

Main Points

1) Interspecific competition

- interference and exploitative competition
- regional species pools and local communities

2) Evolutionary and ecological effects of interspecific competition

- Tomiya and Miller
- character displacement in mustelids
- competitive exclusion by singing mice

3) Competitive release of *Peromyscus* and Lyme disease

4) Answers for quizzes (if there's time)

Pre-reading: Wed 1 Nov = Cantor et al; Mon 6 Nov = Pauli et al

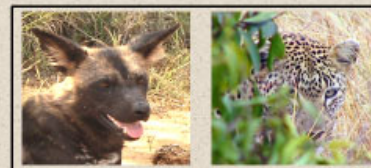
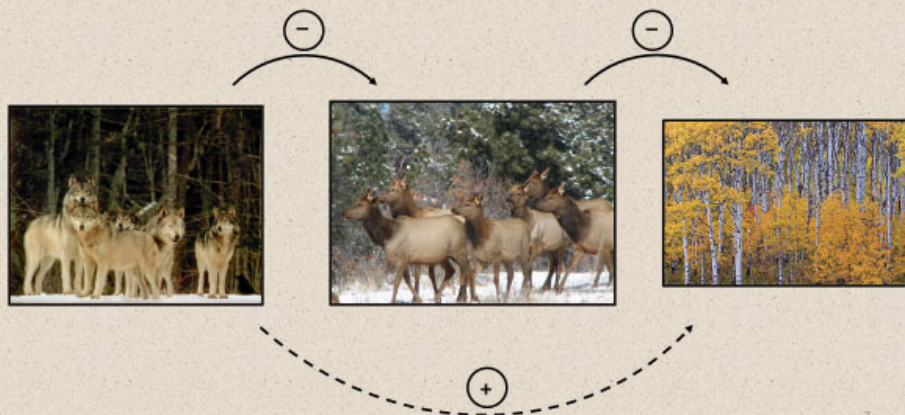
Q8 available today at 5pm, covers today and Wed 25 Oct, due Mon 20 Nov.

Terms: habitat filtering, competitive exclusion, adaptive zone, character displacement, nestedness, dilution effect

Punchline #1: we discussed two varieties of trophic cascades, and how a behaviorally-mediated trophic cascade was contingent on plant defense (but not predation strategy). Large carnivores made savanna tree communities less thorny.

Indirect effects and trophic cascades

- **trophic cascade** = the indirect effect of predators on the abundance, distribution, or growth of plants



Hypothesis 3
predation risk
increases the
abundance of
less-thorny trees

Hypothesis 1
impala avoid risky habitats



Hypothesis 2
impala both prefer to
eat and suppress the
abundance of less-
thorny trees

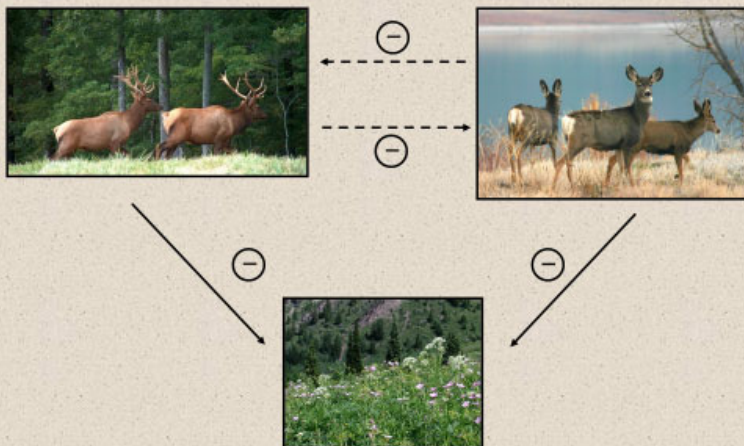


Hypothesis 3
predation risk
has negligible
effects on the
abundance of
thorny trees

Punchline #2: exploitative competition is an indirect effect, because the negative effects of species are routed through other species. Interference competition between *L. canadensis* and *L. rufus* sets the southern range limit of the former, while snow depth sets the northern range limit of the latter. This supports Connell's hypothesis.

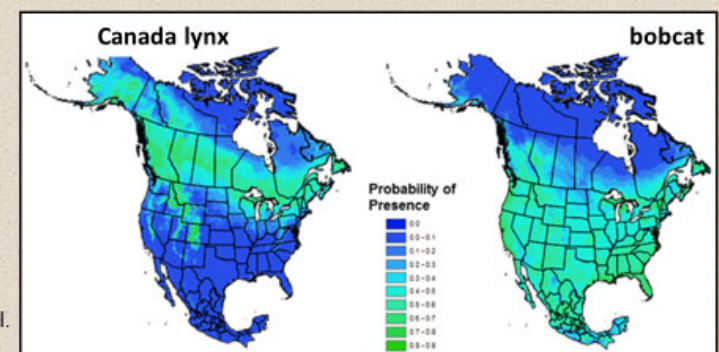
Interspecific competition

exploitative competition = negative interaction between pairs of species, routed through a resource.



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Biogeographic effects of competition



Peers et al.
2013.

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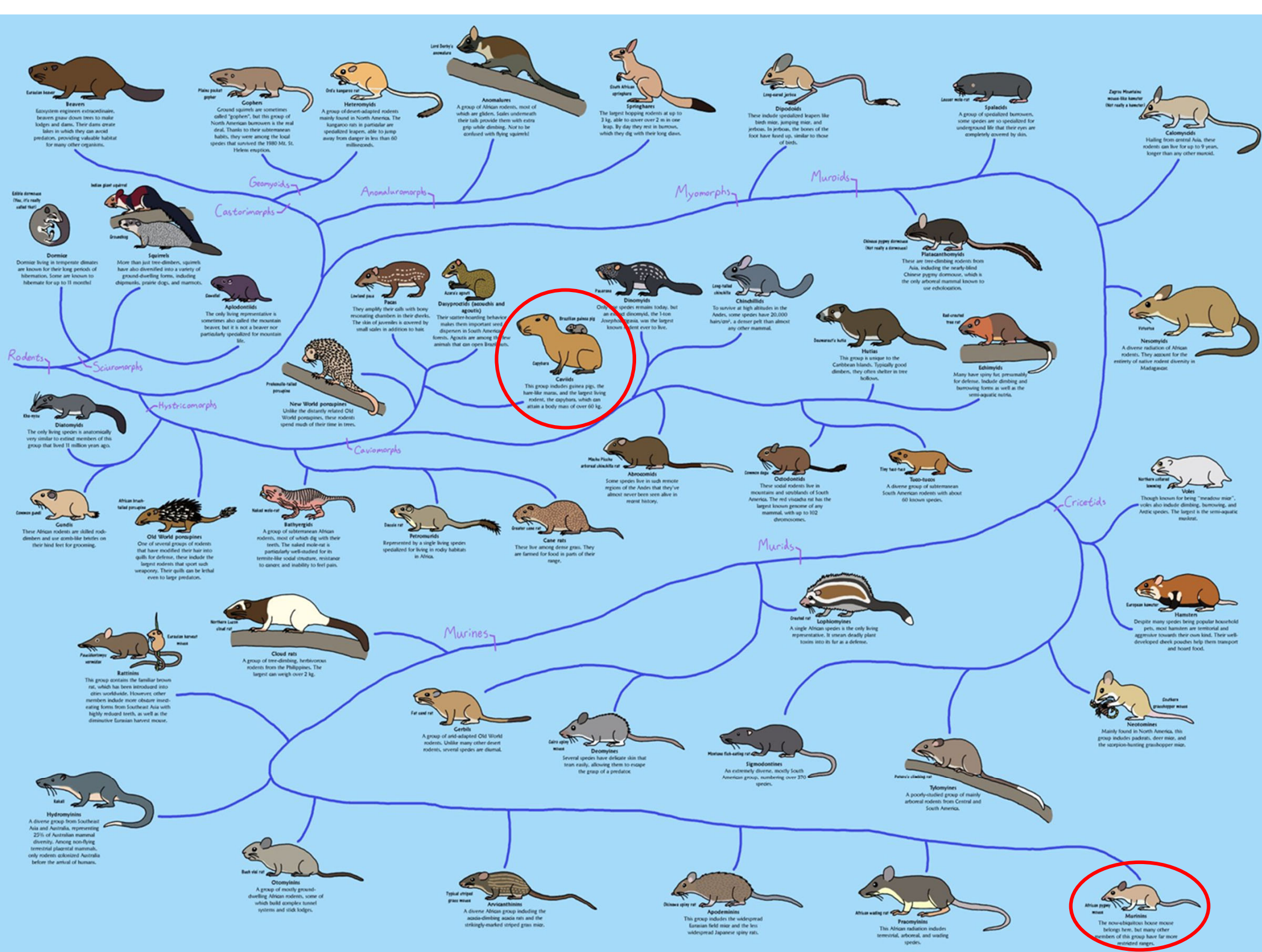
Punchline #3: local communities are assembled from regional pools, such that local communities are a subset of all the species whose geographic ranges overlap a “site”.

Biogeographic effects of competition

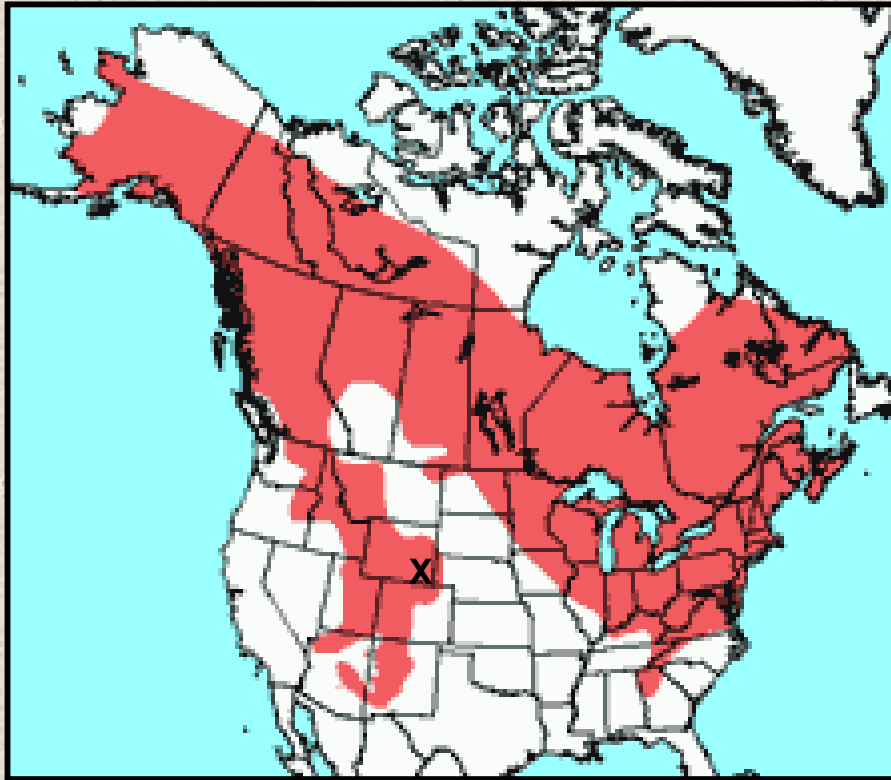
- regional species pool = all of the species whose geographic ranges overlap a site/area/locality.
- local community = area over which individuals encounter and interact with one another.

Regional species pools (Name That Smammal)

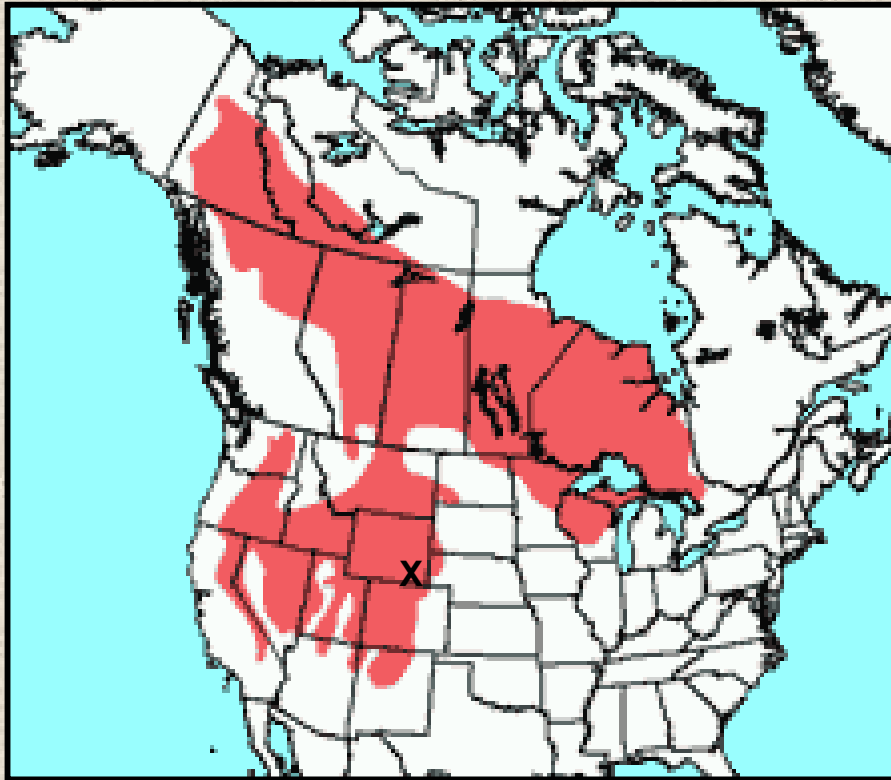




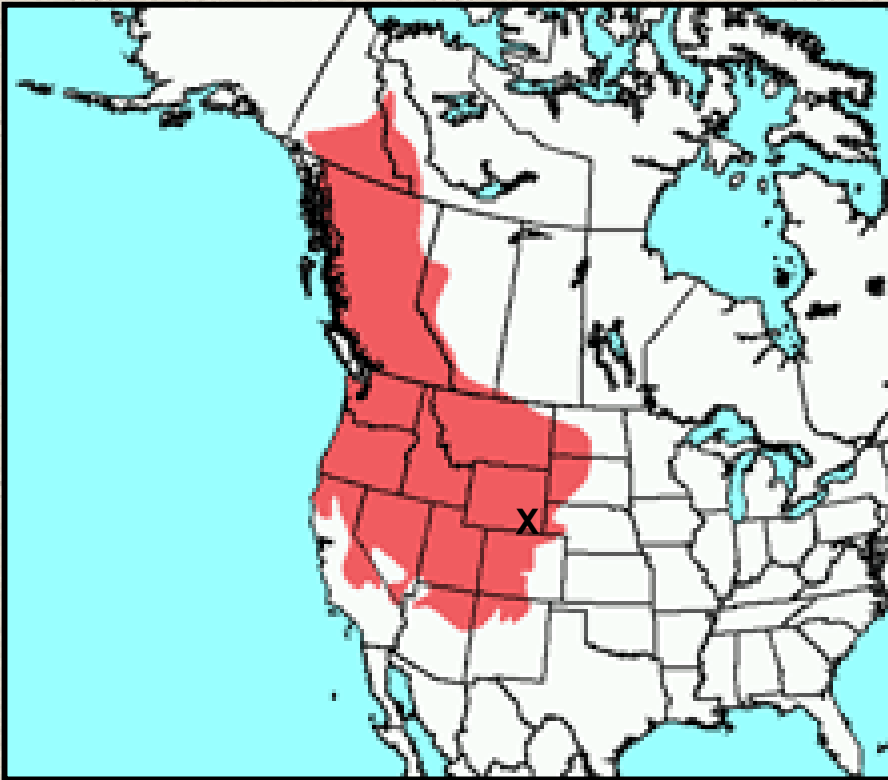
Regional species pools (Name That Smammal)



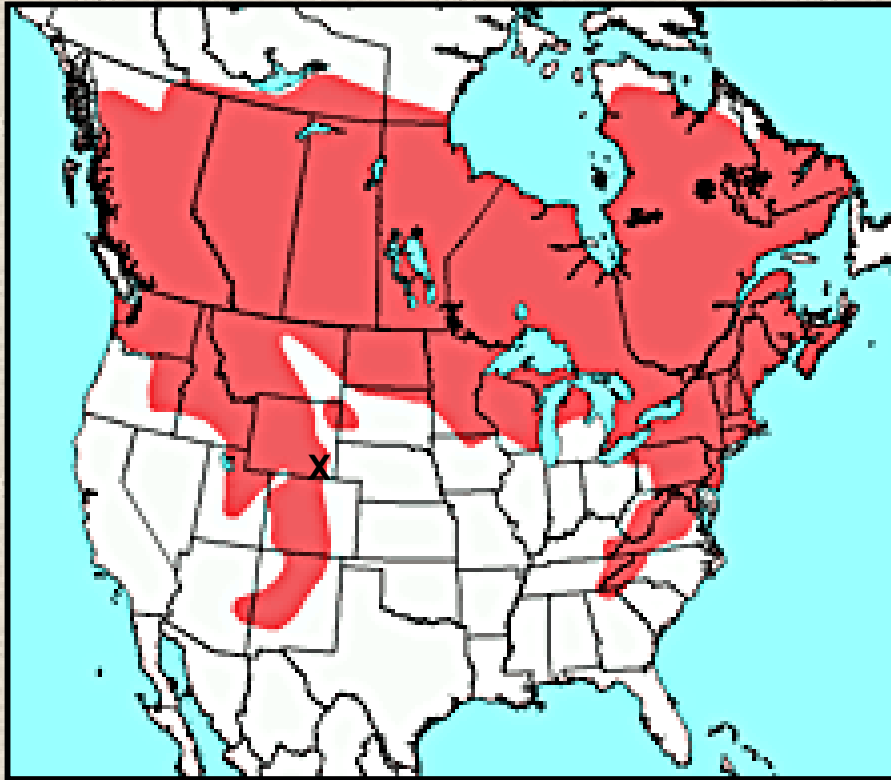
Regional species pools (Name That Smammal)



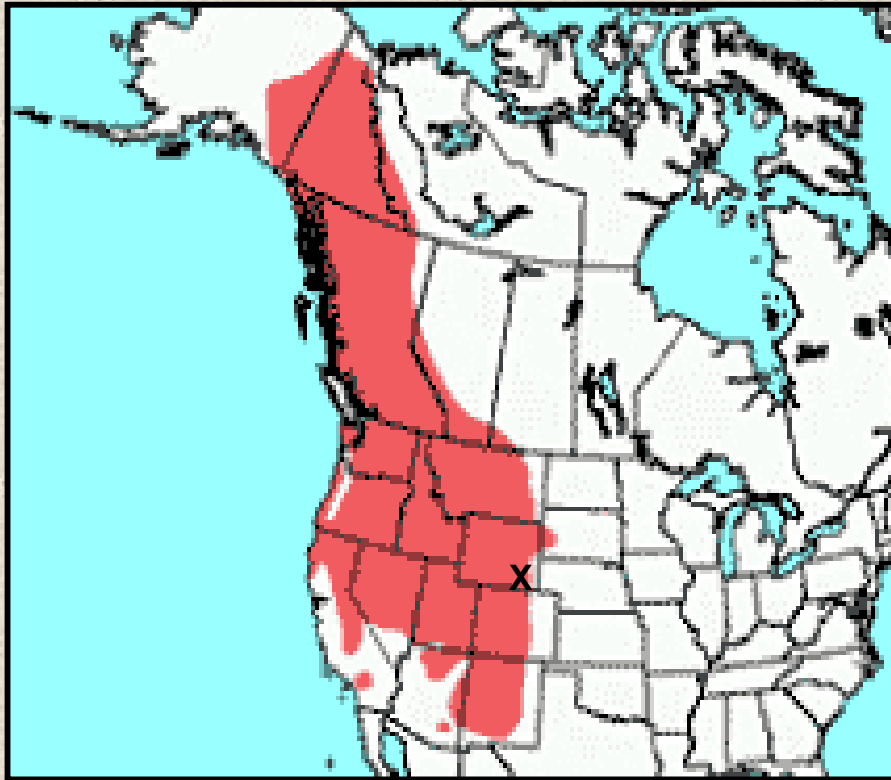
Regional species pools (Name That Smammal)



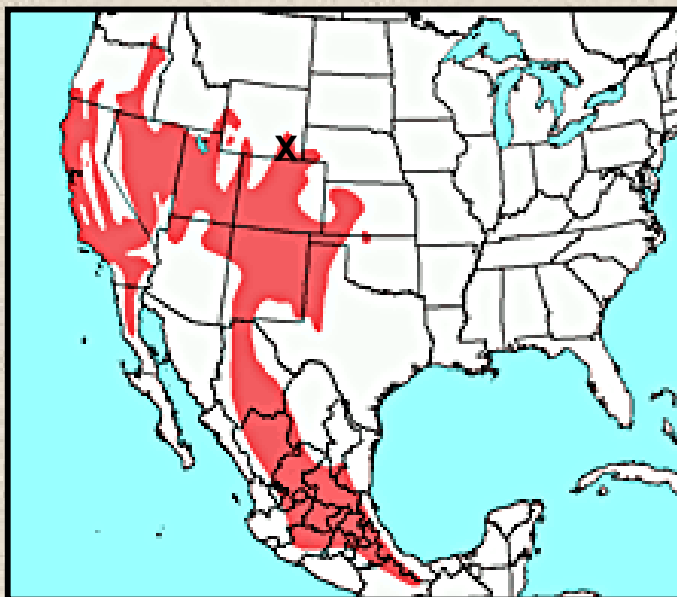
Regional species pools (Name That Smammal)



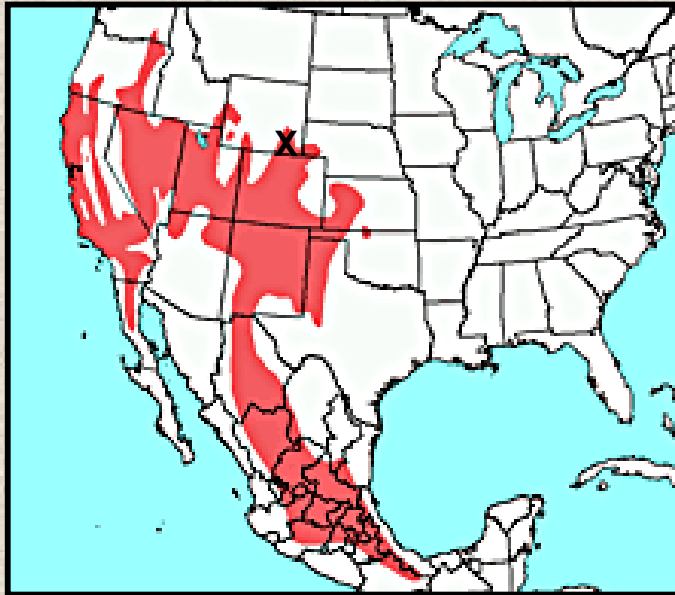
Regional species pools (Name That Smammal)



Regional species pools (Name That Smammal)



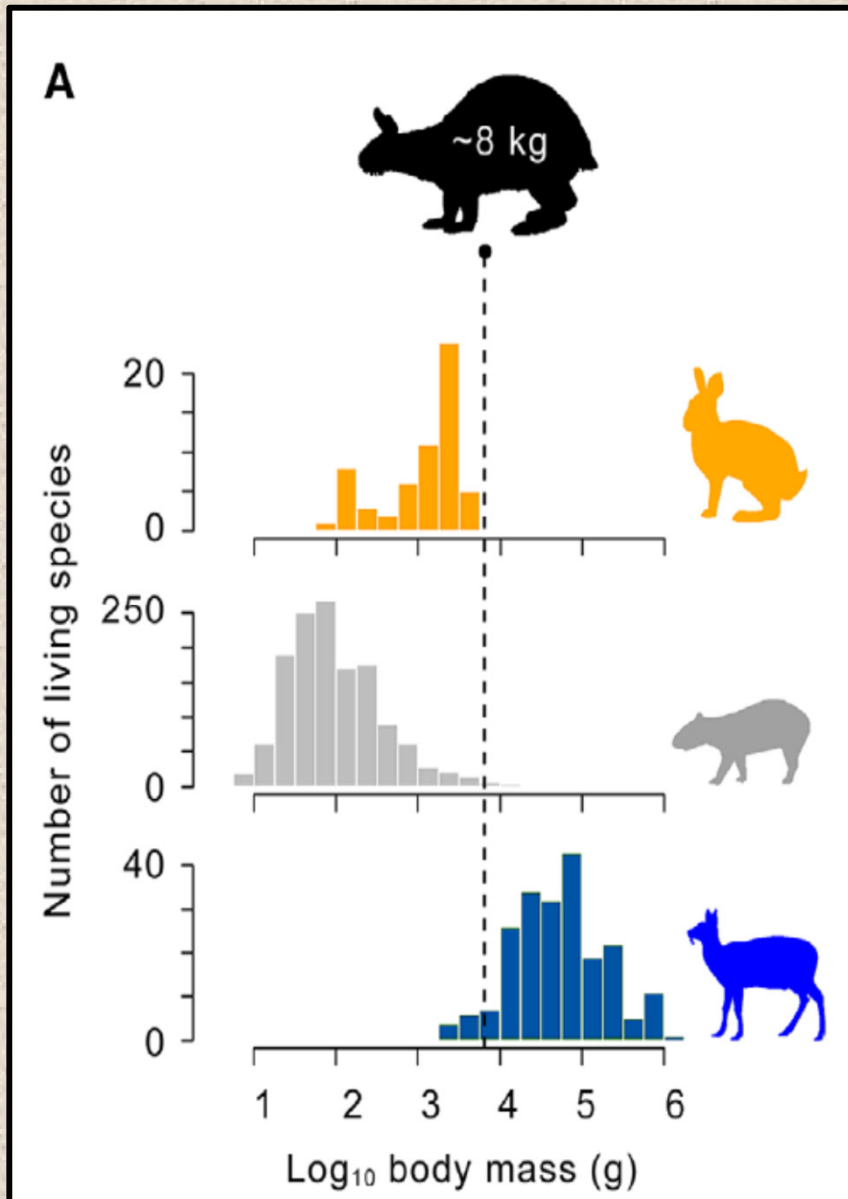
Discussion: come up with 2-3 hypotheses for why pinyon mice and American pikas did not occur at this sampling site.



Evolutionary effects of competition

- **habitat filtering** = species at a site share abilities to allow them to exist in particular habitats
- **competitive exclusion** = only species that are not too ecologically similar can coexist at a site

Evolutionary effects of competition



pygmy rabbit (~0.5 kg)

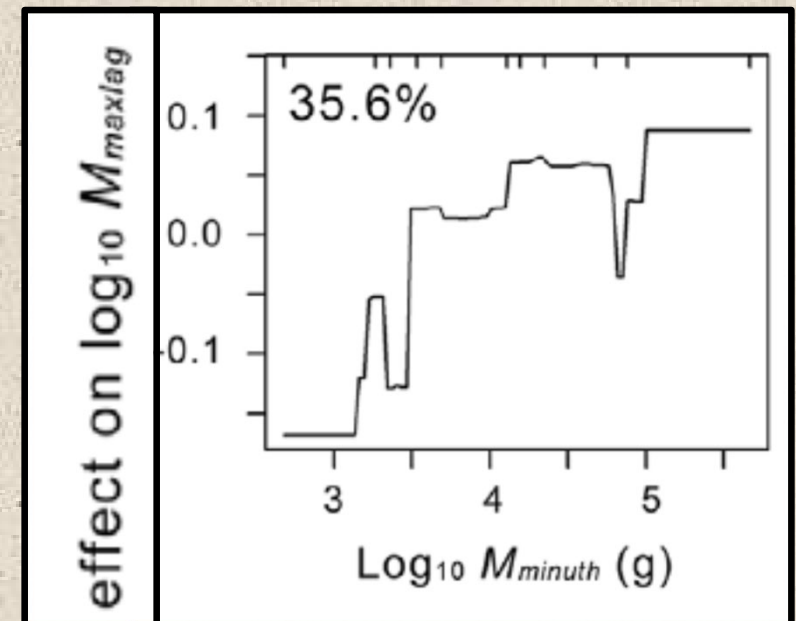
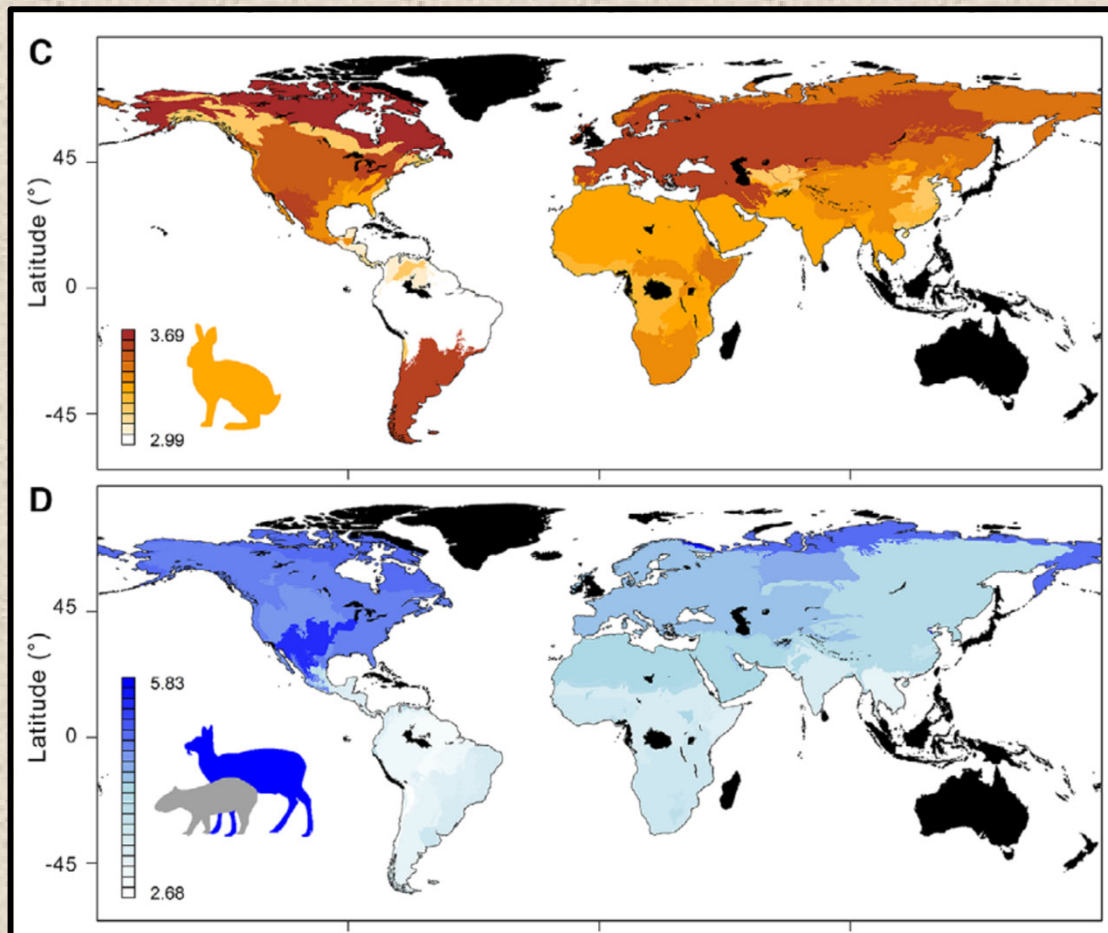


European hare (~5 kg)



Evolutionary effects of competition

- adaptive zone = an environment with opportunity for speciation or adaptive radiations.

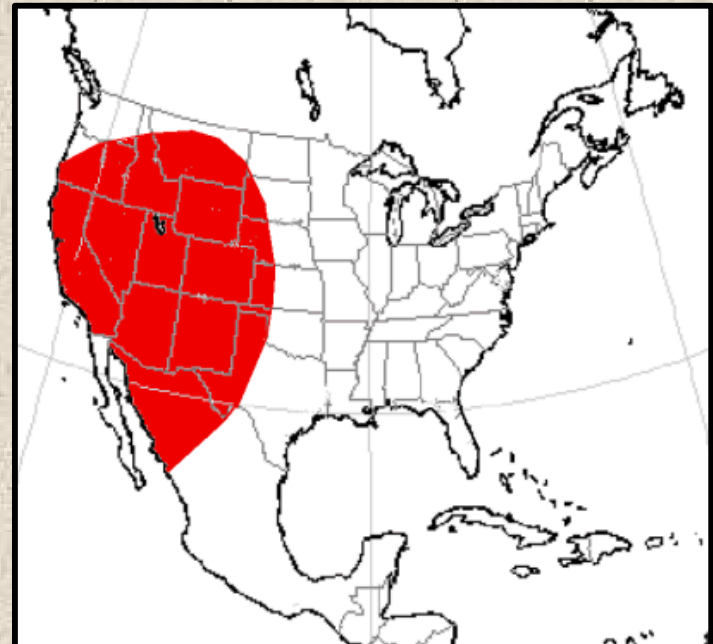


Submitted questions for Tomiya and Miller (edited a tidge for clarity)

Q: The reading states that maximum mass of lagomorphs is around 5 kg, and this is set by the minimum mass of “ungulate-type herbivores” (which is roughly 5 kg). Given this, why do we not have larger lagomorphs in the U.S. since we don't have any ungulates that are nearly as small as 5 kg?

A: Because through this mid-Miocene (~11 MYA), we used to have 5-7 kg ungulates, like like this:

Hypertragulus



Submitted questions for Tomiya and Miller (edited a tidge for clarity)

Q: How does the concept of "incumbent advantage" or priority effect apply to the interactions between lagomorphs and ungulate-type herbivores over evolutionary time scales?

A: I don't know. This is a great question!

Submitted questions for Tomiya and Miller (edited a tidge for clarity)

Q: Are there other examples of different clades putting enough evolutionary pressure on another to influence morphology?

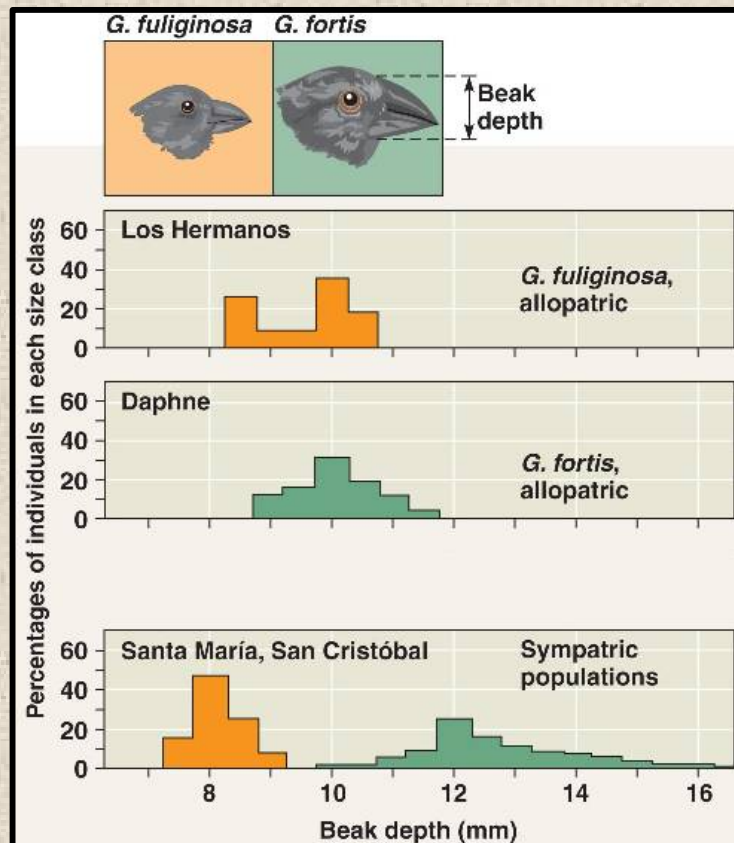
A: Yes, please standby.

Evolutionary effects of competition

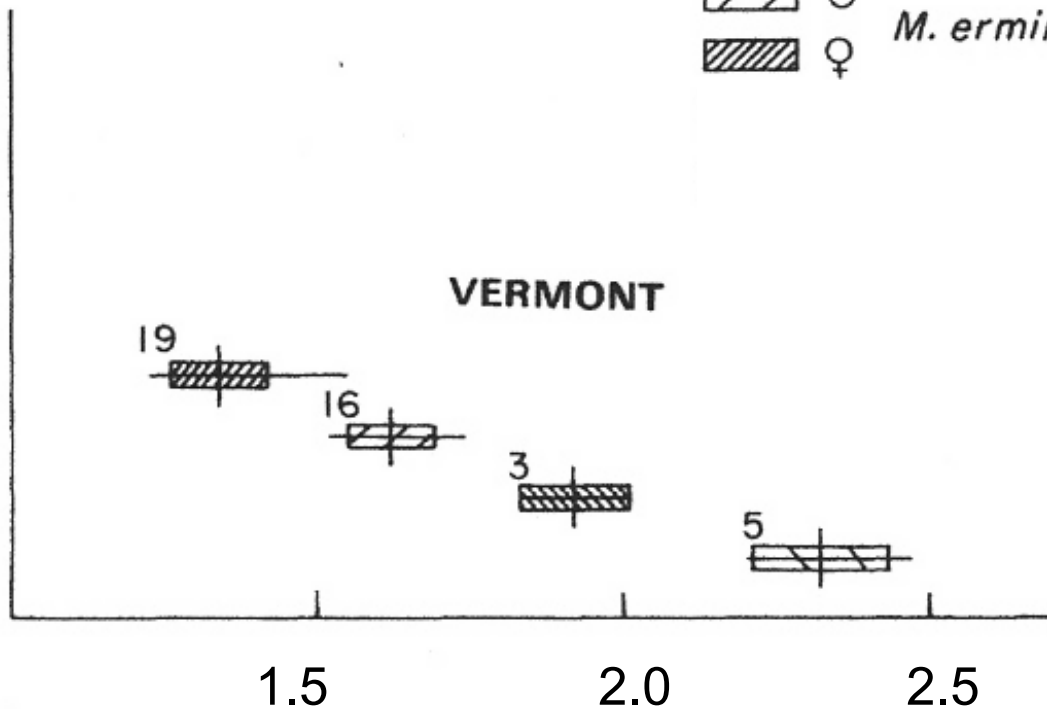
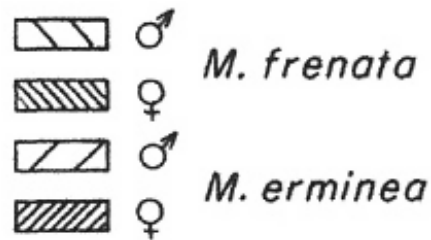
- **character displacement** = divergence of a trait of two or more similar species where they overlap, so that they use different resources

Evolutionary effects of competition

- character displacement = divergence of a trait of two or more similar species where they overlap, so that they use different resources



The cool example: character displacement in *Mustela*



upper canine diameter (mm)

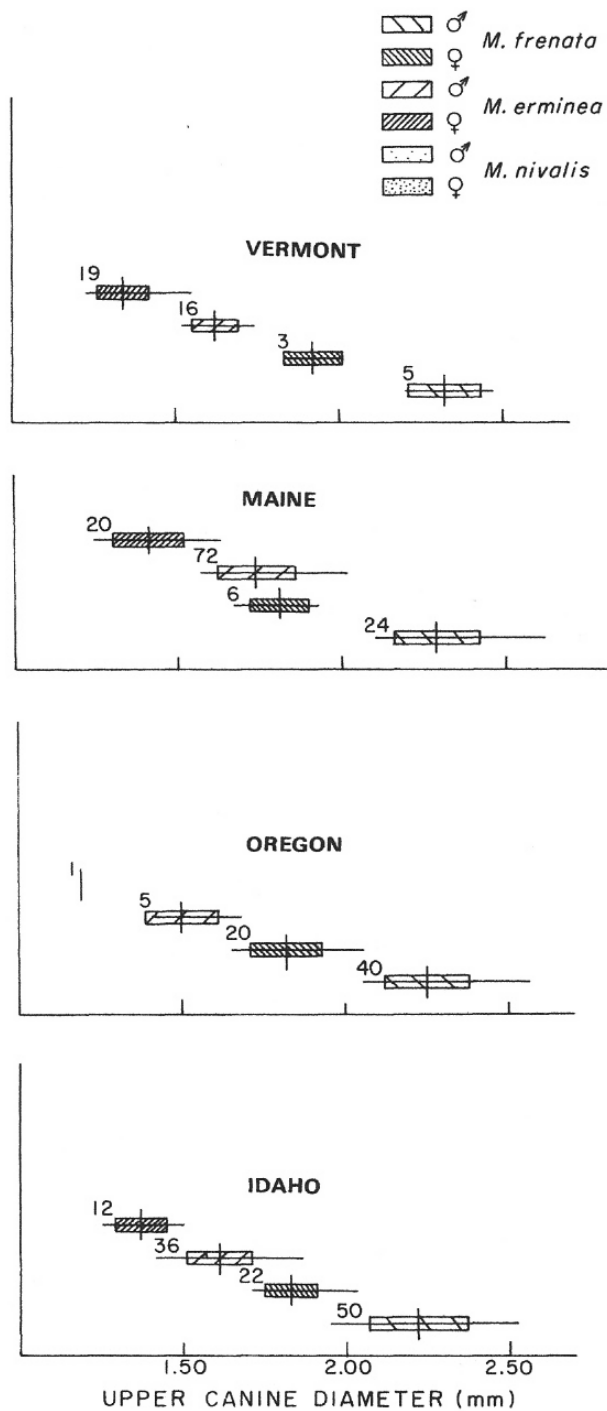
long-tailed weasel



short-tailed weasel



Dayan et al. 1989.

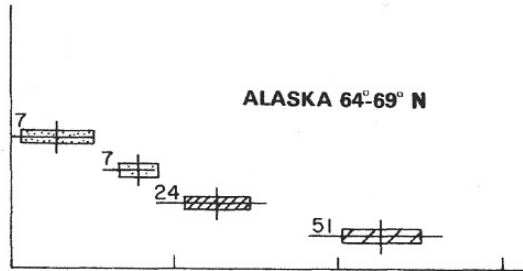
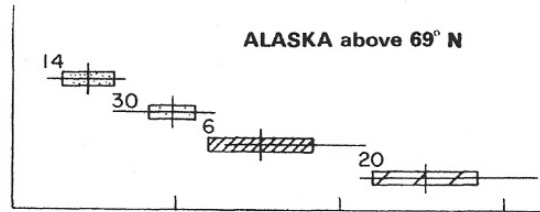
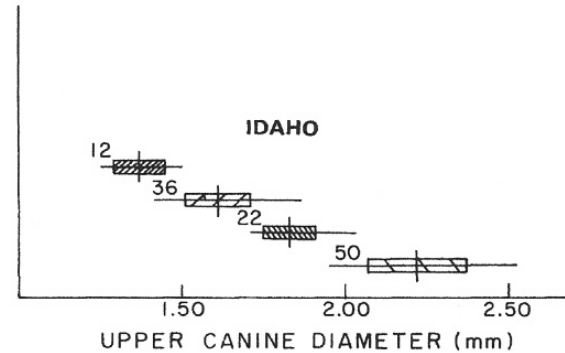
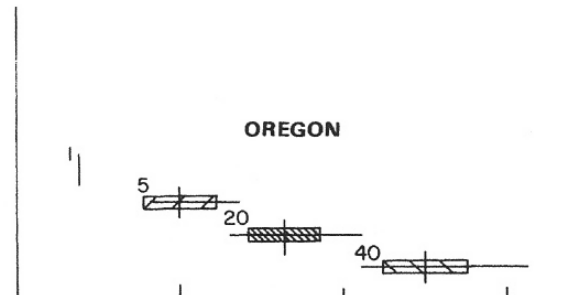
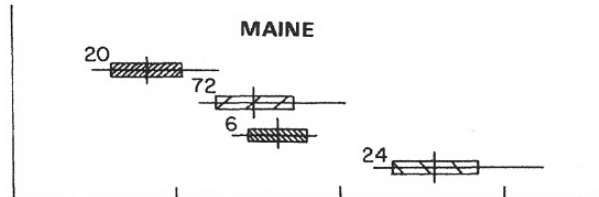
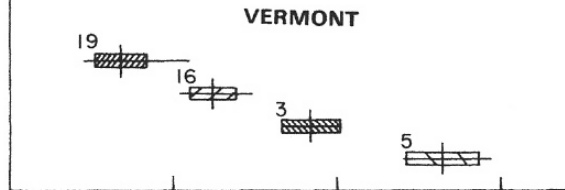
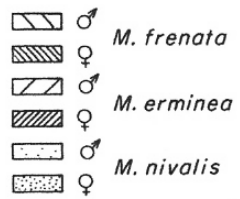


long-tailed weasel



short-tailed weasel



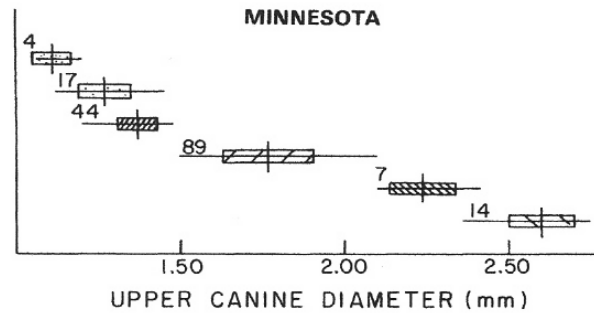
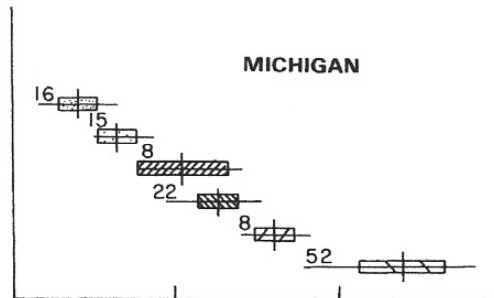
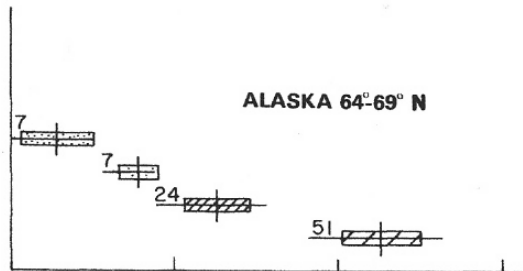
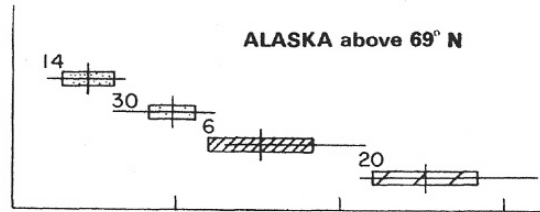
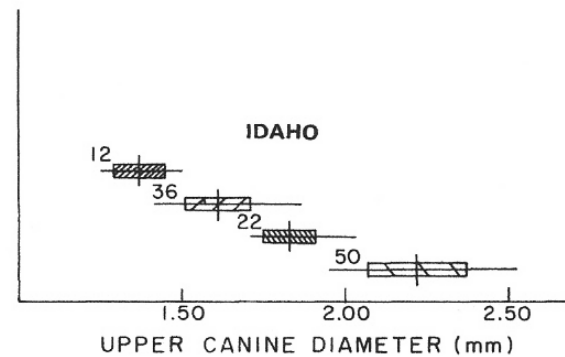
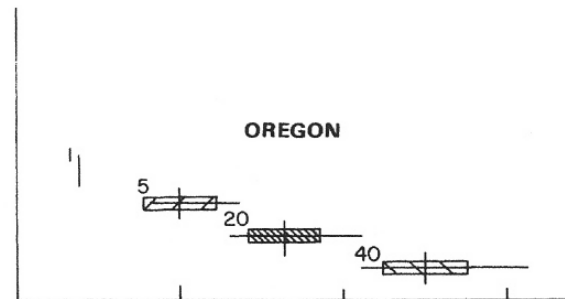
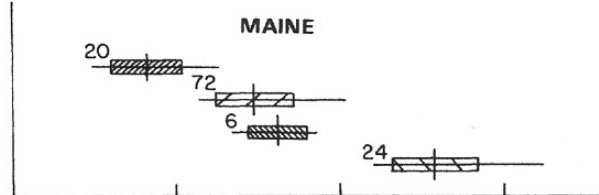
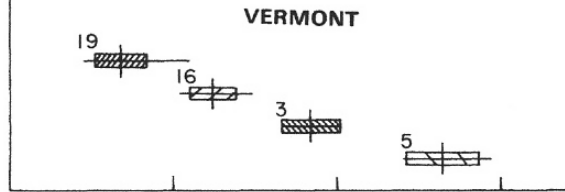
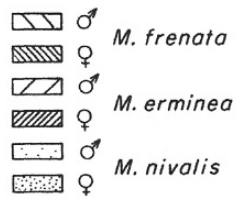


short-tailed weasel

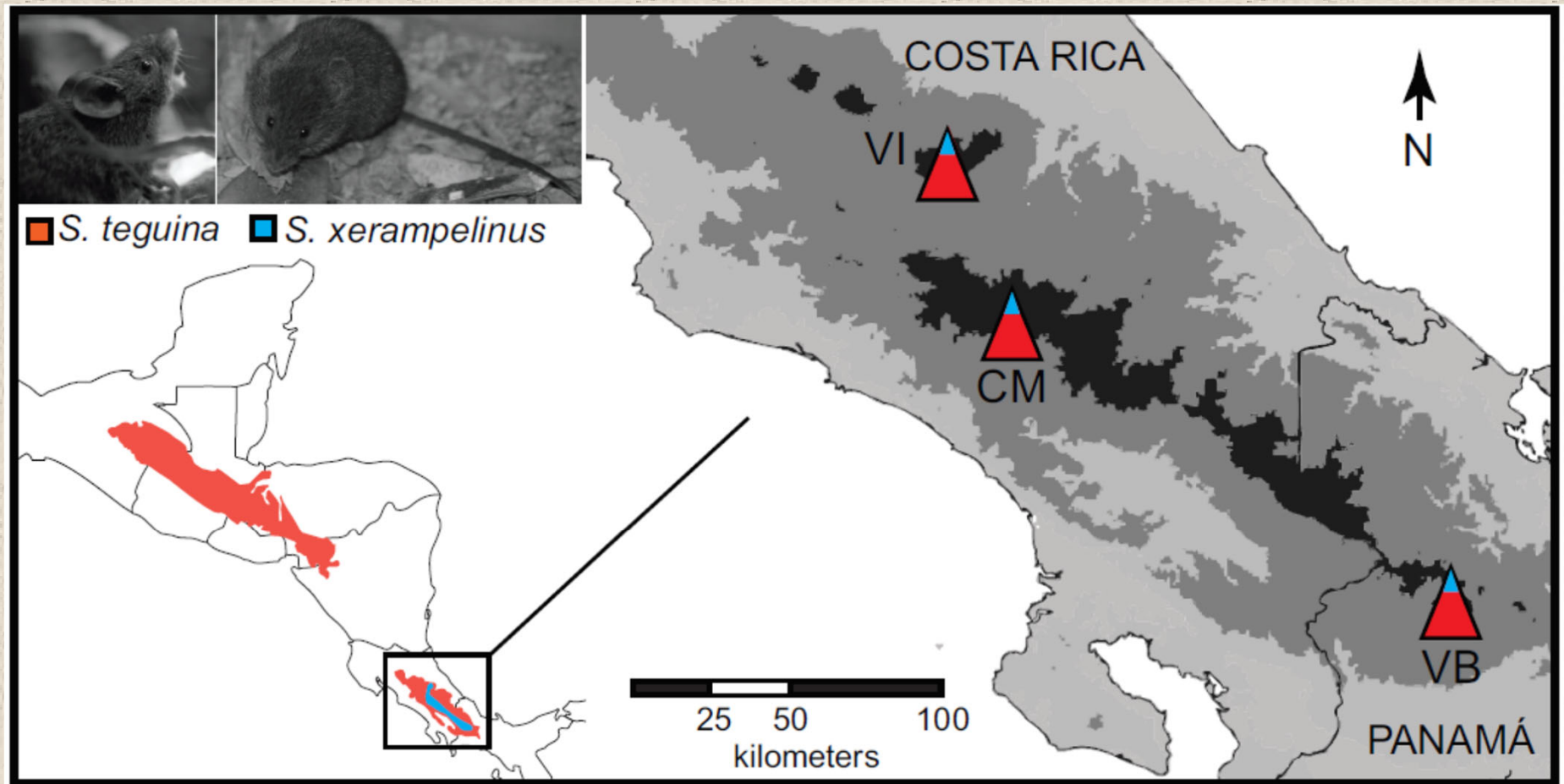


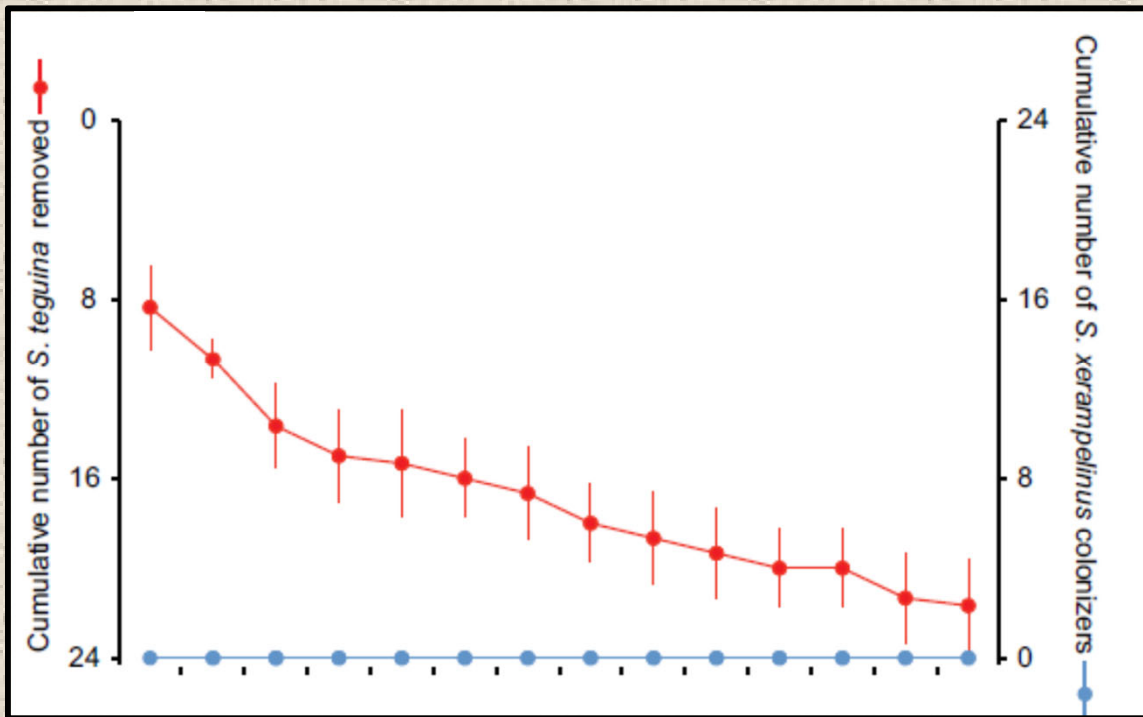
least weasel



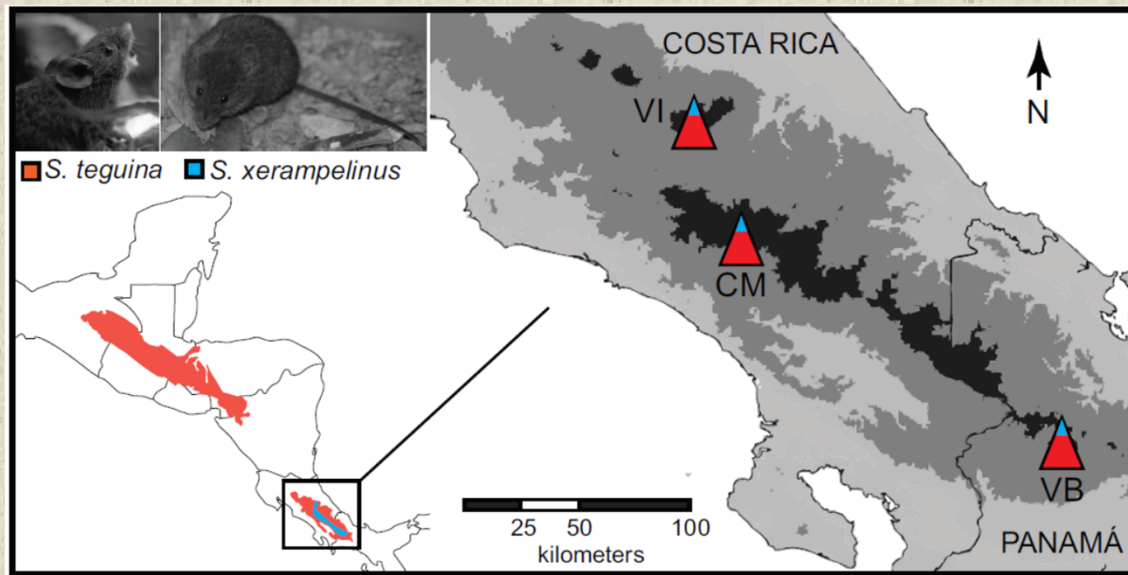


Ecological effects of competition





Chiriqui singing mouse
Scotinomys xerampelinus



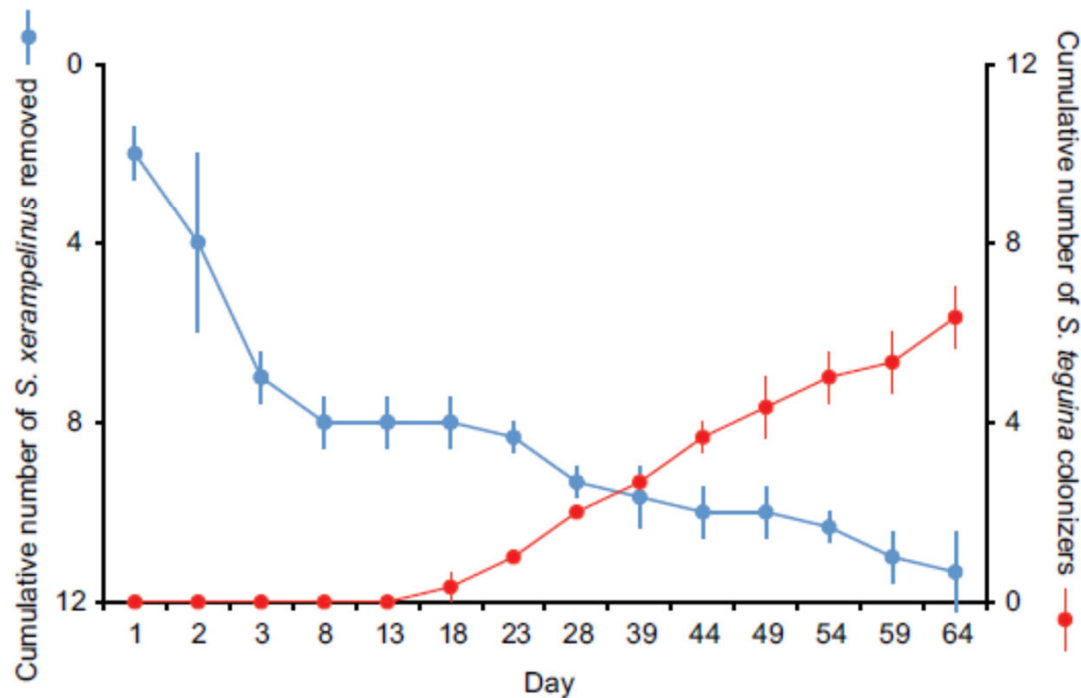
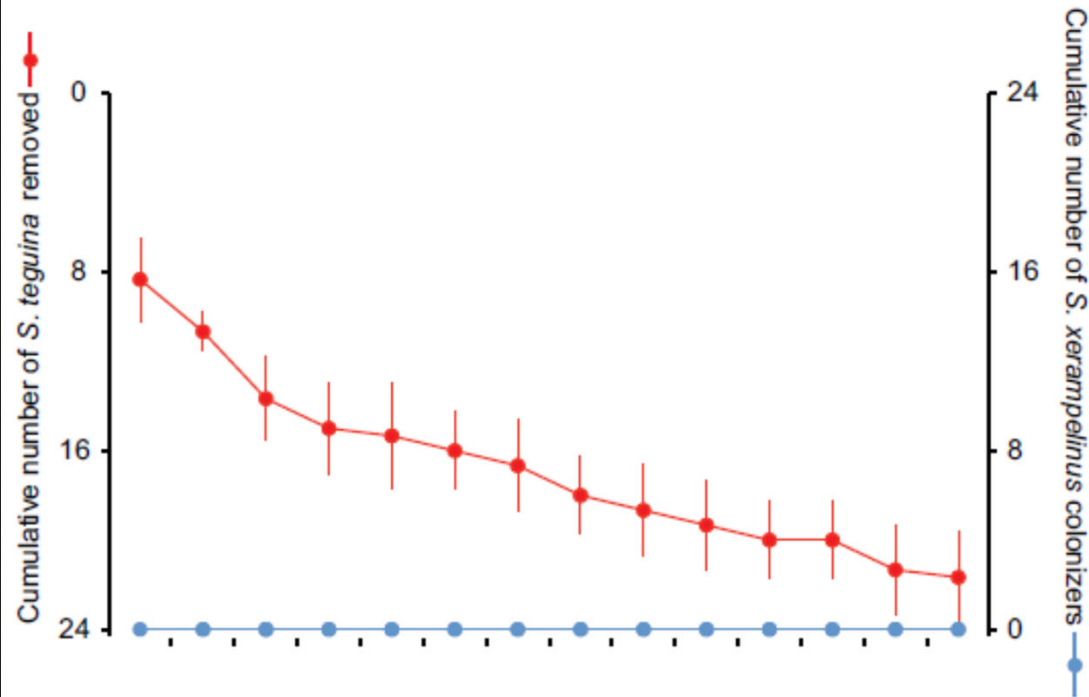
Alston's singing mouse
Scotinomys teguina



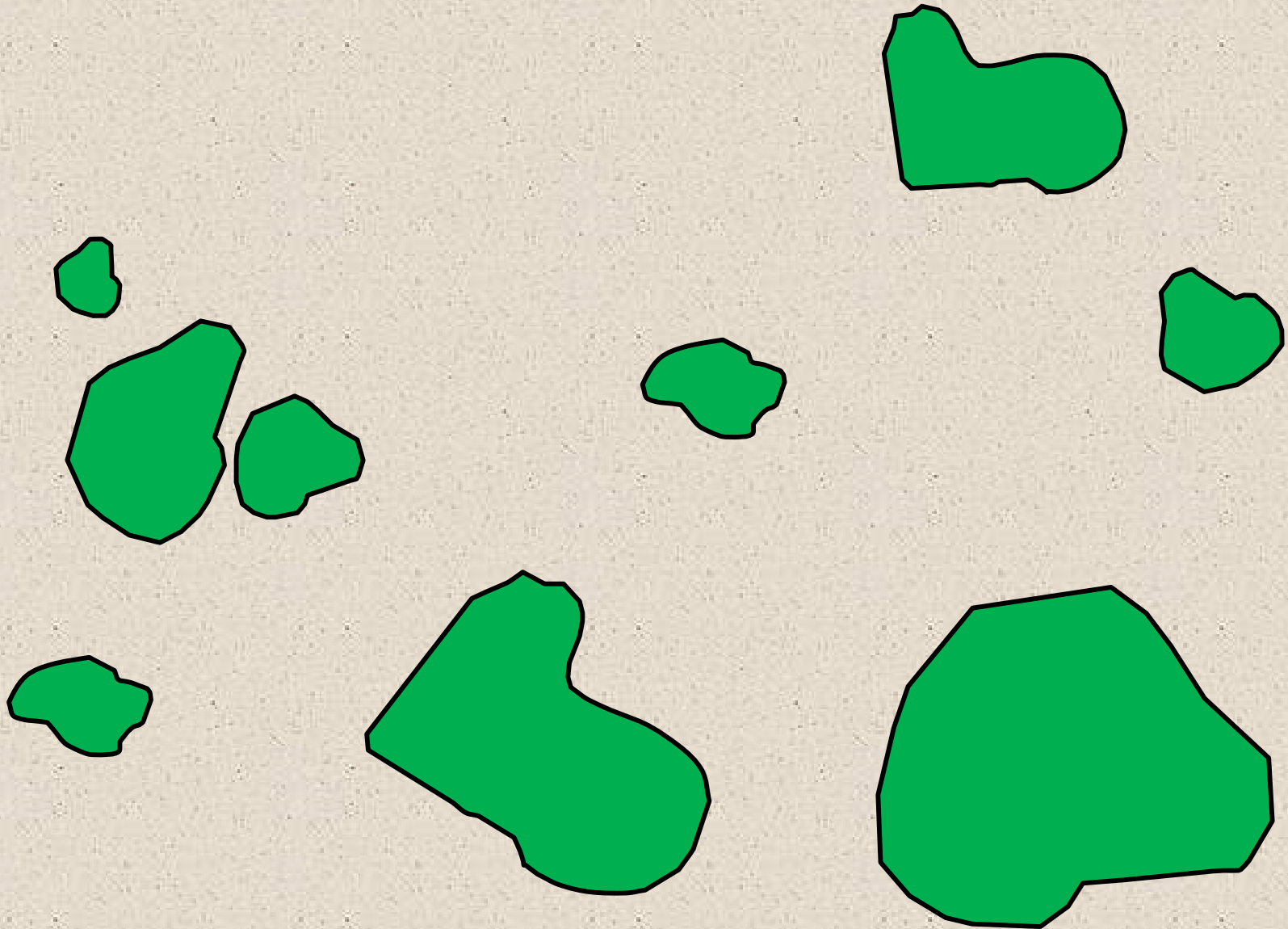
Chiriqui singing mouse
Scotinomys xerampelinus
 high-elevation, dominant



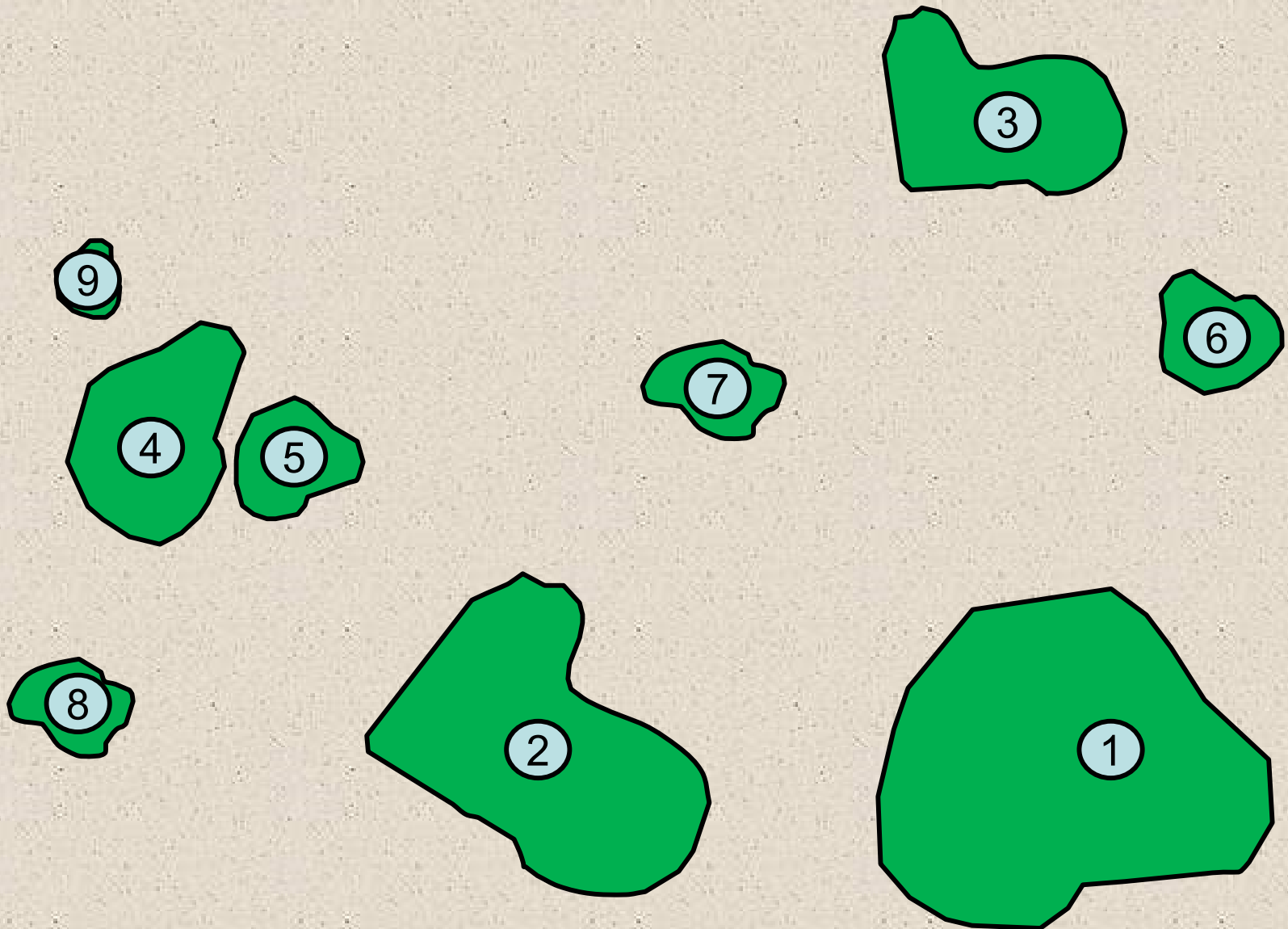
Alston's singing mouse
Scotinomys teguina
 low-elevation, subordinate



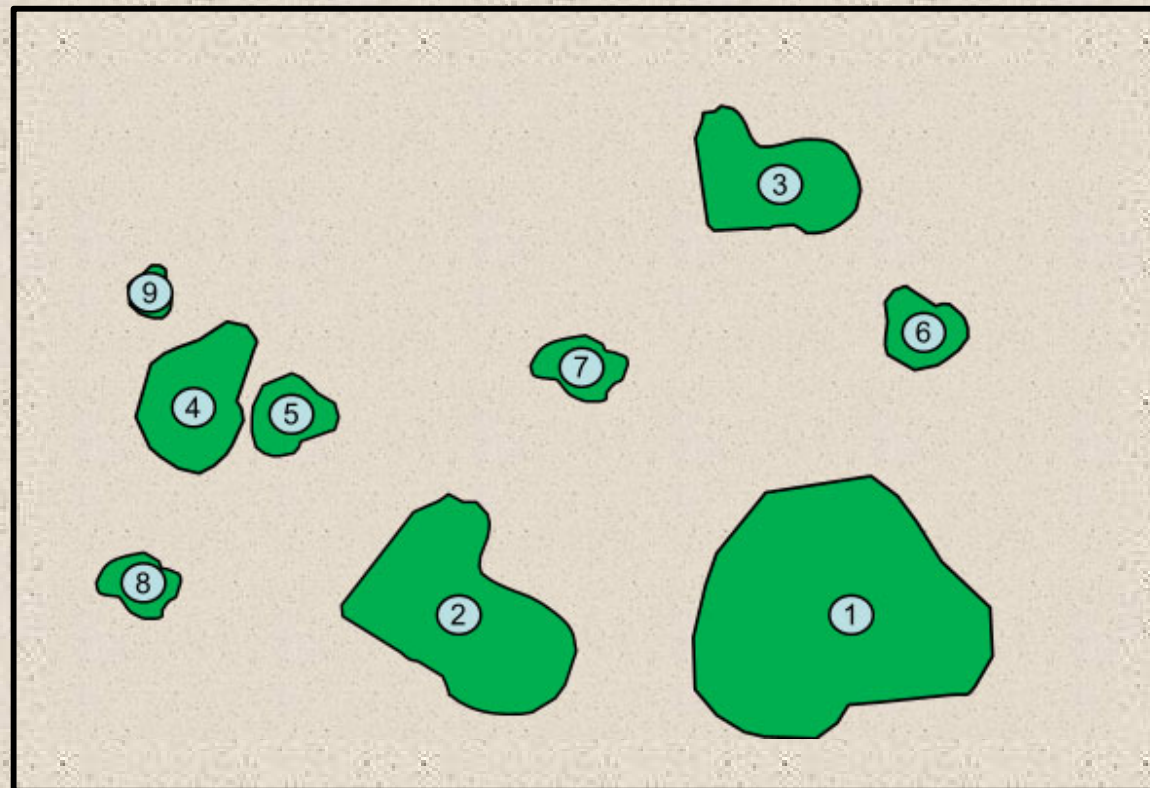
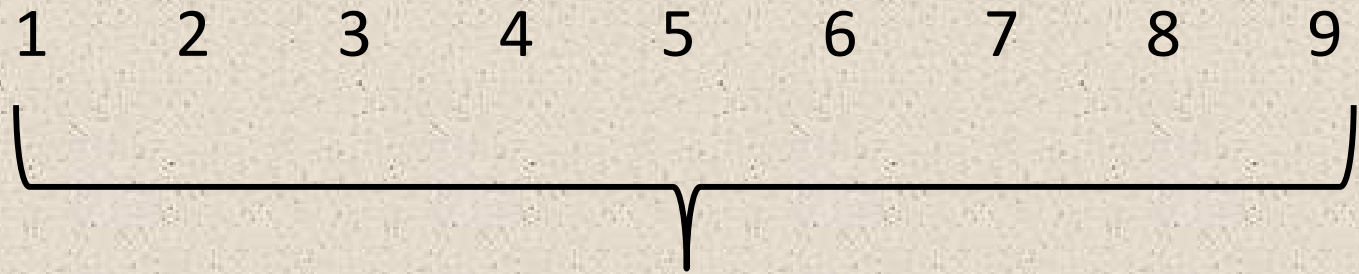
Lyme disease, nestedness, and the dilution effect: why studying competition in rodents matters



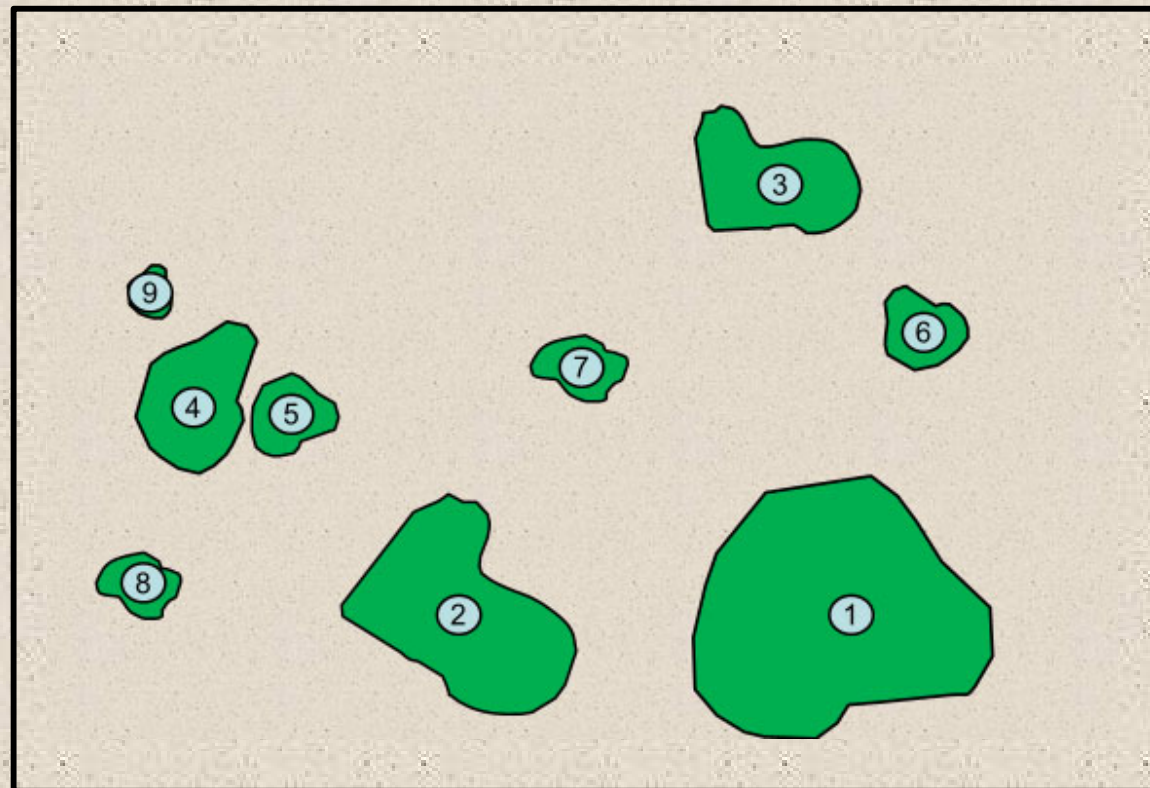
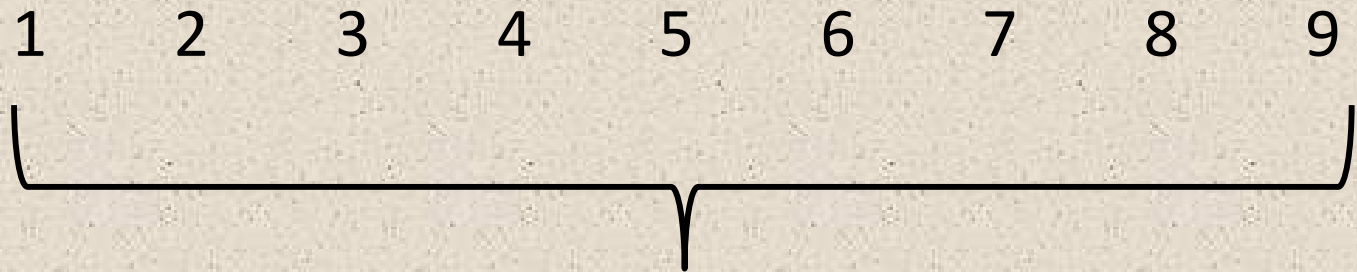
Lyme disease, nestedness, and the dilution effect: why studying competition in rodents matters

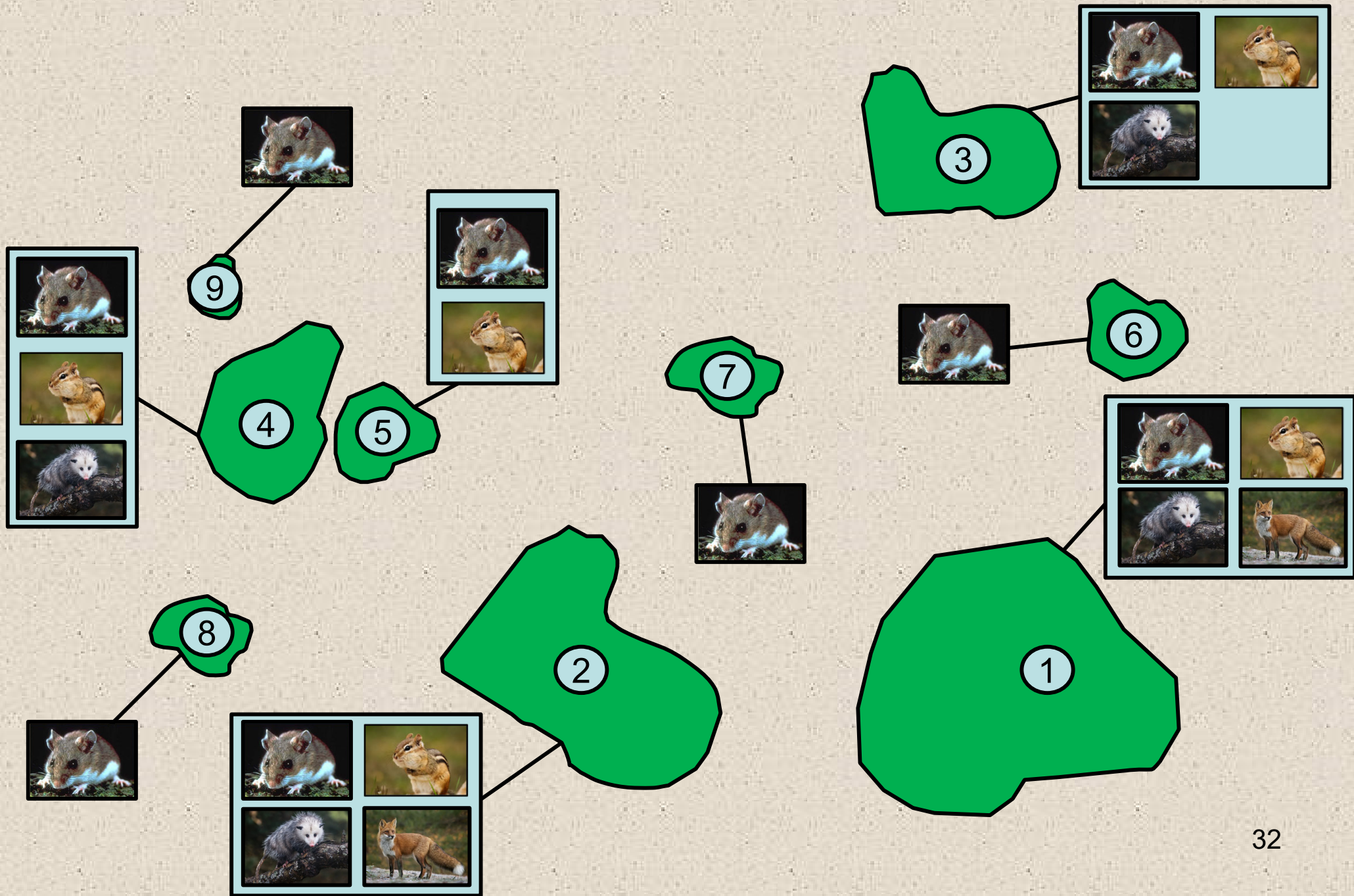


Lyme disease, nestedness, and the dilution effect: why studying competition in rodents matters



Lyme disease, nestedness, and the dilution effect: why studying competition in rodents matters





Lyme disease, nestedness, and the dilution effect: why studying competition in rodents matters



1	2	3	4	5	6	7	8	9
X	X	X	X	X	X	X	X	X



X	X	X	X	X
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X	X	X	X
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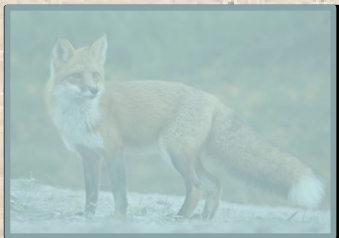
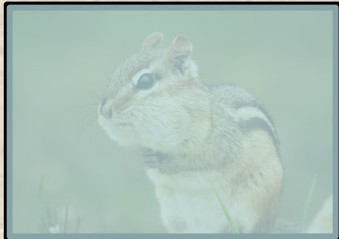


X	X
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- **nestedness** = a pattern in biogeography or landscape ecology in which species-poor local communities are a predictable subset of species-rich local communities

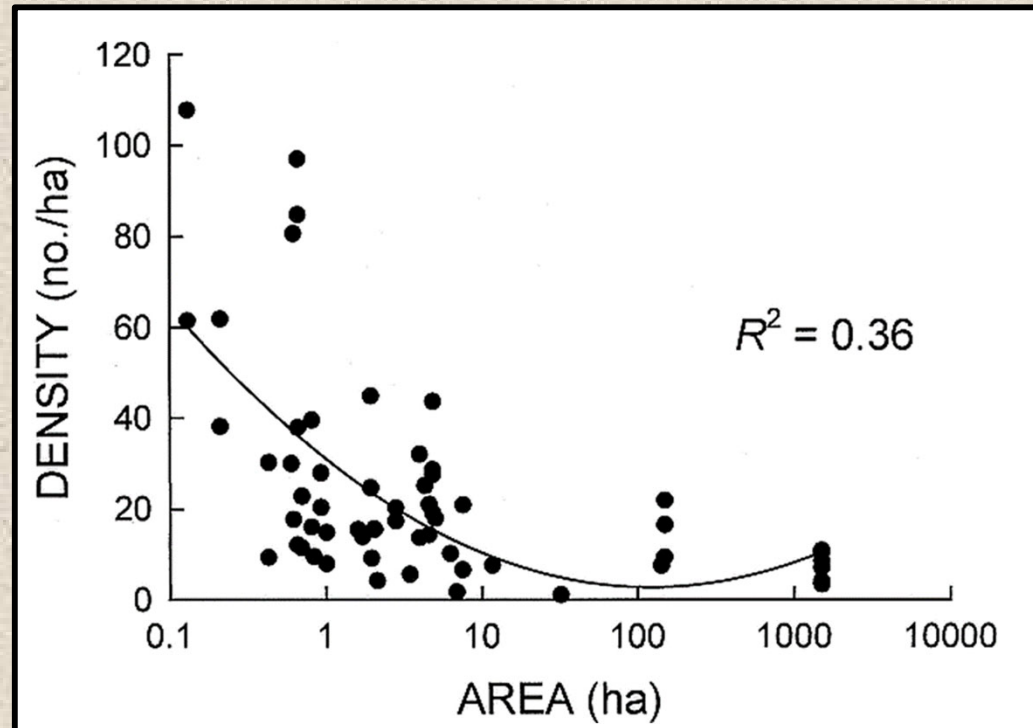
	1	2	3	4	5	6	7	8	9
	X	X	X	X	X	X	X	X	X
	X	X	X	X	X				
	X	X	X	X					
	X	X							

- nestedness = a pattern in biogeography or landscape ecology in which species-poor local communities are a predictable subset of species-rich local communities

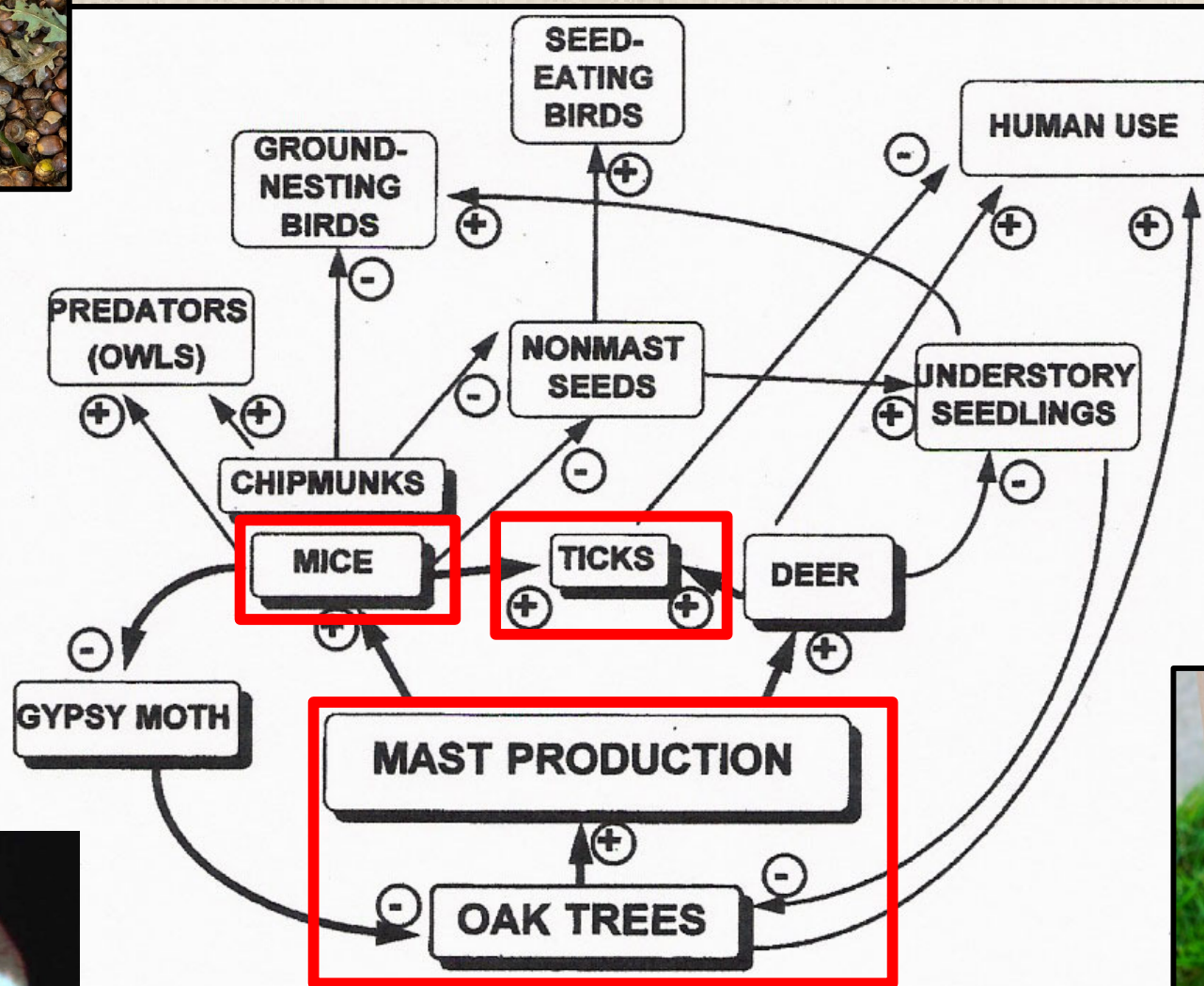


1	2	3	4	5	6	7	8	9
X	X	X	X	X	X	X	X	X

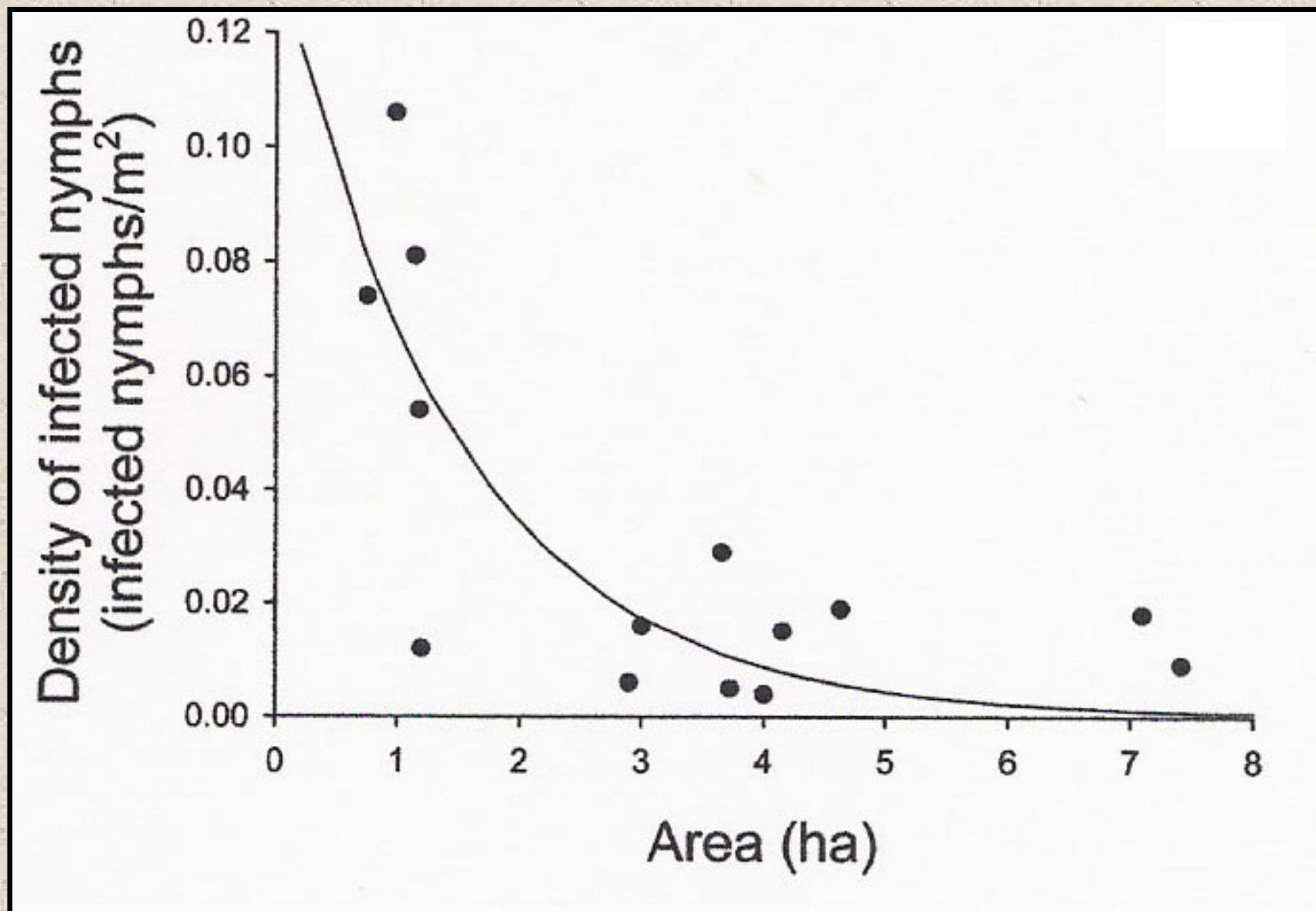
competitive/predation release = increasing *Peromyscus* abundance



Lyme disease, nestedness, and the dilution effect: why studying competition in rodents matters

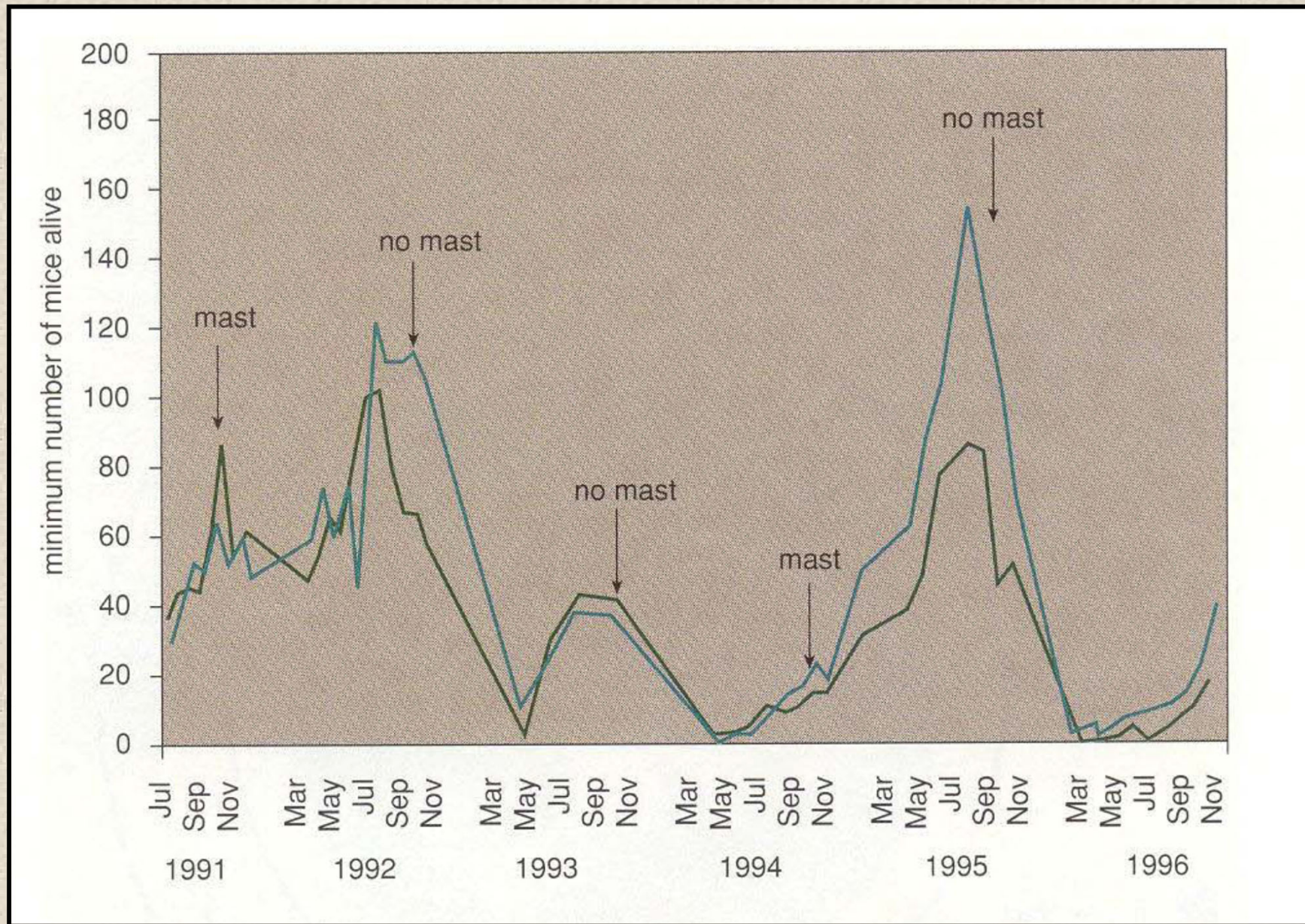


Lyme disease, nestedness, and the dilution effect: why studying competition in rodents matters



Allan et al.
2003.

Lyme disease and the dilution effect



1) The Wyoming pocket gopher is categorized as “Least Concern” on the IUCN Red List. What data from your studies would result in Wyoming pocket gophers being categorized as “Vulnerable” after the subsequent review by IUCN? Click on a single answer.

- ☐ (A) more rapid population declines than in previous years
- ☐ (B) a small geographic range and declining populations
- ☐ (C) a global population size of <2500 individuals
- ☒ (D) more than one, but not all of A through C
- ☐ (E) all of A through C
- ☐ (F) none of A through C

Question 2

QUIZ #4

4 pts

2) Based on your mammalogy course lectures, which of the following would be *least* expected?
Click on a single answer.

- ☐ (A) a mammal <100g with a geographic range throughout North America
- ☐ (B) a mammal <100g with a geographic range restricted to a single state in the U.S.
- ☐ (C) a mammal >100kg with a geographic range throughout North America
- ☒ (D) a mammal >100kg with a geographic range restricted to a single state in the U.S.

Question 3

2 pts

3) Based on IUCN ranking criteria, Bowyer et al showed that odd-toed ungulates had one of the highest % threat levels of all mammalian orders.

- ☒ True
- ☐ False

4) Which of the following statements is correct (click on just one)?

- ☐ (A) compared to ruminant fermentation, hindgut fermentation extracts more energy from plants because most fermentation occurs anterior to the small intestine
- ☐ (B) hindgut fermentation results in quicker rates of food passage than ruminant fermentation
- ☐ (C) coprophagy does not typically occur in ruminants
- ☐ (D) ruminant fermentation is associated with cud-chewing
- ☐ (E) all of A through D
- ☒ (F) some but not all of A through D

Question 5

QUIZ #4

4 pts

5) The energetic-equivalence rule:

- ☐ (A) shows that populations of mammals of different body sizes that occur in the same area tend to consume equivalent amounts of energy
- ☐ (B) occurs because two allometries—one between body size and energy consumption by individuals, and one between body size and population density—cancel out
- ☒ (C) both A and B
- ☐ (D) neither A nor B

Question 6

2 pts

6) Regarding Bergmann's Rule, Alston et al found that Nearctic bats at higher latitudes were larger than those at lower latitudes.

- ☒ True
- ☐ False