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DYNAMIC EQUILIBRIUM

Population Calculation Practice

1. Calculate the population density if there were 300 birds in a 10 ha area in 1985 near Sylvan Lake.

$$D = N/A \quad = 300/10 \quad = 30 \text{ bird/hectare}$$

2. Data from a sparrow population was collected over a year in Jan., 1999.

Original Population: 1000
Natality: 800
Mortality: 600
Immigration: 300
Emigration: 200

Calculate the population growth rate.

$$\begin{aligned} Gr = ? \quad Gr = \Delta N / \Delta T \quad \Delta N = (n+i)-(m+e) \quad \text{so...} \quad &= 300 / 1 \text{ year} \\ &= 300 \text{ sparrows} \\ &Gr = 300/\text{yr} \end{aligned}$$

3. In Canada, the population in 1986 was 25.0 million compared to 23.1 million in 1976. Calculate the annual per capita growth rate.

$$\begin{aligned} Cgr = ? \quad Cgr = \Delta N / N^i \quad &= \frac{25 \text{ million} - 23.1 \text{ million}}{23.1 \text{ million}} \\ &= 0.0822 \end{aligned}$$

4. On a range of 450 hectares, there are 1 275 jackrabbits. Studies indicate the following counts for this population:

a. Determine the change in population size.	Mortality	2 225/year
b. Determine the per capita growth rate.	Natality	3400/year
	Emigration	775/year
	Immigration	150/year

$$\begin{aligned} a. \quad \Delta N = (n+i)-(m+e) \\ &= (3400+150)-(2225+775) \\ &= 550 \end{aligned} \quad \begin{aligned} b. \quad cgr = \Delta N / N^i \\ &= 550 / 1275 \\ &= 0.43 \end{aligned}$$

5. On October 15, 1992, the beginning of the grouse hunting season that year, biologists counted 75 spruce grouse in a 30 hectare forest plot. On December 15, 1992, 42 spruce grouse were counted in the same area.

a. What was the density of the grouse population on October 15? On December 15?

$$\begin{aligned} D = N/A \quad &D = N/A \\ = 75/30 \quad &= 42/30 \\ = 2.5 \text{ grouse/ha} \quad &= 1.4 \text{ grouse/ha} \end{aligned}$$

6. Data from a sparrow population was collected over a year, starting in January 1995. The study area was 4 000 ha.
Original population 200 000 (January 1995)
Natality 150 000
Mortality 130 000
Immigration 5 000
Emigration 2 000

1. a.) Calculate the original population density. Record your answer as a whole number.

$$\begin{aligned} D &= N/A \\ &= 200000/4000 \\ &= \mathbf{50 \text{ sparrow/ha}} \end{aligned}$$

1. b.) Calculate the new population size. Record your answer as a whole number.

$$\begin{aligned} \Delta N &= (n+i)-(m+e) \\ &= (150000+5000)-(13000+2000) \\ &= 140,000 \\ &= 140,000 + 200,000 = \mathbf{340,000 \text{ sparrows}} \end{aligned}$$

1. c.) Calculate the new population density. Record your answer as a whole number.

$$\begin{aligned} D &= N/A \\ &= 340000 / 4000 \\ &= \mathbf{85 \text{ sparrows/ha}} \end{aligned}$$

1. d.) Calculate the per capita growth rate (cgr) for the 1995 year.

$$\begin{aligned} cgr &= \Delta N / N^i \\ &= \frac{140,000}{200,000} \quad \begin{array}{l} \text{(already calculated)} \\ \text{(initial population)} \end{array} \end{aligned}$$

$$\mathbf{Cgr = . 0.7}$$

- 1) Limiting factors can be classified as density dependent and density independent. The severity is dependent on population size in regards to density dependent factors. Density independent factors affect any population size equally. For each of the following indicate if they are DD or DI.

__DI__ 1. Freezing weather

__DD__ 2. Has a greater effect on a larger population

__DI__ 3. A volcanic eruption

__DD__ 4. Predation

__DI__ 5. Floods

__DD__ 6. Food supply

__DI__ 7. May limit the population before it even gets close to carrying capacity

__DD__ 8. Disease or parasites

__DD__ 9. Decreases when the population is below carrying capacity; increases when the population exceeds carrying capacity

__DI__ 10. Fire

__DI__ 11. Intensity of effect no greater for larger population, no less for smaller population

__DD__ 12. May cause cyclical changes in lynx and hare populations

__DI__ 13. Storms

__DD__ 14. Tends to be a biotic factor

__DI__ 15. Tends to be an abiotic factor

- 2) K-selected and r-selected life histories are the two ends of the spectrum of life-history patterns. State whether each of the following characteristic is an example of a K-selected life history pattern (K) or an r-selected life history pattern (r).

- ☐ r ☐ 1. Age at first reproduction occurs younger
- ☐ r ☐ 2. Relative body size is small
- ☐ K ☐ 3. Stability of population near carrying capacity
- ☐ K ☐ 4. Low number of offspring
- ☐ r ☐ 5. Large number of offspring per reproduction
- ☐ K ☐ 6. Emphasis on quality and care of offspring
- ☐ K ☐ 7. Polar bears are an example
- ☐ r ☐ 8. Rapid population growth when conditions are favourable
- ☐ r ☐ 9. Dandelions and insects are examples