

## 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

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

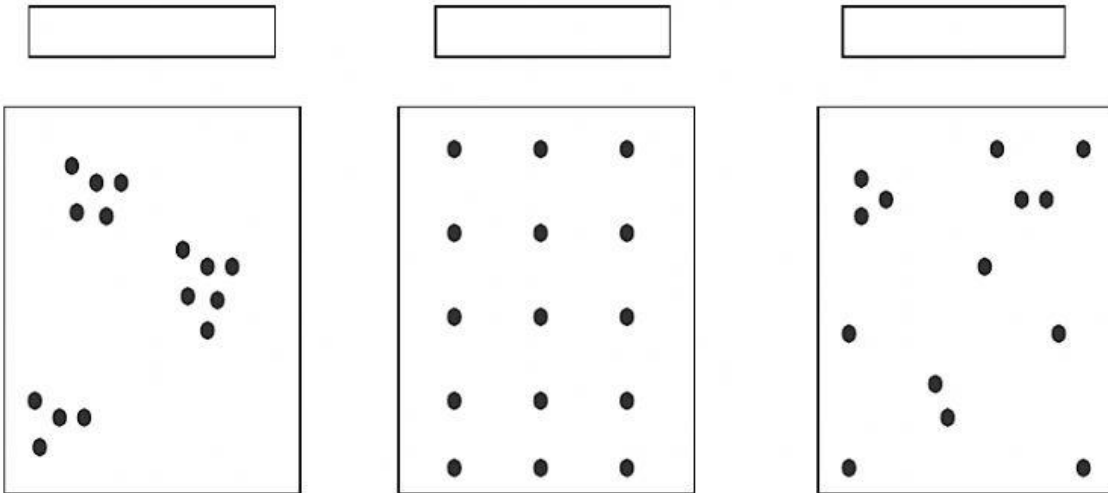
d. crude density vs ecological density

\_\_\_\_\_ = 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



## 2. Calculating population characteristics

eg A. A population of 450 porcupines live in an area 12.1 km by 15.3 km in which there are three lakes [7.1 km<sup>2</sup>, 15.2 km<sup>2</sup> and 2.7 km<sup>2</sup>]. 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<sup>2</sup> 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<sup>2</sup> in the area?

### 3. Mark – Recapture Method of Counting

- some individuals in a population are \_\_\_\_\_, \_\_\_\_\_ or \_\_\_\_\_ in some way
- the marked individuals are then \_\_\_\_\_
- the experimenters then wait a time, return and \_\_\_\_\_ individuals in the same area
- they note whether the captured animals are \_\_\_\_\_ [recaptured] or \_\_\_\_\_ [new]
- 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

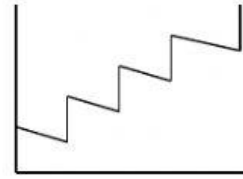
- a quadrat is a sampling frame used to estimate population \_\_\_\_\_
- the \_\_\_\_\_ may be 1.0m x 1.0m for small species or 100m x 100m for large species
- the quadrat only works for \_\_\_\_\_ species [ones that don't move] eg trees, barnacles
- usually more than one quadrat is counted & then \_\_\_\_\_ 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?

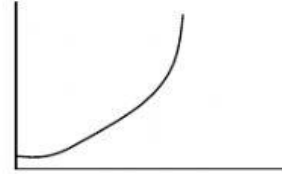
## B. CHANGES IN POPULATION SIZE

### 1. Population growth models

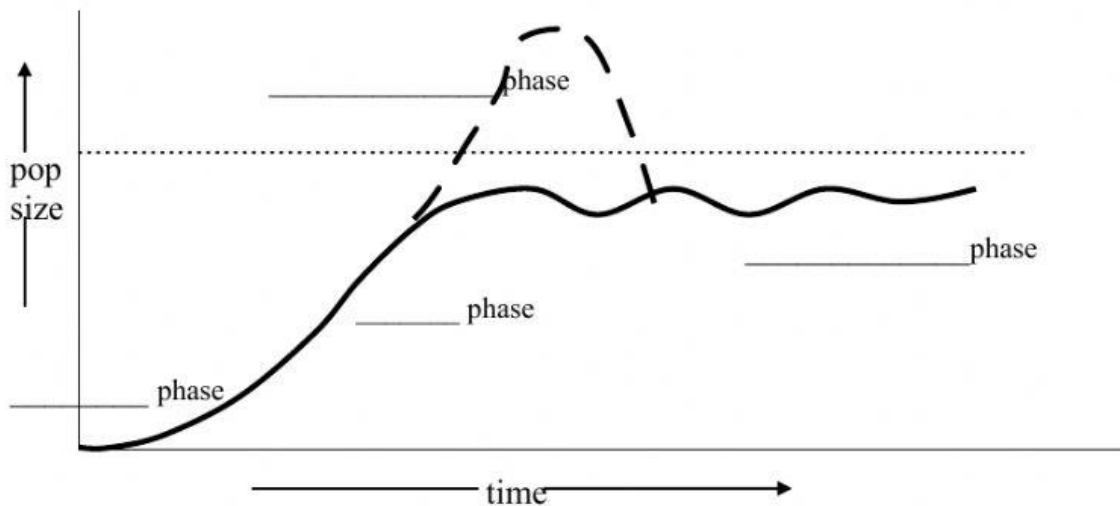
- a. \_\_\_\_\_ growth  
for populations with \_\_\_\_\_ breeding time:  
eg. one breeding cycle per year



- 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

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 \_\_\_\_\_

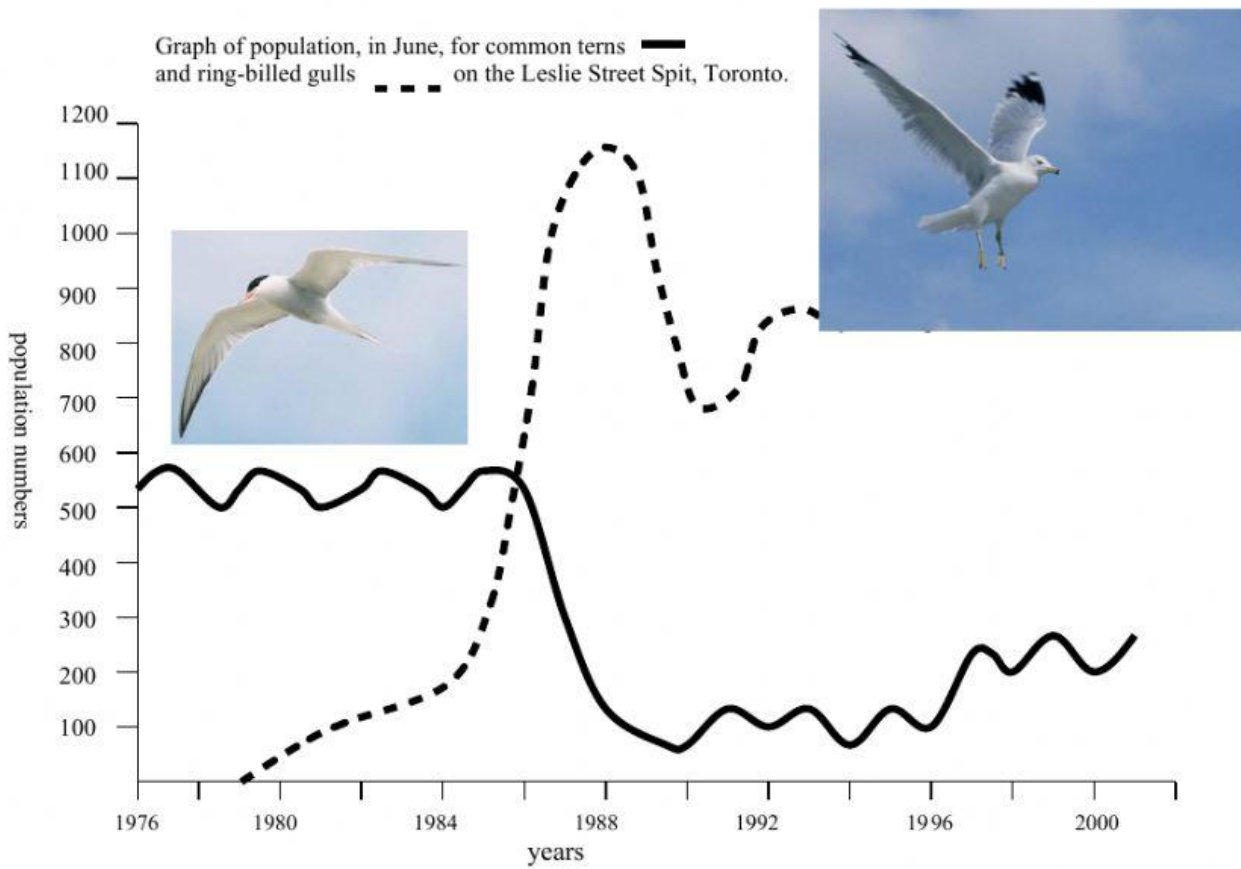
from a prey view point

- more prey / predator – prey has less chance of being \_\_\_\_\_

- less prey / predator – prey has more chance of being \_\_\_\_\_

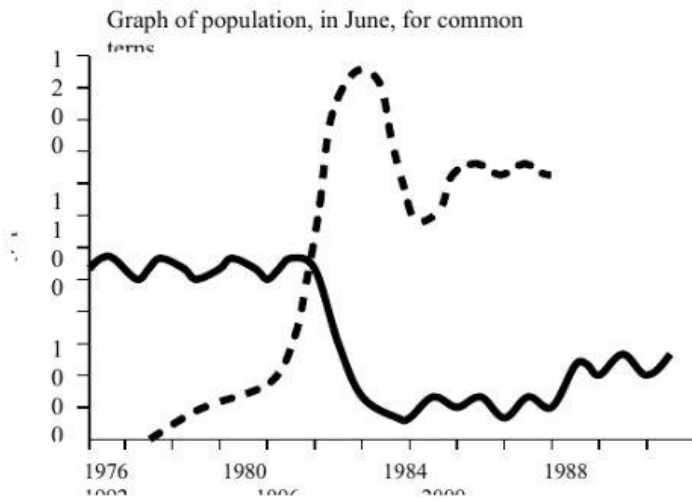
## Populations and Carrying Capacity [Gulls & Terns]

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 arriving back in May.





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?

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!