5. Growth in Natural Populations

- **a. Regulated growth**
  - **1) mechanisms**
  - **2) density dependent factors**
- **b. Unregulated growth**
  - **1) density independent factors**
- **c. Applied population dynamics**
  - **1) Maximum sustainable yield**
    - **general logic**
    - **effects of age**
    - **effects of sex**
  - **2) Controlling pest populations**
  - **3) The Human population**

Fig. 52.11 The patterns of exponential and logistic population growth

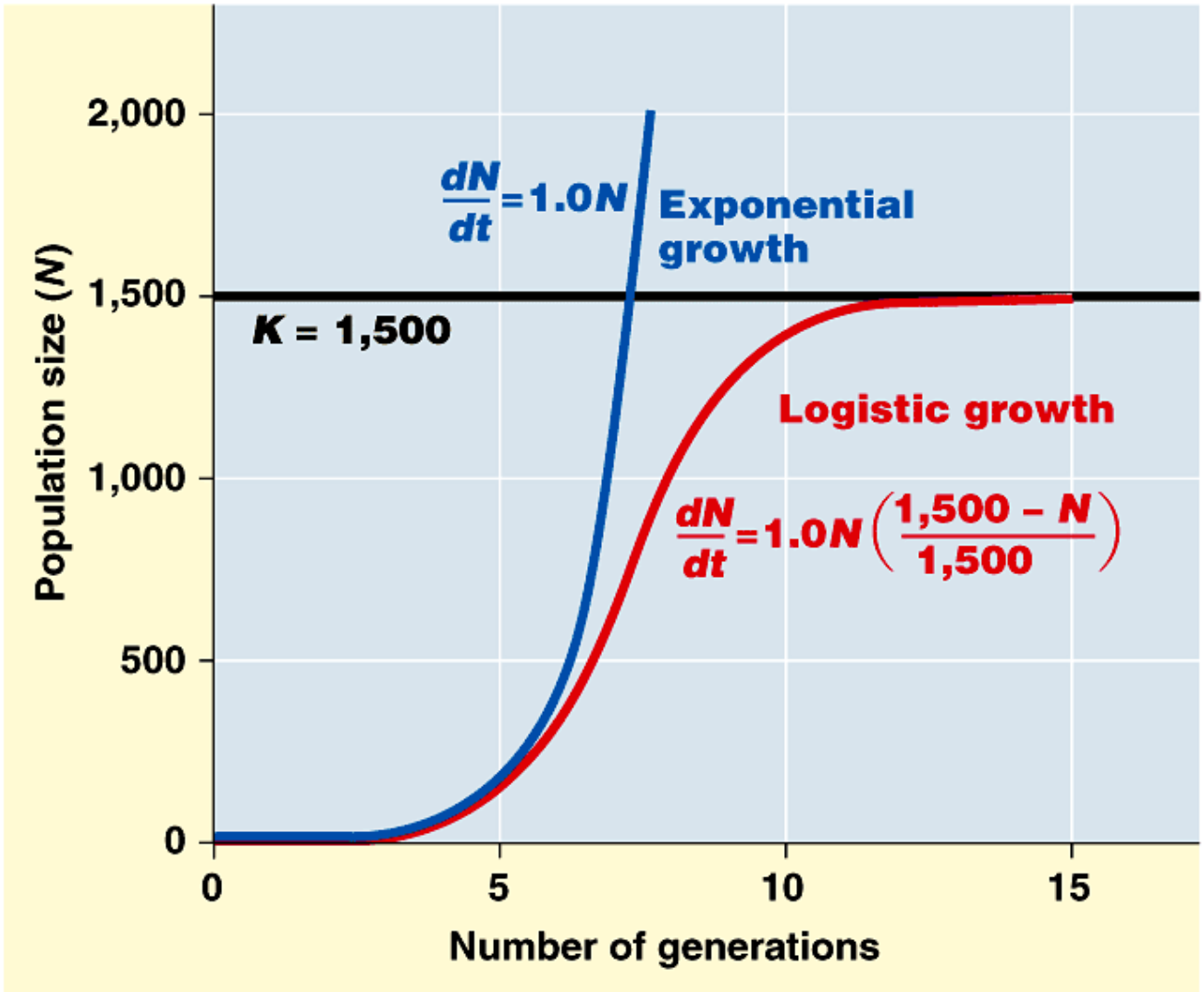
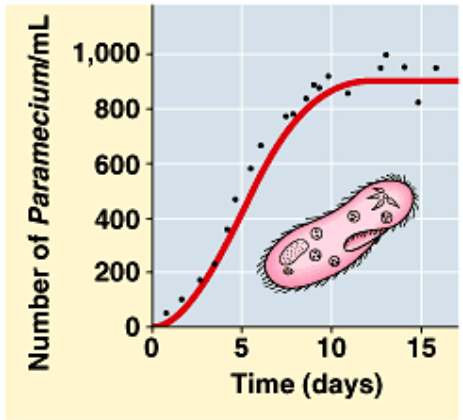
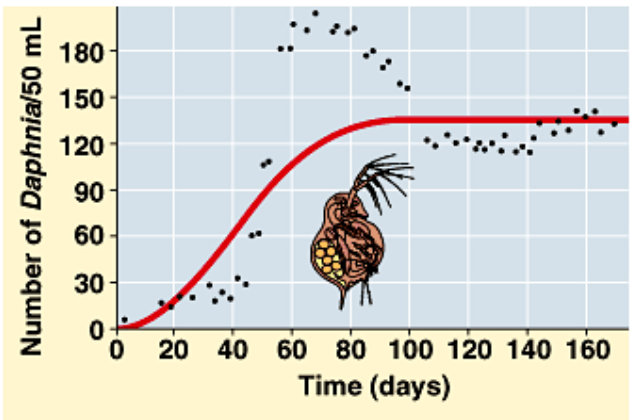


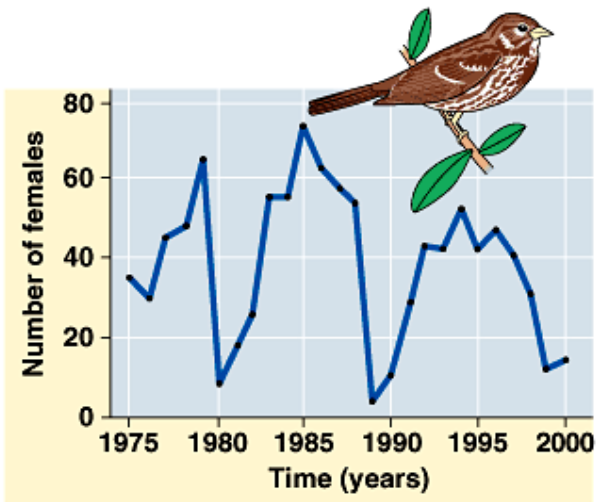
Fig 52.12 Growth in real populations



(a) A *Paramecium* population in the lab



(b) A *Daphnia* population in the lab



(c) A song sparrow population in its natural habitat

Logistic model for population growth

$$\mathbf{dN/dt = r\,N\,[(K - N)/K]}$$

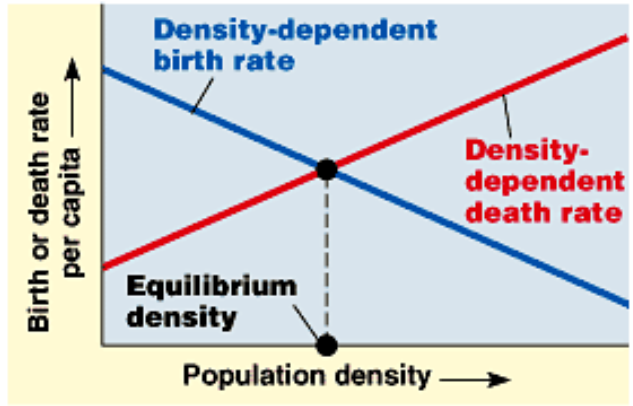
If N < K, dN/dt is positive and the population grows

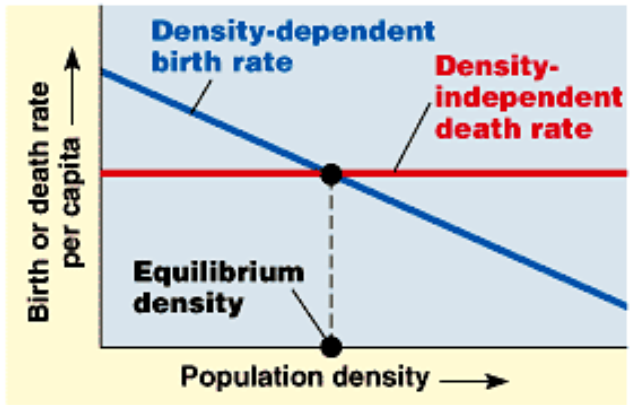
If N = K, dN/dt is zero and the population does not grow

If N > K, dN/dt is negative and the population shrinks

The growth rate is **density-dependent,** growth is **regulated**

Fig. 52.13





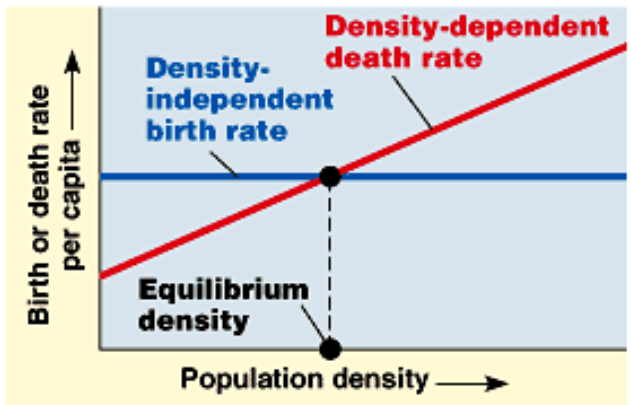
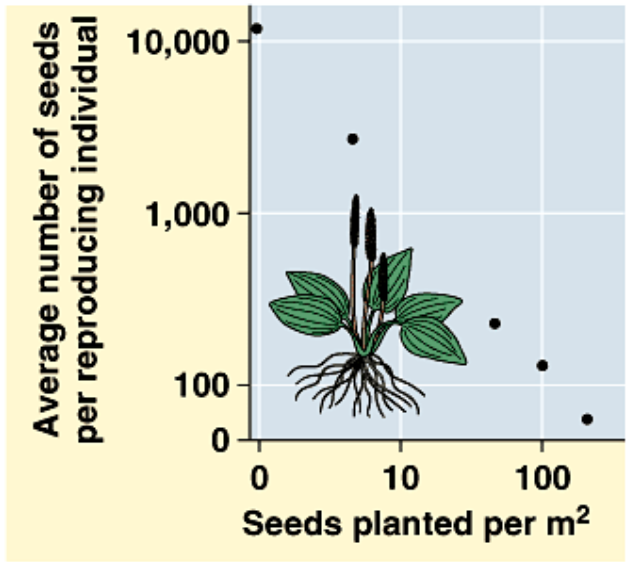
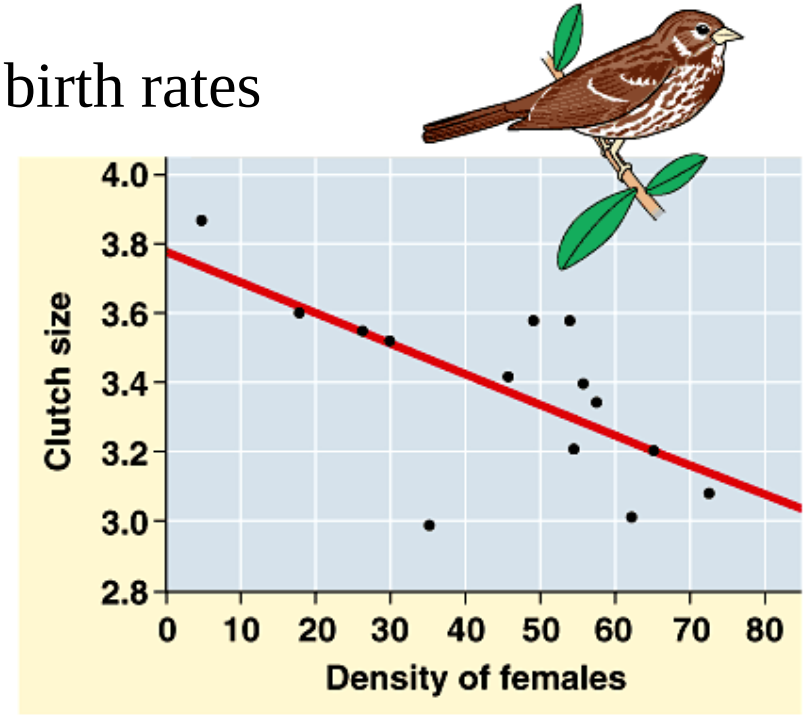


Fig. 52.14 Density dependent birth rates

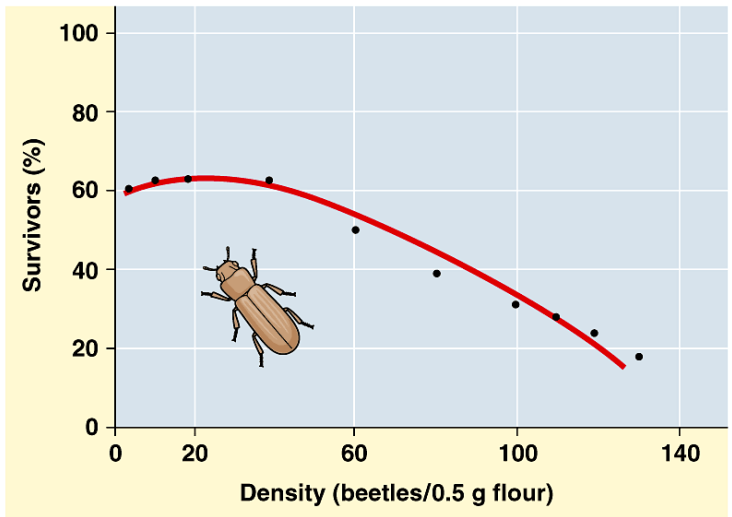


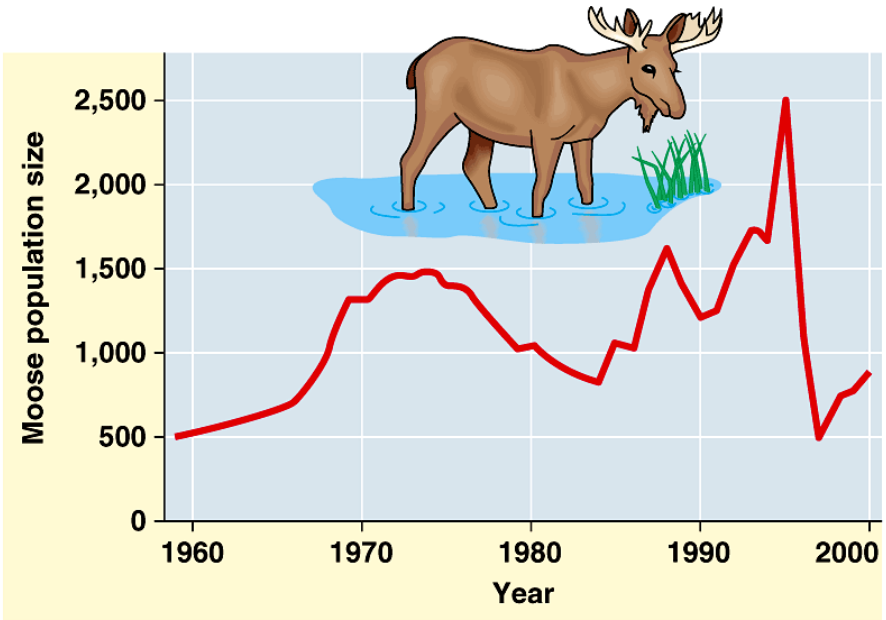
(a) Plantain

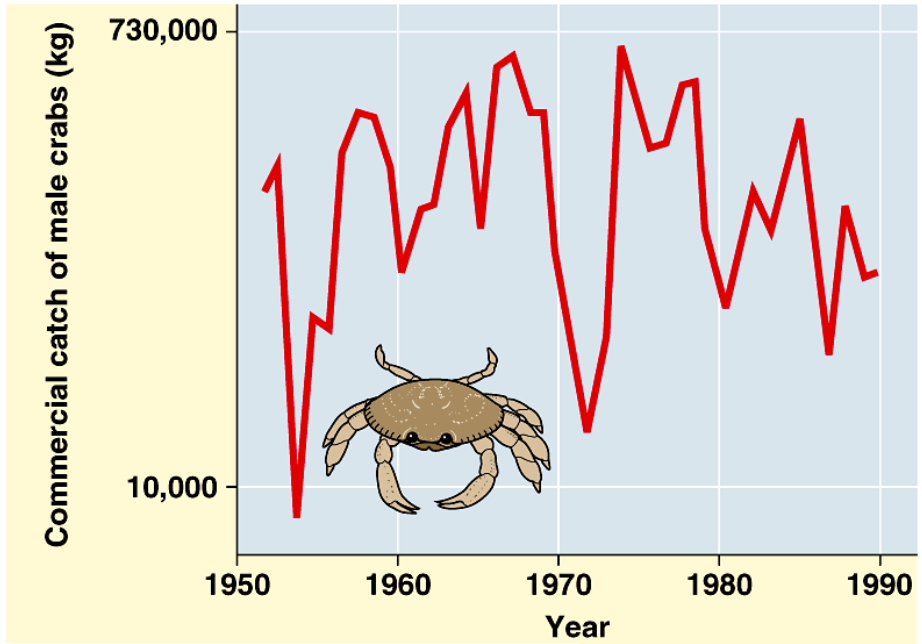


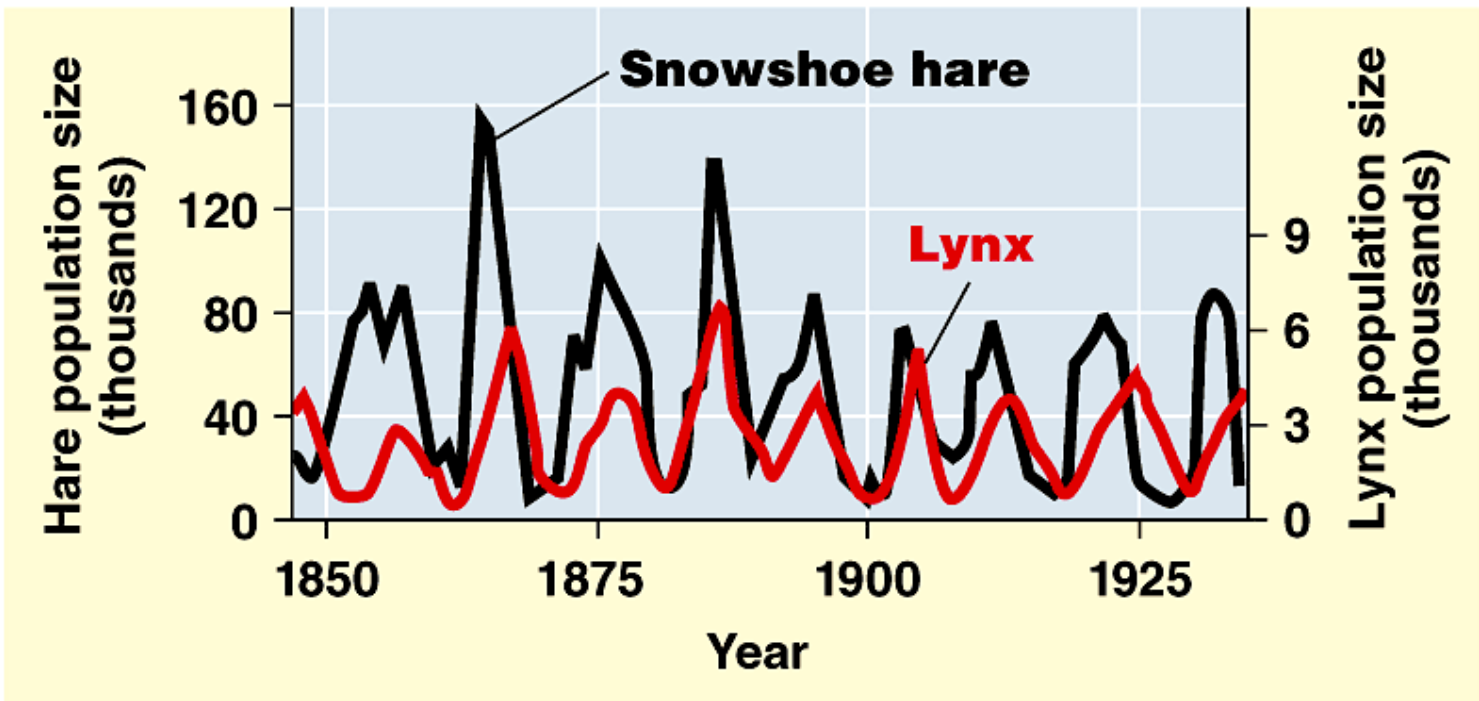
(b) Song sparrow

Fig. 52.15 Density-dependent survival



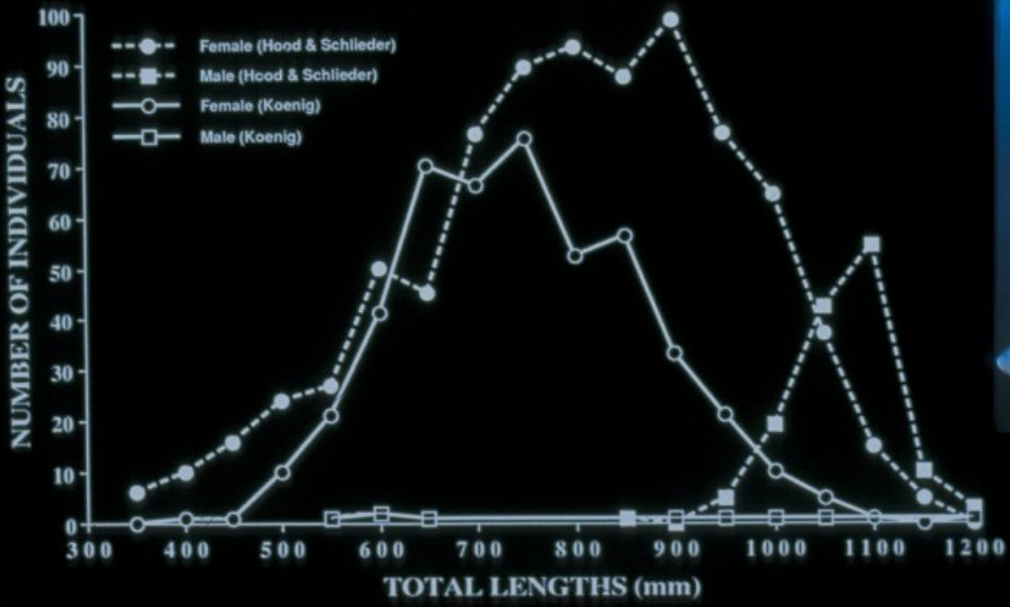






Slot limits can protect specific age classes

Mycteroperca microlepis
N.E. GULF OF MEXICO



A population model that includes age, sex, and harvesting

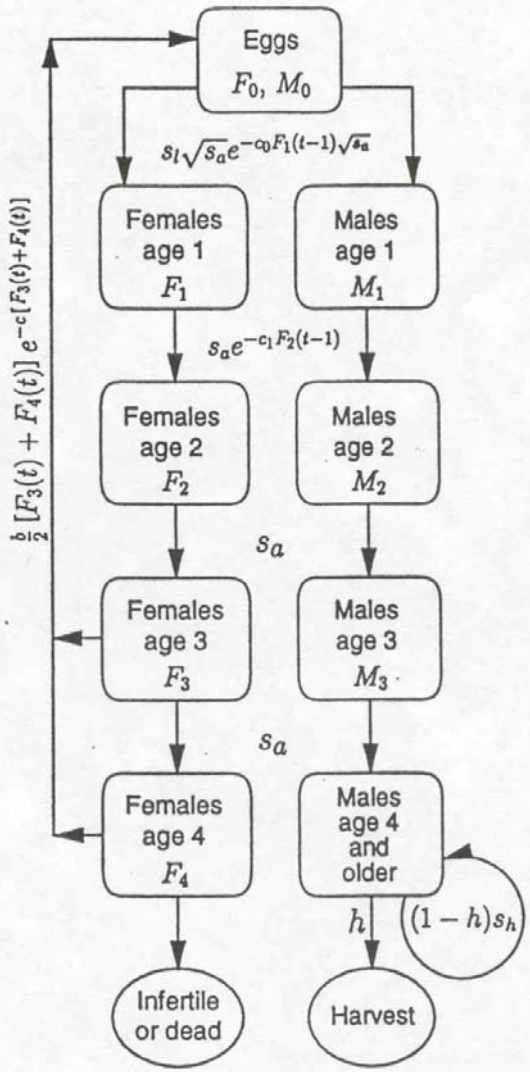


Fig. 1. Deterministic model skeleton for Dungeness crab. The model clock starts in December

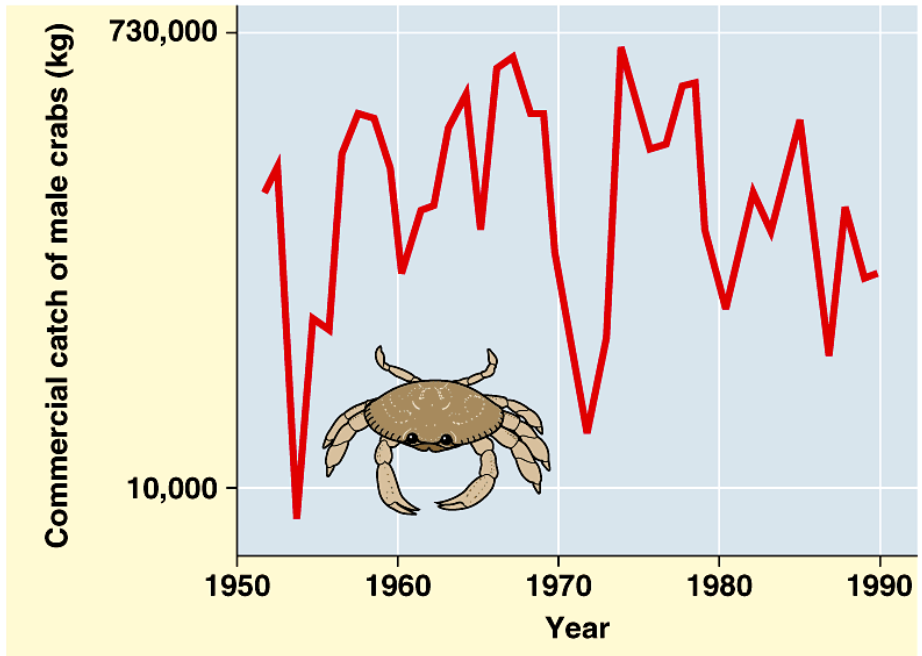


Fig. 52.20 Human population growth

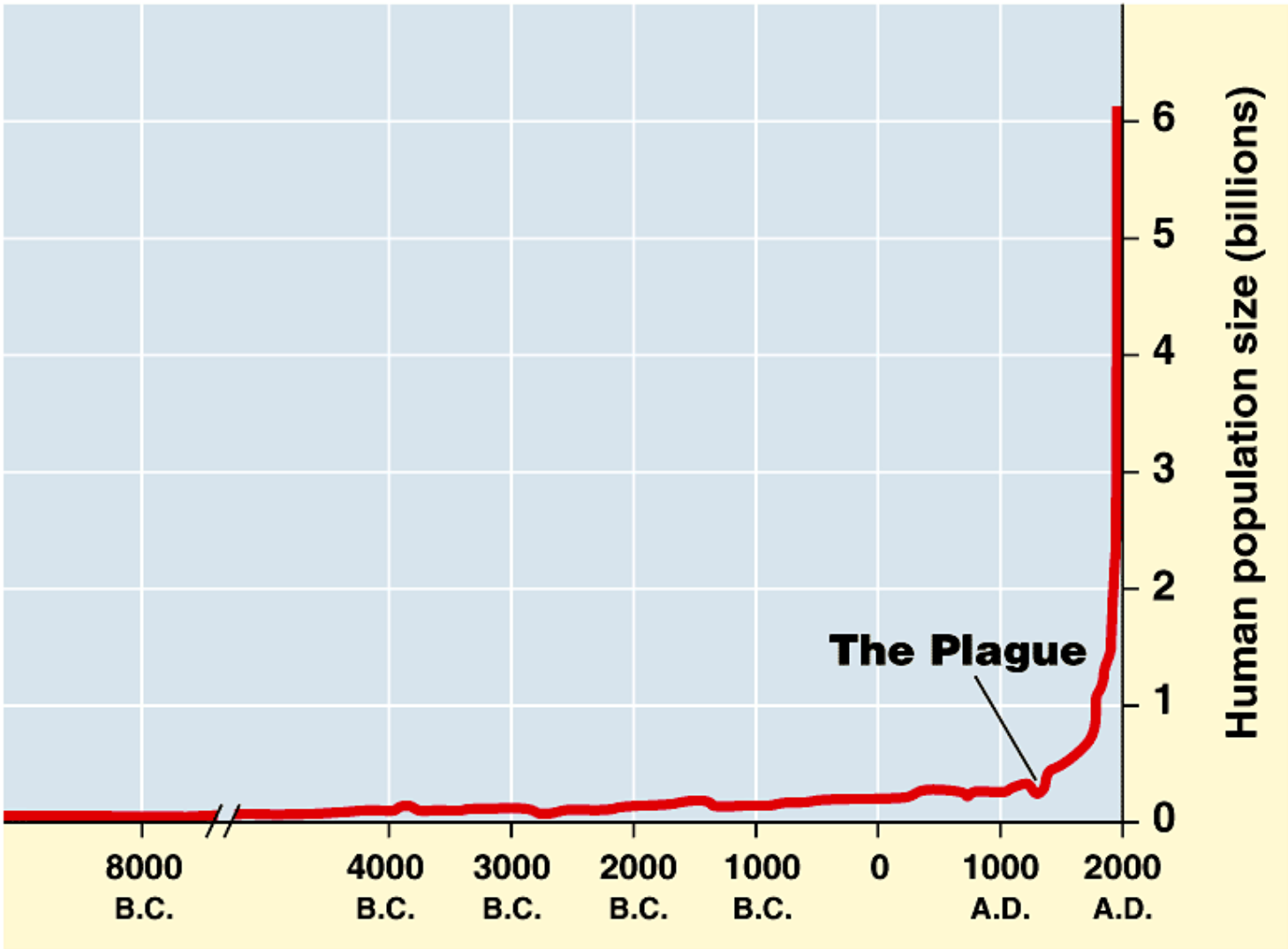
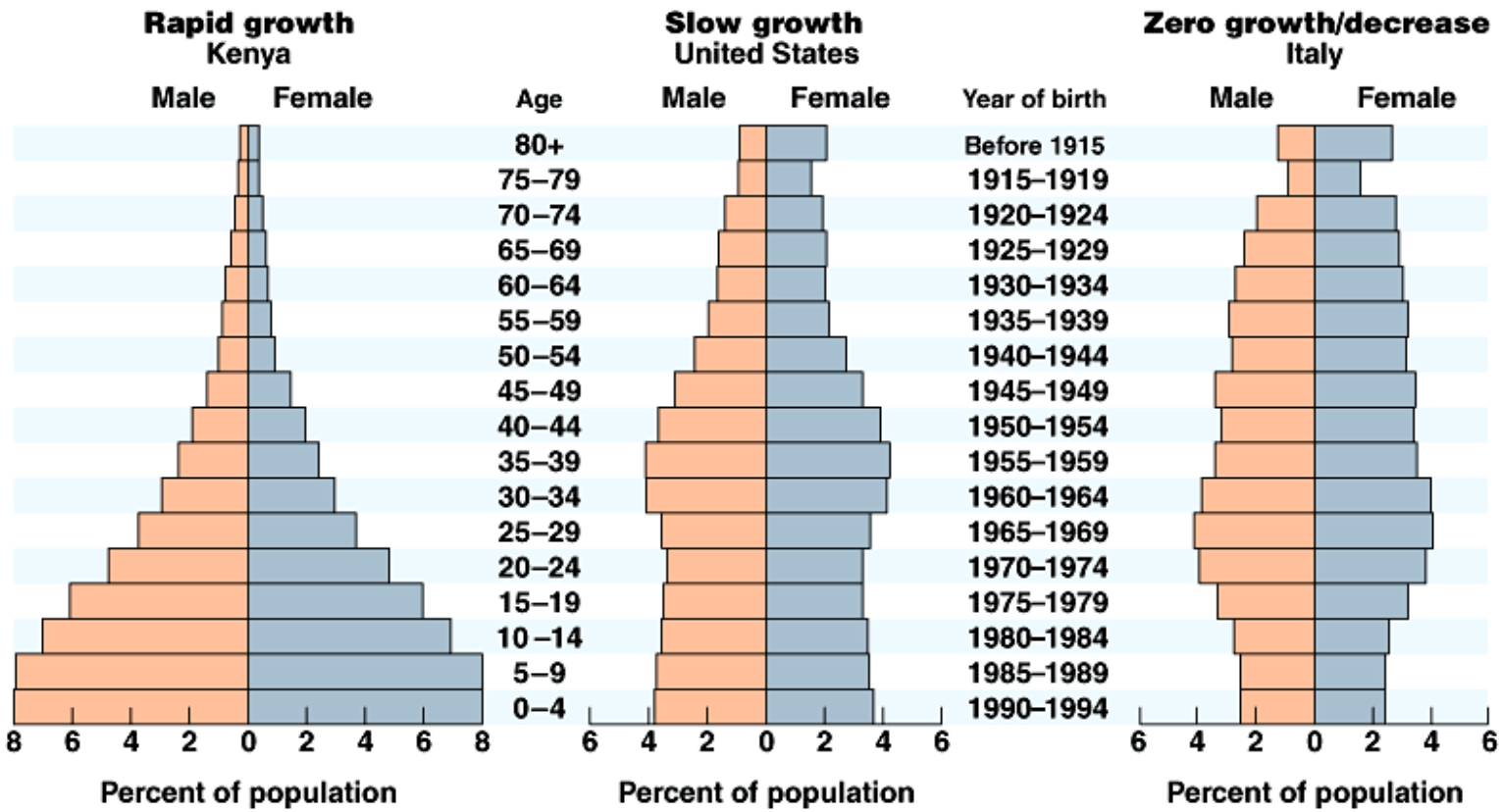


Fig. 52.22



About 80% of the human population is in countries where growth is rapid