3.5, mean=4.3; AG median=2.5, mean=2.9; Wilcoxon, $p=0.001$). The oldest animal in the AG group was 6.5 years old while the SP sample contained 14 animals between 7 and 11.5 years of age. There were no differences in weight, length or thinness between adults of different ages (ANOVA, $p>0.20$). Controlling for sex and age, adult raccoons in the recreational area were shorter (ANOVA, $p<0.001$) and weighed less (Friedman, $p<0.003$) than those in the farming area, but they were not significantly thinner (ANOVA, $p>0.10$).

Gingival and calculi index scores, attachment loss measurements and tooth wear differed between age groups (Figure 1; BD, $p<0.01$). All dental parameters except pocket depths (AL and CAL) were significantly different between sites (Figure 2; CMH, $p<0.001$). Among juveniles and yearlings, most animals were scored as normal/healthy on these indices. There were no significant differences between sites in the dental scores for raccoons in either of these age groups. Among adults, tooth wear increased with age (BD, $p=0.002$) but there were no significant trends for GI, GJ, CGJ or CI. When sites were compared for adults controlling for age, GI, CI and tooth wear were greater in the recreational area (BD, p<0.001 for all) but other indices did not vary significantly. Animals with more tooth wear were thinner (Wilcoxon, p<0.001) but there were no other differences in weight, length or thinness between adults differing on any of the dental parameters.

Overall, 105 (19.4%) of the raccoons had broken or missing teeth and the proportions with tooth damage differed between age groups (Figure 1; BD, p<0.001). The most frequently affected teeth were the canines, with 11.7% of raccoons having damage to canines alone, 3.5% having canines and premolars or molars affected and 4.0% having only premolars or molars affected. Incisor teeth were not included in these analyses. Among affected animals, the number of broken/missing teeth ranged from 1 to 11, with a median of 3. There were no differences in the number of broken/missing teeth between males and females or between study sites. There were no differences in length, weight or thinness for animals with and without broken teeth. The proportion of animals with broken or missing teeth, controlled for age differences, increased as gingival index, calculi index, attachment loss scores and tooth wear increased (BD, p<0.002 for all).

Dental caries was observed in only 37 (6.8%) of all animals. The teeth primarily affected were the molars and last premolars. The proportion of raccoons with dental caries was higher in adults than yearlings or juveniles (Figure 1; BD, p<0.001), but did not vary with age among adults. The number of animals with caries was similar between genders. There were no differences in weight, length or thinness between animals with and without dental caries. The proportion of animals with caries, among adults, increased as gingival index, calculi index and tooth wear increased (BD, p<0.001 for all).

There were five times more animals with caries in the recreational than the agricultural site (Figure 2; Fisher, $p<0.001$).

DISCUSSION

Contact between humans and wildlife has positive and negative consequences for each species. Human-raccoon interaction occurred in both study sites, but the consistency and type of contact differed. A positive effect for the park raccoon population was increased longevity. Hunting and trapping were prohibited within the park, but allowed on adjacent land. Sport harvest accounted for 63% of known-cause adult mortality in the farmed area and 24% in the park (Nixon et al., 1994). Although decreased harvest pressure undoubtably shifted the population age structure, more abundant and accessible seasonal food sources in the park may have also allowed older animals to continue to survive despite age-related infirmities. Analysis of other potential risk factors included adjustment for these significant age effects.

Differences in average body size have been reported for raccoon populations from disparate geographic locations and from areas differing in soil fertility (Johnson, 1970). The differences in lengths and weights between our neighboring study sites were unexpected, especially in conjunction with the similarity in relative body condition. In domestic species, diminished adult stature or body size is a recognized consequence of inadequate nutrition of young animals, while body fat reflects more recent nutritional status (Church and Pond, 1988). Attainment of adult weight and epiphyseal closure occur at 15-18 months of age in raccoons, corresponding to their second autumn

(Johnson, 1970). The decreased size of SP raccoons may have resulted from cessation of supplemental feeding of the higher density park population during the fall to spring period when human garbage was absent. Intermittent access to refuse of high caloric content may have allowed some spring/summer compensatory weight gain, sustaining relative body mass and condition.

A striking finding in raccoons captured in the park was their poor oral health (Figure 3). Dental scores increased with age in both populations, but gingival and calculi indices, tooth wear and caries prevalence were significantly higher in the park, after adjusting for age differences. Dental health was generally good for juveniles and yearlings from both sites, with SP adults scoring consistently poorer across all adult age classes. Presence of dental lesions can have varying impact on wild populations. For most species, dental health has not been evaluated in the wild. For Darajani baboons (Papio cynocephalus) and Weddell's seal (Leptonychotes weddelli), dental pathology and tooth loss have been reported to limit adult lifespan (Robinson, 1979). Decreased body condition of our adult raccoons was associated with increased tooth wear, but not with age alone. Because raccoons with missing teeth and/or substantial periodontal changes were not thinner than raccoons with healthier mouths, consequences of disease may be less severe than of tooth wear for raccoons which can grasp food with either teeth or paws. In the park, where the population was older and where dental health was the most compromised, availability of human food refuse might have minimized consequences of decreased ability to catch and chew naturally occurring prey items.

Periodontal changes may occur following tooth damage or may be an inciting factor for tooth loss. Although periodontal disease was more prevalent and severe in the park, there were no differences in the number of broken teeth between locations. This suggests that the higher level of disease in the park was not due merely to physical trauma from using teeth to open cans and garbage containers. Specific nutritional deficiencies may lead to gingival and periodontal disease (Spolsky, 1990). Others have speculated that the consistency and carbohydrate composition of refuse as well as the presence of increased bacterial levels in decaying food may lead to periodontal disease in animals (Jones and Cave, 1960; Robinson, 1979; Vosburgh et al., 1982). Caries, which has been associated with increased oral carbohydrate fermentation in humans (Sanz et al., 1990), was also more prevalent among SP raccoons, supporting this theory.

In both populations, gingival and periodontal changes, tooth wear, tooth damage/loss and caries increased from juveniles to yearlings to adults. Among adults, tooth wear increased with age, as has been reported by others (Grau et al., 1970; Johnson, 1970; Kaufmann, 1982; Hoffmeister, 1989), but there was no trend of worsening gingival or dental health in older animals. In humans, gingivitis peaks in puberty, then drops sharply to remain almost constant or increase slowly with age (Spolsky, 1990). Periodontal disease, in humans and dogs, increases in both prevalence and severity with age (Spolsky, 1990; Hamp et al., 1984). Among adult bears, there was no relationship between periodontal disease and age, however, caries increased with age (Manville, 1992). Increased periodontal indices and tooth loss were positively correlated among raccoons, as has also been reported for humans (Spolsky, 1990). In all but one animal, the tooth damage appeared traumatic in origin, with secondary periodontal changes. One older SP male had high scores on periodontal indices, loss of several premolars and molars and loosening of other teeth.

Human-raccoon interaction can provide an enriching experience for humans, although the potential exists for negative consequences, such as bites, zoonotic infection or property damage. Visitors to the park studied here were almost unanimously pleased with the presence of raccoons at the site. One trail was informally designated the "Raccoon Path" because visitors, especially those with children, found it a convenient place to consistently observe raccoons. But while encouraging public interest in wildlife, the benefits and consequences for wild populations, including the effect of supplemental feed sources on growth, longevity and dental health, should be considered. Further work on the nature and prevalence of oral disease in raccoons and other wild species is needed to allow inclusion of dental health in assessment of effects of human activity.

ACKNOWLEDGMENTS

We wish to thank the landowners, park personnel, especially Park Superintendent James Assell, and park visitors who allowed us access to the study areas and helped with their cooperation and goodwill. We would also like to thank Dr. J. Thomas, J. Seets, G. R. Lang, A. Rothering and J. Frey for help with data collection and entry. This paper is a contribution (in part) of Federal Aid in Wildlife Restoration, W-104-R, the Illinois Department of Conservation, the U.S. Fish and Wildlife Service, the University of Illinois and the Illinois Natural History Survey, cooperating.

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Table 1. Epidemiologic measures used to evaluate dental health in western Illinois raccoons, 1989-1993.

INDEX	DEFINITION
Gingival Index (GI)	0 = Normal
	1 = Mild inflammation, characterized by slight change in color, slight edema; no bleeding on palpation.
	2 = Moderate inflammation characterized by redness, edema and glazing; bleeding on palpation.
	3 = Severe inflammation with marked redness, edema and ulcerations; tendency to spontaneous bleeding
Attachment Loss (AL)	Measured in millimeters and averaged separately for canine teeth (CAL) and for all other teeth (AL)
Calculi Index (CI)	0 = Absent
	1 = Supragingival only with no or slight ($\leq$ 1 mm) extension below the gingival margin
	2 = Moderate amount of calculus on teeth with both supragingival and subgingival calculus present on at least one tooth
	3 = Abundant supragingival and subgingival calculus on several teeth
Tooth wear	0 = None
	1 = Mild as characterized by blunting of tooth profiles
	2 = Moderate as characterized by wear present but crests of molars still evident
	3 = Heavy as characterized by teeth in one or more quadrants worn close to the gingival margin

Figure 1. Comparison of oral health indices between juvenile, yearling and adult raccoons from western Illinois, graphed as mean scores for Gingival Index, Attachment Loss, Calculi Index, Tooth Wear and percent affected for Tooth Damage and Caries, 1989 to 1993.

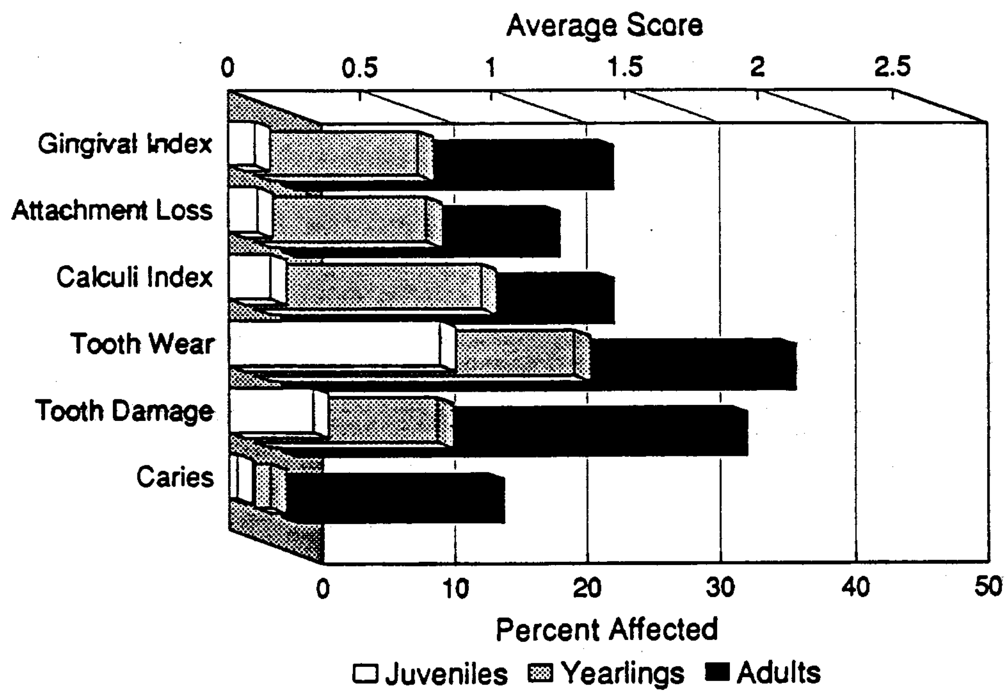

Figure 2. Comparison of oral health indices between raccoons from an agricultural area and nearby state park in western Illinois, graphed as mean scores for Gingival Index, Attachment Loss, Calculi Index, Tooth Wear and percent affected for Tooth Damage and Caries, 1989 to 1993.

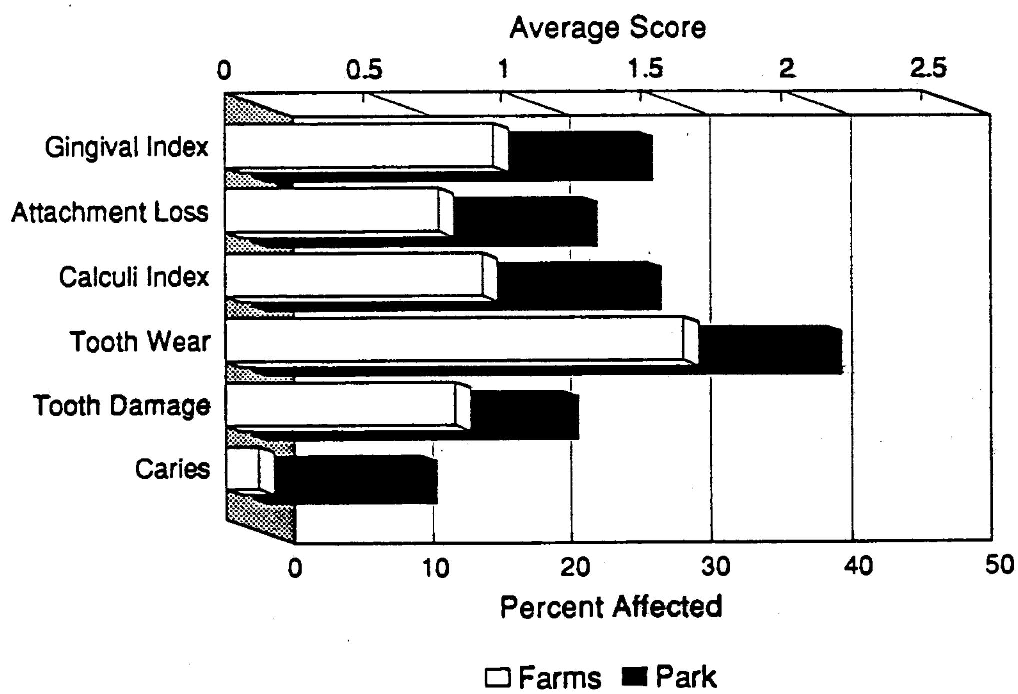

Figure 3. Photograph of the oral cavity of an adult female raccoon from the state park population in western Illinois, 1990.

APPENDIX 6. ABSTRACT: SURVEY OF THE ORAL AEROBIC MICROBIAL FLORA OF *PROCYON LOTOR*.

Survey of the Oral Aerobic Microbial Flora of *Procyon lotor*

M.A. Mitchell, L.L. Hungerford, C.M. Nixon, T.L. Esker,
R. Koerkenmeier, A.R. Smith

Submitted to : American Society for Microbiology
Journal of Clinical Microbiology

Abstract

The raccoon (*Procyon lotor*) can inflict bite injuries leading to wound infection. Bacteria from the oral cavity of twenty-nine healthy raccoons were cultured aerobically. Fifteen different species were isolated. The aerobic flora was similar to that reported for other wild and domestic carnivores. The most prevalent isolates were *Streptococcus sp*., *Staphylococcus sp*., and *Bacillus sp*. In twenty-seven of the raccoons the oral flora was both gram positive and gram negative. Knowledge of the typical oral aerobic microbial flora may be useful to clinicians planning the medical management of a raccoon bite wound.

APPENDIX 7. ABSTRACT: SEROLOGIC SURVEY FOR CANINE DISTEMPER VIRUS, *LEPTOSPIRA SP.*, PSEUDORABIES VIRUS, AND *TOXOPLASMA GONDII* IN RACCOONS FROM ILLINOIS.

SEROLOGIC SURVEY FOR CANINE DISTEMPER VIRUS, LEPTOSPIRA SP., PSEUDORABIES VIRUS, AND TOXOPLASMA GONDII IN RACCOONS FROM ILLINOIS.

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ABSTRACT: Seroprevalence patterns of 4 infectious agents, canine distemper virus, Leptospira sp., pseudorabies virus, and Toxoplasma gondii were examined in 479 raccoons livetrapped in a state Park (209 raccoons) and farmland area (270 raccoons) located in west-central Illinois. Eighty-six (23%) of 368 raccoons were seropositive for canine distemper, with no significant differences detected between study areas, seasons, or sexes. Seroprevalence was higher in adults (39%) than for juveniles (14%) or yearlings (13%) and was also higher in 1991 compared with 1992. Two hundred twenty-two of 459 (48.3%) raccoons tested were positive for Leptospira interrogans, with no significant difference detected between study years, seasons, or sexes. Seroprevalence was lower in raccoons captured on the Park study area and for juveniles (33%) compared with yearlings (53%) or adult raccoons (58%). Eighty-two of 479 (17%) raccoons tested positive for pseudorabies virus, with no significant differemces found between study areas, study years, seasons, or sexes. Sertoprevalence among juveniles was lower (3%) than for yearlings (15%), or adults (30%). One hundred eighty-four

of 379 (48.5%) tested positive for Toxoplasma gondii, with no differences detected between study areas, study years, or sexes. Raccoons captured in the fall had higher seroprevalence rates (73%) than those captured in spring (33%). Juveniles had a significantly lower infection rate (14%) compared with yearlings (53%) or adults (73%).

In light of CDV seroprevalence in free ranging raccoons, vaccination against CDV for domestic canids and control over exposure is strongly recommended. The findings of high prevalence of Leptospira raises concern for the potential exposure of humans and domestic animals where raccoons are abundant. Identification of free-ranging pseudorabies infected raccoons that survive > 6 months could indicate a potential for raccoons to maintain and spread the disease among swine herds. The high seroprevalence of Toxoplasma gondii in Illinois raccoons should be of concern to those humans who consume raccoon meat, if the meat is poorly cooked and prepared.

APPENDIX 8. ABSTRACT: RECOVERY RATES FOR RACCOONS IN WEST-CENTRAL ILLINOIS.

Recovery Rates for Raccoons in West-central Illinois

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Charles M. Nixon, Illinois Natural History Survey, Champaign 61820

Joseph B. Sullivan, Illinois Natural History Survey, Timewell 62375

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ABSTRACT

The objectives of the study were to determine the effects of hunting, trapping, body condition, breeding condition, and exposure to disease on raccoon survival. Raccoons were livecaptured on 2 areas in Brown County, west-central Illinois during 1989-93, one (SSSP) closed to hunting and trapping during the study and the second (MSA) open to hunting and trapping. Kaplan-Meier estimates showed higher annual survival ($\pm$SE) for radiocollared raccoons ($S = 0.79 \pm 0.05$) compared to non-radiocollared ($S = 0.66 \pm 0.03$) ($X^2 = 4.97$, 1 df, $P = 0.03$), but overall survival was not significantly different ($X^2 = 1.16$, 1 df, $P = 0.28$). In MSA, annual recovery rates of after-birth-year (ABY) females (0.75) were greater than ABY males (0.57) ($P = 0.04$) and females had lower mortality during the harvest season (Nov thru mid-Jan) than males.

Recovery rates were not associated with the breeding status of female raccoons ($P = 0.56$) nor was breeding status related to body condition ($P = 0.62$). Recovery rates were not related to condition index in MSA ($P = 0.82$) or SSSP ($P = 0.37$). In the harvested population, higher indices were recorded in late fall for juveniles ($P < 0.0001$) and yearlings ($P = 0.004$)

Actual survivorship (not recovery) was calculated for a subsample of raccoons for which their life history was known. For these, the probability of a juvenile male surviving to become a yearling in SSSP (0.87) was almost twice that in MSA (0.46). SSSP raccoons showed a linear decline in survival probability from year to year, and both MSA and SSSP male yearlings (1 year

old) had lower expected survival to adulthood (2 years old) than did adults of reaching 3 years old. However, reaching adult age conferred only a temporary increase in survivability, particularly for raccoons in MSA.

Hunting and trapping (harvest mortality) accounted for 67.7% of known deaths (N = 124) in MSA, but no single age group was more susceptible to hunting versus trapping (P = 0.69). The mean age of MSA raccoons which were killed by hunters was 2.01 years, compared to 2.95 years for disease-killed and 4.16 years for those killed by dogs.

Of the 301 raccoons tested for exposure to diseases, 72% tested positive for at least one of the following: distemper, leptospirosis, toxoplasmosis, and PRV (pseudo-rabies). We could find no difference in recovery rates between positively and negatively tested raccoons in MSA (P = 0.40) or SSSP (P = 0.17).

ILLINOIS
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CENTER FOR WILDLIFE ECOLOGY
217-244-4289

11 October 1995

Mr. Bob Bluett
Division of Wildlife Resources
Illinois Department of Natural Resources
Lincoln Tower Plaza
524 S. Second Street
Springfield, IL 62701-1787

Re: **Addition to Final Report** for Cooperative Furbearer Research, Illinois Raccoon Investigations, Project W-104-R

Dear Bob:

I have enclosed 5 copies of the thesis ("Home Range of Adult Raccoons Pre- and Post-Removal of a Same Sex Neighbor in West-Central Illinois" by Anthony Rothering). These should be attached to the 5 copies of the above referenced report sent to you on August 29, 1995. Also, please find 10 additional copies of this thesis for the Feds.

Please let me know if you have any questions.

Thank you!

Sincerely,

Patrick W. Brown
Director

PWB:ts

Enclosures (5 copies)

Note: As of July 1, 1995, this Survey is part of a newly formed Department of Natural Resources. To conserve natural resources and reduce waste, agencies affected by the merger are using their remaining inventory of stationery and printed envelopes.

607 East Peabody Drive, Champaign, Illinois 61820 USA (217) 333-6880 Fax (217) 333-4949
Department of Energy and Natural Resources

ILLINOIS
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CENTER FOR WILDLIFE ECOLOGY
217-244-4289

29 August 1995

Mr. Bob Bluett
Division of Wildlife Resources
Illinois Department of Natural Resources
Lincoln Tower Plaza
524 S. Second Street
Springfield, IL 62701-1787

Re: Final Report for Cooperative Furbearer Research, Illinois Raccoon Investigations, Project W-104-R

Dear Bob:

I have enclosed 5 copies of the above referenced project and 10 additional copies (for the Feds.) of the 3 publications (see Appendix 3, 4, 5) included in this report.

Please let me know if you have any questions.

Thank you!

Sincerely,

Patrick W. Brown
Director

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Enclosures (5 copies)

Note: As of July 1, 1995, this Survey is part of a newly formed Department of Natural Resources. To conserve natural resources and reduce waste, agencies affected by the merger are using their remaining inventory of stationery and printed envelopes.

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