

# Movement patterns around dens in two Illinois beaver populations



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# Beavers

- ✓ Widespread
- ✓ Keystone species
- ✓ Ecosystem engineers
- ✓ Social mammals
- ✓ Denning mammals
- ✓ Commercially valuable



# Social Structure

Multiple generations:

- ✓ Adults (>36 months)
- ✓ Sub-adults (24-36 months)
- ✓ Yearlings (12-24 months)
- ✓ Kits (<12 months)

Colony territory, with a main den  
and  $\geq 1$  secondary den



- ✓ Generalist herbivores, feed on a variety of woody and herbaceous vegetation
- ✓ Beavers typically concentrate foraging and other movements near the den



Due to a limited use of common research techniques on beavers (radiotelemetry)

- ✓ Information about beaver behavior is rare in the literature
- ✓ There is little information about beaver activity patterns



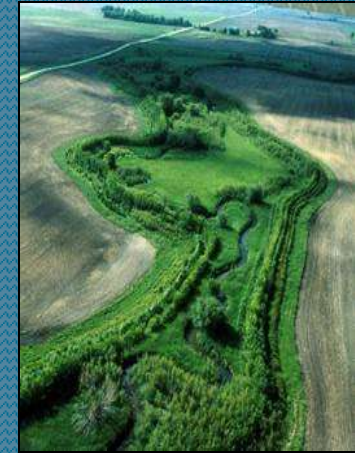
# Objectives

Quantify differences in beaver movement patterns near dens:

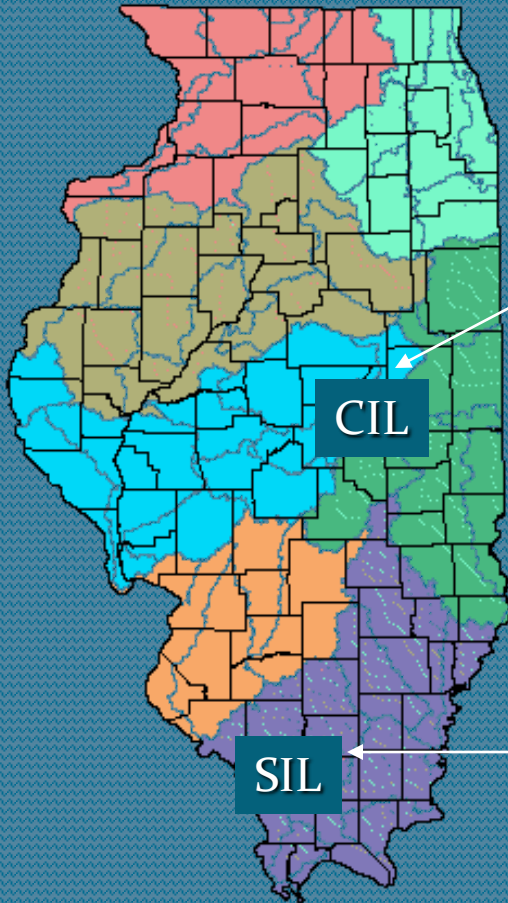
1. Between Central Illinois and Southern Illinois beavers
2. Age and sex classes within sites
3. Among seasons within sites

# Study Area

Long, narrow habitat corridors;  
Exploited population



Forested wetland complex habitat;  
Unexploited population



# Population Density

## Central Illinois

0.4 colonies/km (linear)

5.6 beavers/colony ( $\pm 2.5$ )

2.2 beavers/km stream



11 beavers/km<sup>2</sup> habitat

## Southern Illinois

3.3 colonies/km<sup>2</sup> (areal)

9.5 beavers/colony ( $\pm 1.5$ )



31.1 beavers/km<sup>2</sup> habitat

✓ Southern IL beavers are at K; central IL near K

# Home Range Size

Home range sizes did not differ between males and females

Home range sizes differed seasonally

- ✓ Larger in winter
- ✓ Smaller in summer



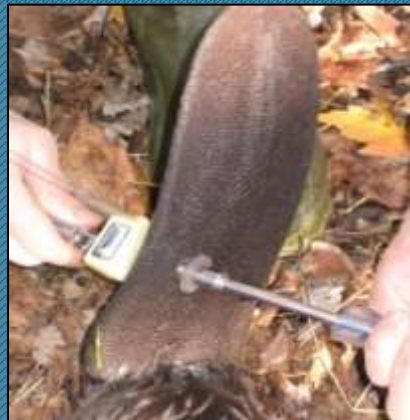
# Methods- Capture

- ✓ Snares were used to capture beavers during September-December 2004 and 2005
- ✓ Target: yearlings, sub-adults and adults



# Handling

- ✓ Immobilized
- ✓ Weighed
- ✓ Aged
- ✓ Sexed
- ✓ Tagged with
  - ✓ Ear tags
  - ✓ Radio-transmitter



# Radiotelemetry

- ✓ Monitored during  
Sep 2004 - Sep 2006
- ✓ Triangulation using  
the program LOCATE II
- ✓ 3-5 times per week
- ✓ Mostly nocturnal locations



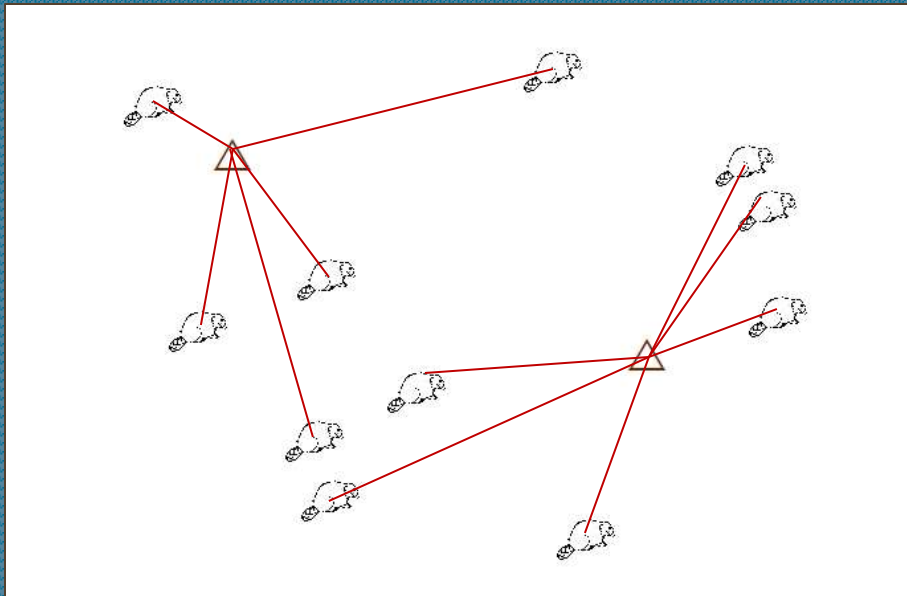
# Beaver Dens

- ✓ Active dens were geolocated using a hand-held GPS unit
- ✓ Each beaver was associated with  $\geq 1$  colony den
- ✓ If a beaver dispersed and settled in a new colony, we changed den association



# Data Analysis

- ✓ We calculated the straight-line distance between the animal's nearest den site and each location using the Hawth's Tools Animal Movements extension in ArcGIS 9.3



Den location



Beaver location

# Data Analysis

- ✓ We created histograms with intervals of 40 m to assess frequencies of beavers occurrence from nearest den for:
  - ✓ Southern and Central Illinois
  - ✓ Sex
  - ✓ Ages
  - ✓ Seasons

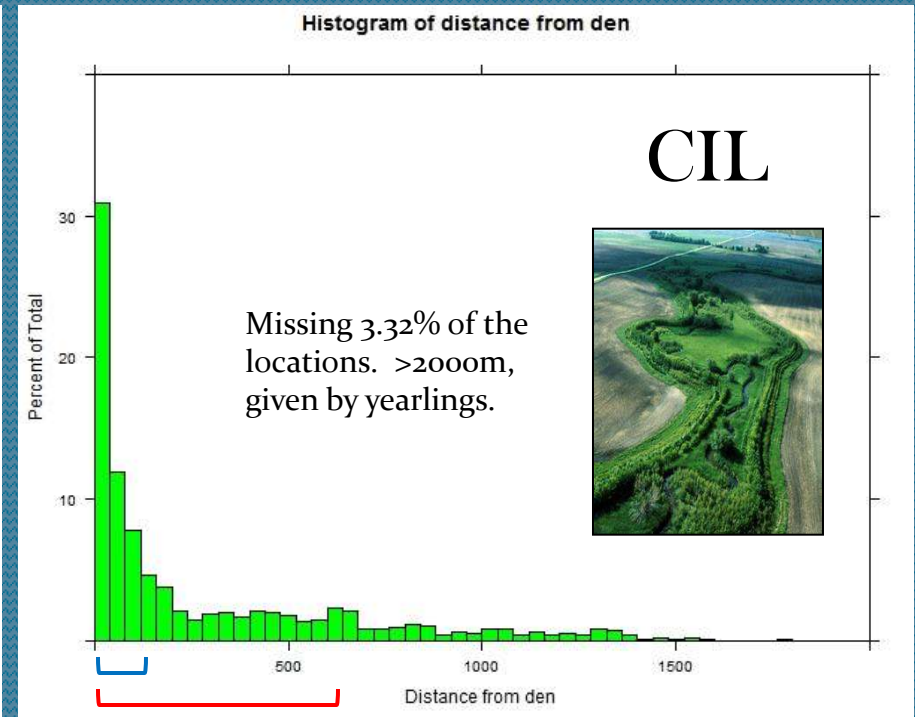
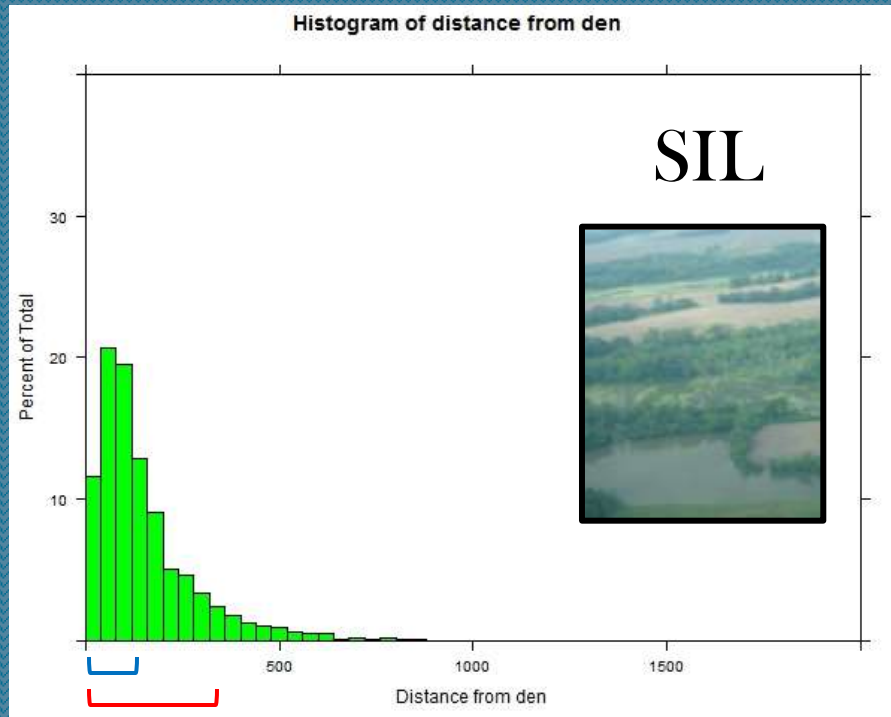
# Results

- ✓ During 2004-2006 we live-captured and radio-tagged 67 beavers

Site	Total	Males	Females	Adults	Sub-adults	Yearlings
CIL	26	18	8	5	11	10
SIL	41	21	20	15	10	16

- ✓ CIL: 2 beavers dispersed and changed colony
  - 2135 locations in CIL
  - 4350 locations in SIL
  - Error: 11 m

# Frequency of occurrence from dens between Central Illinois and Southern Illinois beavers

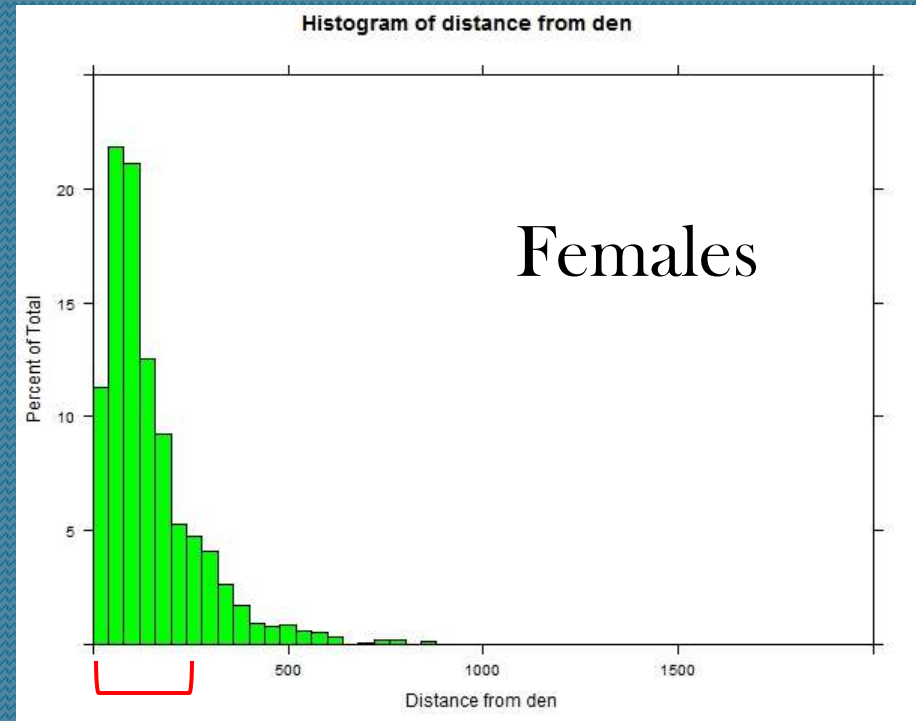
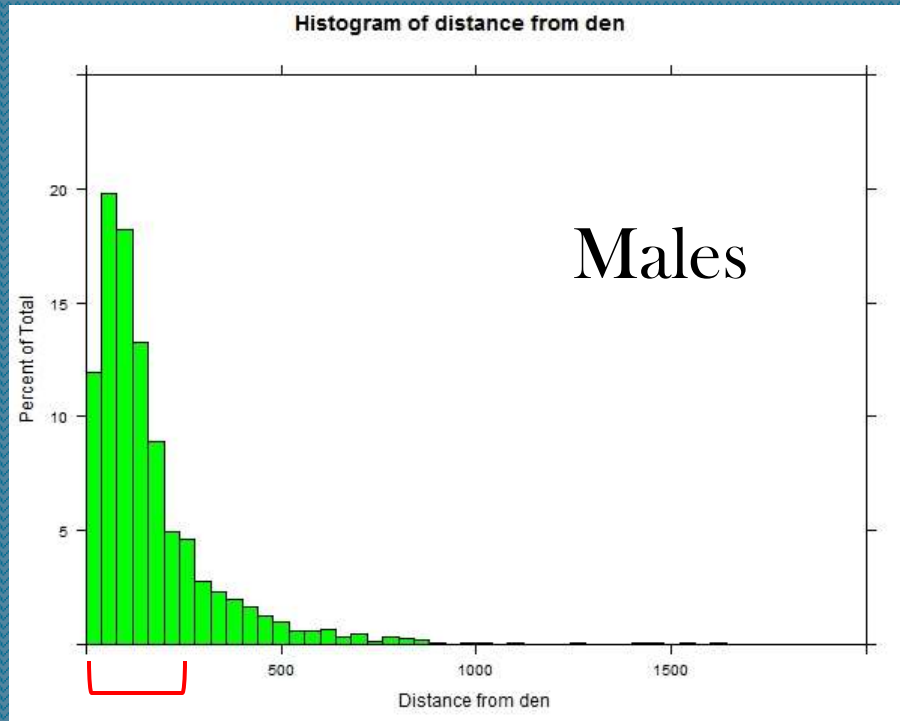


Movement patterns differed between sites

SIL: 50% of beaver locations <115m from nearest den  
80% of beaver locations <334 m from nearest den

CIL: 50% of beaver locations <115m from nearest den  
80% of beaver locations <644m from nearest den

# Frequency of occurrence from dens by sex at Southern Illinois

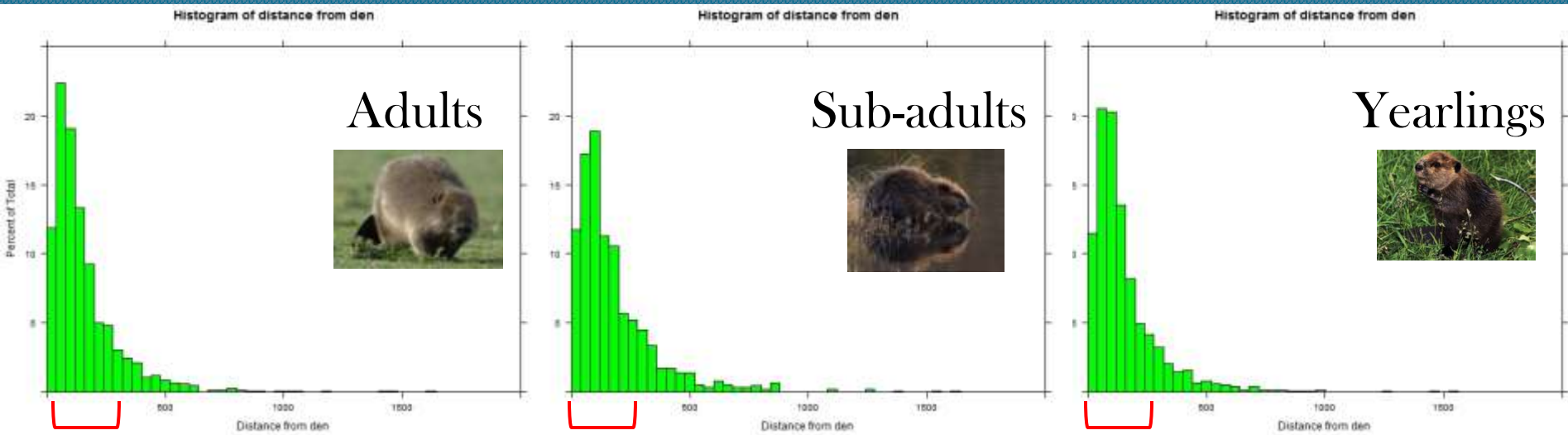


Similar movement patterns between males and females

Males: 80% of beaver locations <246m from nearest den

Females: 80% of beaver locations <230m from nearest den

# Frequency of occurrence from dens by age at Southern Illinois



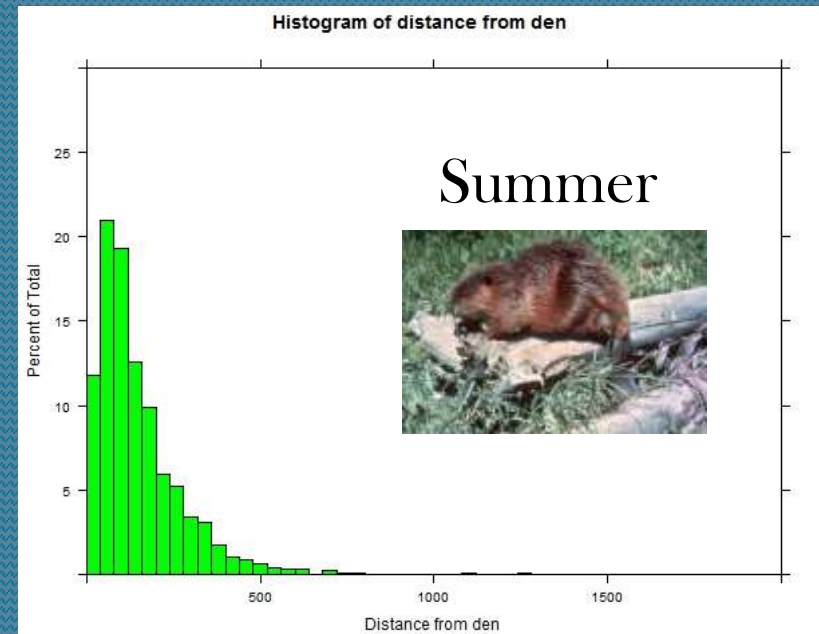
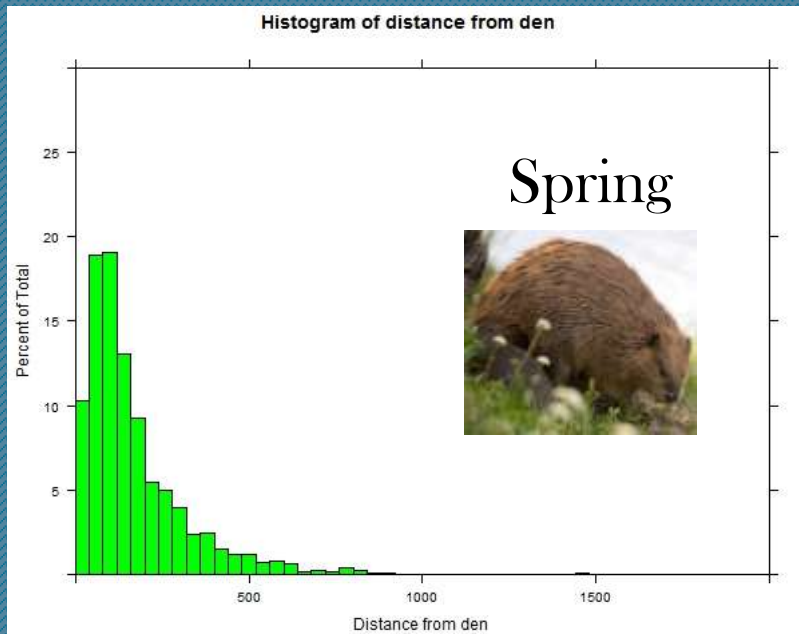
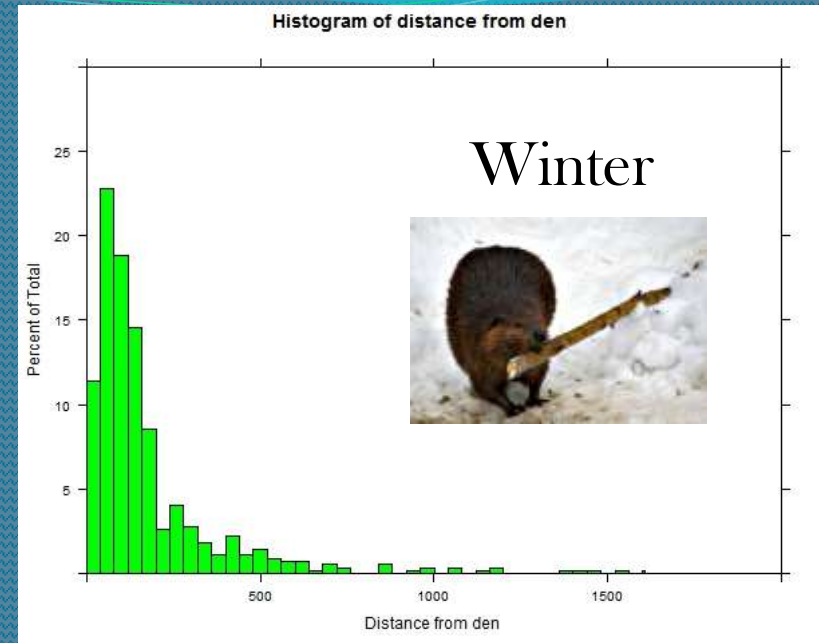
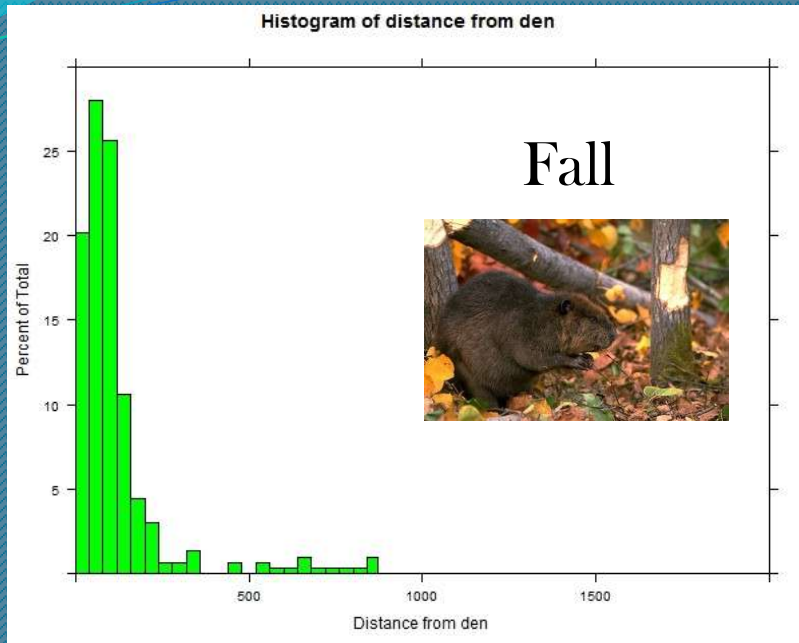
Similar movement pattern among ages

Adults: 80% of beaver locations <233m from nearest den

Sub-adults: 80% of beaver locations <269m from nearest den

Yearlings: 80% of beaver locations <249m from nearest den

# Frequency of occurrence from dens by season at S. Illinois



# Frequency of occurrence from dens by season at S. Illinois

Similar movement pattern among seasons

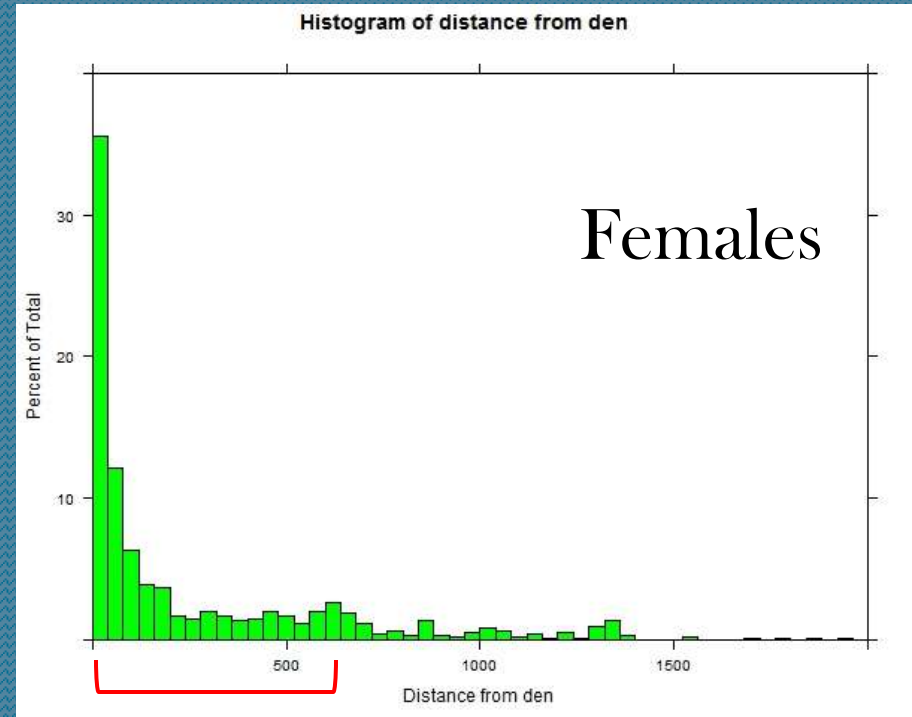
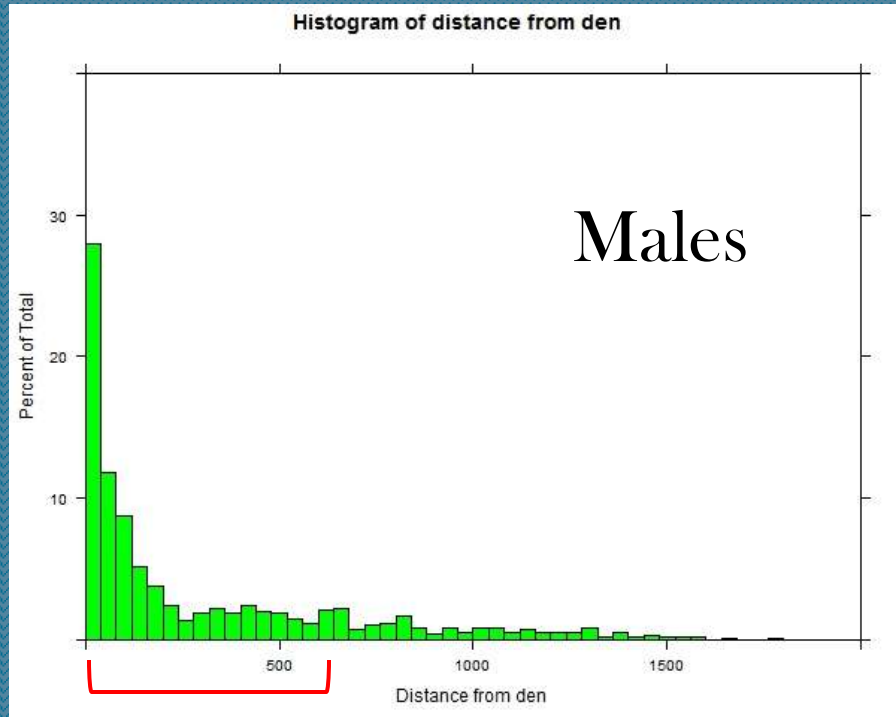
Fall: 80% of beaver locations <233m from nearest den

Winter: 80% of beaver locations <269m from nearest den

Spring: 80% of beaver locations <249m from nearest den

Summer: 80% of beaver locations <249m from nearest den

# Frequency of occurrence from dens by sex at Central Illinois

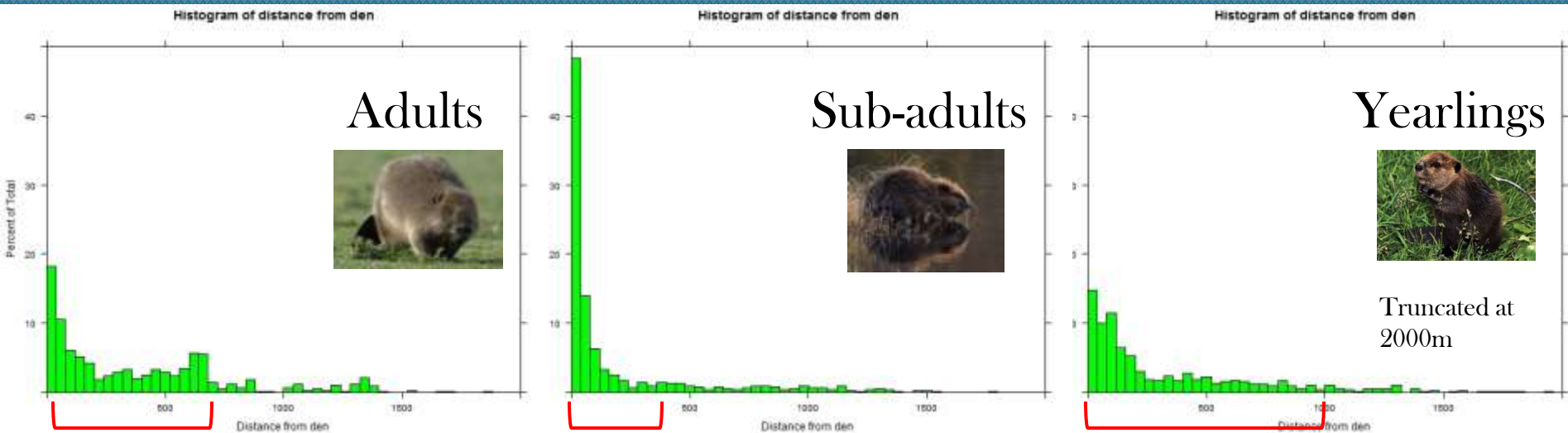


Similar movement pattern between males and females

Males: 80% of beaver locations <651m from nearest den

Females: 80% of beaver locations <616m from nearest den

# Frequency of occurrence from dens by age at Central Illinois



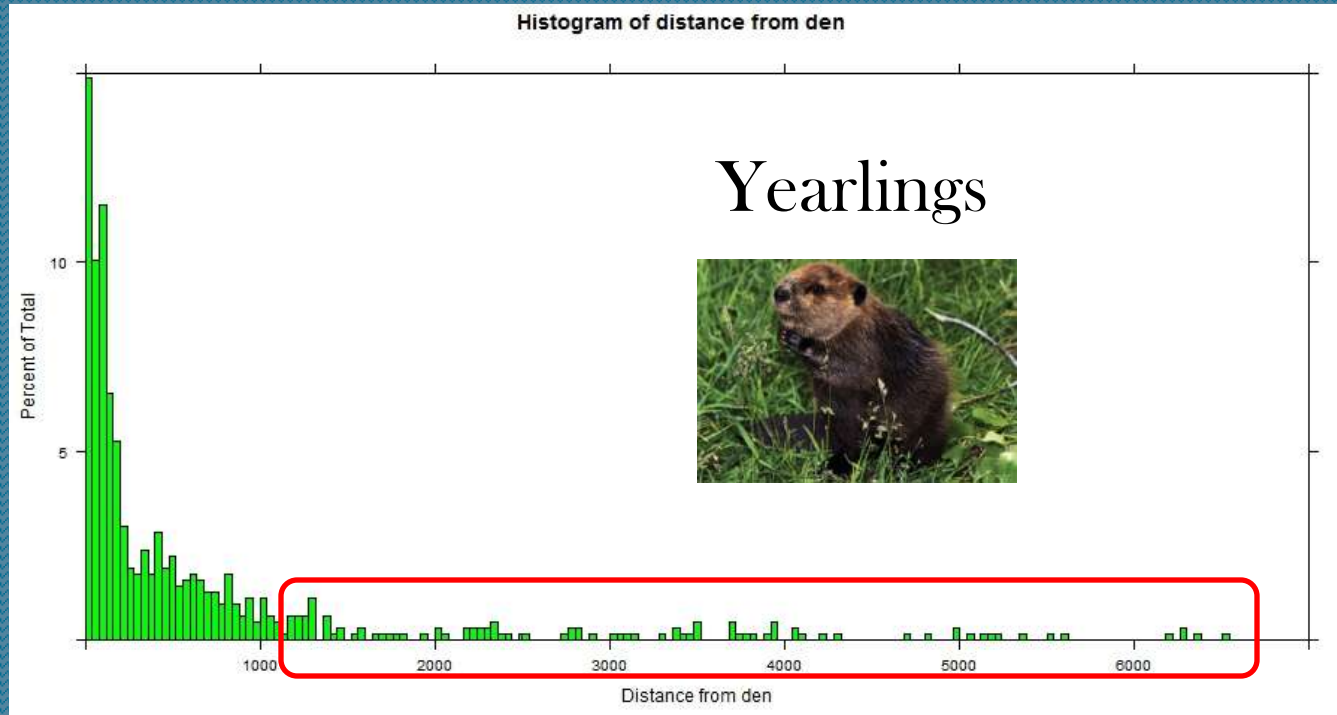
## Different movement pattern among ages

Adults: 80% of beaver locations <650m from nearest den

Sub-adults: 80% of beaver locations <381m from nearest den

Yearlings: 80% of beaver locations <939m from nearest den

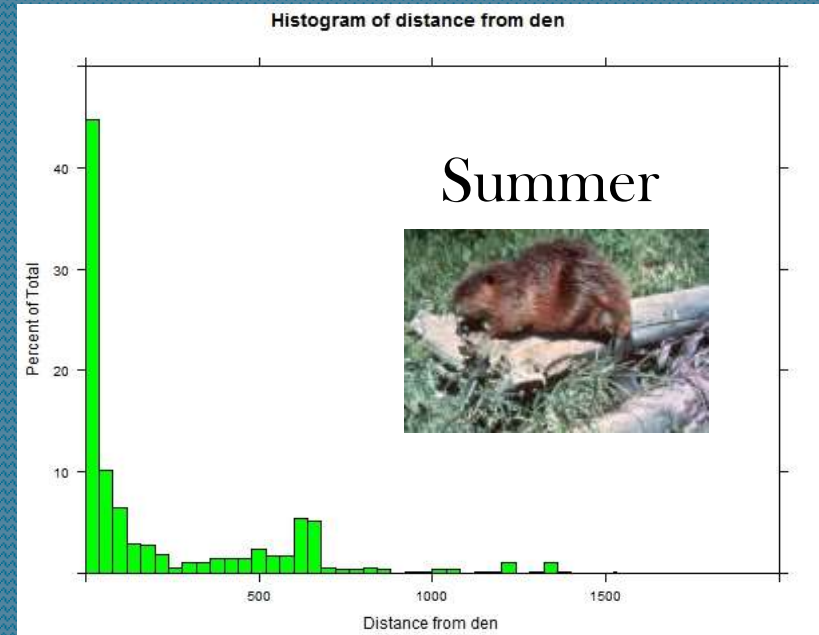
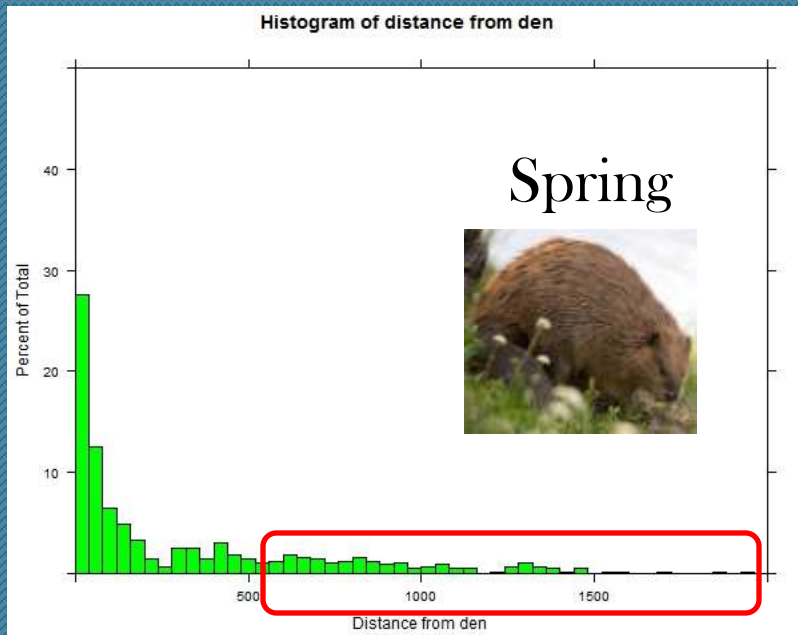
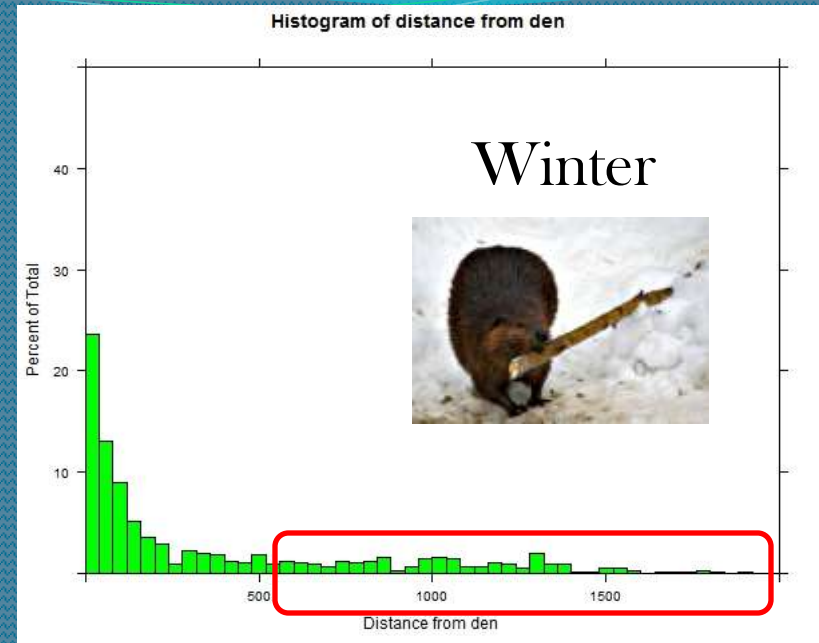
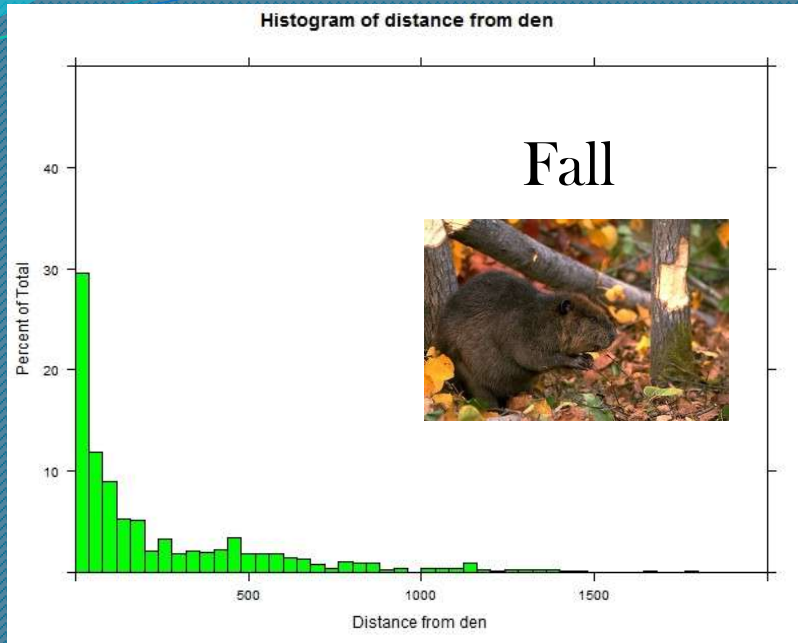
# Frequency of occurrence from dens by age at Central Illinois



Yearlings: 20% of locations between 939 and 7758m from the nearest den

These represent pre-dispersal exploratory movements

# Frequency of occurrence from dens by season at C. Illinois



# Frequency of occurrence from dens by season at C. Illinois

## Differences in movement pattern among seasons:

- Longer in winter and spring
- Shorter in Fall and Summer

Fall: 80% of beaver locations <513m from nearest den

Winter: 80% of beaver locations <913m from nearest den

Spring: 80% of beaver locations <794m from nearest den

Summer: 80% of beaver locations <538m from nearest den

# Discussion

Beavers in CIL moved longer distances from dens than beavers in SIL

- Food and construction resources in the linear river system of CIL are more widely distributed compared to the wetlands of SIL
- Beavers in CIL need to travel longer distances to secure adequate food and construction resources



Males and females have similar movement patterns in either site

- Males and females present similar behaviors
- In accordance with previous home range studies

In Southern Illinois there were no movement pattern differences among ages

- We expected see yearlings exploring and dispersing
- Population in carrying capacity (9.5 beavers/colony ( $\pm 1.5$ ))

In Central Illinois there were movement pattern differences among ages

- Yearlings showed exploratory movements. 2 beavers dispersed
- No explanation for pattern among sub-adults

In Southern Illinois there were no differences in movements among seasons

- Stable habitat
- No dispersal

In Central Illinois there were differences in movements among seasons

- Moved longer distances during winter and spring
- Summer kit rearing
- Movement restricted by environmental conditions

# Future work

Statistical analysis:

- We have count data with Poisson distribution
- We have a complicated temporal pseudo-replication

Appropriate statistical analysis to precede:

- Generalized Mixed Models

# Acknowledgements

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# Questions?

