Community Ecology 2
Exploitation: Predation, parasitism, pathogens and herbivory
Ch. 14, plus pp. 156-163, 164-166

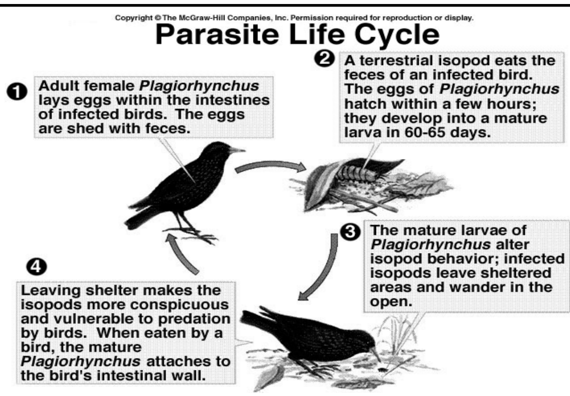
I. Regulation of population size of the prey
- A. Reduction of population size
- B. Predator-prey cycles
- C. Maintaining predators and prey

II. Responses of predators
- A. Numerical
- B. Functional (I, II, and III)
- C. Predator satiation

III. Predation as an evolutionary force

Predation

BHT CD



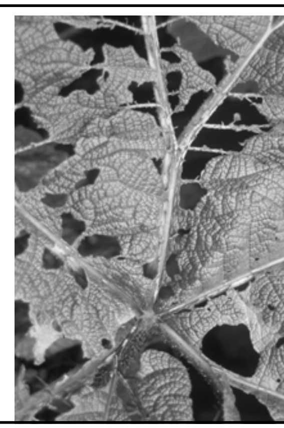
14.2 – Acanthocephalan (thorny-headed worm) life cycle

Parasitoids

Ricklefs 2001

Parasitoids

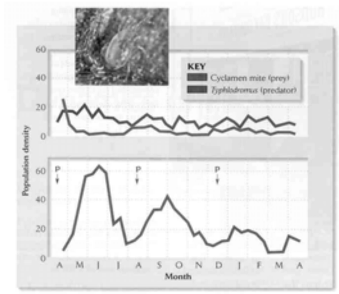
Herbivory



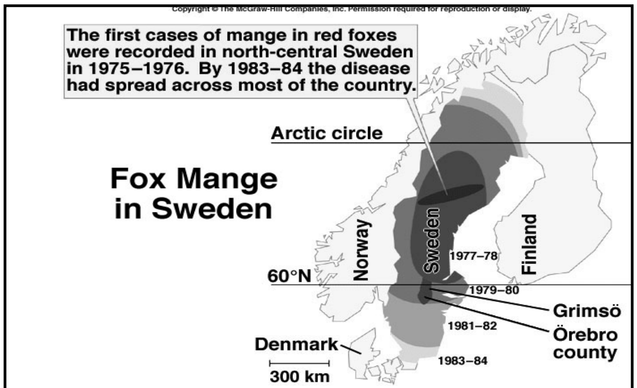
I. Regulation of population sizes

A. Reduce population size of prey

1. Cyclamen and *Typhlodromus* mites - biocontrol

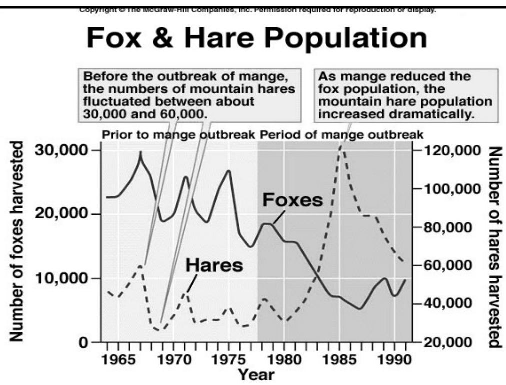


Ricklefs 2001
Fig. 18.3



2. Mange, foxes and hares

14.12



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

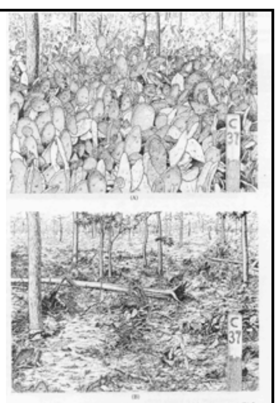
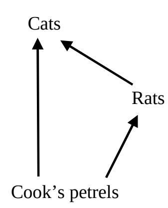


FIGURE 13–1 (A) Queensland forest plot choked with *Opuntia* cactus. (B) Same forest plot after introduction of South American cactus-eating moths, *Cactoblastis cactorum*.

2. Mesopredator release



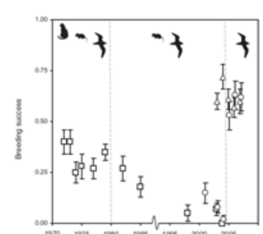
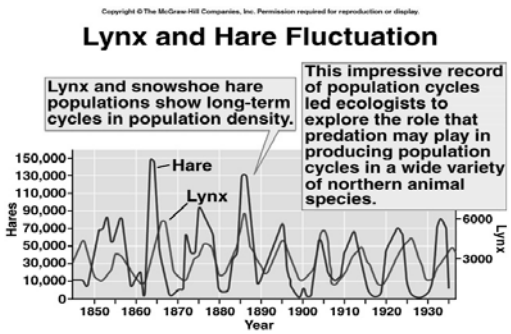


Fig. 1. Proportion of study burrows at high- and low-altitude study sites (±SE) fledging chicks during successive predator regimes on Little Barrier Island. Values for the high-altitude study sites are represented by squares ("Thumb" site) and circles ("Orau" site). Values for the low-altitude "Valley" study site are represented by triangles. Temporal differences in breeding success at high-altitude study sites are significant ($F = 35.67$, 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

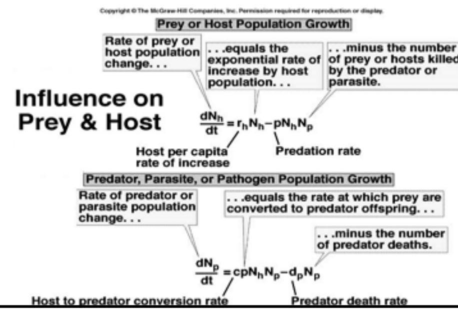
1. Examples



14.14

B. Predator-prey cycles

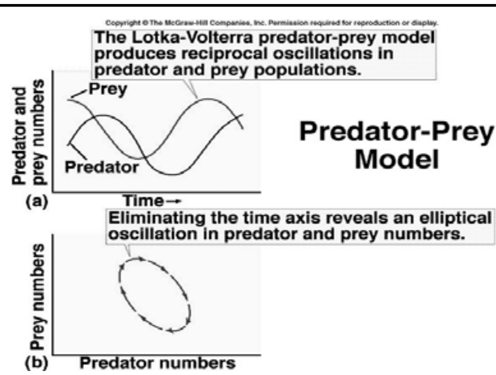
2. Lotka-Volterra models



$$\frac{dN_h}{dt} = r_h N_h - pN_h N_p$$

$$\frac{dN_p}{dt} = cpN_h N_p - d_p N_p$$

14.15



14.16

Predator-prey cycles

Ecobeaker demo: zooplankton and phytoplankton

Assumptions:

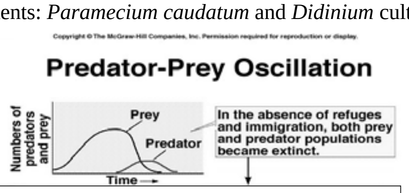
1. The environment does not change and genetic adaptation is slow.
2. No migration
3. The prey population finds ample food at all times.
4. The food supply of the predator population depends entirely on the prey populations.
5. Instantaneous feedback to birth and death rates.
6. The rate of change of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

Is this reality?

I. Regulation of population sizes

B. Predator-prey cycles

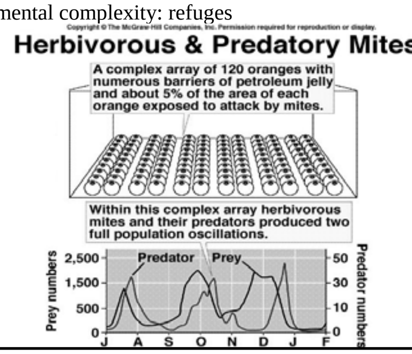
3. Experiments: *Paramecium caudatum* and *Didinium* cultures



14.18

C. Maintaining predators and prey

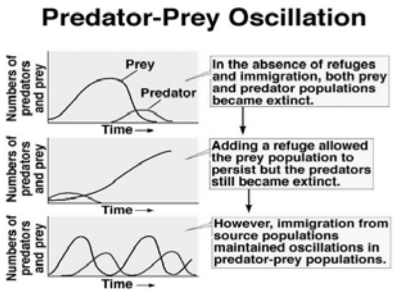
1. Environmental complexity: refuges



14.19

C. Maintaining predators and prey

2. Immigration



14.18

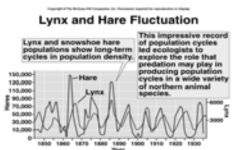
C. Maintaining predators and prey

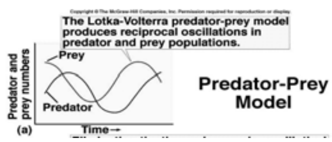
3. Switching: Alternative food sources for predators

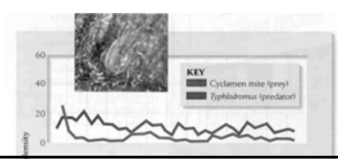
II. Responses of predators

5th: 164-166

A. Numerical responses

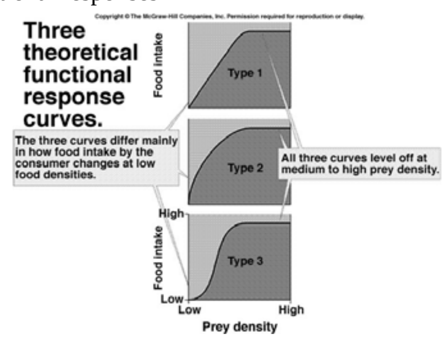




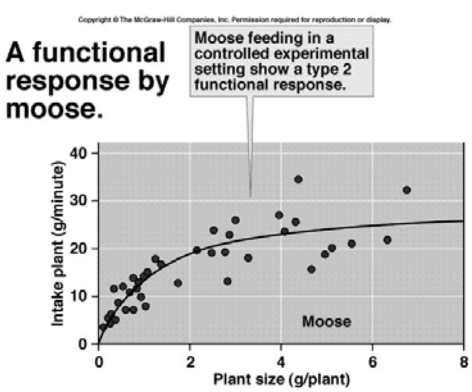


II. Responses of predators

B. Functional responses



6.21



6.22

Wolf functional response

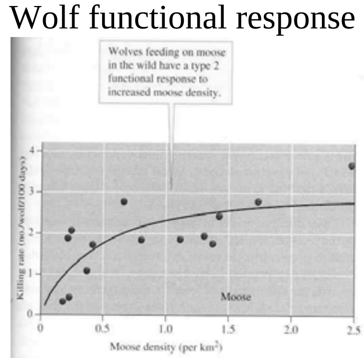
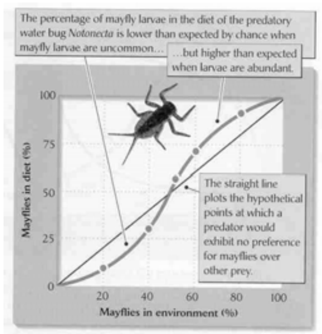


FIGURE 6.23 *Wolf functional response (data from Messier 1994).*

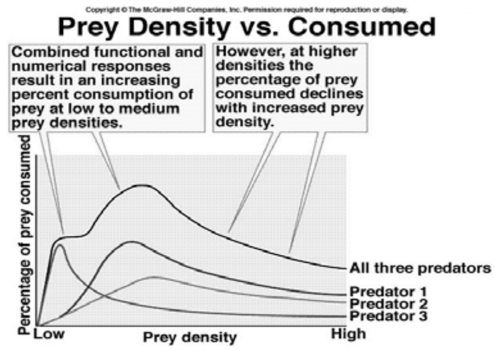
6.23

Type III functional response



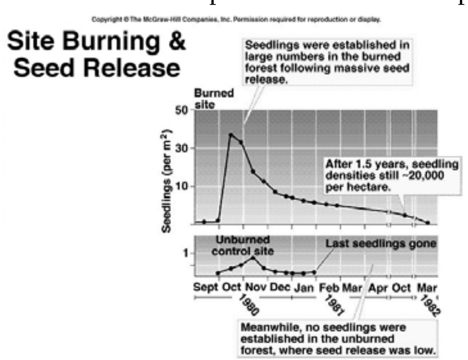
Ricklefs 18.13

C. Predator satiation



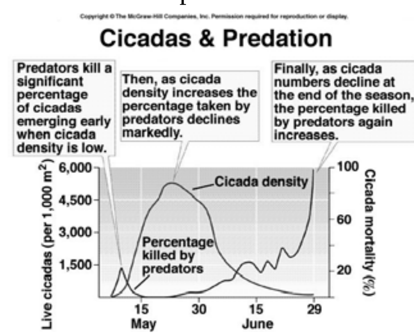
14.20

Predator satiation – reproductive success of prey



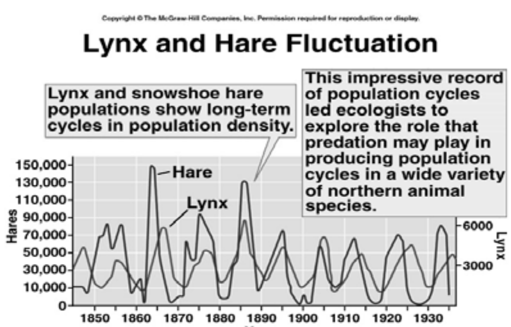
14.21

Predator satiation – reproductive success of prey



14.23

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



14.14

III. Predation and adaptations

Reading, 5th: 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?