Main Points

1) Use of life tables to visualize age-specific fecundity and survival
   -- life-history variables
   -- example: life in the slow lane for order Primates
   -- r and K strategies
   -- example: exceptional life histories and foraging strategies in the Canidae
   -- example: density-dependent versus risk disturbance effects of shooting on black-tailed prairie dogs (Pauli and Buskirk reading)

2) Non-consumptive effects of predators
   -- maternal effects and stress
   -- example: the snowshoe hare cycle and implications for the lingering effects of stress
   -- example: ambush predators, coursing predators, and the evolution of hunting behavior

Pre-reading: Wednesday 25 Oct = Ford et al. 2014.
Monday 30 Oct = NA.

Wednesday 1 Nov = Test 2. Bring questions for Q&A at the end of class for next Monday.

<u>Terms:</u> life table, survivorship curve, prey switching, maternal effect, coursing predator, ambush predator

Convergent evolution of migration

Common attributes of migratory systems:

1) resource is sufficiently attractive to warrant moving such distances

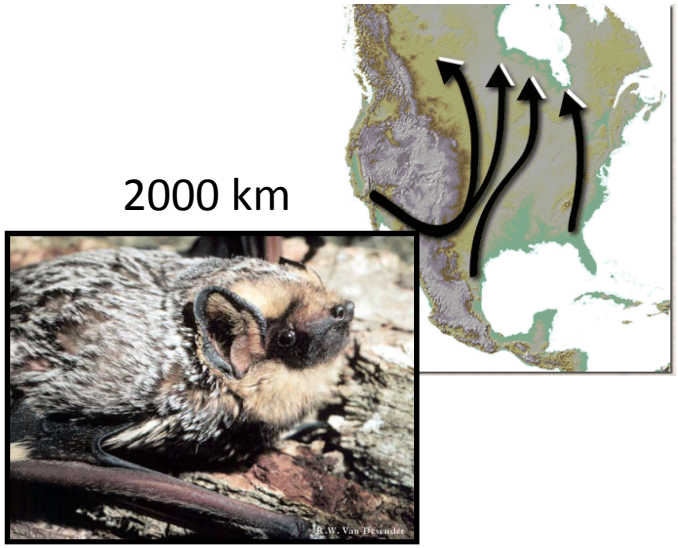
2) return movement is initiated by the depletion of the periodic resource

3) no physical barriers to movement

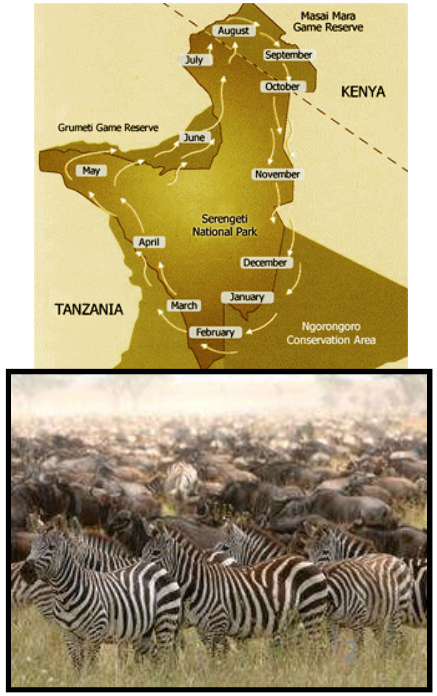
4) cycle of available resources must be predictable based on external cues

5) movement of population is directional

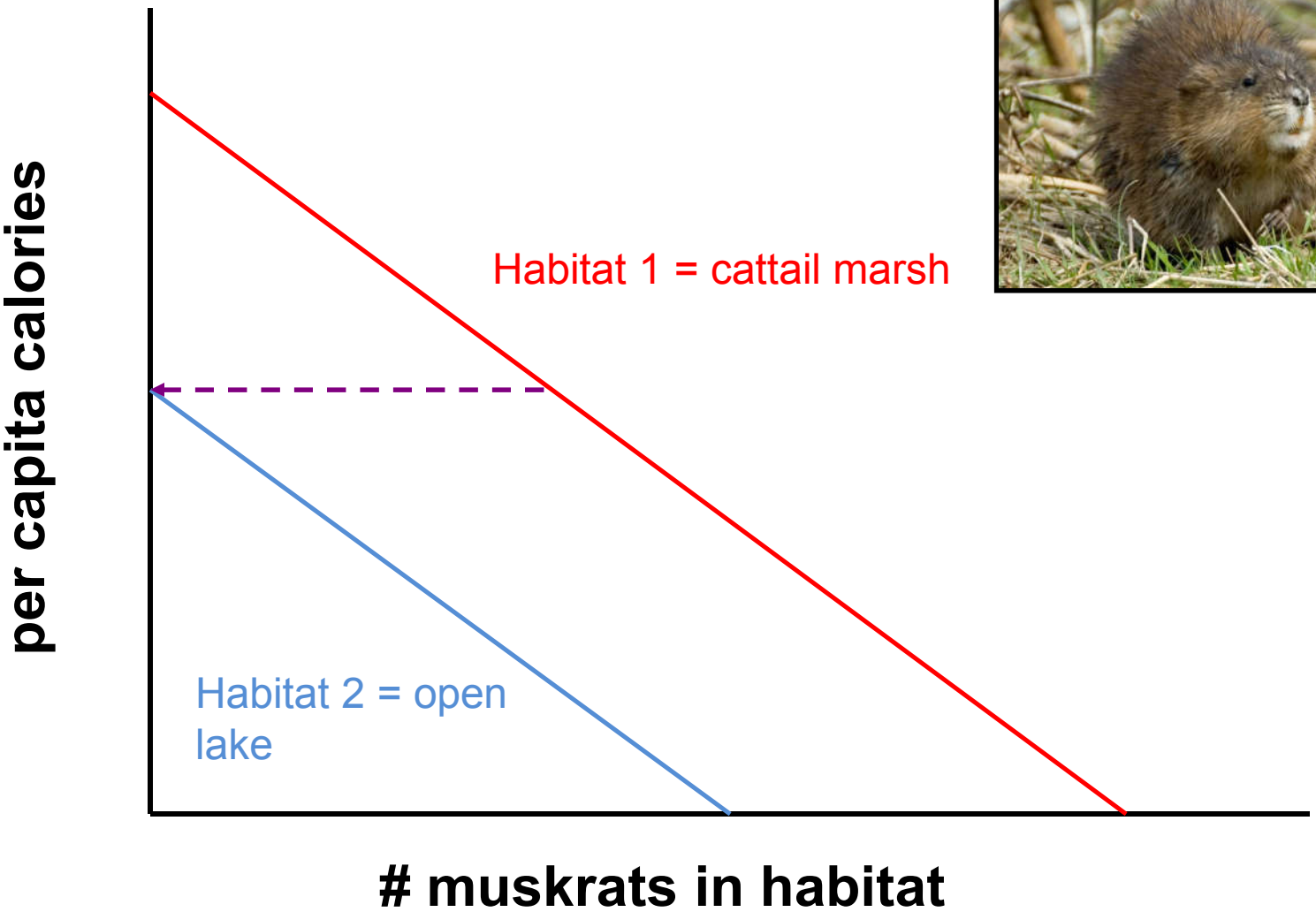
2000 km



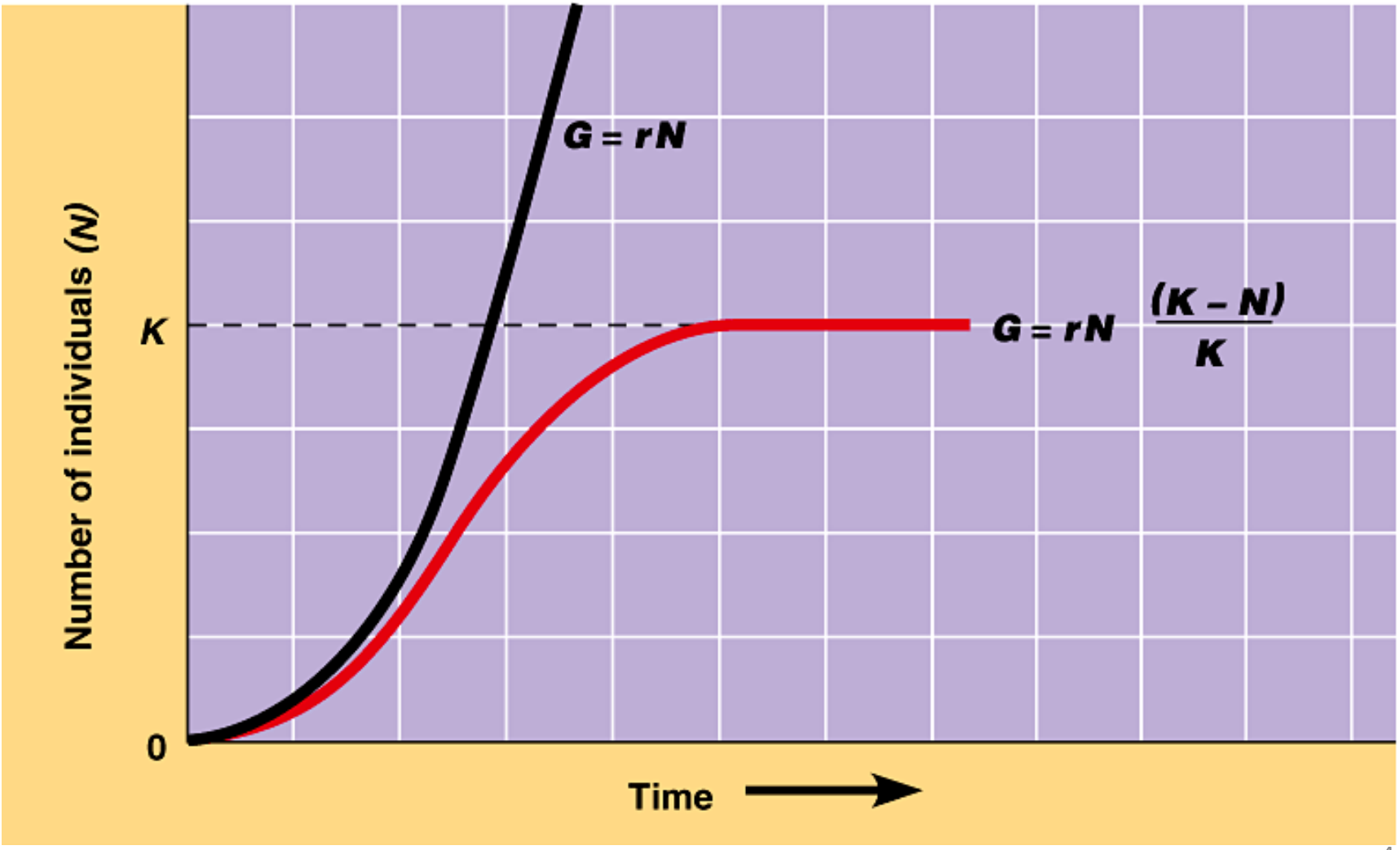
800 km



Ideal Free Muskrats



Population growth review



Units of biological organization

INDIVIDUAL

Age
Size
Sex
Behavior
Development
Growth
Feeding
Reproduction
Death

POPULATION

Age distribution
Sex ratio
Spatial distribution
Density
Population growth
Survivorship
Demographics

COMMUNITIES

Species Diversity
Species Interactions
Food Webs
Feeding Guilds
Energy Flow

Life history strategies

- **three most important life-history variables controlling population growth and demography:**

  1) female age at first reproduction
  2) mean number of female offspring per female
  3) mean female survival

Life history strategies

Common Name	Species Name	Age at First Reproduction (yr)	Maximum Age (yr)	Mean Female Offspring per Female	Mean Fertility (*F*)	Mean Adult Survival (*P*)
Red deer[1]	*Cervus elaphus*	2	15	0.34	0.30	0.80
Wildebeest [2]	*Connochaetes taurinus*	2	16	0.38	0.15	0.84
Zebra[3]	*Equus burchellii*	3	20	0.24	0.20	0.89
African elephant[4]	*Loxodonta africana*	14	60	0.10	0.07	0.94
Lion[5]	*Panthera leo*	2	17	0.39	0.19	0.90
Harbor seal[6]	*Phoca vitulina*	4	35	0.41	0.16	0.89
Orca[7]	*Orcinus orca*	13	60	0.07	0.07	0.99
Chimpanzee[8]	*Pan troglodytes*	14	50	0.09	0.08	0.95
Short-tailed fruit bat[9]	*Carollia perspicillata*	1	10	0.65	0.35	0.66
Little brown bat[10]	*Myotis lucifugus*	1	12	0.50	0.16	0,86
Belding's ground squirrel[11]	*Spermophilus beldingi*	1	9	1.70	0.66	0.52
Red squirrel[12]	*Tamiasciurus hudsonicus*	1	6	1.90	0.63	0.52
Snowshoe hare[13]	*Lepus americanus*	1	4	9.30	0.95	0.20

Discussion Q: what do you notice about the life history variables of species in this table? Why do you think this occurs?

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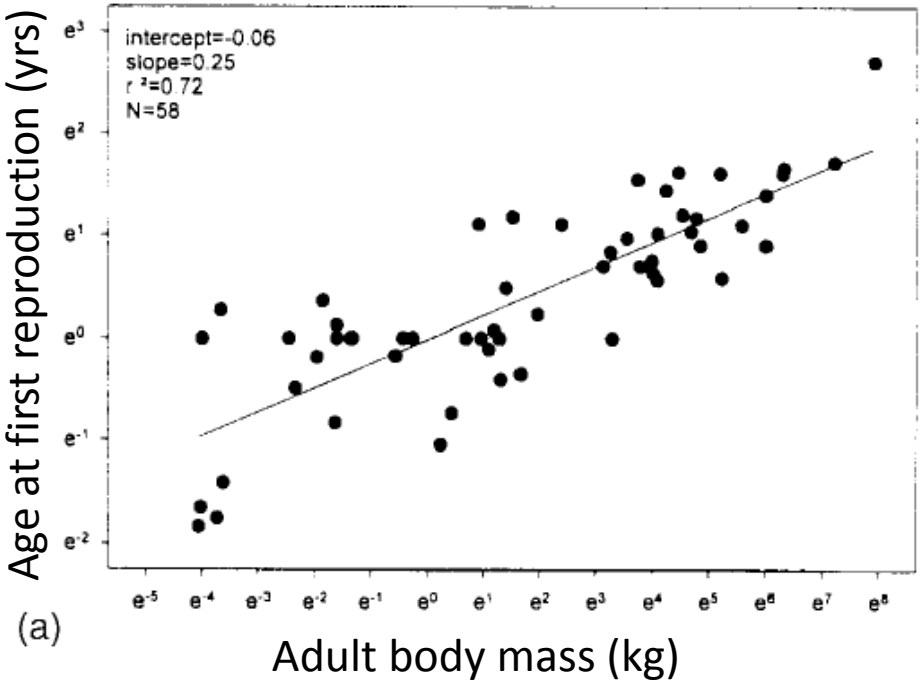
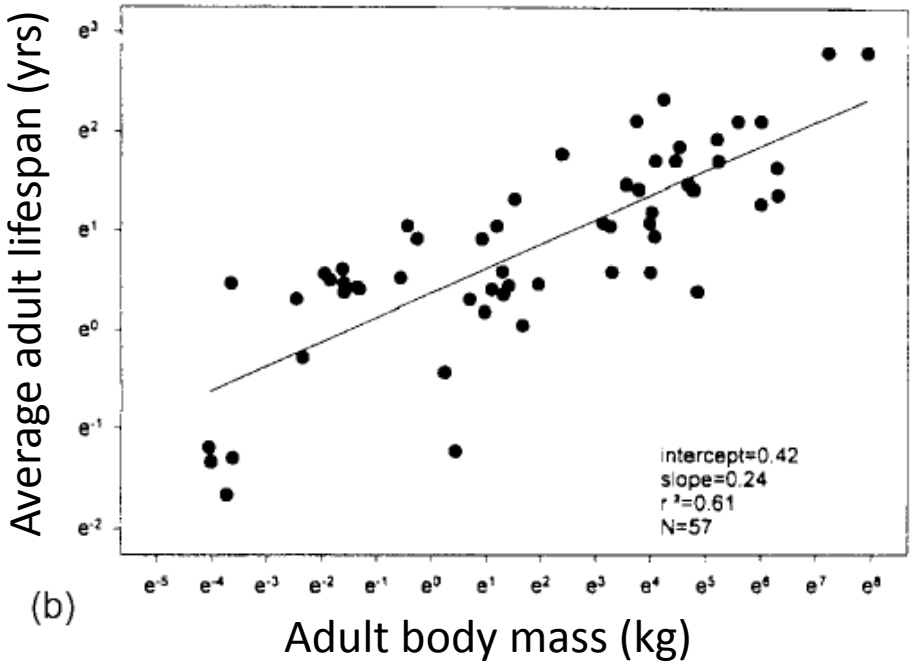
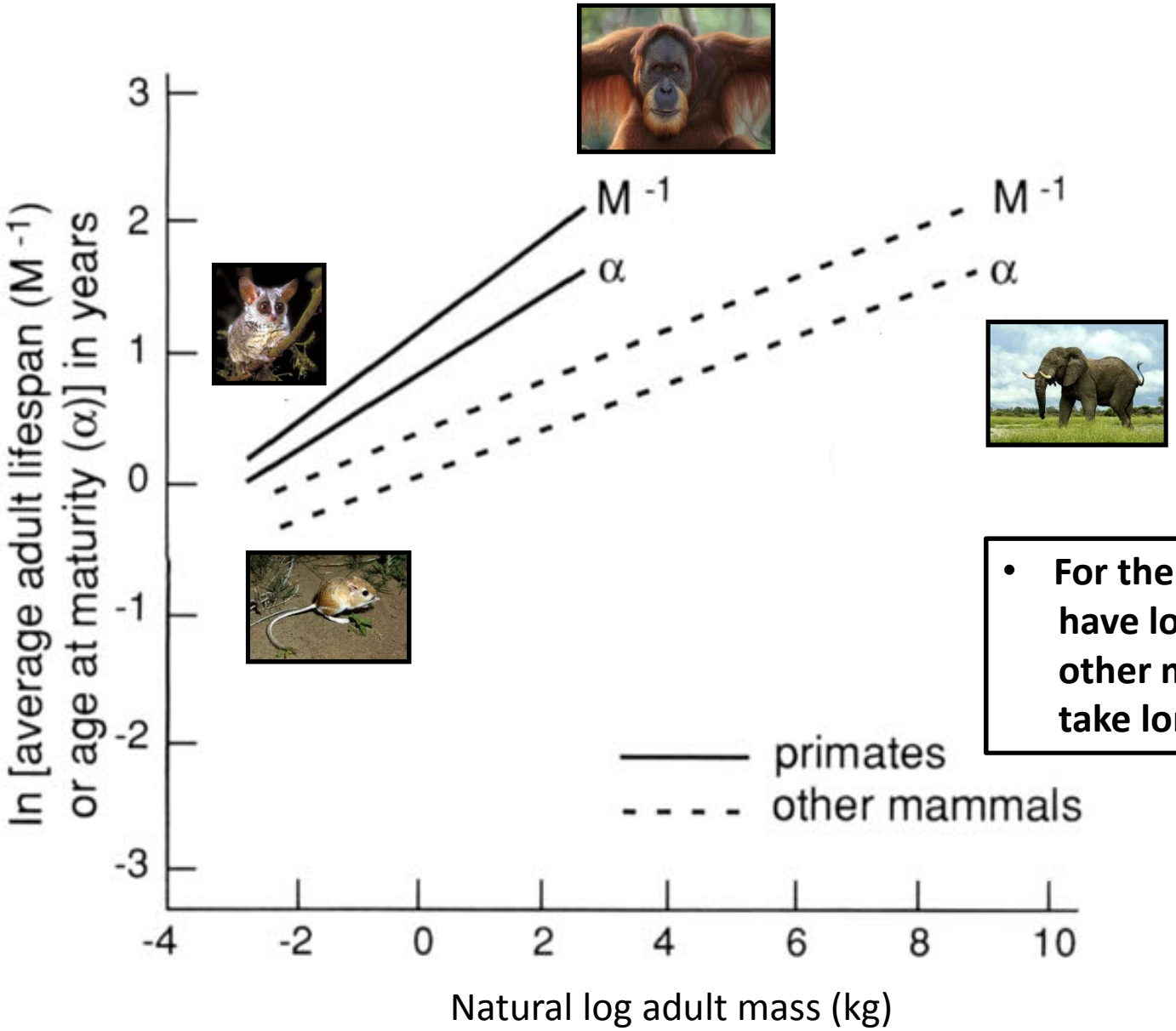
Life history strategies of “typical” mammals



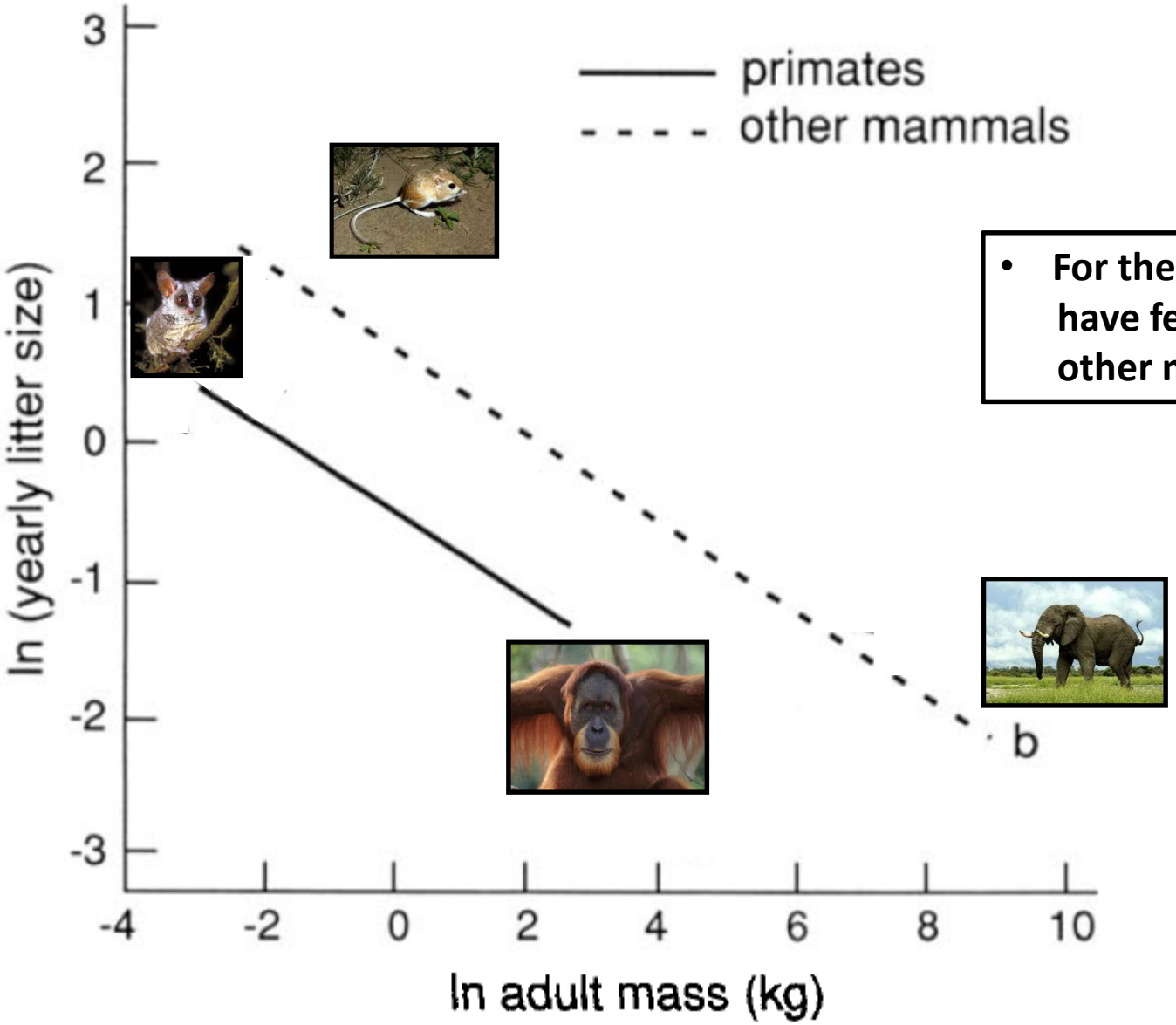


Life history strategies of Primates



- **For their size, primates have longer lifespans than other mammals, and they take longer to mature.**

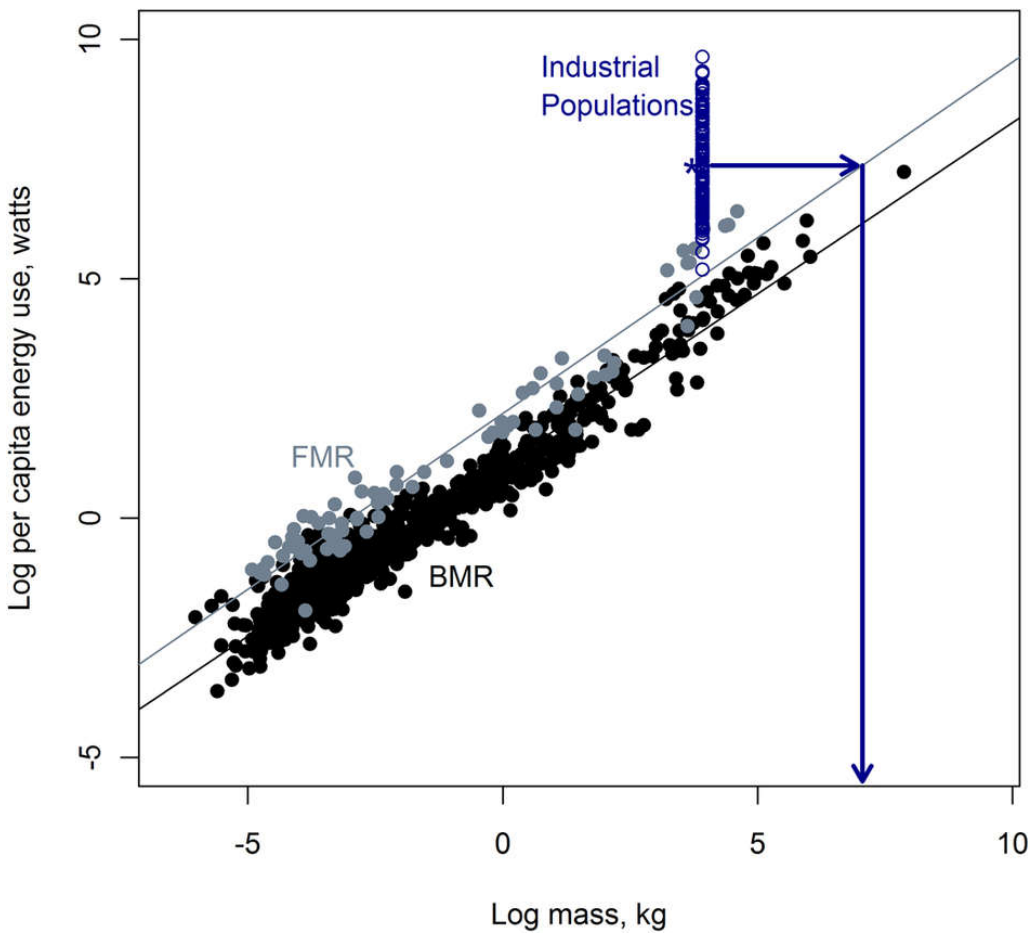
Life history strategies of Primates



- **For their size, primates have fewer kids than other mammals.**

Life history strategies of Primates

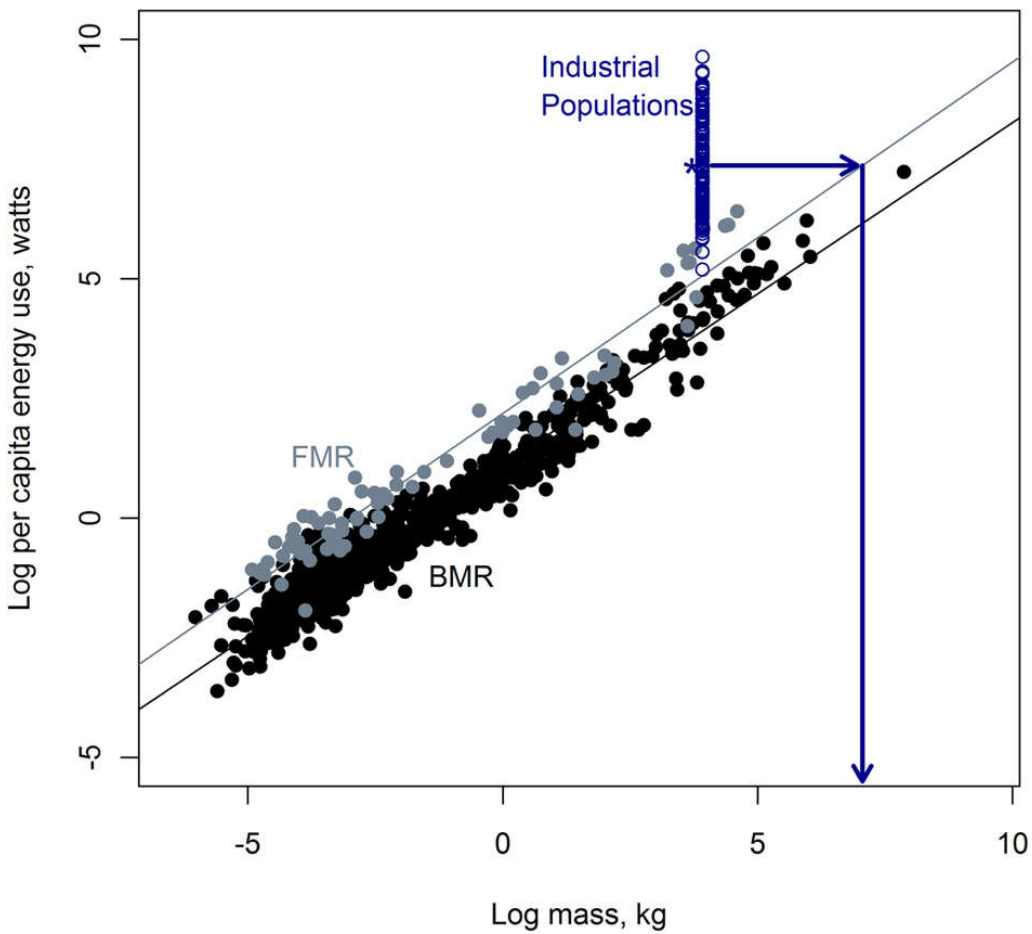
- **technologies of <u>H. sapiens</u> increases its energy use through extra-metabolic energy**



Burger et al. 2011.

Life history strategies of Primates

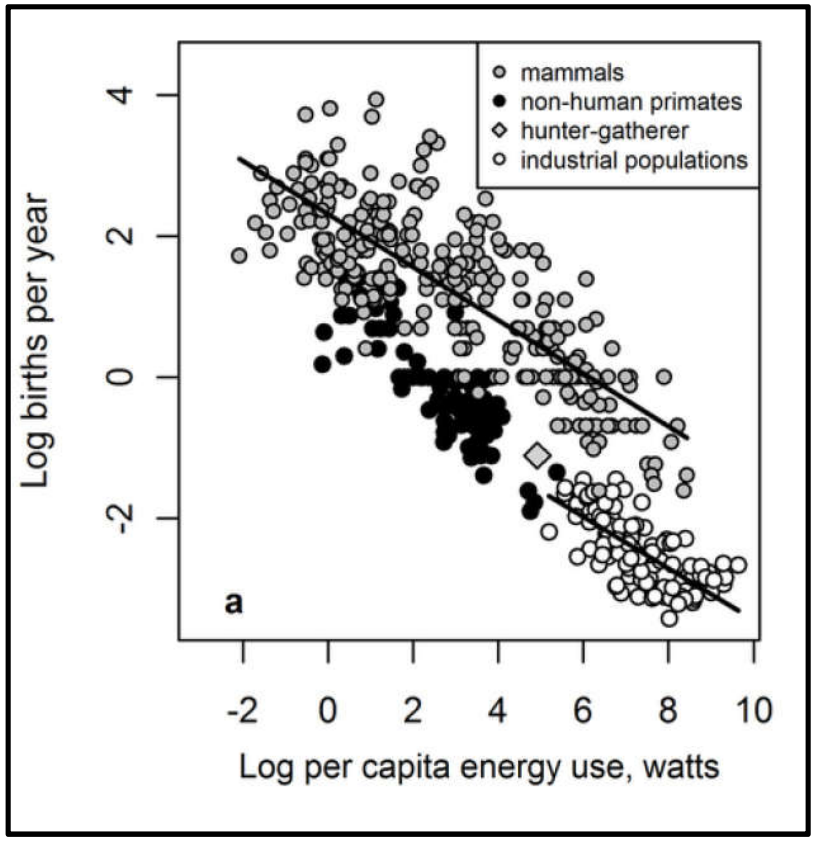
- **per capita energy use by <u>H. sapiens</u> is roughly that expected of a 92,500 kg primate.**



Burger et al. 2011.

Life history strategies of Primates

- **number of births per year declines with energy use**



small (0.1 kg) non-human primate

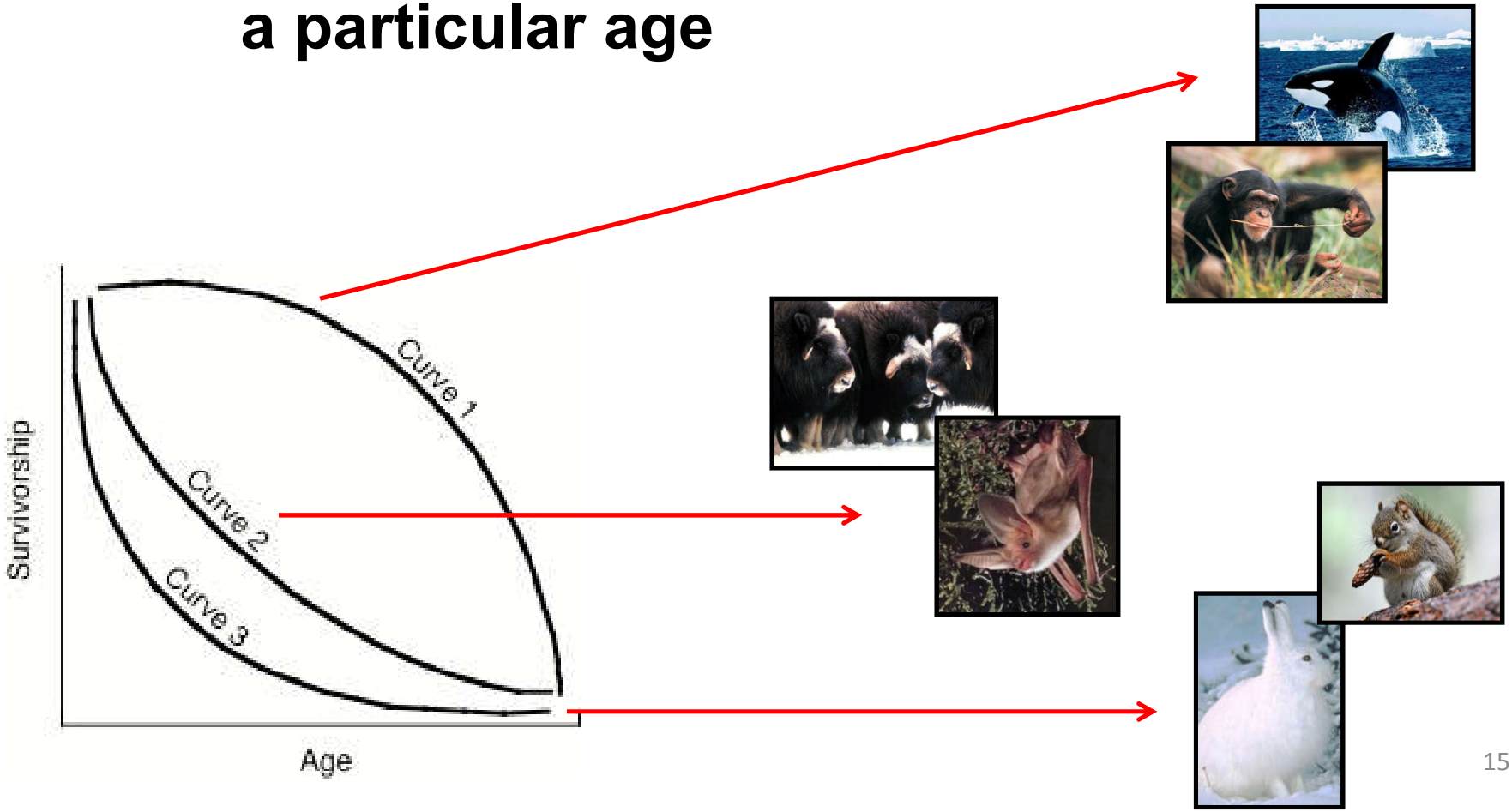
large (70 kg) non-human primate

human (70 kg) hunter-gatherer primate

human (70 kg) non hunter-gatherer primate

Life history strategies

- <u>survivorship curve</u> = graph showing number or proportion of individuals surviving for a particular age



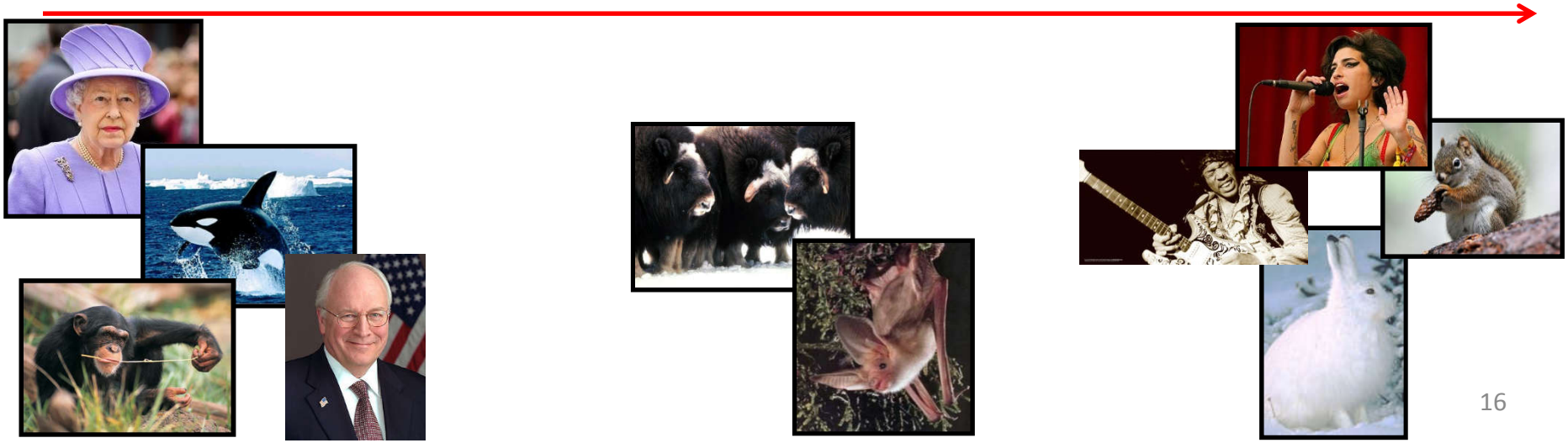
Life history strategies

- <u>r selection</u> = selection for high growth rates

-- low adult survival

-- large litter sizes

-- parental care is minimal



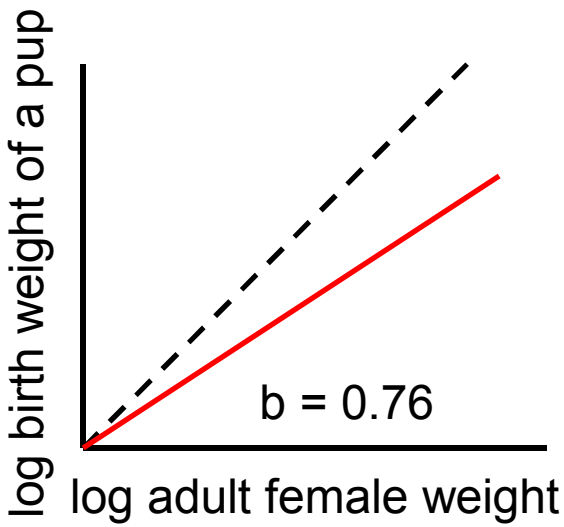
Life history strategies

- <u>K selection</u> = selection for low growth rates.
  -- high adult survival
  -- low litter sizes
  -- slow development/long maturation leads prolonged parental care

Life histories and foraging in the Canidae

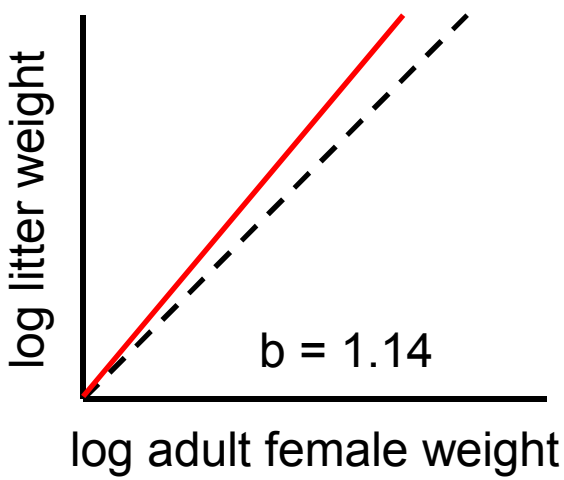
- **Most medium-sized canids (10-20kg; e.g., coyotes, most jackals, many foxes, bush dog, raccoon dog) are obligately monogamous**

Life histories and foraging in the Canidae



= isometry

= allometry in canids



<u>Allometry Review:</u>
birth weight = a(adult female weight^b)

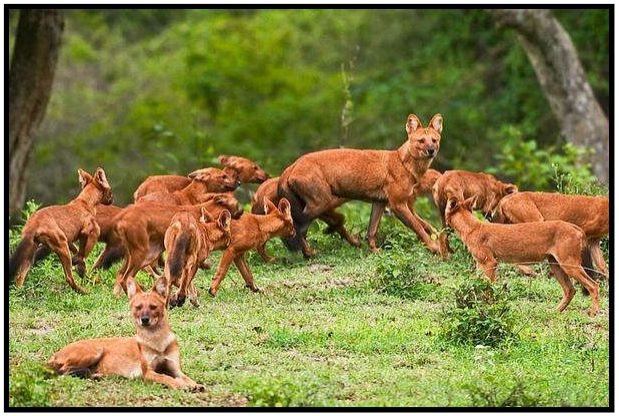
log (birth weight) =
log a + b*(log adult female weight)

Life histories and foraging in the Canidae

- **Large canids (~ 30 kg) sometimes monogamous, sometimes tend toward <u>polyandry</u> (esp. in AWD and dhole)**
  -- large litters
  -- young are altricial
  -- young survive better when helper males are present
  -- sometimes female competition for males

African wild dog, avg 12 pups
adult weight = 30 kg

dhole, avg 6 pups
adult weight = 25 kg



gray wolf, avg 5 pups
adult weight = 35 kg

Life histories and foraging in the Canidae

- **Small canids (< 5 kg) sometimes monogamous, sometimes tend toward polygyny (esp. in BEF)**
  -- small litters
  -- young are precocial
  -- male competition for females

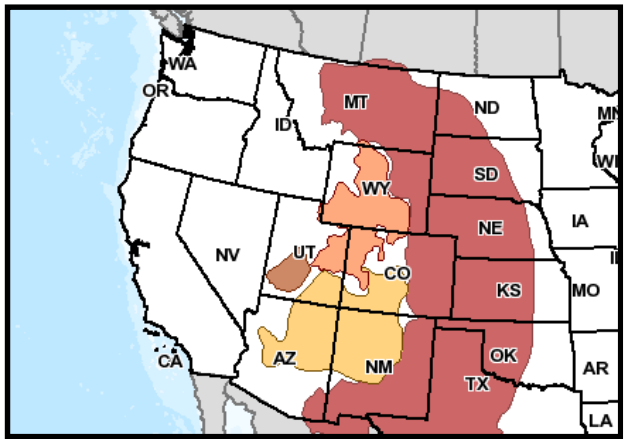
bat-eared fox, avg 3 pups, adult weight = 3 kg

fennec, avg 2 pups, adult weight = 1.5 kg

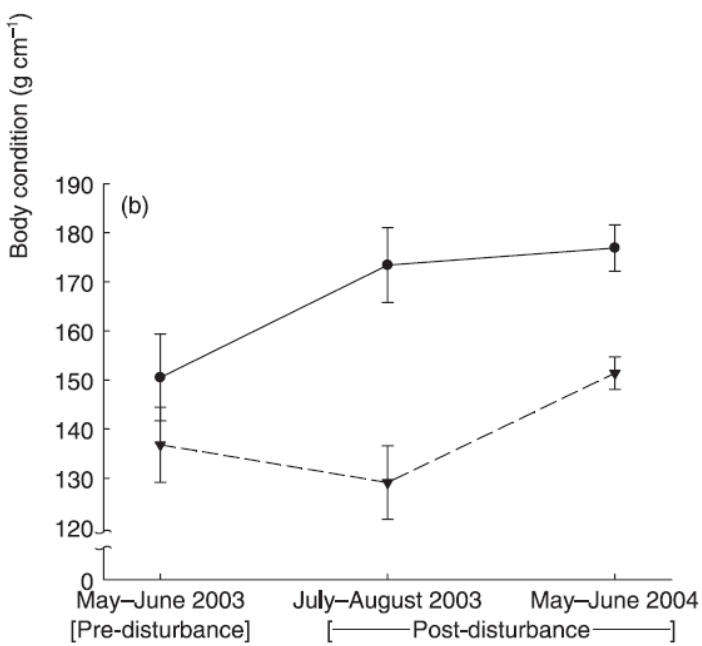
Prairie dog shooting in Wyoming

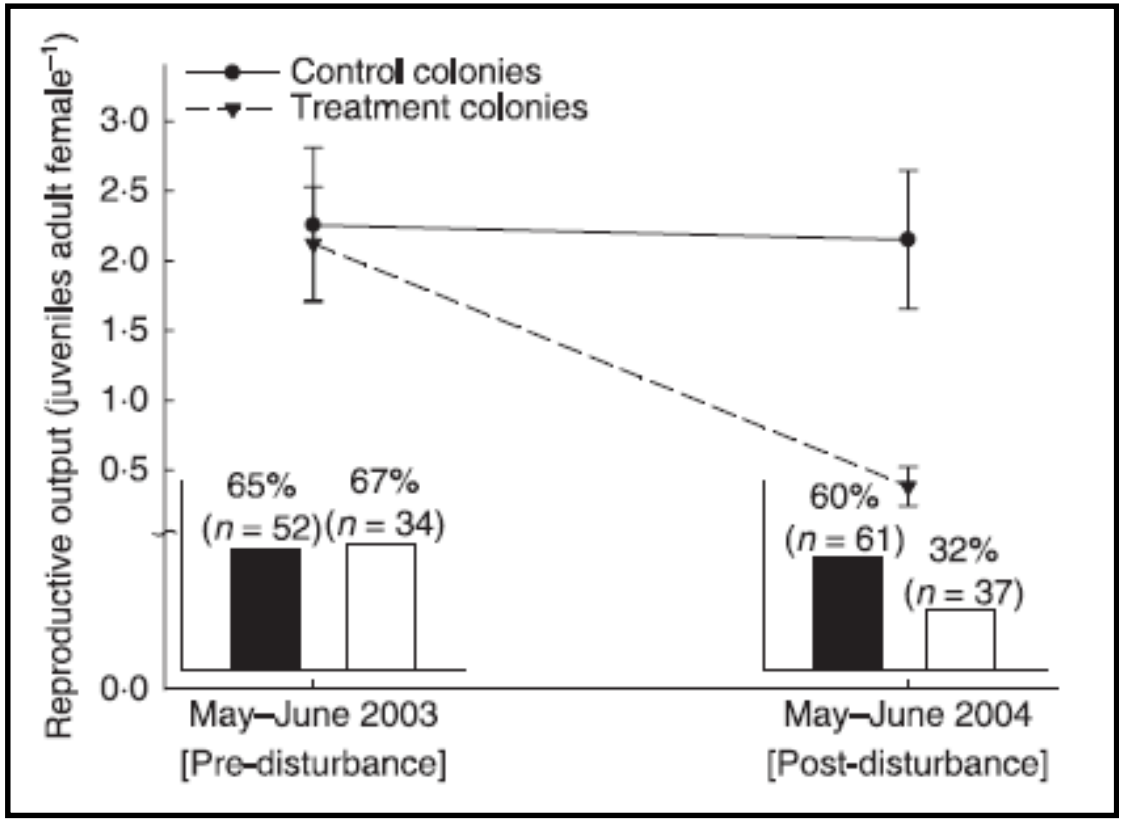
- black-tailed prairie dogs formerly widespread throughout shortgrass and mixed-grass prairie

- Reduced to <2% of its historic range; now conserved through managed "hunts"



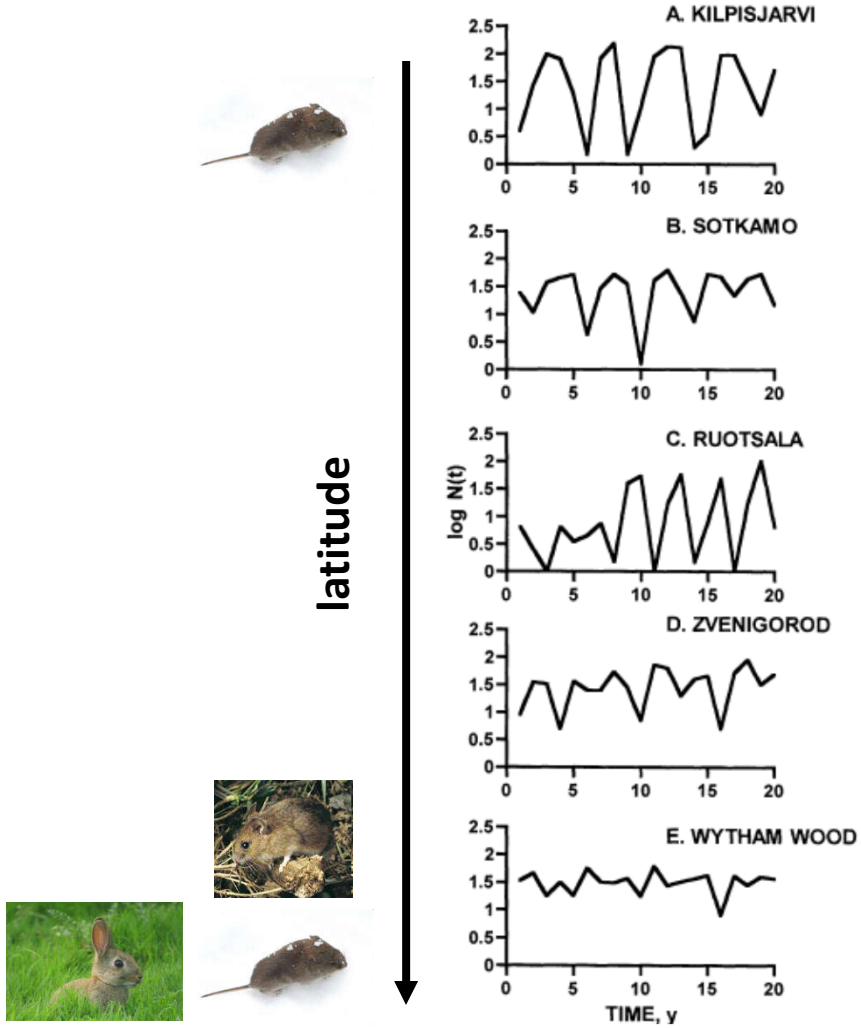
<u>Discussion Q:</u> Pauli and Buskirk described a counterintuitive result in the demography of hunted versus control black-tailed prairie dog towns. What was this result? How did they interpret it?





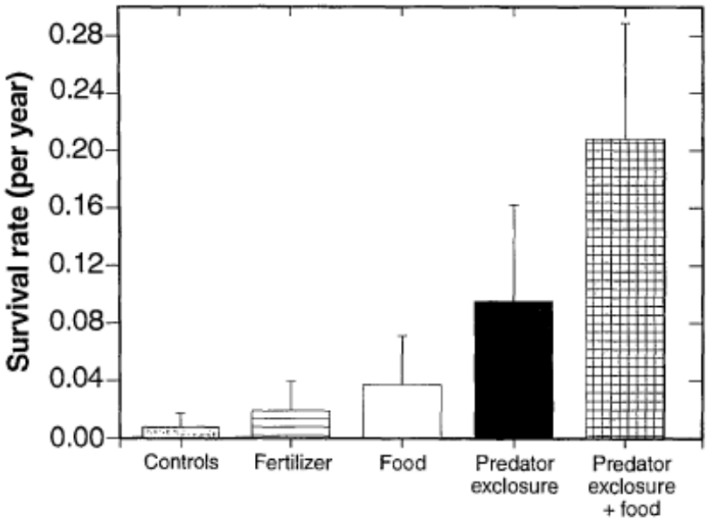
Generalist and specialist predators

- **Vole populations exhibit higher population peaks (amplitudes) at higher latitudes with lower prey diversity.**



Generalist and specialist predators

- **In the Yukon, lynx specialize on snowshoe hares (and cycle synchronously with them).**



ECOLOGY, Figure 12.1

PTSD and the snowshoe hare cycle

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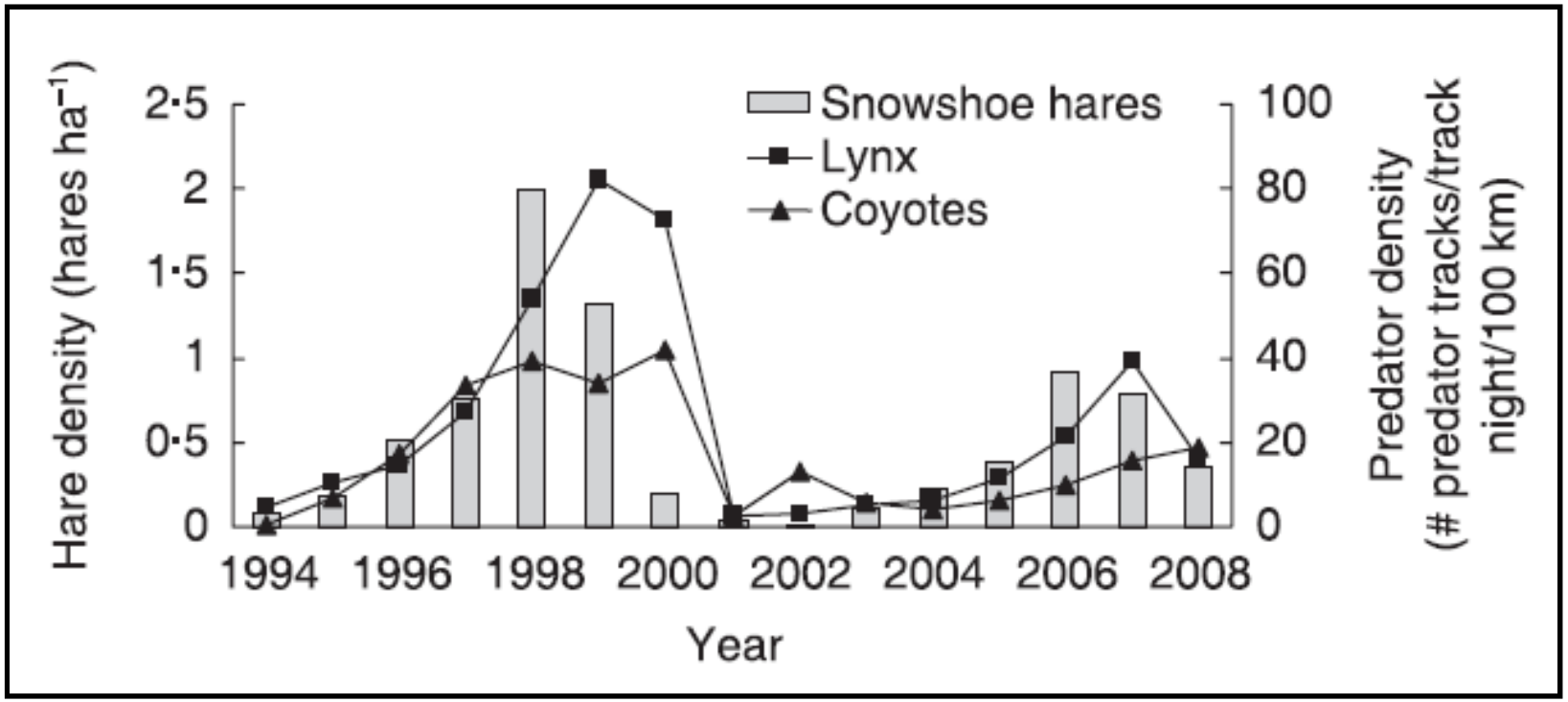
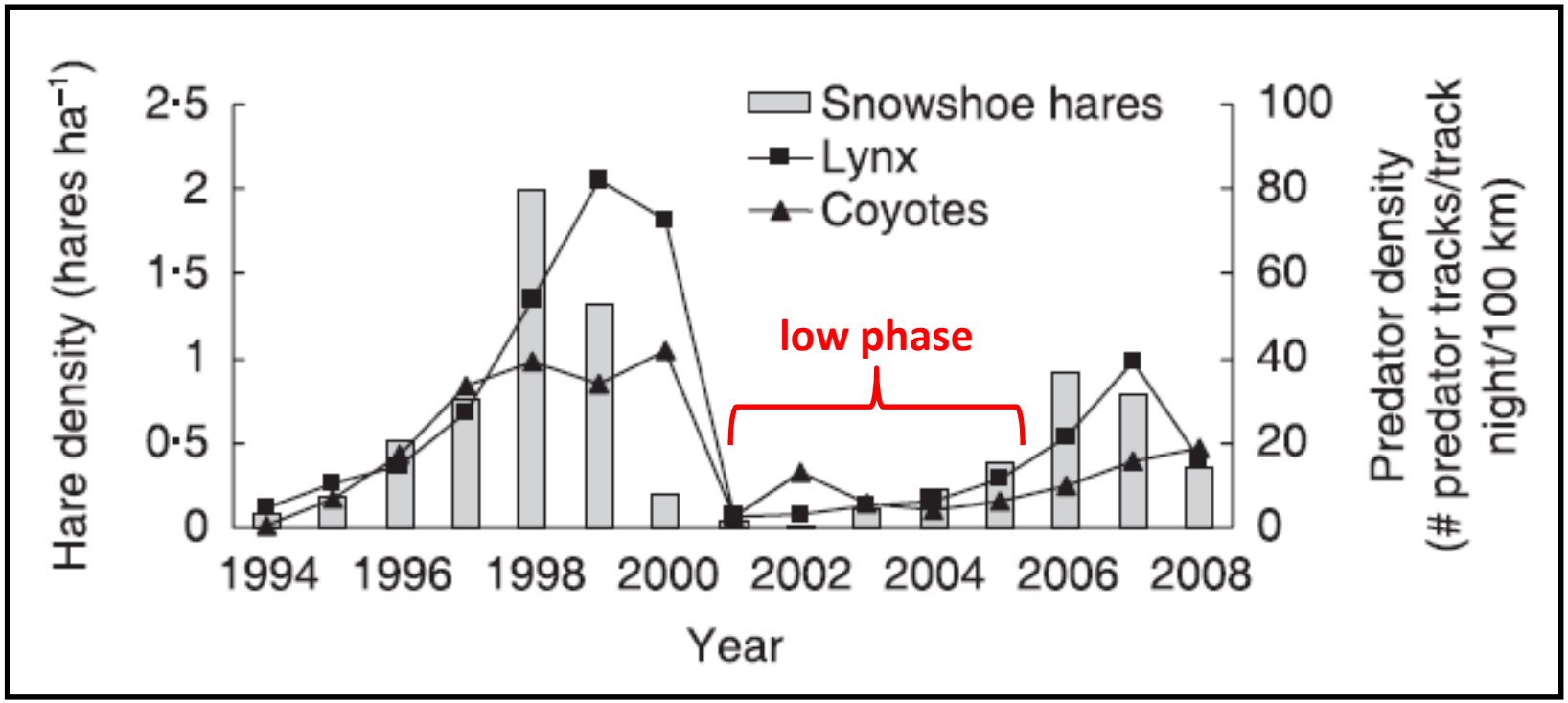
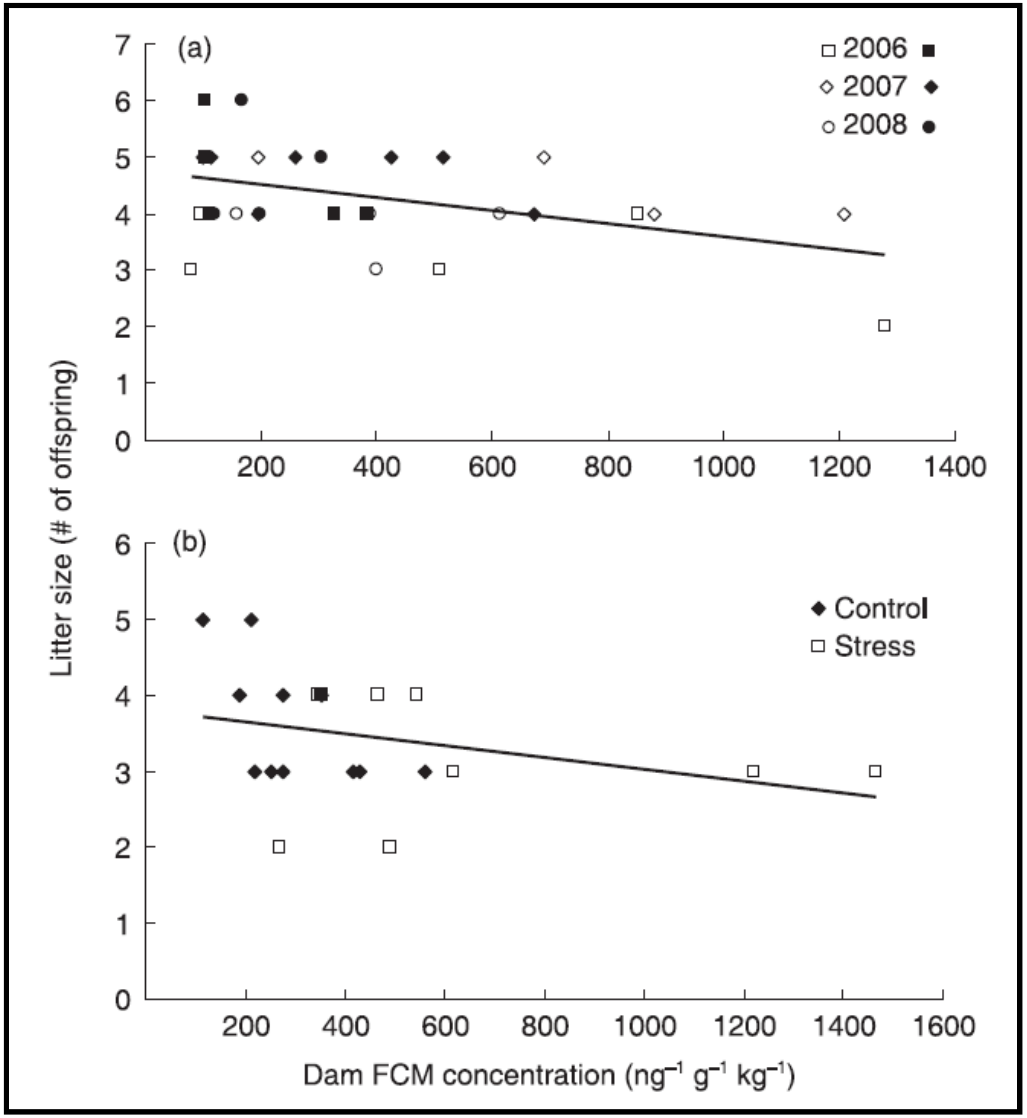


PTSD and the snowshoe hare cycle

- **why is "low phase" before population recovery so long for hares?**

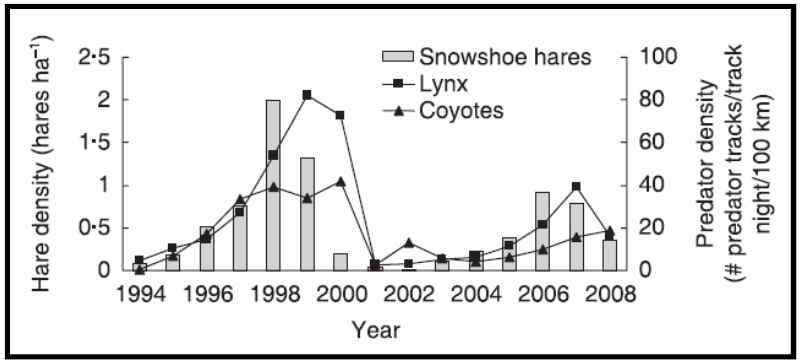


PTSD and the snowshoe hare cycle



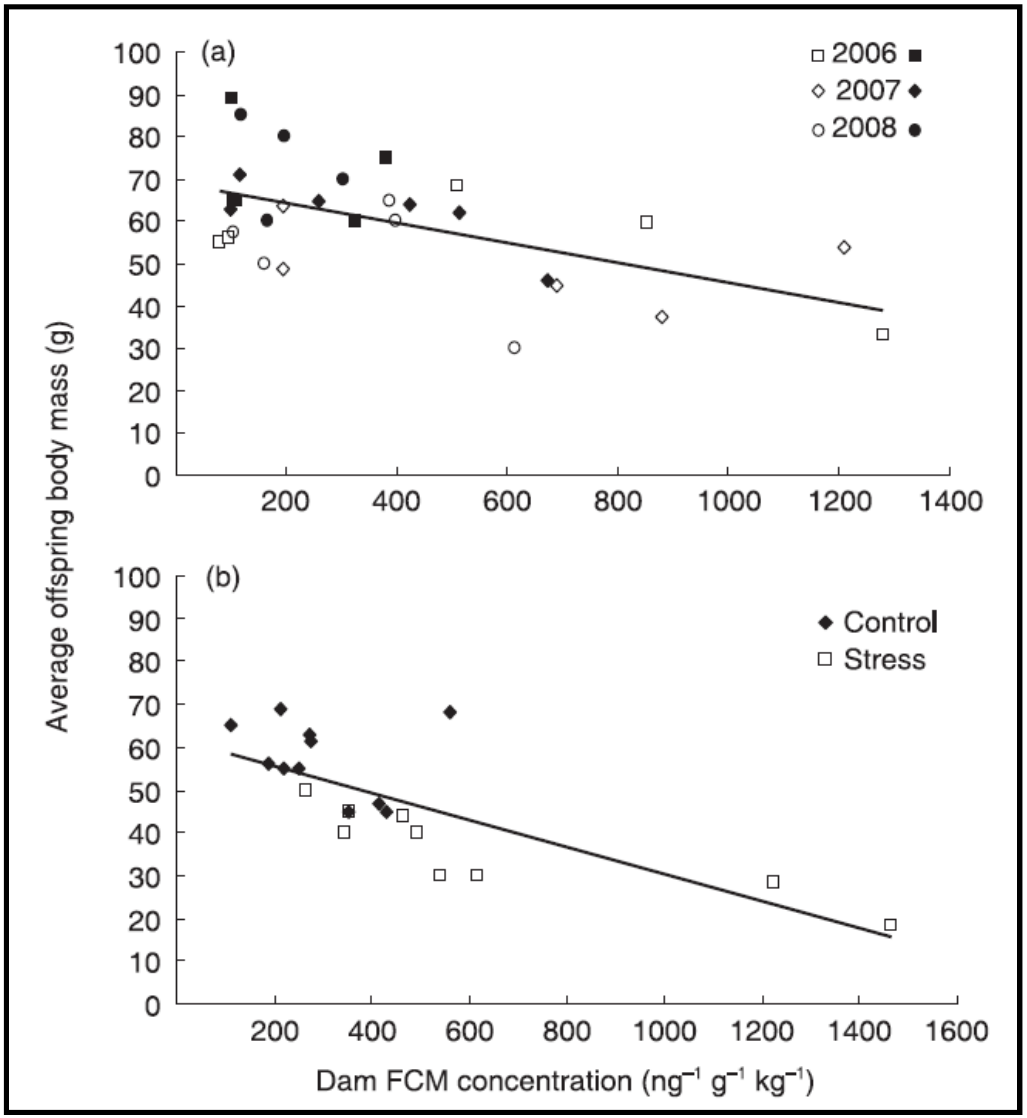
- **Litter size declined with increasing stress.**

ECOLOGY, Figure 12.1



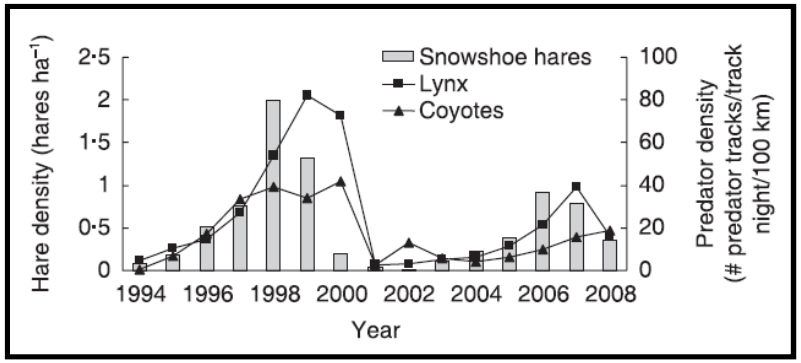
Sheriff et al. 2009.

PTSD and the snowshoe hare cycle



- **Offspring condition declined with increasing stress.**

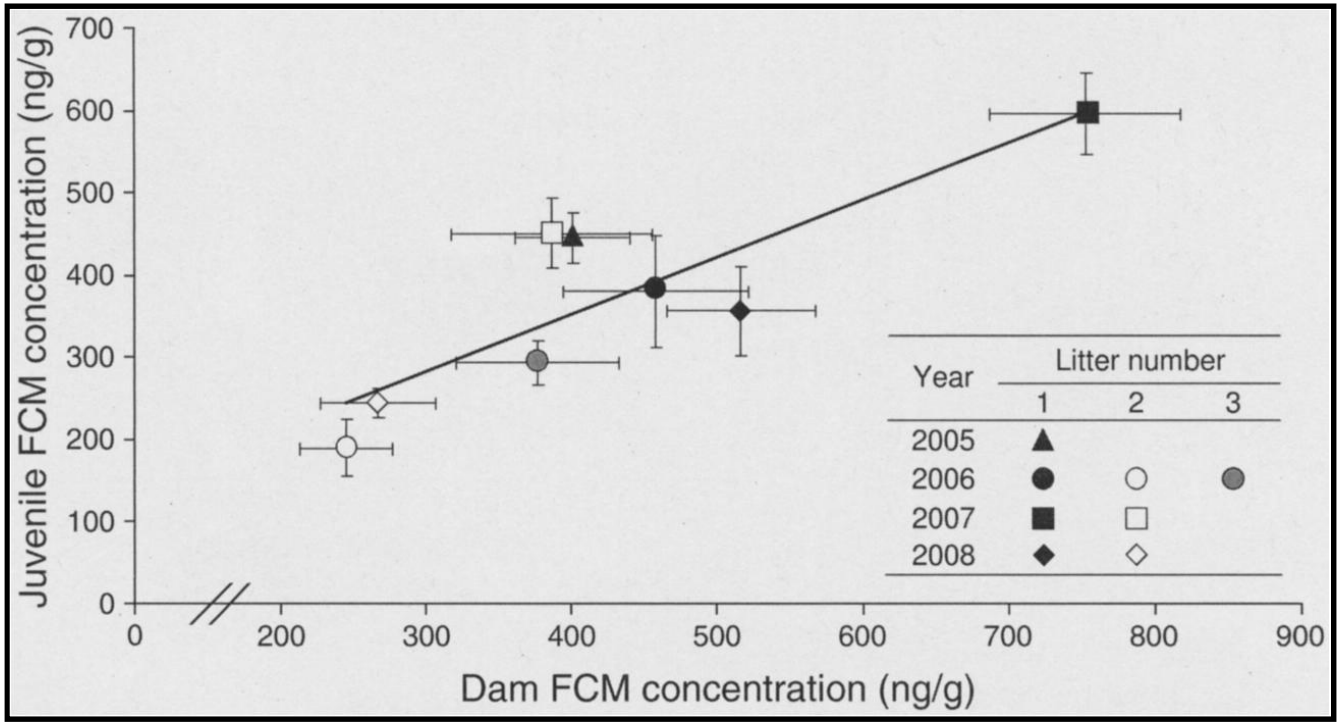
ECOLOGY, Figure 12.1



Sheriff et al. 2009.

PTSD and the snowshoe hare cycle

- **<u>maternal effect</u> = mom's phenotype affects kid's phenotype through non-genetic pathways.**



ECOLOGY, Figure 12.1

Sheriff et al. 2009.

Predation and the evolution of life histories

<u>Suborder Feloidea</u>
-- include cats, hyenas, civets, mongooses, etc.

<u>Suborder Canoidea</u>
--include dogs, bears, weasels, procyonids, etc.

Predation and the evolution of life histories

<u>Suborder Feloidea</u>
-- include cats, hyenas, civets, mongooses, etc.
-- evolved in forested areas

<u>Suborder Canoidea</u>
--include dogs, bears, weasels, procyonids, etc.
-- evolved in open grasslands

Predation and the evolution of life histories

Suborder Feloidea

-- include cats, hyenas, civets, mongooses, etc.
-- evolved in forested areas
-- typically asocial (social members hunt occur in open areas)

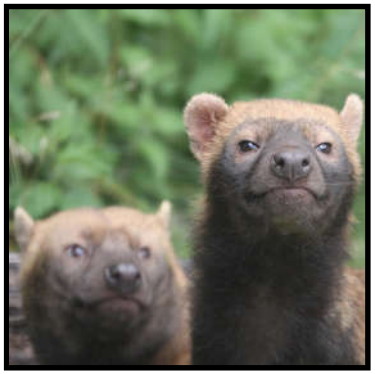
-- tend toward promiscuity
-- poor olfaction, good vision
-- adapted for leaping (ambush)

Suborder Canoidea

--include dogs, bears, weasels, procyonids, etc.
-- evolved in open grasslands
-- typically social (asocial members hunt in cover or consume lots of plants)
-- tend toward monogamy
-- good olfaction
-- adapted for running (coursing)

Predation strategies

<u>Coursing predator</u> = predator (typically a carnivore) that searches for pursues prey over wide areas; typically goes hand-in-hand with pack hunting and/or killing of large prey



Predation strategies

<u>Ambush predator</u> = predator (typically a carnivore) that attacks from a vantage point and typically avoids lengthy pursuit