UNIT 5 POPULATION DYNAMICS

A. CHARACTERISTICS OF POPULATIONS

1. Terms

a. _____ – a group of individuals of the same species living in the same geographical area

b. _____ – the number of individuals of the same species occupying a given area/volume at a given time

c. _____ – the number of individuals of the same species that occur per unit area or volume

_____ = $\frac{\text{population number}}{\text{space occupied}}$ $D = \frac{N}{S}$

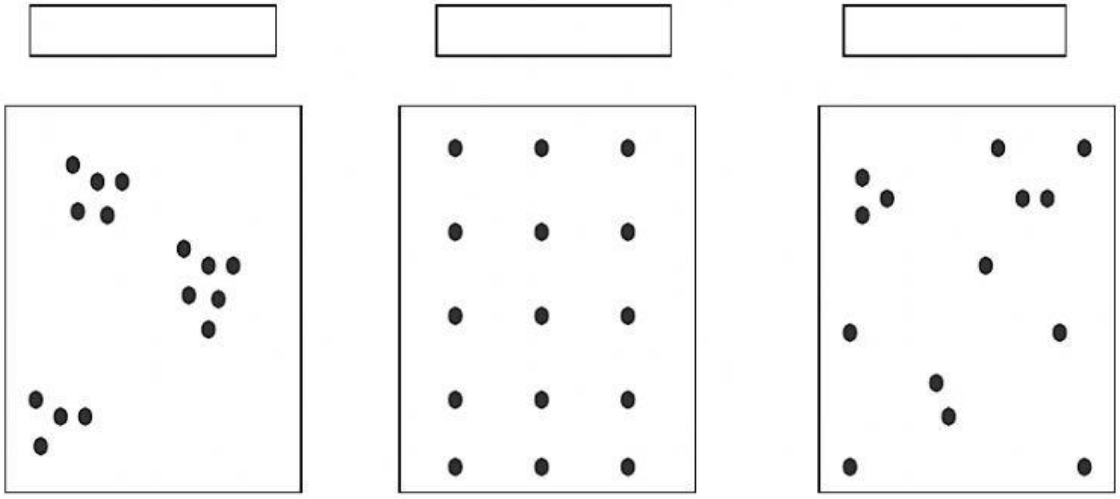
d. crude density vs ecological density

_____ = the population number divided by the total area

_____ = the pop number divided by the usable area

eg. for fish density in a park,
we only want their density in the area of lakes or rivers, not the total area of the park

e. _____ the general pattern of individuals within an area



LIVEWORKSHEETS

2. Calculating population characteristics

eg A. A population of 450 porucpines live in ana rea 12.1 km by 15.3 km in which there are three lakes [7.1 km^2, 15.2 km^2 and 2.7 km^2]. What is the crude density of this population? What is the ecological density?

eg. B If the wolf population density in an area is 0.093 wolves /km^2 and the study area is 47.3 km by 60.4 km, how many wolves would there be in the area? How many wolves would be in the area if there is a lake of 361.3 km^2 in the area?

LIVEWORKSHEETS

3. Mark – Recapture Method of Counting

a. some individuals in a population are_____, _____ or _____ in some way

b. the marked individuals are then _____

c. the experimenters then wait a time, return and _____ individuals in the same area

d. they note whether the captured animals are_____ [recaptured] or _____ [new]

e. they determine the_____ population in the area with the formula

$$\frac{\text{total\# marked [____]}}{\text{total population [____]}} = \frac{\text{\# of recaptures [____]}}{\text{size of second sample [____]}}$$

eg. In a population of unknown size – researchers capture and mark 72 mink. After release, they capture 65 individuals on a second trapping, of which 8 are marked. What is the total population of mink?

4. Quadrat sampling

a. a quadrat is a sampling frame used to estimate population _____

b. the _____ may be 1.0m x 1.0m for small species or 100m x 100m for large species

c. the quadrat only works for _____ species [ones that don't move] eg trees, barnacles

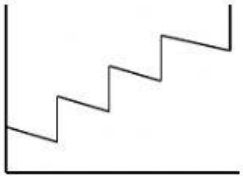
d. usually more than one quadrat is counted & then _____ values are used

eg using a 10m by 10m quadrat, young pines trees were counted in an area with the following results.....23, 17, 19, 25. What is the population of pine trees in an area 2.3 km by 1.7 km?

LIVEWORKSHEETS

B. CHANGES IN POPULATION SIZE

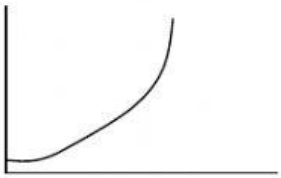
1. Population growth models



a. _____ growth

for populations with _____ breeding times

eg. one breeding cycle per year



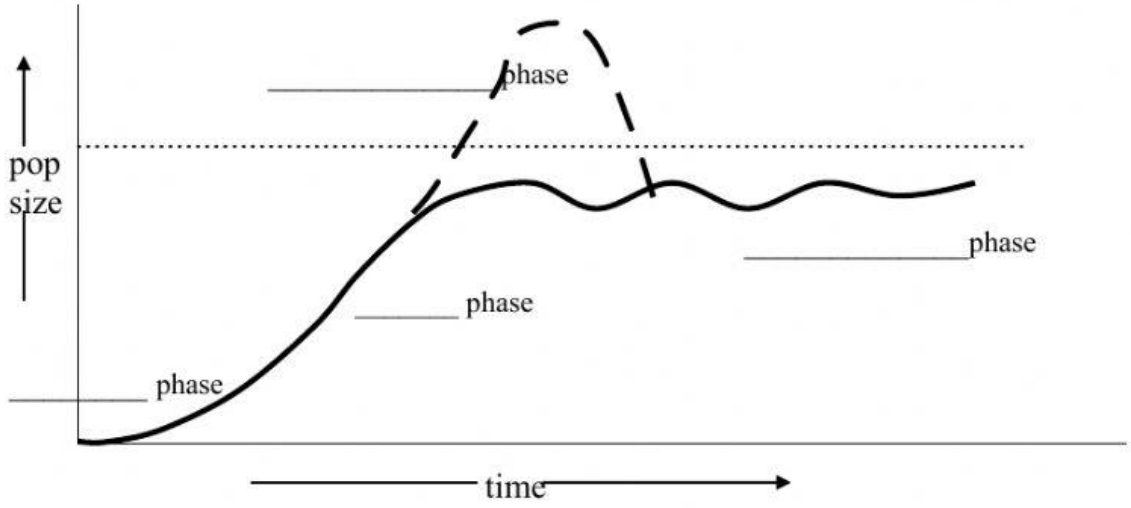
b. _____growth

for populations that are _____ growing

c. _____ growth rate

growth that levels off as the population grows towards its carrying capacity

_____ – the maximum number of organisms that can be sustained by the available resources over a period of time



_____ phase – slow growth at start as get established

_____ phase – rapid growth when population is settled in new area

_____ phase – long term pattern fluctuates, but always below carrying capacity

_____ phase – pass carrying capacity, damage environment and so pop is reduced

LIVEWORKSHEETS

2. affecting population change

_____, _____, _____ & _____

3. Types of populations

a. _____ population – all 4 factors affect population

b. _____ population – no emigration or immigration to change the population

4. percentage population change

% population change =

Complete Populations and carrying capacity

C. FACTORS AFFECTING POPULATION CHANGE

1. Density Dependent Factors – factors that have a greater effect when the pop density is _____

a. _____ competition
- individuals compete for nest space, food, light, etc, with others of the _____ species

- eg. high density trees – lots of shade, little water, few nutrients per tree

b. _____
from a predator viewpoint
- more prey / predator -- predator has _____

- less prey / predator -- predator has more _____

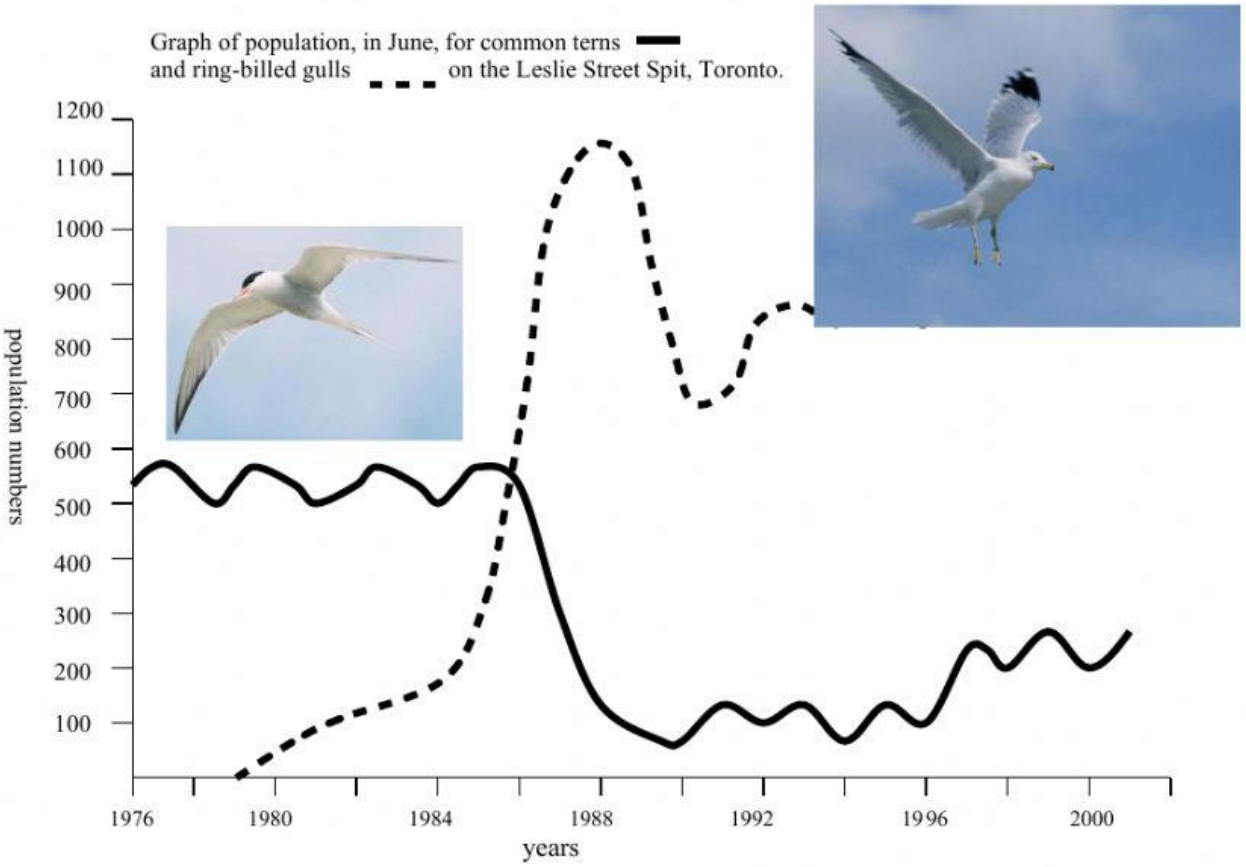
from a prey view point
- more prey / predator – prey has less chance of being _____

- less prey / predator – prey has more chance of being _____

LIVEWORKSHEETS

Populations and Carrying Capacity [Gulls & Terns]

The common tern is a small, delicate bird that eats only fresh fish. The ring-billed gull is a larger, aggressive bird that eats fresh fish, garbage and just about anything it can get its beak onto. Both species nest in colonies with their nests little more than depressions in the soft sand portion of the land. Both species migrate south for the winter, with the gulls arriving back in April and the terns arrving back in May.



LIVEWORKSHEETS

1. Determine the carrying capacity of this environment for the common terns, explaining your work
    a. prior to the arrival of the ring-billed gulls?

    b. after the ring-billed gulls were established, but prior to 1996?

2. Explain why the population of terns varies from year to year before the gulls arrived?

3a. Describe at least 3 ways that ring-billed gulls could DIRECTLY effect common tern populations.

b. Describe at least 3 ways that ring-billed gulls could INDIRECTLY effect common tern populations.

4a. Determine the carrying capacity of this environment for the ring-billed gulls, explaining your work?

b. Why would this environment have a higher carrying capacity for the gulls than it does for terns?

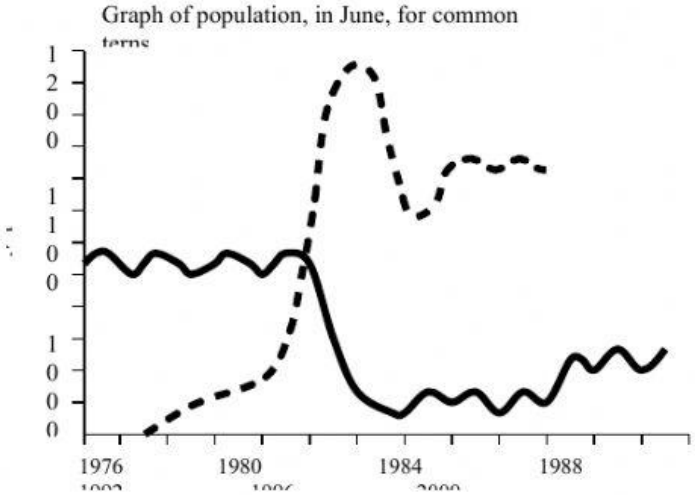
c. Explain what happened to the ring-billed gull population between 1986 and 1991?

5a. After 1996, the population of terns changed, explain what likely happened to the population of gulls.

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LIVEWORKSHEETS

b. On the graph, show the pattern for the ring-billed gulls from 1996 – 2001.



6a. To count a population of gulls, 120 birds were captured and marked. Because the gulls were molting, they could not fly away and when a second capture was made, 98 birds were recaptured of which 17 were marked. What would be the total gull population.

b. Given that the area where the gulls nest is 1.5 km by 2.1 km, what is the population density of gulls from 6a?

LIVEWORKSHEETS

c. Allee effect

reproduction fails to equal _____ due to low density

eg. can not find a _____

eg. species that rely on '_____' can't do so when numbers low

d. Minimum viable populations size

enough individuals so that the pop can cope with variations in _____ & _____

eg with human help – _____ whooping cranes was enough

eg in wild – _____ elephant seals was enough

for many species – _____ are needed for this

2. Density Independent Factors

the number or density of individuals does not affect the _____

a. _____ factor – one part of the life cycle that is limited and

can not be compensated for by _____ elsewhere

eg. if seeds need 3 days of _____ to scarify them and we have a warm winter

with no frost, _____ grow even if it is a good Spring!

eg. DDT makes hawk _____ _____ _____, regardless of how many hawks

are in an area or how many good nest sites & how much food!

LIVEWORKSHEETS