POPULATION ECOLOGY

POPULATION

POPULATION CHARACTERISTICS

Ecology Activity #3 page 1
POPULATION GROWTH MODELS

- Exponential growth model
- Logistic growth model
- S-shaped curve
- Density-dependent population growth
- Resource limitation
- Ecological carrying capacity

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QUESTIONS

1. Match the definition with the correct term

   A. Demography  
   B. Density  
   C. Dispersion  
   D. Population

   ______ Individuals of the same species that simultaneously occupy the same general area
   ______ The number of individuals per unit area or volume
   ______ Pattern of spacing among individuals within the geographical boundaries of the population
   ______ Study of the vital statistics that affect population size

2. Identify the pattern of dispersal (Clumped, Random, Uniform) described in each of the following.

   ______ Fish grouped together in a school
   ______ Evenly spaced
   ______ Corn plants in a field
   ______ Individuals aggregated in patches
   ______ Distribution of trees in tropical rain forests
   ______ Humans in cities
   ______ Unpredictable, patternless dispersion
   ______ Trees in an orchard
   ______ Rare in nature

3. Examine the age structure diagrams below.

   A   B   C   D   E

   a. Which of the above populations is experiencing the fastest growth?
   b. Which is most nearly experiencing zero population growth over the time period represented?
   c. Which is experiencing the effect of severe limiting factors?
4. Identify the survivorship curve (I, II, or III) described in each of the following.

_____ Most individuals survive to middle age; after that mortality is high
_____ The length of survivorship is random; the likelihood of death is the same at any age
_____ Most individuals die young, with only a few surviving to reproductive age and beyond
_____ Exhibited by humans and many large mammals that produce relatively few offspring but provide them with good care
_____ Relatively flat at the start, reflecting low death rates during early and midlife, and dropping steeply as death rates increase among older age groups
_____ Drops sharply at the left of the graph, reflecting very high death rates for the young, but then flattens as death rates decline
_____ Characteristic of organisms that produce large numbers of offspring but provide little care for them
_____ Oyster that produces millions of eggs

_____ Death rates more constant over life span

_____ Characteristic of some annual plants, invertebrates, some lizard species, and some rodents

5. Explain the following statement:
“Limited resources mandate trade offs between investments in reproduction and in survival.”

________________________________________________________

________________________________________________________

________________________________________________________

6. A population of 500 individuals experiences 55 births and 5 deaths during a one-year period.

a. What is the reproductive rate for the population during this one-year period?

________________________________________________________

b. If the population maintains the current growth pattern, what would a plot of its growth resemble?

________________________________________________________
7. Identify the population growth model (Exponential or Logistic) described in each of the following.

______ Describes an idealized population in an unlimited environment

______ Modified to incorporate changes in $r$ as population size grows toward carrying capacity

______ Produces a sigmoid (S-shaped) curve when population size is plotted against time

______ Produces a J-shaped curve when population size is plotted against time

______ Occurs when limiting factors restrict the size of the population

$$\frac{\Delta N}{\Delta t} = rN$$

$$\frac{\Delta N}{\Delta t} = rN\left(\frac{K-N}{K}\right)$$

8. What are the two types of life-history strategies?

_____________________________________________________________

9. Identify each of the following as true of $K$-selected species or $r$-selected species.

______ Exhibit rapid growth

______ Population size remains relatively constant (at the carrying capacity)

______ Species that quickly invade a habitat, quickly reproduce, and then die

______ Opportunistic species

______ Grasses and many insects

______ Produce a small number or relatively large offspring that require extensive parental care until they mature

______ Small, mature quickly, and require little, if any, parental care

______ Large mammals

10. What impact do limiting factors have on a population?

_____________________________________________________________

_____________________________________________________________
11. What are the two categories of limiting factors?

_____________________________________________________________

12. Identify each of the following as true of density-dependent (D) or density-independent (I) limiting factors.

_____ Factors whose limiting effect becomes more intense as the population density increases
_____ Factors that affect a population regardless of its size
_____ Natural disasters
_____ Parasites and disease
_____ Competition for resources
_____ Predation
_____ Extreme climates

13. Describe the graph of the population growth of humans on Earth.

_____________________________________________________________

Why hasn’t the population of humans on Earth leveled off or reached carrying capacity?

_____________________________________________________________

_____________________________________________________________

_____________________________________________________________

_____________________________________________________________

Eventually, provided human population growth follows that of other populations, what will happen to the population of humans on Earth? Why?

_____________________________________________________________

_____________________________________________________________

_____________________________________________________________
14. Examine the age structure diagrams below. This data reflects information collected in 1990.

<table>
<thead>
<tr>
<th>Description</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population is predicted to increase dramatically</td>
<td>Sweden</td>
</tr>
<tr>
<td>Population is relatively stable</td>
<td>Mexico</td>
</tr>
<tr>
<td>Population is declining</td>
<td>United States</td>
</tr>
<tr>
<td>Survival of older females is higher than older males</td>
<td></td>
</tr>
</tbody>
</table>

Identify the age structure diagram described in each of the following.