Population

Big Picture

Populations are groups of the same species. Populations make up communities and have many factors that can influence their population size, population density, and population distribution. A population's rate of growth reflects how healthy the group of organisms is. The equation r=(b+i)-(d+e) displays the factors that impact r (the growth rate).

Key Terms

Population: Refers to a group of organisms of the same species that lives in the same area.

Population Size: The number of of individuals in a population.

Population Density: The individuals that make up the population size per unit area or volume.

Population Distribution: How the individuals in a population are distributed throughout their habitat.

Age-Sex Structure: The number of individuals of each sex and age in the population.

Population Pyramid: A bar graph that represents age-sex structure.

Survivorship Curve: A line graph that represents the number of individuals alive at each age.

Population Growth Rate (r): How fast a population changes in size over time.

Immigration: When part of a population joins another population elsewhere.

Emigration: When part of a population leaves to go elsewhere.

Dispersal: When offspring move away from their parents.

Migration: The regular movement of individuals or populations every year during certain seasons.

Exponential Growth: Pattern of population growth in which a population starts out growing slowly but grows faster as population size increases.

Logistic Growth: Pattern of population growth in which growth slows and population size levels off as the population approaches the carrying capacity.

Carrying Capacity: Represented by the variable (K), carrying capacity is the largest population size a niche can support without being harmed.

K-Selected Species: Species that live in a stable environment, in which their population growth is controlled by density-dependent factors.

r-Selected Species: Species that live in an unstable environment, in which their population is uncontrolled and rapid.

Size, Density, & Distribution

Populations make up communities and act as a unit of natural selection and evolution. Its health can be measured by how large it is and how fast it is growing.

- **Population size** influences the chances of a species surviving or on the brink of being extinct. Very small populations generally are at the greatest risk of extinction.
- **Population density** reflects how crowded the population is. A large population density means there is a lot of individuals living in the area.
- Generally individuals in a population are not spread out evenly in the area. The **population distribution** looks to see how the individuals are spread throughout their habitat. Organisms may be:

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Population Growth Rate

The **population growth rate (r)** gives us an idea on how fast a population changes over time. The rate can be calculated with this equation:

r=(b+i)-(d+e)

r = population growth rate
b = birth rate
i = immigration rate
d = death rate
e = emigration rate

- A population growth rate is most affected by the birth rate (b) and the death rate (d).
- **Immigration** rate (i) also reflects individuals entering the population from somewhere else.
- **Emigration** rate (e) reflects individuals leaving the population to go somewhere else.
- If the population growth rate is positive, the population is increasing. If the rate is negative, the population is decreasing.

*Think of **i**mmigration as coming **in**, **e**migration as **e**xiting.*

There are other factors that can affect population size and growth:

- **Dispersal** prevents competition with the parents for resources.
- **Migration** changes population size in a regular pattern. The purpose of migration is generally to find food, mates, or other resources.

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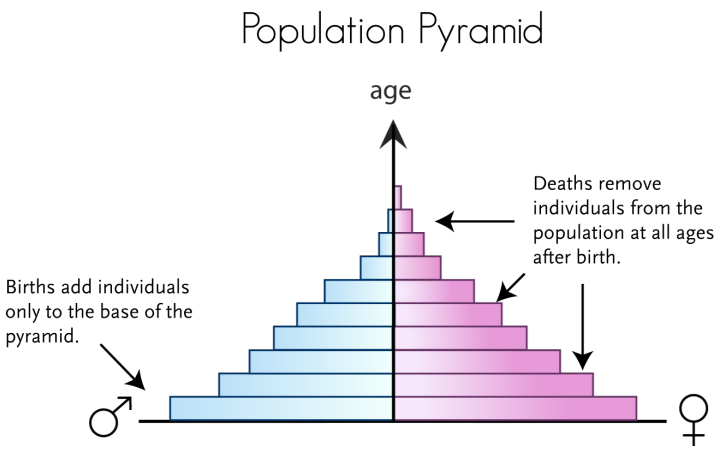
Population cont.

Population Growth

Population growth reflects the changes in the size of the population over time.

- The **age-sex structure** will influence population growth. Younger people are more likely to reproduce, so a large number of younger people may result in a large number of births, increasing the population. Older people have a higher rate of dying, so a large number of older people may result in a decrease in population.
- The age-sex structure can be shown in a **population pyramid.**



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Survivorship curves show how deaths affect populations. You may see one of these three types of curves:

- Type I: Parents provide care to a few offspring, which allows them to grow into adulthood and reproduce. Type I usually describes mammals, such as humans.
- Type II: Parents produce a moderate number of offspring and provide some care, but deaths occur more uniformly throughout life than type I. This describes asexual species and animals like birds.
- Type III: Parents produce a large number of offspring but provide little care. This results with most of the offspring dying at a relatively young age. Type III is typical of plants, invertebrates, and fish.

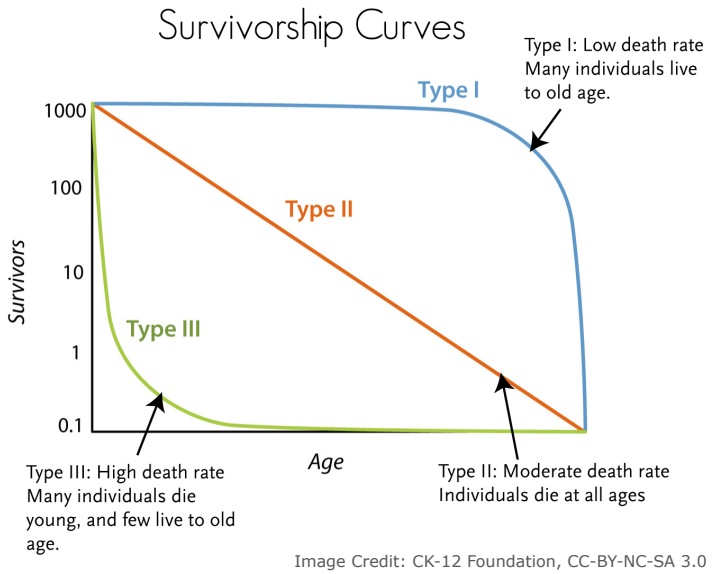

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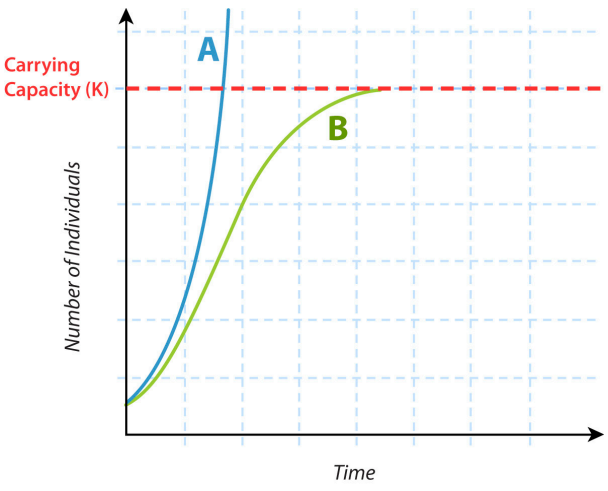
Figure. Survivorship curves for Type I (humans), Type II (songbirds), and type III (frogs).

Patterns of Population Growth



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Types of population growth pattern:

- **Exponential growth** (curve A in the graph): When a population's initial growth is slow, but the population size increases as the growth rate increases. The larger the population, the faster it grows. On a line graph, exponential growth forms a J-shape.
  - The lower part of the exponential growth curve represents **r-selected species**, whose population growth is uncontrolled and rapid.
- **Logistic growth** (curve B in the graph): When a population begins to grow exponentially, but as the population encounters factors that limit its growth, it starts to level off. On a line graph, logistic growth forms a S shape. The **carrying capacity (K)** limits the amount a population can grow, so the curve will start to level off near the carrying capacity.
  - Logistic growth describes **K-selected species**. K-selected species are generally close or at the carrying capacity.