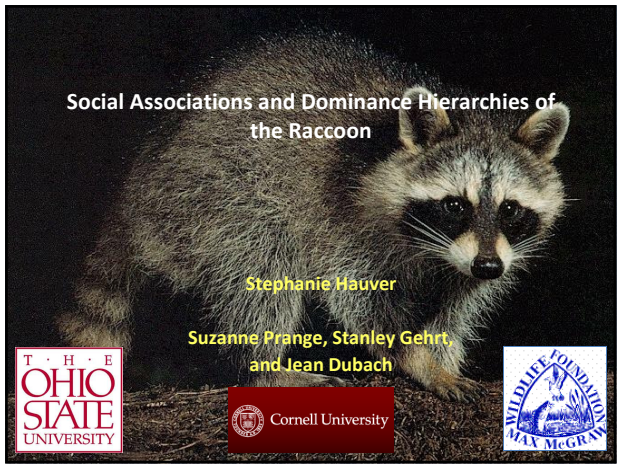
Stephanie Hauver 氏

ステファニー・フーバー

2005年からアライグマの研究開始。2009年まで社会関係や繁殖について研究。

2009年から2010年はアフリカで野生動物の研究に従事。

現在はコーネル大学でアライグマ狂犬病対策のため、経口ワクチンの研究やアライグマの個体間関係の調査をしています。

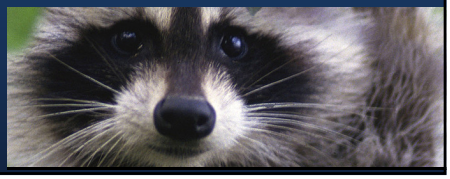


Overview

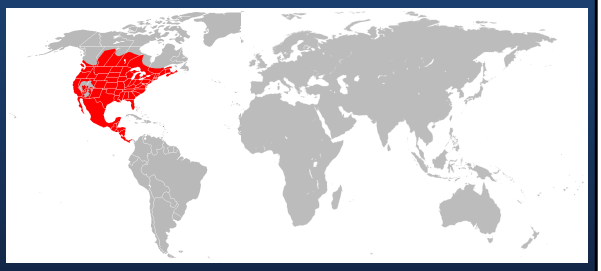
- Introduction to raccoons
- Comparison of Urban vs. Rural Raccoons
  - Home range size
  - Home range overlap
  - Contact rates
- Dominance Hierarchies
- Difference in Capture Techniques/Implications

The Raccoon

- Mid-sized carnivore (omnivore)
- Nocturnal
- Semi-arboreal
- Males live in groups for mating access
- Wide spread and common in North America

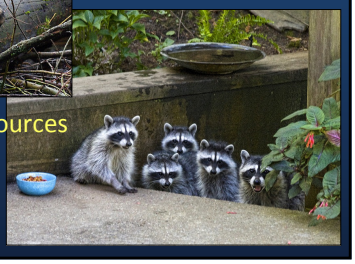


Range



Increasing Population

Rural vs. Urban Populations



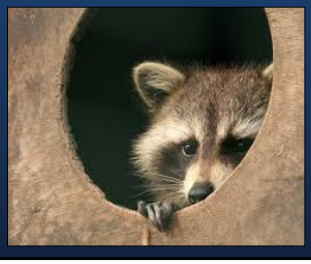
Changes in food resources leads to changes in social behavior?

Rural Raccoon Populations

- Low density
- Aggressive and territorial (Fritzell 1978)
- Neighbor recognition (Barash et al. 1974)

Urban Raccoon Populations

- How does raccoon behavior change as density increase and food resources become more abundant?



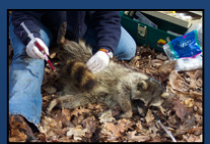
Study Site

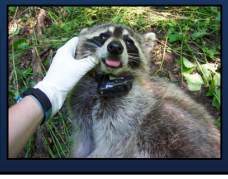
- Ned Brown Forest Preserve; Busse Woods
- 20 miles Northwest of Chicago, IL
- 1499 ha forest preserve park
- Used for picnicing
- 20 ha core area

Proximity Detectors

- Traditional VHF transmitter
- Transmits and receives encoded UHF signals
- Records:
  - ID of contacted collar
  - Time contact began
  - Duration of contact
- Information stored until downloaded via computer interface

Data Collection





Trapping

- Placed opportunistically in 20 ha core
- Maintained during May 2004
- Age, weight, and sex determined
- Fitted with proximity detecting collars

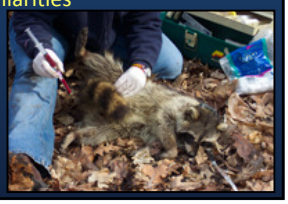
Spatial Distribution

- 30 locations per season
  - Summer (June – August)
  - Fall (Sept – Nov)
  - Winter (Daytime Resting Area)
  - Spring (March – May)

- Fixed-kernel home ranges (95 and 50%)
- Percent home range overlap
  = $2(\text{Overlap Area}_{1,2})/(\text{Area}_1+\text{Area}_2)$

Genetics

- Blood samples collected from trapping
- PCR amplification
- 16 highly variable microsatellites
  - Variable repeat sequence
- Pairwise comparisons of similarities
  - Kinship software
  - Relatedness ranges -1 to 1



Results

- 42 Raccoons Captured (20 M, 22 F)
  - 39 in 1st 2 weeks, 3 in 3rd week, 0 in 4th week
- Obtained blood samples from all individuals
  - FF more highly related than MM dyads (P= 0.002)
  - FF more highly related than MF dyads (P= 0.03)
  - MM less related than MF dyads (P=0.05)

Sample Size for Association Data

Season	MM Dyads	MF Dyads	FF Dyads
Summer (15M, 17F)	70	204	240
Autumn (13M, 16F)	72	167	88
Winter (12M, 12F)	56	129	63
Spring (11M, 15F)	42	150	99

Home Range Size

	Summer 04		Fall 04		Spring 05	
	Mean	SD	Mean	SD	Mean	SD
Male	48.5	14.8	58.4	47.2	66.9	22.5
Female	44.0	52.6	46.5	28.1	16.9	15.2

Typical Range: 50-300 ha

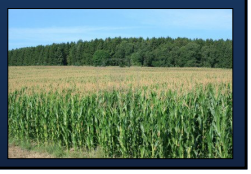
Prange et al. 2004

- Simultaneously studied urban, suburban, and rural populations.

★ Urban	36.6 – 72.6 raccoons/km2	25.2 – 58.8 ha	N = 29
Suburban	41.1 – 93.0 raccoons/km2	21.4 – 37.2 ha	N = 34
Rural	3.1 – 14.6 raccoons/km2	71.2 – 182.4 ha	N = 39

Home Range Variation

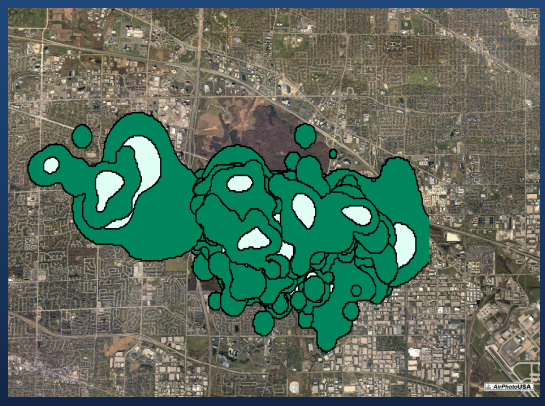
- Seasonal shift most pronounced in rural site.
  - Urban and Rural shifted due to resource availability.
- Abundant resources reduced size and increased stability of home ranges.



Home Range Overlap
Urban Raccoons

- Adult Females had 12 -15% overlap
- Adult Males (non-group) had 9.4 – 17% overlap
- Adult Group Males had 43.9 -72% overlap

- Males of large groups exhibited more home range overlap with females than solitary males or males of small groups.



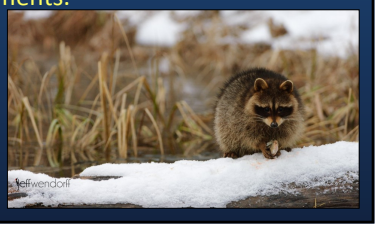
Home Range Overlap
Rural Raccoons

- Adult Females had 2.2 – 12.5% overlap
- Adult Males (non-group) had 0 – 3.2% overlap
- Adult Group Males had 81.6 – 95.5% overlap

- Justin A. Pitt, Serge Larivière, and François Messier (*2008*) Social organization and group formation of raccoons at the edge of their distribution. Journal of Mammalogy: June 2008, Vol. 89, No. 3, pp. 646-653.

Home Range Overlap

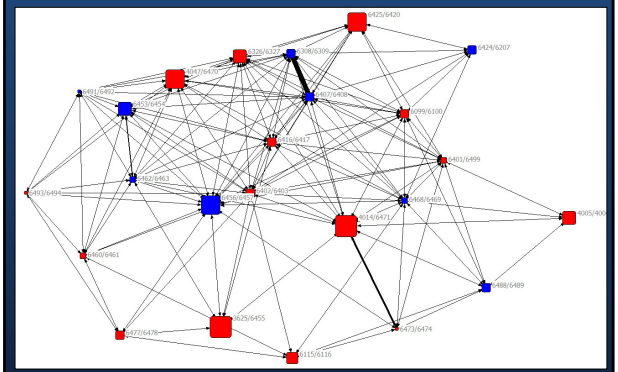
- Raccoons in rural or low density environments have less home range overlap
- Male groups appear more defined in rural/low density environments.



Contact Rates

- We collected 77, 543 contacts within 1 year!
- Over half of all possible dyads exhibited at least 1 contact during the year.
- For all dyad types and all seasons (except FF in winter) contacts significantly different from random.
- Wide variation.

Contact Variation

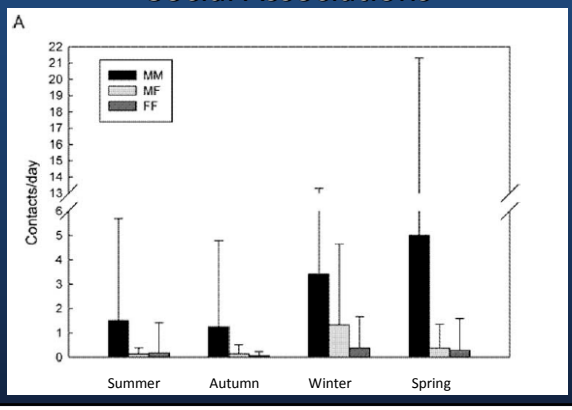


Contact Rates

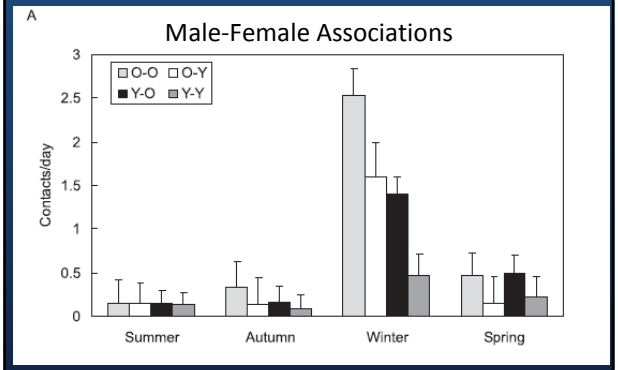
- Adult Females: 0 -15.1 contacts/night
  - 11 of 34 relationships were significant
- Adult Males (non-group): 0 -45 contacts/night
  - 6 of 25 relationships were significant
- Adult Group Males: 0.04 -60 contacts/night
  - 23 of 27 relationships were significant

MM dyads had significantly more contact than FF or MF dyads.

Social Associations



Age effected contact rate for MF dyads only.



Contact Rates of Rural Raccoons

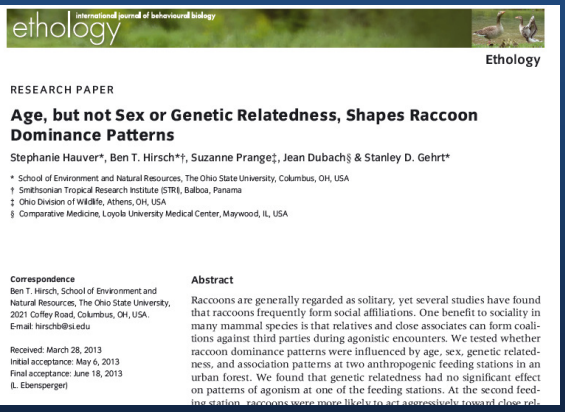
- Examined bite rates between raccoons feeding at landfill.

In Comparison To Rural Raccoons:

- Raccoons bit and were bitten 0.99 – 1.28 times per hour, respectively.
- The authors found no difference between number of bites for males or females and suggested a dominance hierarchy exists.
- Totton et al. (2002) Journal of Wildlife Diseases 38 (2): 313-319.

Contact Rates

- Positive relationships observed that were maintain throughout the year, especially for MM dyads.
- Less aggression observed in high density population?



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Ethology

RESEARCH PAPER

Age, but not Sex or Genetic Relatedness, Shapes Raccoon Dominance Patterns

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Abstract

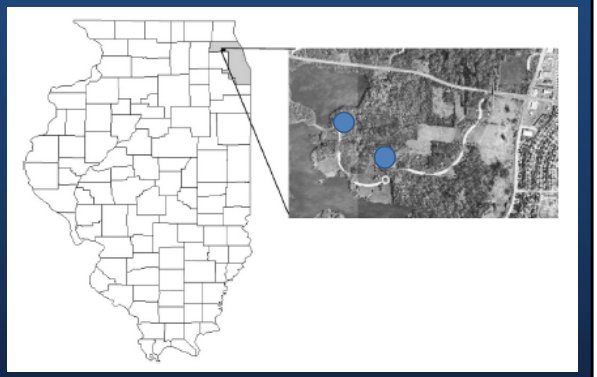
Raccoons are generally regarded as solitary, yet several studies have found that raccoons frequently form social affiliations. One benefit to sociality in many mammal species is that relatives and close associates can form coalitions against third parties during agonistic encounters. We tested whether raccoon dominance patterns were influenced by age, sex, genetic relatedness, and association patterns at two anthropogenic feeding stations in an urban forest. We found that genetic relatedness had no significant effect on patterns of agonism at one of the feeding stations. At the second feeding station, raccoons were more likely to act aggressively toward close rel-

Dominance Hierarchies

- Competition for food often results in high levels of aggression.
- Aggression is costly!
- Dominance hierarchies result in reduced aggression and are often seen in social species, usually based on sex and social partners.

Hierarchies in Raccoons?

- Solitary species have dominance hierarchies based on fighting ability.
- Raccoons allow us to examine the evolution of sociality.
- Will raccoons have hierarchies? Based on fighting ability or sex and social partners?



Methods

- 9kg of dog food placed at 2 feeding stations.
- 2 infrared cameras with VCR connection plus proximity detecting radio collars at stations.
- Rechecked every day.

Video Footage

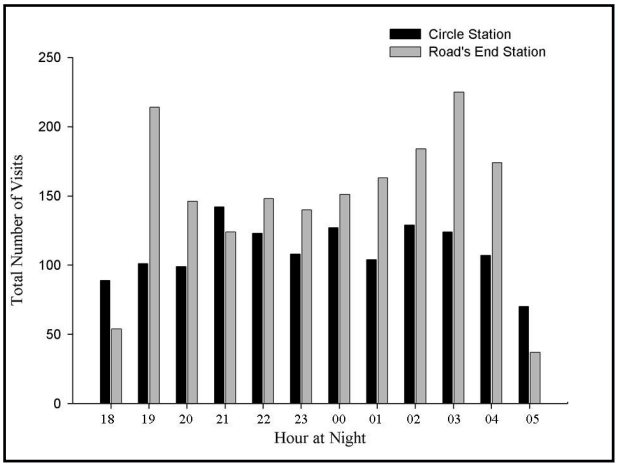
- Cower
- Displacement
- Attack

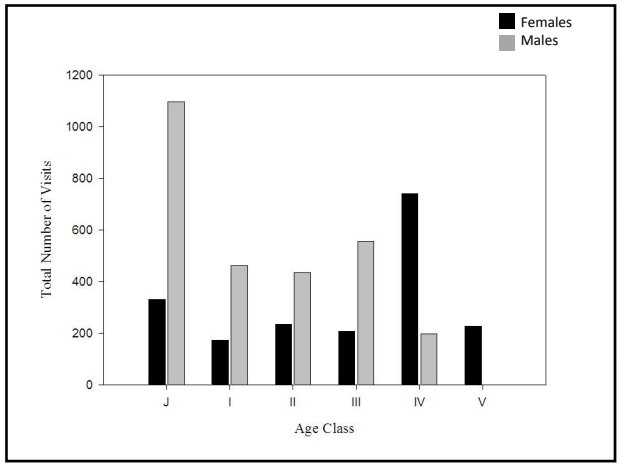
Results

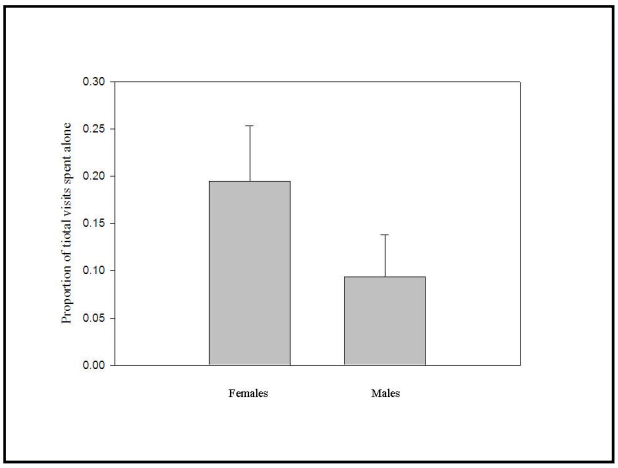
- 272 hours of footage.
- 10 M, 11 F radio identifiable raccoons.
- 2,943 visits recorded by collars, 555 additional visits by uncollared raccoons.
- 66.5% of visits occurred when other raccoons present.
- Raccoons appeared together for 28% of visits.

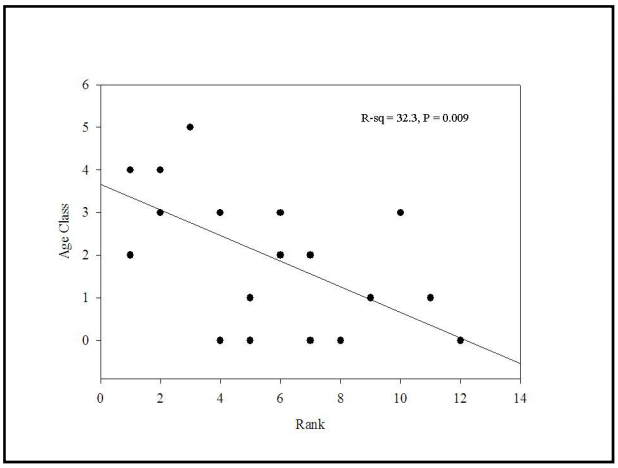
Results

- Despite frequent interactions, aggression was not common (7% of visits).
- 73 cowers
- 269 displacements
- 138 attacks



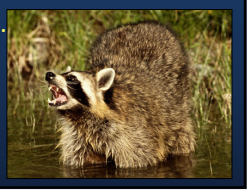






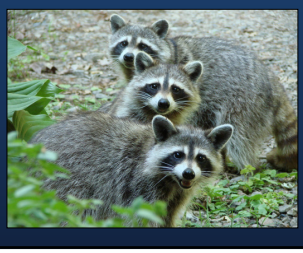
Conclusion

- Less aggression observed in high density population. (.99 -1.28 bites vs .50 attacks/hr)
- Dominance not effected by kinship or sex of individual.
- Older individuals (larger) tend to be more dominant, regardless of sex.



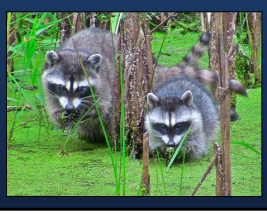
Discussion

- Raccoons in our study show high degree of sociality, but their dominance structure mimics that of a solitary species.



Discussion

- As raccoon population increases, raccoon behavior seems to shift from aggressive and territorial to social and tolerant which is well adapted to the changing environment.



In Summary

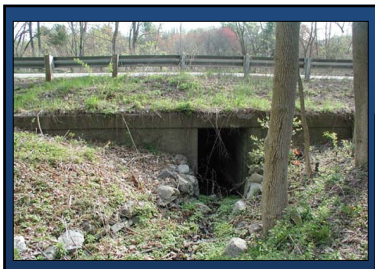
- When raccoons live in habitat not modified by human presence, they occur at lower density and exhibit more solitary behavior.
- The raccoon adapts well to new environments and seems to change behavior to exploit new food source opportunities.

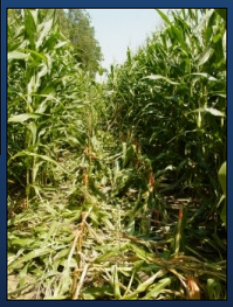
In Summary

- We have seen changes such as:
  - Smaller home range (travel less)
  - Greater amount of home range overlap
  - Males groups less distinct
  - Increased tolerance of social interaction

Variation in Trapping Methods

- Rural raccoons travel more than urban raccoons





Raccoons repeatedly use same areas
1-7 raccoons per latrine
No difference between sexes

Differences in Trapping Methods

- In general, it is best to catch rural raccoons while they are “on the move” – traveling between food patch and den sites.
- Urban raccoons are easier to catch at the den site, latrine area, or exploited food patch.

Raccoons in Japan

- Modify trapping methods based on raccoon habitat.
- It is unlikely that raccoon population will limit itself based on strict anti-social behavior.
- Reduce access to human food sources and shelters.

Acknowledgements

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- Additional Institutions: The Brookfield Zoo, The Ohio State University-Terrestrial Wildlife Ecology Lab

I have a question…