

## Community Ecology 2

Exploitation: Predation, parasitism, pathogens and herbivory  
Ch. 14, plus pp. 156-163, 164-166

- I. Regulation of population size of the prey
  - A. Reduction of population size
  - B. Predator-prey cycles
  - C. Maintaining predators and prey
- II. Responses of predators
  - A. Numerical
  - B. Functional (I, II, and III)
  - C. Predator satiation
- III. Predation as an evolutionary force

## Predation



BHT CD

## Parasite Life Cycle

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- 1 Adult female *Plagiorhynchus* lays eggs within the intestines of infected birds. The eggs are shed with feces.

- 2 A terrestrial isopod eats the feces of an infected bird. The eggs of *Plagiorhynchus* hatch within a few hours; they develop into a mature larva in 60-65 days.

- 4 Leaving shelter makes the isopods more conspicuous and vulnerable to predation by birds. When eaten by a bird, the mature *Plagiorhynchus* attaches to the bird's intestinal wall.

- 3 The mature larvae of *Plagiorhynchus* alter isopod behavior; infected isopods leave sheltered areas and wander in the open.

14.2 – Acanthocephalan (thorny-headed worm) life cycle

## Parasitoids



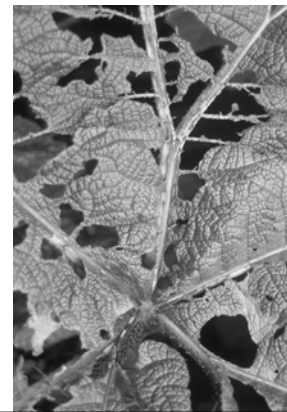
Ricklefs 2001

Figure 17.2 Parasitoid wasps develop inside the larvae or pupae of other insects. Photo by Scott Bauer.

## Parasitoids



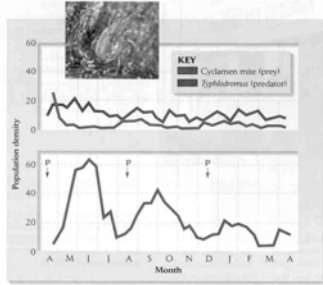
## Herbivory



# I. Regulation of population sizes

## A. Reduce population size of prey

### 1. Cyclamen and *Typhlodromus* mites - biocontrol



Ricklefs 2001  
 Fig. 18.3

The first cases of mange in red foxes were recorded in north-central Sweden in 1975–1976. By 1983–84 the disease had spread across most of the country.

## Fox Mange in Sweden

Arctic circle

60°N

Denmark

300 km

1977–78

1979–80

1981–82

1983–84

Grimsö  
 Örebro county

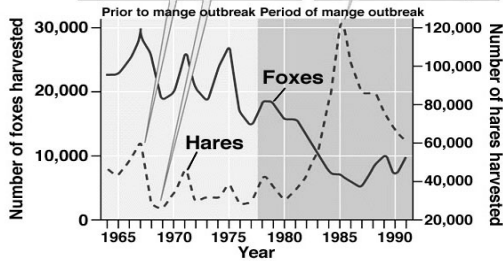
2. Mange, foxes and hares

14.12

## Fox & Hare Population

Before the outbreak of mange, the numbers of mountain hares fluctuated between about 30,000 and 60,000.

As mange reduced the fox population, the mountain hare population increased dramatically.



14.13

## Predator effects with invasive species (2 examples)

1. Enemy-release hypothesis
2. Mesopredator release

## 1. Enemy-release

*Opuntia* and *Cactoblastis cactorum*

Moths introduced: 1925  
 Cacti mostly gone: 1935

Ehrlich & Roughgarden (1987) Fig. 13-1  
 Molles 14.11



FIGURE 13-1 (A) Queenland forest plot thinned with *Opuntia* cactus. (B) Same forest plot after introduction of South American cactus-eating moths, *Cactoblastis*.

## 2. Mesopredator release

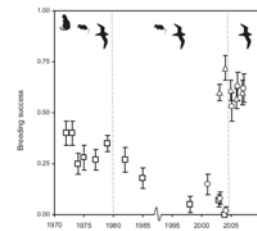
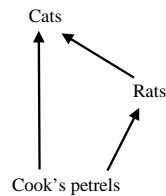


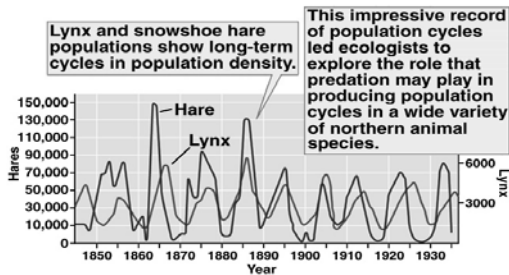
Fig. 1. Proportion of study burrows at high- and low-altitude study sites (ES) fledging chicks during successive predator regimes on Little Skuas Island. Values for the high-altitude study sites are represented by squares ("Thrush" site) and circles ("Oven" site). Values for the low-altitude "Valley" study site are represented by triangles. Temporal differences in breeding success at high-altitude study sites are significant ( $F = 35.42, df = 2, P < 0.001$ ). Temporal difference in breeding success at low study site is not significant.

Rayner et al. 2007 PNAS

## B. Predator-prey cycles

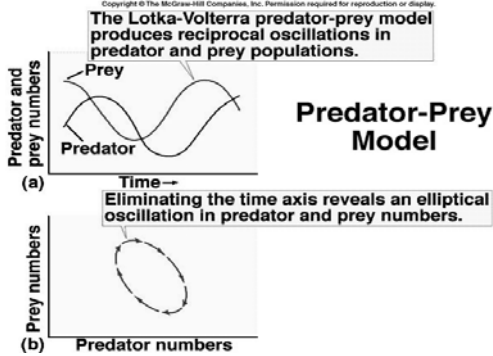
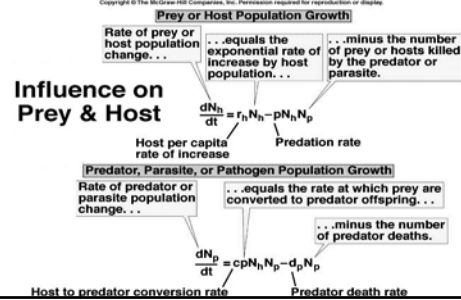
### 1. Examples

#### Lynx and Hare Fluctuation



## B. Predator-prey cycles

### 2. Lotka-Volterra models



## Predator-prey cycles

Ecobeaker demo: zooplankton and phytoplankton

Assumptions:

1. The environment does not change and genetic adaptation is slow.
2. No migration
3. The prey population finds ample food at all times.
4. The food supply of the predator population depends entirely on the prey populations.
5. Instantaneous feedback to birth and death rates.
6. The rate of change of population is proportional to its size.

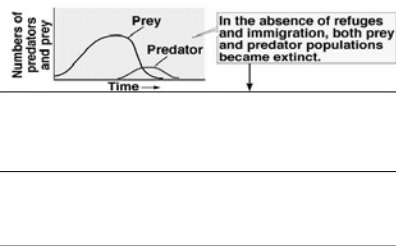
Is this reality?

## I. Regulation of population sizes

### B. Predator-prey cycles

#### 3. Experiments: *Paramecium caudatum* and *Didinium* cultures

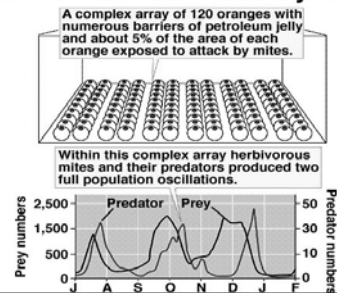
#### Predator-Prey Oscillation



## C. Maintaining predators and prey

### 1. Environmental complexity: refuges

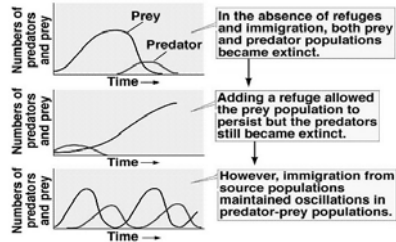
#### Herbivorous & Predatory Mites



## C. Maintaining predators and prey

### 2. Immigration

#### Predator-Prey Oscillation



14.18

## C. Maintaining predators and prey

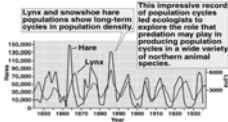
### 3. Switching: Alternative food sources for predators

## II. Responses of predators

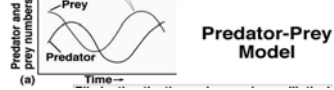
5<sup>th</sup>: 164-166

### A. Numerical responses

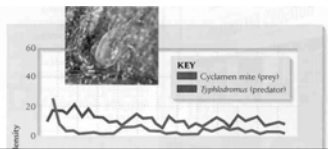
#### Lynx and Hare Fluctuation



This impressive record of population cycles led ecologists to explore the role that predation may play in producing population cycles in a wide variety of northern animal species.



#### Predator-Prey Model



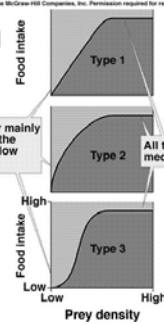
KEY  
 Cyclops (prey)  
 Daphnia (predator)

## II. Responses of predators

### B. Functional responses

#### Three theoretical functional response curves.

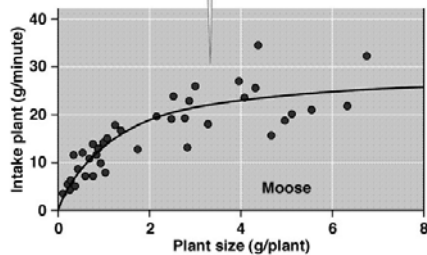
The three curves differ mainly in how food intake by the consumer changes at low food densities.



6.21

#### A functional response by moose.

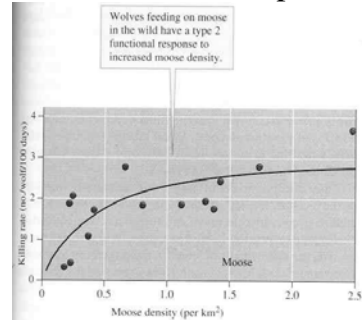
Moose feeding in a controlled experimental setting show a type 2 functional response.



6.22

#### Wolf functional response

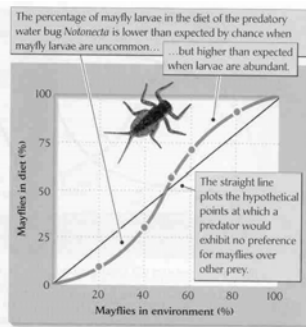
Wolves feeding on moose in the wild have a type 2 functional response to increased moose density.



6.23

FIGURE 6.23 Wolf functional response (data from Messier 1994).

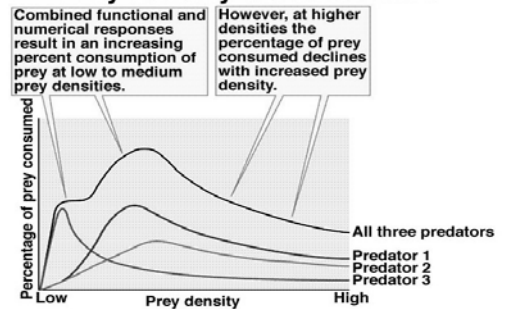
## Type III functional response



Ricklefs 18.13

## C. Predator satiation

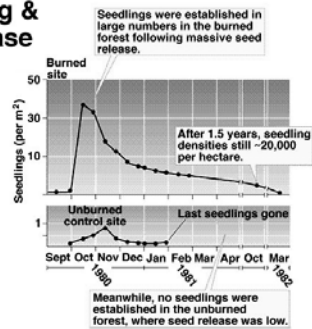
### Prey Density vs. Consumed



14.20

## Predator satiation – reproductive success of prey

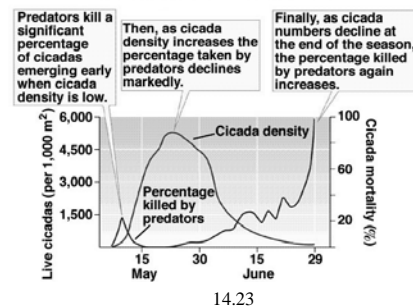
### Site Burning & Seed Release



14.21

## Predator satiation – reproductive success of prey

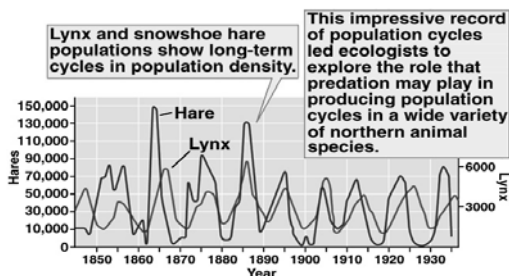
### Cicadas & Predation



14.23

Look back at the lynx-hare cycles: which of the mechanisms we've discussed are involved in these cycles?

## Lynx and Hare Fluctuation



14.14

## III. Predation and adaptations

Reading, 5<sup>th</sup>: pp. 156-163

- What roles do plant nutrient content and plant defenses play in herbivory dynamics?
- What is the difference between cryptic vs. aposematic (warning) coloration?
- What are the two main types of mimicry?
- What is co-evolution and how does it differ from convergent evolution?