

Name: _____ Per: _____ Date: _____

Population Ecology Notes

A population is....

Demographics is the statistical study of...

Three key factors of populations:

1. Size

Growth rate =

2. Density

4 ways that impact population density:

Immigration

Emigration

Density-dependent factors

Density-independent factors

3. Dispersion

Random

Uniform

Clumped

How we determine population size

1. Direct count

2. Estimation

a. *Random sampling*

b. *Mark & recapture*

Patterns of population growth

R-strategy species

1.

2.

3.

4.

5.

Exponential growth pattern

K-strategy species

1.

2.

3.

4.

5.

Logistic growth pattern

Carrying capacity (k)

Factors that limit growth rates of populations

Boom bust cycles

STUDENT PRACTICE

PART 1. Population Density

1. Calculate the population density of the following countries.

| Country | Population | Land Area (km ²) | Density (km ²) |
|----------------|---------------|------------------------------|----------------------------|
| Canada | 32,805,000 | 9,976,140 | |
| China | 1,306,313,800 | 9,596,960 | |
| Japan | 127,417,200 | 377,835 | |
| India | 1,080,264,400 | 3,287,590 | |
| Monaco | 32,410 | 2 | |
| Spain | 40,341,500 | 504,782 | |
| United Kingdom | 60,441,500 | 244,820 | |
| United States | 295,734,100 | 9,629,091 | |

2. What does population density tell us about a population and potentially its environment?

Dispersion Patterns & Biotic Potential

1. Identify the type of dispersion pattern. (clumped, uniform, or random)

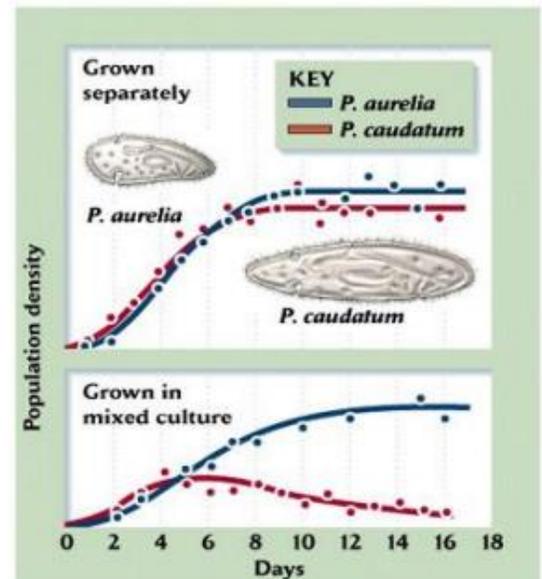
- _____ A bunch of mushrooms growing on a rotting log.
- _____ The sage plant secretes toxins, a chemical that kills off surrounding plants in a circle around the individual sage plants.
- _____ Dandelions have wind-dispersed seeds that germinate wherever they happen to fall in a favorable environment.
- _____ A herd of elephants gather around a watering hole.

2. Why do most organisms rarely reach their biotic potential?

PART 2. Population Growth & Carrying Capacity

1. The two Paramecium species were grown alone then grown together in a culture. Based on the graphs, what can you conclude about the population density when they are grown separately?

2. When grown separately, what day did each paramecium reach its carrying capacity?

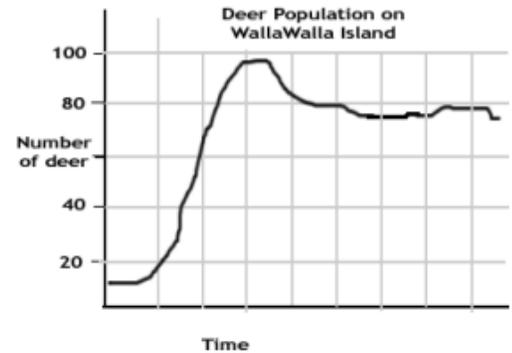


3. Explain what occurred when the two populations were grown together.

4. What is carrying capacity?

5. What happens to a population when they exceed their carrying capacity?

6. What is the carrying capacity of the deer population on Walla Walla Island?



7. Describe the conditions under which logistic growth occurs.

8. Describe the conditions under which exponential growth occurs.

9. Analyze the data and predict what type of growth pattern has occurred in the rabbit population? _____

| Rabbit Population Growth | |
|--------------------------|-------------------|
| Generations | Number of Rabbits |
| 1 | 100 |
| 2 | 105 |
| 25 | 1000 |
| 37 | 1600 |
| 55 | 2400 |
| 72 | 3350 |
| 86 | 8000 |
| 100 | 13150 |

a. Animals such as foxes and cats often prey on rabbits. Based on the growth curve of the rabbit population, what might have happened if a group of predators moved into the rabbit's habitat during the 10th generation? Explain.

10. In 1906, the Kaibab Plateau was established as a preserve to reestablish the deer population. Unfortunately, the Kaibab forest area had already been overgrazed by livestock and predator populations were firmly established. As a result, the deer population was well below its carrying capacity of 30,000. To protect the deer, hunting was banned, predators were exterminated and livestock grazing was limited. By 1923, the deer were on the verge of starvation. Predators were then reintroduced and hunting was allowed.

| DATA TABLE | |
|------------|-----------------|
| Year | Deer Population |
| 1905 | 4,000 |
| 1910 | 9,000 |
| 1915 | 25,000 |
| 1920 | 65,000 |
| 1924 | 100,000 |
| 1925 | 60,000 |
| 1926 | 40,000 |
| 1928 | 35,000 |
| 1929 | 30,000 |
| 1931 | 20,000 |
| 1939 | 10,000 |

a. Were the methods successful? Explain your answer.

b. Why did the population decline after 1925?

c. What type of growth pattern did the deer population exhibit?

d. What factors influenced (limited?) this growth pattern?

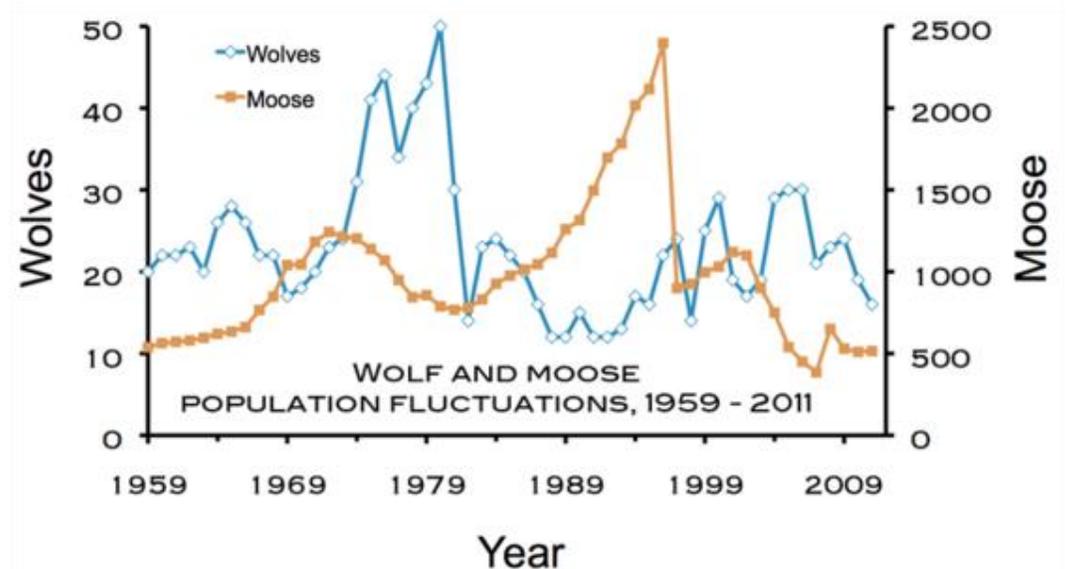
PART 3. Limiting Factors

Lake Winnipeg is a shallow lake composed of two basins: a wide north basin and a narrow south basin that provides a habitat for over 50 different species of fish. Each of the statements below involves a situation that will affect the growth of a population. Classify each of the statements as DD (density dependent) or DI (density independent) and give a reason for your choice.

1. Rainbow smelt and yellow perch attempt to occupy the same area. The more aggressive smelt survive; the perch do not.
2. A severe flood brings a lot of sediment and silt into Lake Winnipeg. The turbidity of the lake increases greatly.
3. Since northern pike prey on yellow perch, an increase in the perch population causes an increase in the pike population.
4. Many fish die due to an increase in water temperature.
5. Due to over-fishing, the number of walleye in Lake Winnipeg decreases.
6. A population is growing quickly when parasites cause disease to spread quickly.
7. Lake sturgeon migrate long distances to spawn and many do not survive the trip.

Isle Royale Example

Moose first arrived at Isle Royale around 1900. The moose population tends to increase in years with mild winters, early spring green-up, abundant winter forage, low wolf numbers and low levels of tick infestation. Wolves first arrived at the island on an ice bridge from Canada in 1940. Between 1980 and 1982, the wolf population declined from 50 to 14, due to canine parvovirus.



1. What was the greatest wolf population? What year did that occur?

2. What was the wolf population when the moose population was the greatest?
3. What would most likely happen to the wolf population if the moose population decreases?
4. What would most likely happen to the moose population if the wolf were all killed by humans?
5. Describe the pattern of the wolf (predator) population in relation to the moose (prey) population.
6. Identify a factor, other than moose population, that may have influenced wolf populations.
7. Identify two factors, other than the wolf population, that may influence the moose population.
8. Are predator-prey relationships density-dependent or density-independent limiting factors? Explain.