Name ________________________________ Date _____________

APES Topic 8 – Population Dynamics Mr. Romano

AIM: What are different ways that populations are measured?

"Population dynamics" refers to the changes in a population in response to environmental stress or changes in environmental conditions. This topic introduces the basic concepts can be applied to all organisms, including humans.

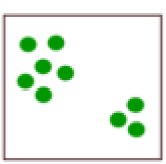
1. population size - number of individuals (China #1, India #2, U.S. #3)

2. population density - # of individuals in a given space (land area or volume of water)

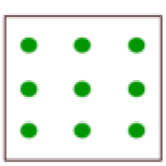
density INDEPENDENT controls / limiting factors	**density DEPENDENT controls / limiting factors**
factors that affect population regardless of its density	factors that have a greater effect as population increases
Examples: natural disasters habitat destruction seasonal temperature changes	Examples: competition for resources predation disease excess waste products

2. population dispersion -
spatial pattern of the members of a population

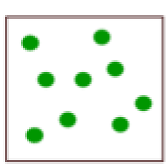
Clumped because of the location of resources



Uniform



Random resources widely available



elephants in savanna gathering near water, food, shade

creosote bush secrete a toxin to keep other bushes at a distance to prevent competition for

dandelions grow wherever seeds land because resource availability is uniform

4. age structure - proportion of individuals in each age group (prereproductive, reproductive, postreproductive)

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AIM: How do populations change in size?

1. Population change is a result of the interplay between 3 factors:

A. Births – crude birth rate (CBR)

B. Deaths – crude death rate (CDR)

these 2 factors are usually rates per 1000 people per year and expressed as %

C. Migration (immigration and emigration)

2. Calculating Population Growth Rate (%):

Formula: (CBR-CDR) x 100

Example 1:
What is the growth rate of a population that experiences 40 births per 1000 people per year and 20 deaths per 1000 people per year?

: (CBR-CDR) x 100 $\left[\frac{40}{1000} - \frac{20}{1000}\right] \times 100$ $\left[\frac{40-20}{1000}\right] \times 100 = 2.0\%$

Example 2:
What is the growth rate of a population that experiences 15 births per 1000 people per year and 20 deaths per 1000 people per year?

: (CBR-CDR) x 100 $\left[\frac{15}{1000} - \frac{20}{1000}\right] \times 100$ $\left[\frac{15-20}{1000}\right] \times 100 = -0.5\%$ (shows a population decline)

3. Local Population Change Factoring in Migration (%):

Formula: : [(CBR+ir) –(CDR+er)] x 100 $\frac{(13+8)}{1000} - \frac{(6+2)}{1000} \times 100$ $\frac{13}{1000} \times 100 = 1.3\%$

Example:
Use all of the following information to calculate a population's growth rate:
13 births per 1000 people per year
6 deaths per 1000 people per year
8 immigrants per 1000 people per year
2 emigrants per 1000 people per year

4. Zero Population Growth (ZPG): (CBR + ir) = (CDR + er)

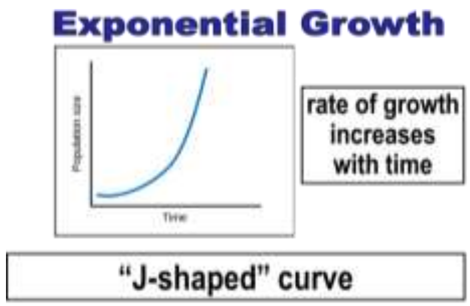
5. Biotic Potential: (a.k.a. intrinsic rate of increase)

A. maximum rate at which a population could increase when there are no limits on its rate of growth (ideal conditions exist)

B. Biotic potential is influenced by:

1. age at which reproduction begins
2. # of offspring per event
3. reproductive rate/frequency
4. timespan of organism's reproductive activity

C. Biotic Potential Graph:



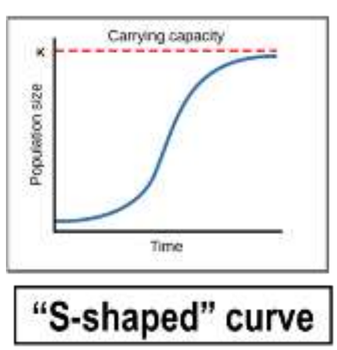
6. Environmental Resistance – all of the factors acting jointly to limit the growth of a population

A. Examples of Environmental Resistance:

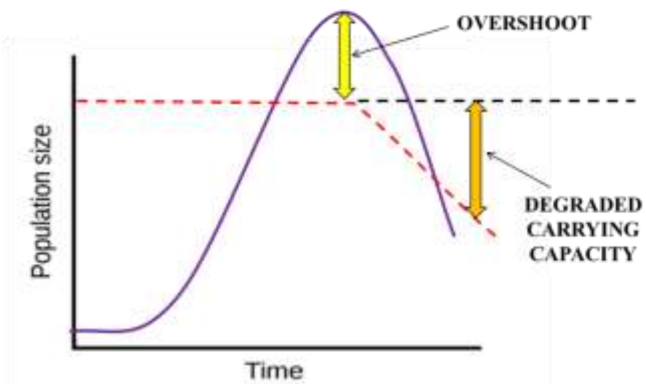
1. light
2. water
3. physical space
4. availability of nutrients
5. number of predators
6. disease

B. **Carrying Capacity (K):** is the maximum population size of a species that the environment can sustain indefinitely in a given space

C. **Logistic Growth:**



7. Population Overshoot:



can lead to environmental degradation and lower the area's carrying capacity

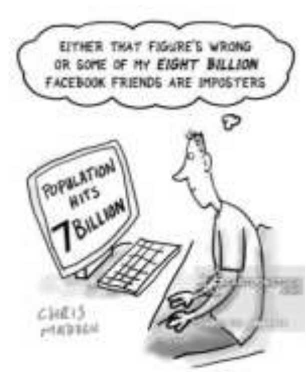
8. Population Doubling Time:

Doubling Time Formula - "the rule of 70" Doubling Time (years) = $\frac{70}{\text{\% growth rate (r)}}$

Example:

If the growth rate of a population is 2%, how many years until the population doubles?

Doubling Time = $\frac{70}{r} = \frac{70}{2}$ = 35 years



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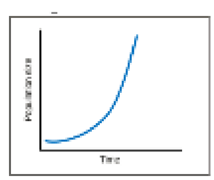
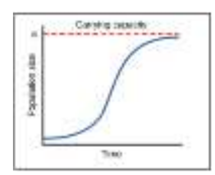
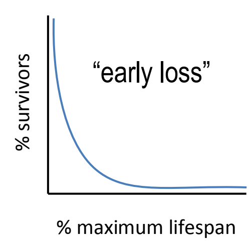
AIM: What are the reproductive strategies that organisms use to maintain their population?

Characteristic	r-strategists	K-strategists
time to reach reproductive maturity	shorter	longer
# of offspring per reproductive event	greater	fewer
parental care of offspring	little to none	care is given
lifespan	shorter	longer
body size	small	typically larger
population graph		
survivorship curve		
niche	generalists	tend to be specialists
example organisms	bacteria, rodents, insects, algae	elephants, whales, humans, eagles, rainforest trees, saguaro cactus
strategy summary	high reproductive rates to overcome massive loss of offspring	keep population stable near carrying capacity