Population Ecology

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Ecology-

- Ecology integrates other branches of science

Population Ecology- deals with factors that influence a population's size, growth, density, and other features

A population is:

Population Size

Depends on a balance between …

- **Natality** = birth rate (**b**)
- **Mortality** = death rate (**d**)

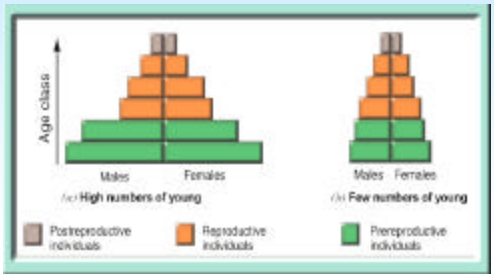
If birth rate (b) > death rate (d) → r is (+); population is increasing in size

If (b) < (d) → r is (-); population is shrinking

If (b) = (d) → r is (0); population size is constant

Natality and mortality may be due in part to the age profile of the population

Age-structure graphs illustrate the make-up of a population



Besides natality and mortality, population size also depends on the movement of individuals between populations (migration)

- **Immigration rate (i)**
- **Emigration rate (e)**

Therefore, more accurately...

Calculating growth rate (r)

	Population A	Population B
Size	1000	1000
Births	400	100
Deaths	100	400
# Immigrating	30	30
# Emigrating	30	30
Growth rate (r)		

Population A
b= 400/1000=0.4
d= 100/1000=0.1
i= 30/1000= 0.03
e= 30/1000= 0.03

Population B
b= 100/1000=0.1
d= 400/1000=0.4
i= 30/1000= 0.03
e= 30/1000= 0.03

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

r (population A)=

r (population B)=

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Population Growth

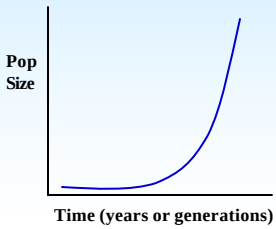
Two forces influence the dynamics of a population:

Biotic Potential =
- promotes positive growth
- *intrinsic* factor (litter size, gestation period)

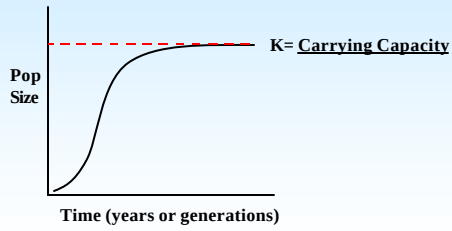
Environmental Resistance
- limits growth
- *extrinsic* factor (weather, food supply, etc.)

Patterns of Population Growth

1. Exponential Growth ("J"-shaped curve)



2. Logistic Growth ("S" - shaped curve)



What limits population size around carrying capacity?

1. Density-dependent factors

- competition (habitat space, food resources, mates)
- disease
- predation

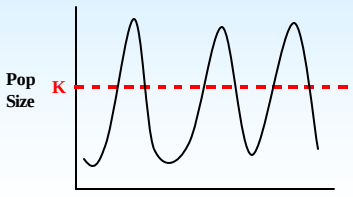
2. Density-independent factors

- weather conditions
- catastrophies
- natural disasters

Life History of Populations

1. Opportunistic Life History

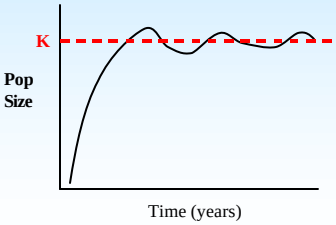
• exhibit extreme fluctuations in population size



These species usually…
- are small
- are short-lived
- have a high reproductive capacity
- invest little in their offspring

2. Equilibrial Life History

• Population size fluctuates around K



These species usually…
- are large
- are long-lived
- have low reproductive capacity
- Invest highly in their offspring

Population Ecology

Study Objectives

1. Define **ecology**. Define **population ecology**.
2. What is a **population**?
3. Define **natality** and **mortality**. Explain how to calculate the **growth rate** of a population using natality and mortality. What does the growth rate tell us about the growth behavior of the population?
4. What do the shapes of **age-structure graphs** tell us about a population?
5. Define **immigration** and **emigration**. Explain how to calculate growth rate , incorporating immigration and emigration into the equation.
6. Contrast **biotic potential** and **environmental resistance**. How do these work on population growth?
7. Describe **exponential growth** of a population. What does the shape of an exponential growth curve look like?
8. Describe **logistic growth** of a population. What does the shape of a logistic growth curve look like? What is **carrying capacity**?
9. Explain how **density -dependent** and **density-independent** growth factors affect the growth of different sized populations and give examples of each.
10. Describe the type of growth pattern seen in species that exhibit **opportunistic life histories**. List some characteristics and examples of these species.
11. Describe the type of growth patterns seen in species that exhibit **equilibrial life histories**. List some characteristics and examples of these species.