ESRM 350

Predation

Autumn 2013

“Tho' Nature, red in tooth and claw”

- Alfred Lord Tennyson, *In Memoriam A. H. H.,* 1850

Predation

- The consumption of all of part of another animal, killing it in the process
- Predation is
  - The most common form of death for most wildlife species*
  - A major driver of wildlife population dynamics
    - can suppress, even extirpate populations

*Charles Elton (1927) *Animal Ecology*

Modeling Population Growth

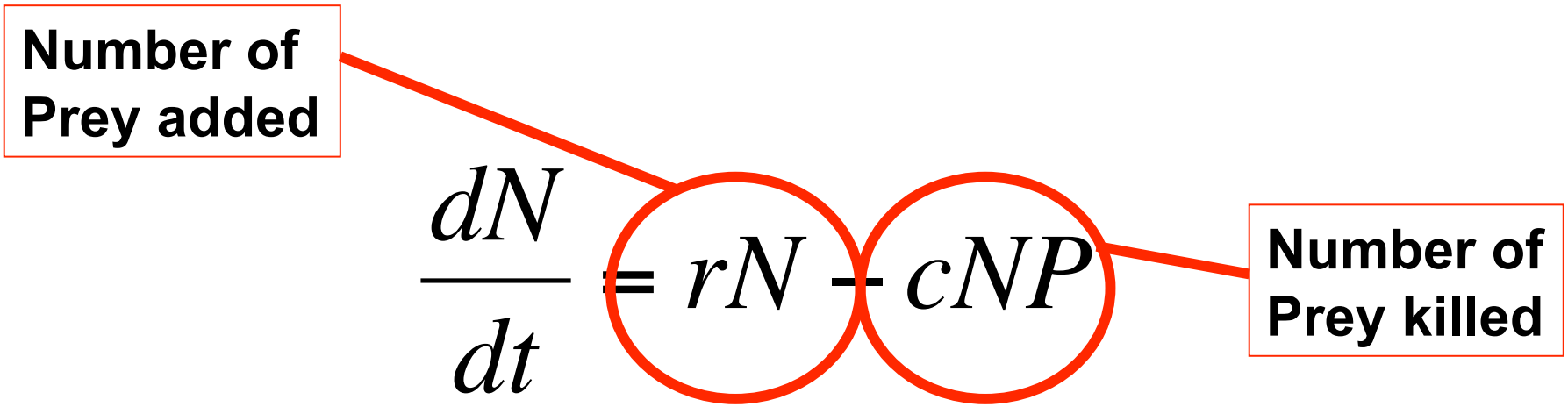
$$\frac{dN}{dt} = rN$$

describes the rate of increase of a **prey** population, where:

N is the number of prey

r is the prey's per capita exponential growth rate

Modeling Population Growth With Predation



describes the rate of increase of a **prey** population, where:

N is the number of prey, *P* is the number of predators

r is the prey's per capita exponential growth rate

c is a constant expressing efficiency of predation

*Lotka-Volterra prey equation

The “Doomed Surplus”

- Preceding model assumes that all depredated animals would have otherwise survived
- But, many animals that succumb to predation would have died anyway*
  - e.g., sick, lame, starving, senescing
  - these other sources of mortality increase with crowding
    - i.e., because of density-dependence
- Thus, we must distinguish between predation on *viable* and *moribund* individuals

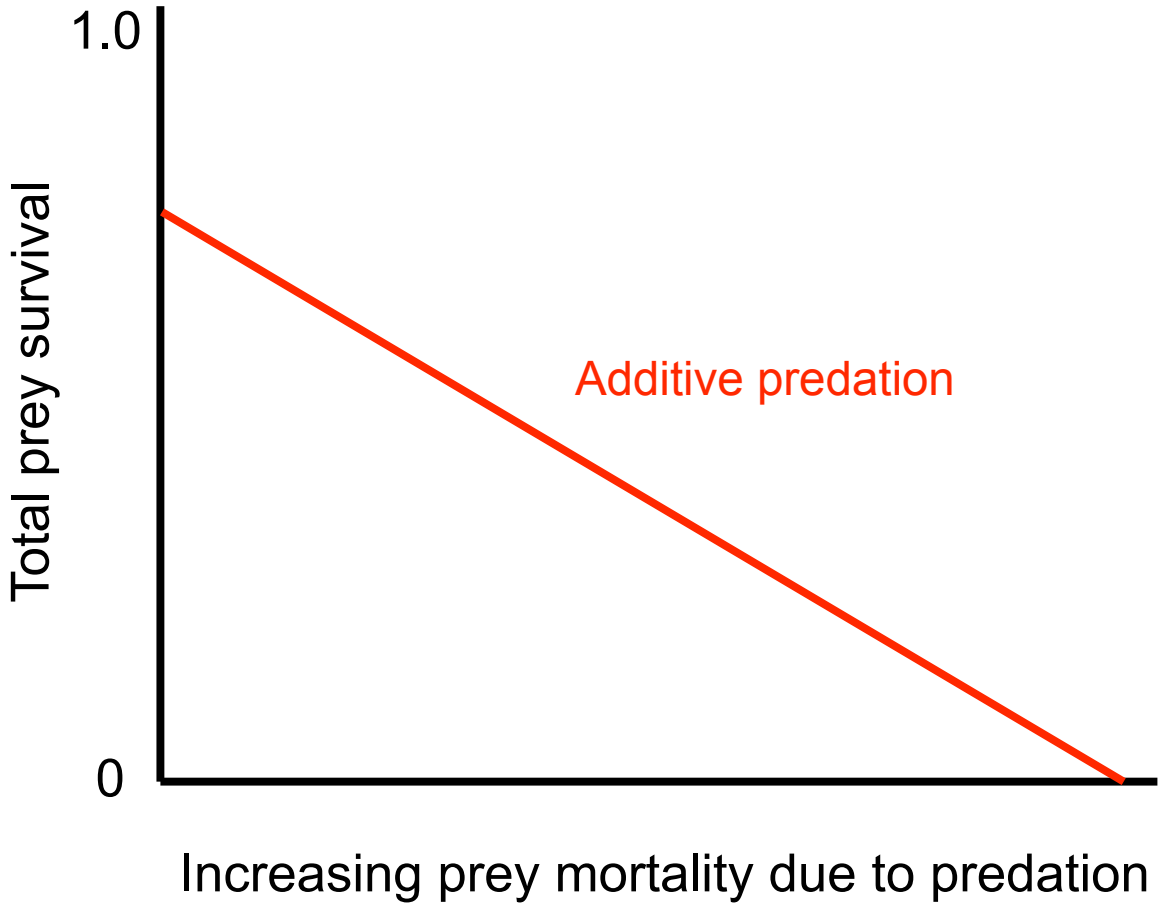
*Errington P. L. (1946) Predation and vertebrate populations. *Q Rev. Biol.* ***21, 144–77.***

Additive vs. Compensatory Predation

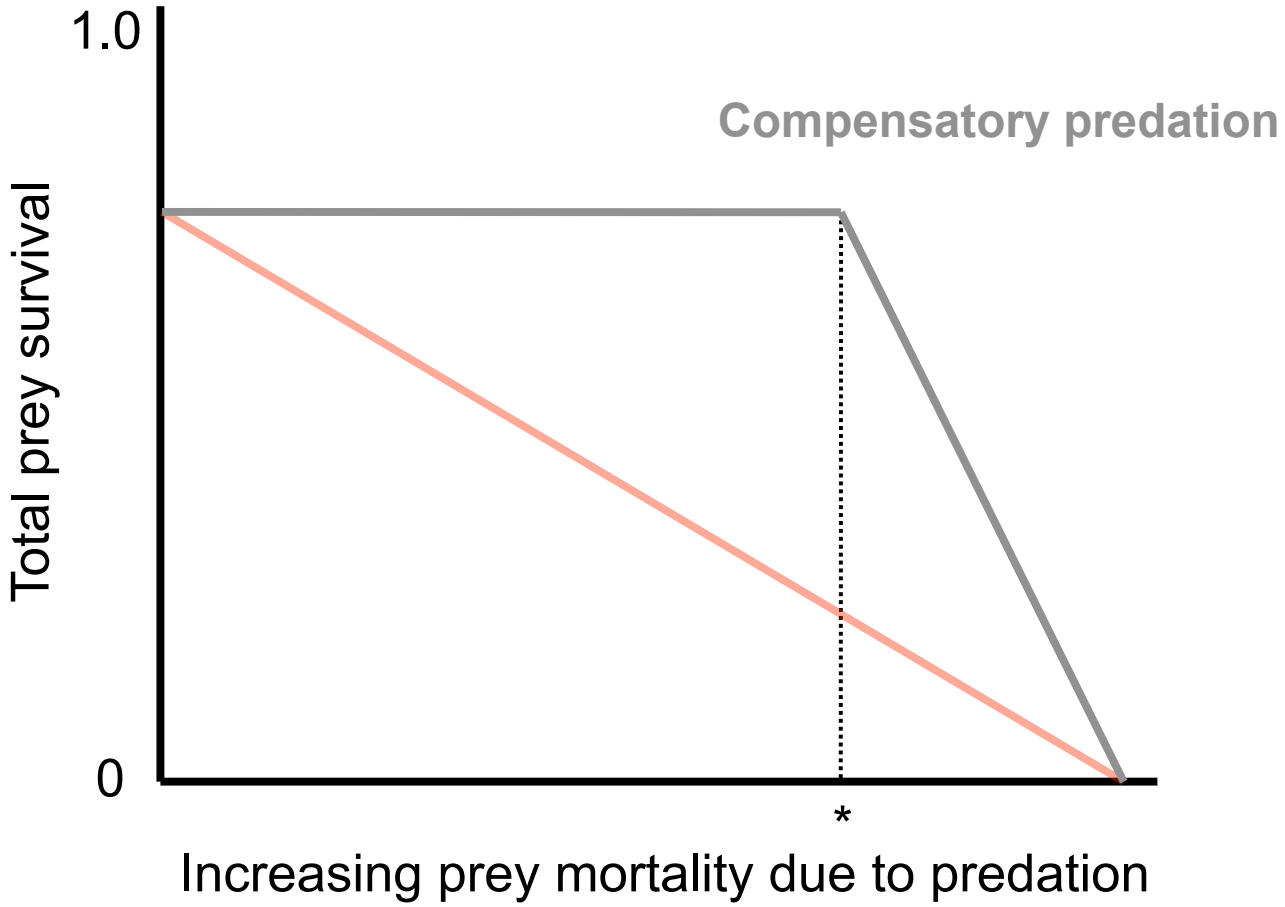
- **Additive predation** – predation that decreases survival in a prey population
  - i.e., “adds” to existing sources of mortality
- **Compensatory predation** – predation that does not affect overall survival in a prey population
  - merely replaces, or “compensates” for, existing sources of mortality

*Errington P. L. (1946) Predation and vertebrate populations. *Q Rev. Biol.* ***21, 144–77.***

Additive vs. Compensatory Predation

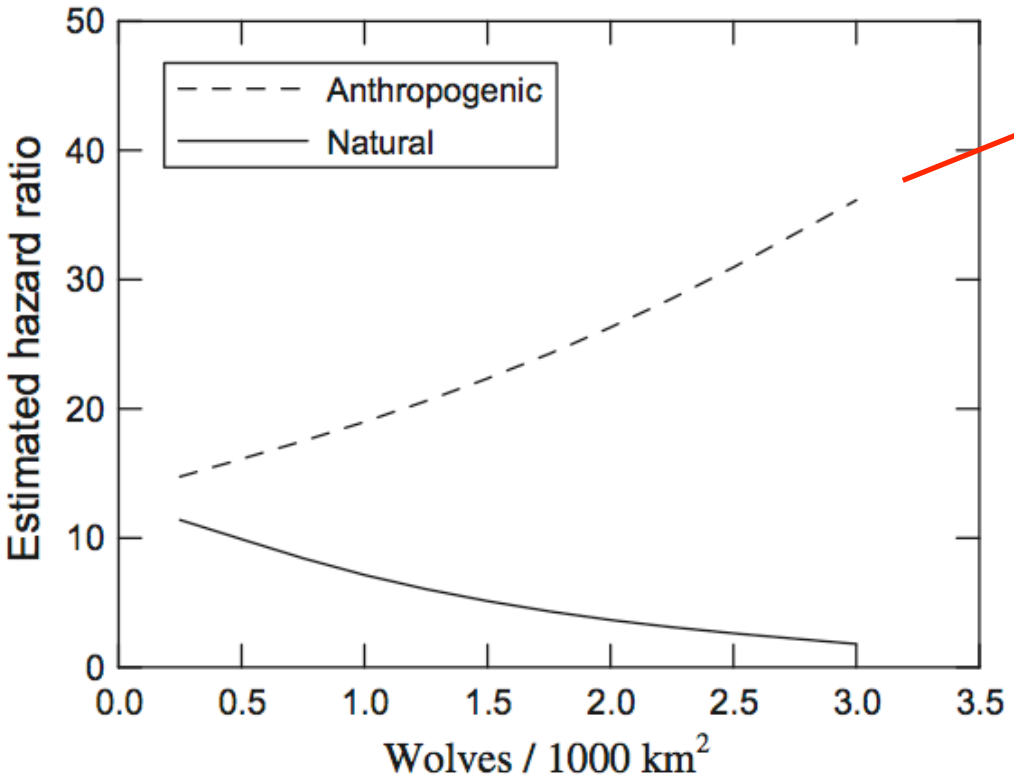


Additive vs. Compensatory Predation



*Threshold intensity beyond which predation become additive

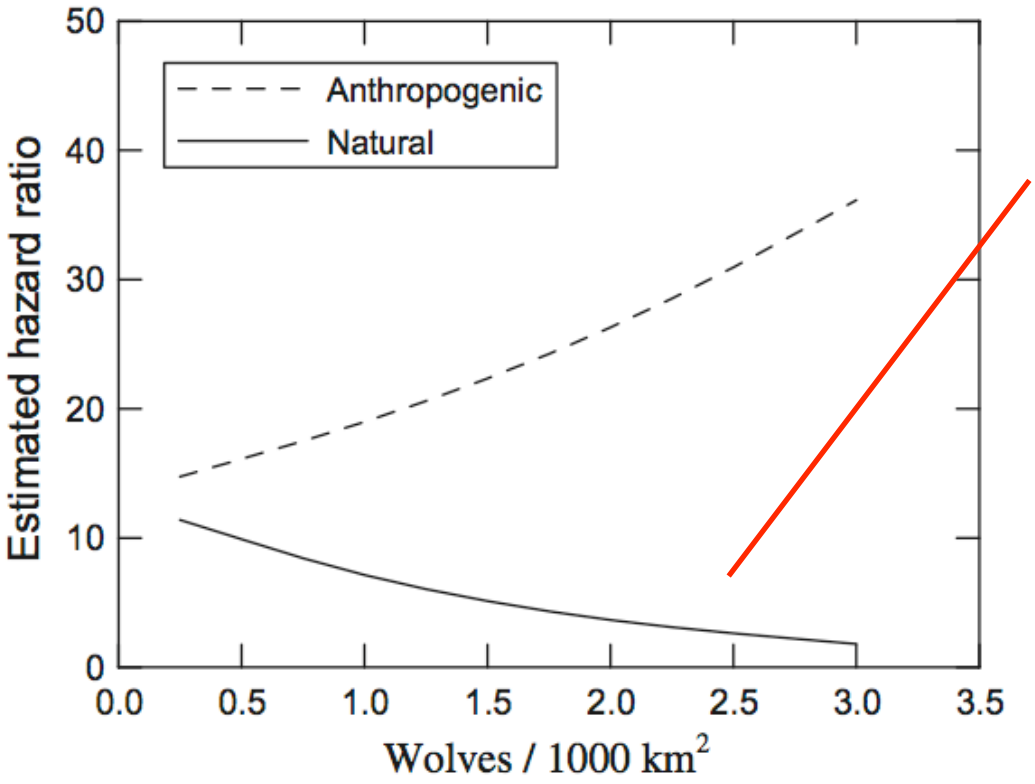
Human “Predation” on Wolves is Partly Compensatory



Human-caused mortality increased with wolf density In the NW USA

Murray et al. (2010) *Biological Conservation*

Human “Predation” on Wolves is Partly Compensatory



but natural mortality decreased, suggesting that some wolves killed by humans would have died because of social strife

Murray et al. (2010) Biological Conservation

Predators and Prey

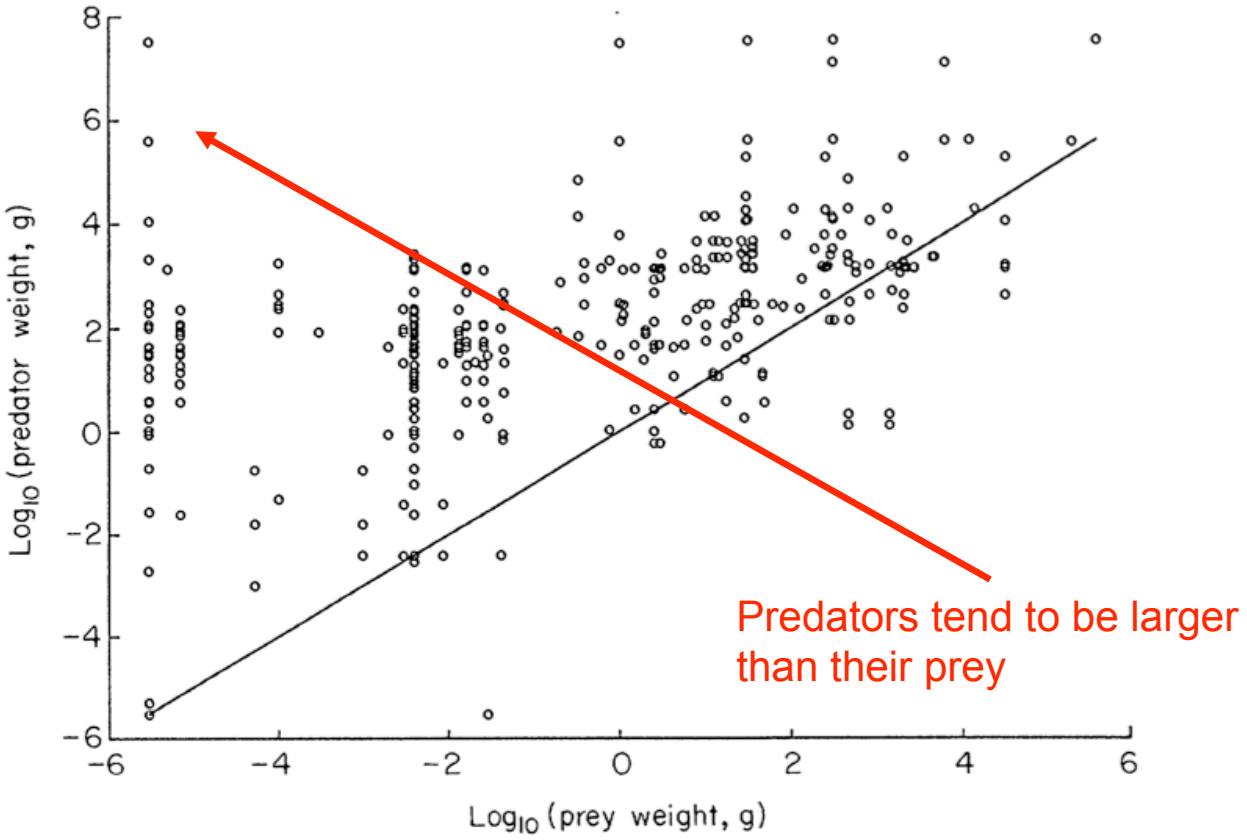
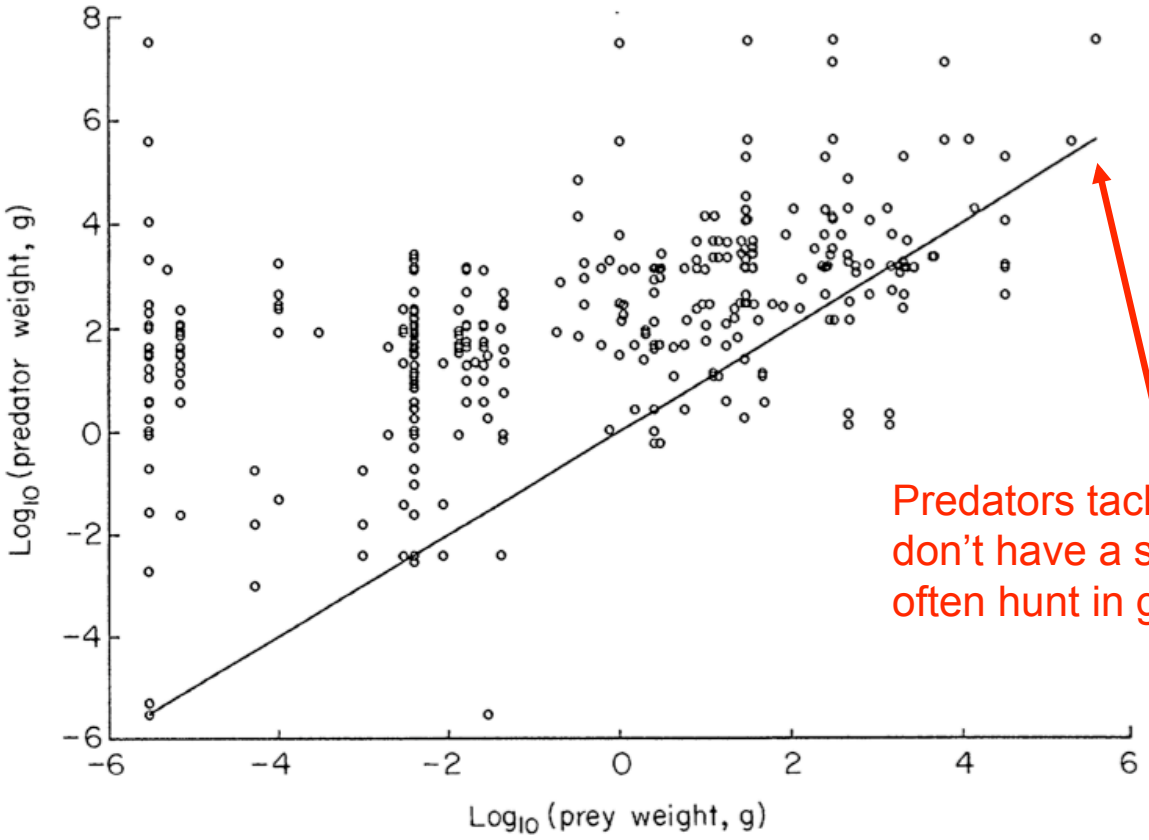


Fig. 1. Log_{10}(weight, g) of animal predators as a function of log_{10}(weight) of animal prey for 354 links in 18 community food webs (data set A; see text). o = one link. Solid line shows where predator weight equals prey weight.

Cohen et al. (1993) *J Anim Ecol*

Predators and Prey



Predators tackling large prey don't have a size advantage; often hunt in groups

Fig. 1. Log_{10}(weight, g) of animal predators as a function of log_{10}(weight) of animal prey for 354 links in 18 community food webs (data set A; see text). o = one link. Solid line shows where predator weight equals prey weight.

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Painted Dogs (*Lycaon pictus*)

80% success rate

Predatory Tactics

- Stalking and Ambush
  - Stalking: try to get close to prey
  - Ambush: let prey come to you

Predatory Tactics

- Roving (active hunting)
  - does not require the element of surprise
  - requires high activity rate, to maximize prey encounter potential

Predatory Tactics

- Prey herding and manipulation
  - often requires teamwork
  - e.g., bubble netting by humpback whales, *Megaptera novaeangliea*

http://www.youtube.com/watch?v=vJvfjiCTvq4

Predatory Tactics

- Prey debilitation
  - e.g., “fish whacking” by marine mammals, venom (snakes)

Bottlenose dolphin (*Tursiops truncatus*)

Western rattlesnake (*Crotalus oreganus*)

Predatory Tactics

- Batch feeding
  - Consuming large number of prey items in single feeding event (e.g., filter or skim feeding in whales)

Blue whale (*Balaenoptera musculus*)

Predatory Tactics

- Tool Use
  - When an object is taken from the environment and modified from its original purpose
  - e.g., chimpanzees with weapons

Senegal bushbaby (*Galago senegalensis*)