Lecture 19

Interspecific interactions: Predation

WILD3810 (Spring 2019)

Readings

> Mills 142-153

Interspecific interactions

Interactions come in many different forms

Species A	Species B	Interaction type
+	+	Mutualism
+	0	Commensalism
+	**-**	**Contramensalism**
0	-	Amensalism
-	-	Competition

Predation

Predation

Important, widespread effects on:

- Evolution of behavior, morphology, physiology

Semelparity

- Synchronous and massive production of offspring
- Predators readily become full (satiated)
- Most offspring escape and survive

Predation

Important, widespread effects on:

- Evolution of behavior, morphology, physiology

Behavior

- Adult birds feign injury to lure predators away from nest

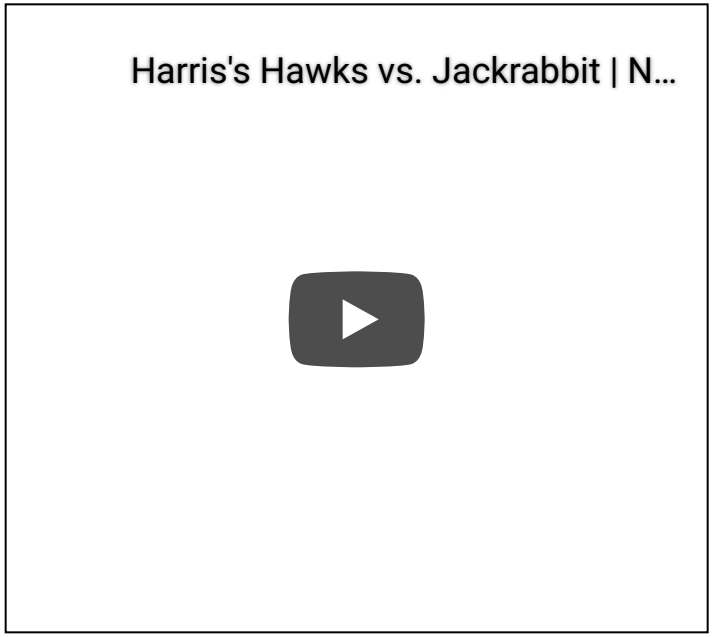
Predation

Important, widespread effects on:

- Evolution of behavior, morphology, physiology

Behavior

- Group hunting



Predation

Important, widespread effects on:

- Evolution of behavior, morphology, physiology

Physical defense

Predation

Important, widespread effects on:

- Evolution of behavior, morphology, physiology

Chemical defense

Predation

Important, widespread effects on:

- Evolution of behavior, morphology, physiology

Camouflage

Predation

Important, widespread effects on:

- Evolution of behavior, morphology, physiology

Aposematic coloration

Predation

Important, widespread effects on:

- Evolution of behavior, morphology, physiology

Mimicry

- *Batesian* mimicry: harmless species mimic poisonous/unpalatable species

Predation

Important, widespread effects on:

- Evolution of behavior, morphology, physiology

Mimicry

- *Mullerian* mimicry: convergence of several harmful species on same pattern

Predation

Important, widespread effects on:

- Evolution of behavior, morphology, physiology

Physiology

Predation

Important, widespread effects on:

- Community structure
  - Picky predators can promote coexistence among competing prey species when the dominant competitor is the preferred prey (i.e. ‘competitive exclusion’ is prevented by predator)

The predator

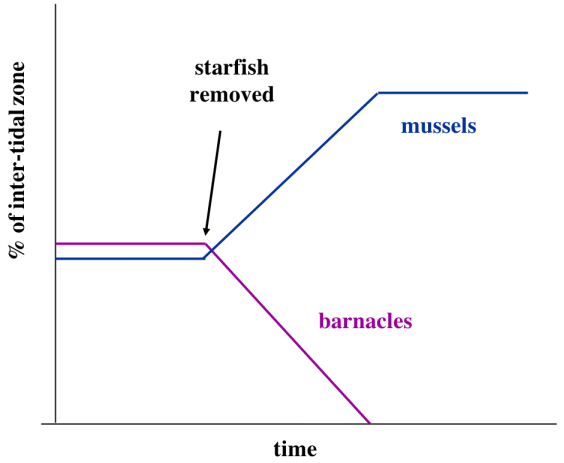
The prey

Predation

Important, widespread effects on:

- Community structure

- In the presence of starfish, mussels and barnacles coexist
- If starfish are experimentally removed, competitive exclusion of barnacles
    - mussels are the dominant competitor but also the preferred prey
- *competitor-mediated coexistance*



Predation

Important, widespread effects on:

- Regulation of abundance and population dynamics of both predator and prey

Do predators control the abundance of their prey?

Yes

- Introduced rats, mongoose, and cats have caused the extinction of at least 43 bird species

Predation

Important, widespread effects on:

- Regulation of abundance and population dynamics of both predator and prey

Do predators control the abundance of their prey?

Yes

- Invasive brown tree snakes caused the extinction of 10 bird species on the island of Guam

Predation

Important, widespread effects on:

- Regulation of abundance and population dynamics of both predator and prey

Do predators control the abundance of their prey?

Yes

- Mesopredator release

Predation

Important, widespread effects on:

- Regulation of abundance and population dynamics of both predator and prey

Do predators control the abundance of their prey?

Maybe?

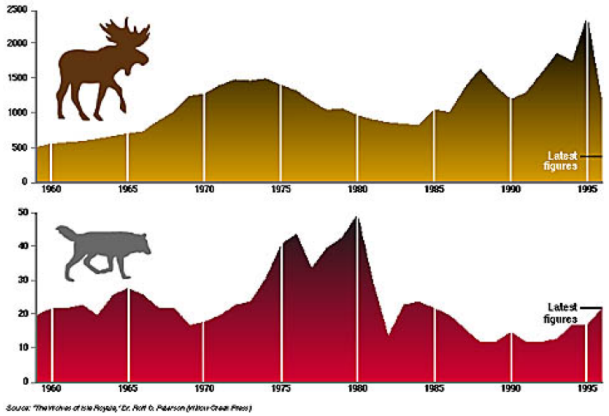
Predation

Important, widespread effects on:

- Regulation of abundance and population dynamics of both predator and prey

Do predators control the abundance of their prey?

- On Island Royale, wolf/moose populations are linked but also influenced by vegetation and winter severity



How do predators impact prey population?

How do predators impact prey population?

Predation rate (P)

> Percentage of prey population killed per unit time

$$P = \frac{\#\ prey\ killed}{Prey\ abundance} \times 100$$

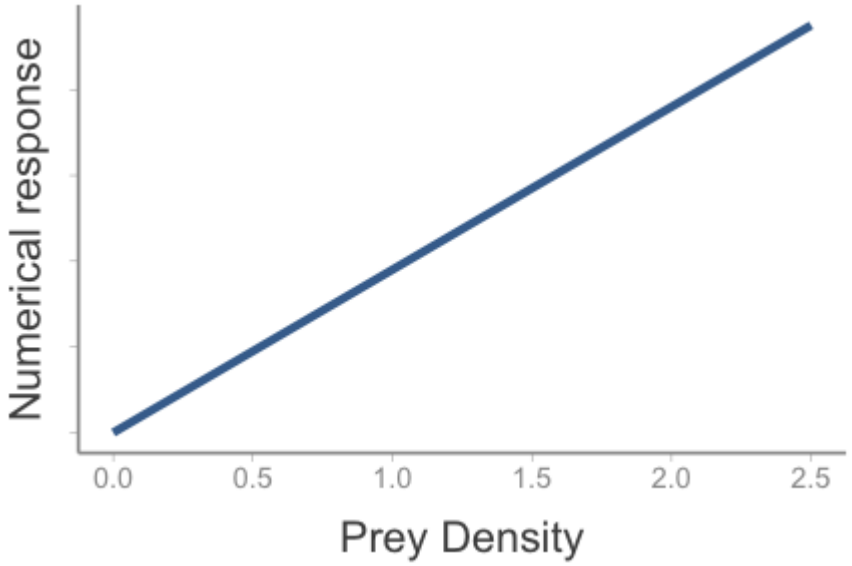
- Number of prey killed = numerical response $\times$ functional response

Numerical response

Numerical response

Change in number of predators as prey abundance changes

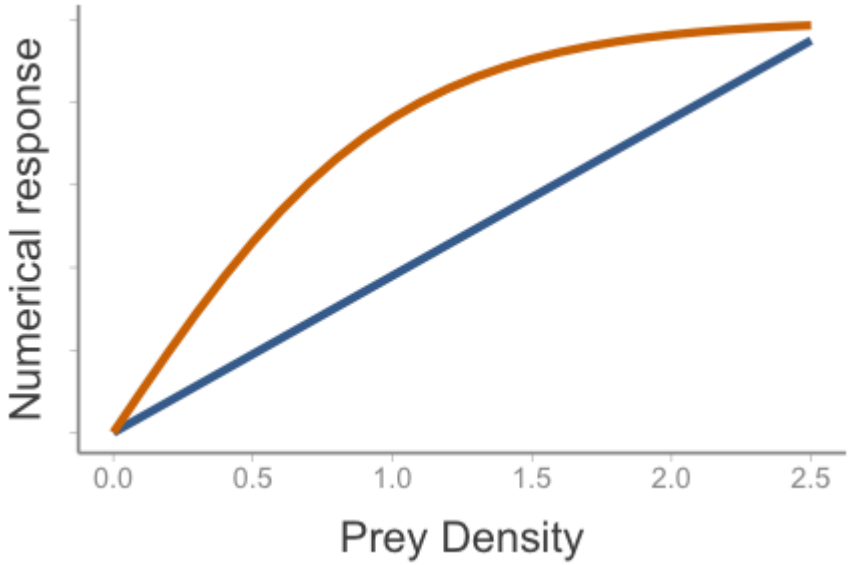
- Number of predators present at a given prey density
- Function of how prey influence B D of predator



Numerical response

Change in number of predators as prey abundance changes

- Number of predators present at a given prey density
- Function of how prey influence B D of predator
- Predators may also congregate at prey source: *aggregative response*



Numerical response

When introduced prey lead to large numerical response of predators, native prey can suffer

- high abundance of predators leads to unsustainable predation on native prey
- **hyperpredation**

Functional response

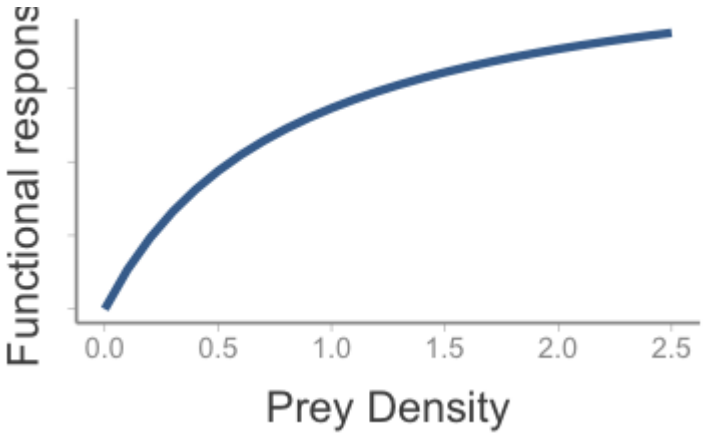
Functional response

Also known as the *kill rate*

> number of prey killed per predator per unit of time

- as number of prey increases, kills rate should change
  - search time
  - handling time
  - satiation

Type II



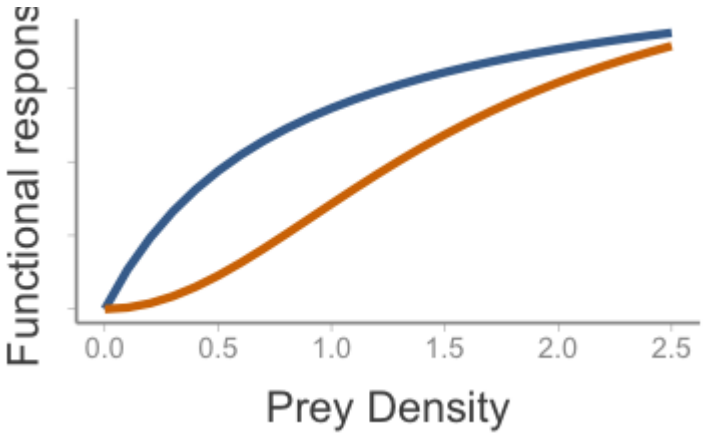
Functional response

Also known as the *kill rate*

> number of prey killed per predator per unit of time

- as number of prey increases, kills rate should change
  - search time
  - handling time
  - satiation

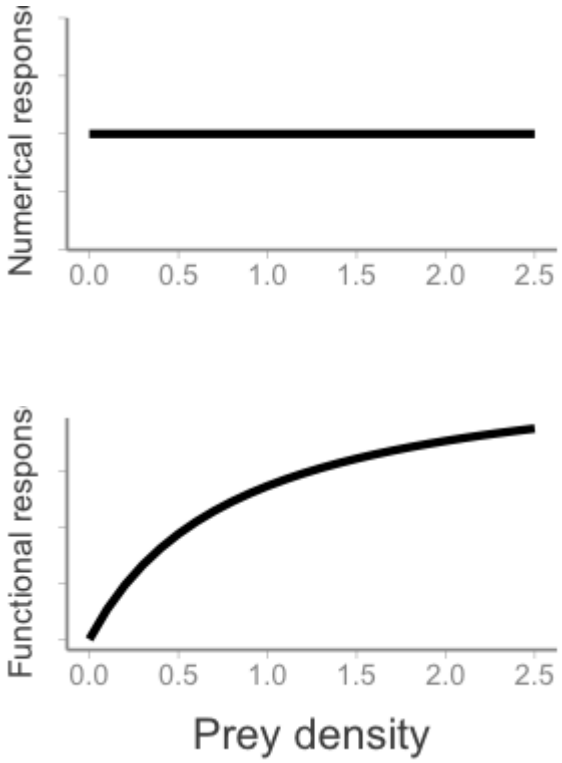
Type III

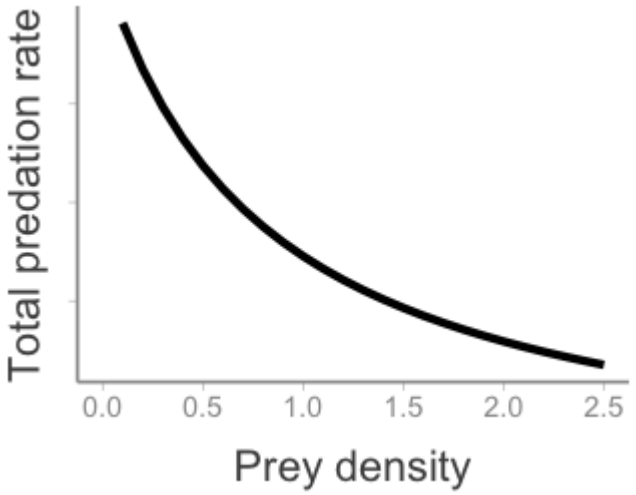


Total predation rate

Total predation rate

$$P = \frac{Numerical\ response \times\ \ functional\ response}{Prey\ abundance} \times 100$$





Total predation rate

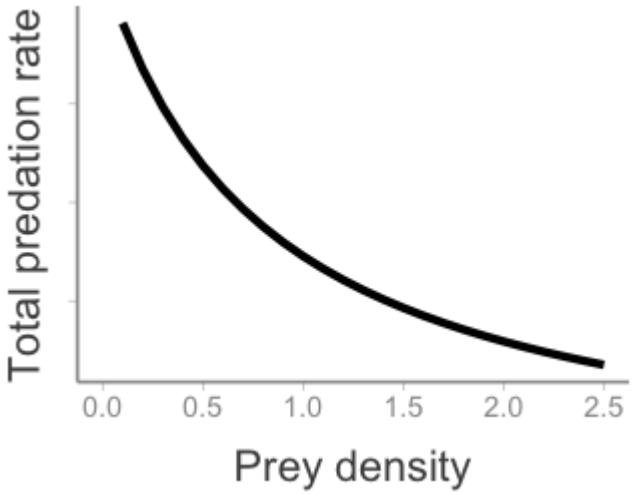
$$P = \frac{Numerical\ response \times\ functional\ response}{Prey\ abundance} \times 100$$

As prey numbers increase:

- predation rate goes down
- survival rate increases
- prey population "escapes" regulation by predator

As prey numbers decrease:

- predation rate goes up
- survival rate decreases
- prey population declines (Allee effect)



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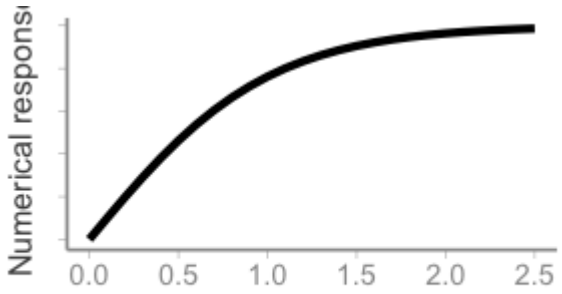

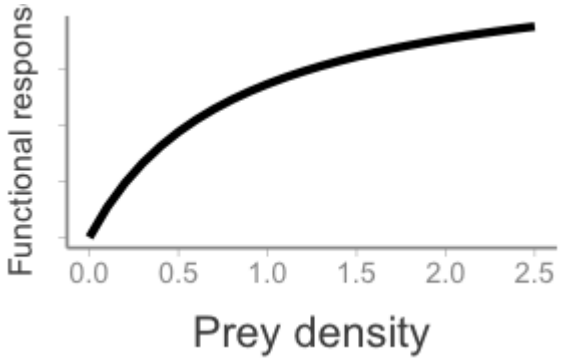

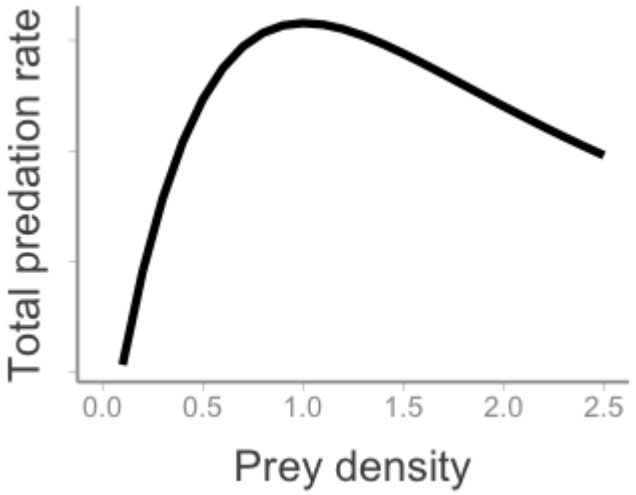

Predation

Other considerations

- Is increased predation compensated by higher fecundity?
- Which individuals are killed?
- Human dimensions