Day 17 - Biology – 9-23-24

QUIZ – Questions & Answers - Population

1) Compare immigration vs emigration.

2) What are the factors that increase population?

3) What are the factors that decrease population?

4) What is the "population natural growth rate formula?"

5) What is population density and what is dispersal?

6) What is carrying capacity?

7) What are density dependent limiting factors?

8) What are density independent limiting factors?

1) Compare immigration vs. emigration

Immigration refers to the movement of individuals into a population from another location. This process can increase the size of a population by bringing new members into the community. For example, animals may immigrate to a new area due to food availability, habitat conditions, or favorable environmental factors.

In contrast, emigration is the movement of individuals out of a population to settle elsewhere. This reduces the size of the original population. Animals might emigrate due to overcrowding, scarcity of resources, or environmental stressors. The balance between immigration and emigration can influence overall population dynamics and growth rates.

2) What are the factors that increase population?

Factors that increase population include a high birth rate, immigration, and improved living conditions. A high birth rate adds new individuals to the population, particularly in areas with good access to food, healthcare, and minimal disease. Immigration, as mentioned earlier, brings new individuals into a population, further boosting its numbers.

In addition, advances in medicine, sanitation, and technology have contributed to population increases by lowering death rates and extending life expectancy. Abundant resources and favorable environmental conditions also promote population growth by improving survival and reproductive success.

3) What are the factors that decrease population?

Factors that decrease population include high death rates, emigration, and scarcity of resources. High death rates can be caused by disease, predation, natural disasters, or poor living conditions that reduce life expectancy. When deaths outnumber births, population size shrinks.

Emigration also contributes to population decline as individuals move away to other locations. In some cases, limited access to resources like food and water, or environmental factors such as drought and pollution, can lead to lower birth rates and increased mortality, further decreasing population size.

4) What is the "population natural growth rate formula?"

The **natural growth rate** of a population refers to the rate at which a population increases or decreases due to births and deaths, excluding migration. It is calculated using the following formula:

$$\text{Natural Growth Rate} = \frac{(\text{Number of Births}) - (\text{Number of Deaths})}{\text{Population Size}} \times 100$$

Explanation:

1. **Number of Births**: The total number of live births in the population over a given period (usually a year).
2. **Number of Deaths**: The total number of deaths in the population over the same period.
3. **Population Size**: The total number of individuals in the population at the start of the period.
4. **Multiplication by 100**: This converts the result into a percentage, making it easier to interpret the natural growth rate as a percentage change in the population.

Example:

- If a population has 1,000 births and 800 deaths in a year, and the population size is 50,000, the natural growth rate would be:

This means the population grew by 0.4% over that year due to natural factors (births minus deaths).

$$\frac{1000 - 800}{50000} \times 100 = \frac{200}{50000} \times 100 = 0.4\%$$

This formula is useful for understanding demographic trends over time, particularly in determining how quickly or slowly a population is increasing or decreasing based on reproductive and mortality rates.

5) What is population density and what is dispersal?

Population density refers to the number of individuals per unit area or volume in a given habitat. It is an important measure for ecologists, as it reflects how crowded or sparse a population is within a defined space. High population densities may lead to competition for resources, while low densities may indicate that resources are more abundant or that environmental conditions are unfavorable.

Dispersal, on the other hand, is the movement of individuals away from their birthplace or from densely populated areas to new locations. Dispersal can reduce competition for resources, increase genetic diversity, and allow populations to colonize new habitats. Both population density and dispersal shape the spatial distribution of species in ecosystems.

6) What is carrying capacity?

Carrying capacity refers to the maximum number of individuals that an environment can sustainably support over time without depleting its resources. It is determined by factors such as food availability, water supply, shelter, and space. When a population exceeds its carrying capacity, resources become limited, leading to increased competition, starvation, and potentially a population crash.

The concept of carrying capacity is important in ecology because it highlights the balance between population size and resource availability. It can fluctuate based on changes in environmental conditions, such as climate change, resource depletion, or human intervention.

7) What are density-dependent limiting factors?

Density-dependent limiting factors are variables that affect population size in relation to its density. These factors become more intense as population density increases. Examples include competition for resources (such as food, water, and space), predation, disease, and waste accumulation. In dense populations, these factors can reduce reproduction and survival rates.

Such factors help regulate population growth by preventing populations from exceeding their environment's carrying capacity. For instance, in crowded conditions, diseases spread more easily, and competition for limited resources intensifies, leading to lower birth rates or higher mortality.

8) What are density-independent limiting factors?

Density-independent limiting factors affect populations regardless of their size or density. These factors are usually abiotic, such as natural disasters (e.g., floods, hurricanes, fires), extreme weather conditions, and human activities like deforestation or pollution. These events can cause sudden reductions in population size by destroying habitats or directly killing large numbers of individuals.

Because density-independent factors are not influenced by population density, they can drastically reduce populations even when numbers are low. These factors play a crucial role in shaping population dynamics, especially in ecosystems where environmental conditions are unpredictable or harsh.