Population Ecology

Population Ecology

Population Size

Depends on a balance between …

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

If birth rate (b) > death rate (d) \( r > 0 \); population is increasing in size

If birth rate (b) < death rate (d) \( r < 0 \); population is shrinking

If birth rate (b) = death rate (d) \( r = 0 \); population size is constant

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...

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:

Calculating growth rate (r)

<table>
<thead>
<tr>
<th></th>
<th>Population A</th>
<th>Population B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>1000</td>
<td>1000</td>
</tr>
<tr>
<td>Births</td>
<td>400</td>
<td>100</td>
</tr>
<tr>
<td>Deaths</td>
<td>100</td>
<td>400</td>
</tr>
<tr>
<td># Immigrating</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td># Emigrating</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Growth rate (r)</td>
<td>( (b - d) ) + (i - e))</td>
<td></td>
</tr>
</tbody>
</table>

\[ r = (b - d) + (i - e) \]

Population A
- \( b = 400/1000 = 0.4 \)
- \( d = 100/1000 = 0.1 \)
- \( i = 30/1000 = 0.03 \)
- \( e = 30/1000 = 0.03 \)

Population B
- \( b = 100/1000 = 0.1 \)
- \( d = 400/1000 = 0.4 \)
- \( i = 30/1000 = 0.03 \)
- \( e = 30/1000 = 0.03 \)
Population Ecology

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)

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
   - catastrophes
   - natural disasters

Patterns of Population Growth

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
   - catastrophes
   - natural disasters

Life History of Populations

1. **Opportunistic Life History**
   - exhibit extreme fluctuations in population size
   - are small
   - are short-lived
   - have a high reproductive capacity
   - invest little in their offspring

   These species usually...

2. **Equilibril Life History**
   - Population size fluctuates around K
   - are large
   - are long-lived
   - have low reproductive capacity
   - invest highly in their offspring

   These species usually...
Population Ecology

Study Objectives

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. Describe 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.