Predation Terminology

- Functional Response – the relationship between the average number of prey eaten by each predator per unit time vs. prey density
- Numerical Response – the increase in the number of predators by reproduction and immigration with increases in the prey population
How many prey does each predator eat per day?
Type I Functional Response

Explanation:
Each individual predator takes a fixed fraction of the prey population each time period. If prey density double, the number each predator eats per day doubles.

Assumptions:
- Encounter and kill rate is simple fraction of prey population, $\alpha V$
- No “saturation” or “satiation” of predator
- No “handling” or “processing” time
- No “switching” from one prey species to another

Biological Basis:
Likely valid for the lower range of prey densities for some species
Type II Functional Response

**Explanation:**
“Saturating functional response” 
As prey density increases, the number of prey each predator eats per day reaches a constant number.

**Assumptions:**
Encounter rate initially limits predation, but processing/handling time (including digestion) or satiation eventually limits food intake
No “switching” from one prey species to another

**Biological Basis:**
Likely applies to most predators, and a nearly Type I response occurs over lower range of prey density
Type III Functional Response

**Explanation:**
“Sigmoid functional response”
Initially predation on this prey species is low, but then, at a threshold, increases sharply. It then saturates or levels off, as in the Type II F.R.

**Assumptions:**
Encounter rate initially increases, but processing/handling time (including digestion) or satiation eventually limits food intake

**Biological Basis:**
If a predator switches from another prey species to the focal one. This could result from developing a “search image” or from changing foraging locations or style to more efficiently capture focal prey species.
Realistic predator regulation

• If:
  – prey have logistic population growth
  – predator has realistic type II (saturating) Functional Response, and carrying capacity proportional to prey abundance

• Then: dampened predator-prey cycles which can be sustained with environmental stochasticity

• But! Stable prey density is always less than K! (so population is “regulated” below K)

Other biological details:
More generalist predators don’t increase with density of 1 prey, so no cycles: Latitudinal gradient in cycling of Scandinavian rodents
Prey refuges prevent prey extinction