Section 20.1: Review Answers

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1. Scientists often estimate population size, rather than count each member because the habitat of a species may be large or inaccessible, making it too costly, time consuming, or even physically impossible to count each member of a population. Because some species range over a large habitat, it is possible to miss individuals or count them twice, resulting in an inaccurate count when a large area is involved.
2. Population density is defined as the number of individual organisms (*N*) in a given area (*A*) or volume (*V*).
3. Population density is not always a reliable tool for estimating population size because organisms are rarely evenly distributed throughout their habitat. Most often, organisms are clumped in areas where resources are readily available and less prevalent in areas where they are not. Thus, estimating population size based on density without knowing the distribution pattern of a population may result in an overestimation or underestimation of a population.
4. Sufficient appropriate food is a determinant of survival for any species population and its abundance and distribution will always affect the distribution of a population. Specifically, species populations will clump around adequate sources of food.

5.

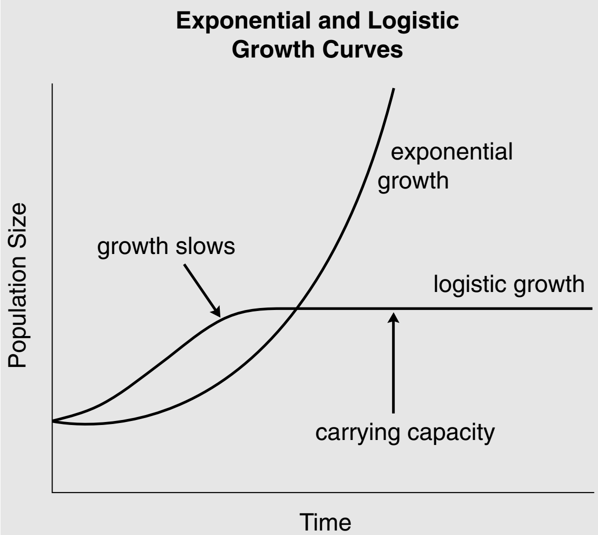
Phase	Comparison of birth and death rates
lag	birth rate greater than death rate
exponential	birth rate much greater than death rate
stationary	birth rate equal to death rate

6. Factors may include three of the following:
   - *Parasites and disease:* increased mortality; if individuals die before their reproductive age or if disease causes sterility, fewer offspring will be produced, again limiting growth; disease may also limit the growth of a population indirectly by reducing the population of another species relied upon as a food source.
   - *Predation:* dense populations attract a larger number of predators and are more likely to suffer losses, often of younger, weaker members who will not reproduce.
   - *Scarcity of resources:* less food and water and fewer safe nesting areas, as well as fewer potential mates leads to higher mortality and lower reproductive rates.
   - *Abiotic factors such as harsh weather (e.g., extreme temperatures, severe storms), drought, floods, and forest fires:* limit population growth by reducing the number of offspring being born or compromising their chances of survival, increasing overall mortality, or destroying habitat, nesting sites, and food sources.
   - *Human activity, such as hunting or harvesting and creation of hazards (i.e. highways):* limits population growth through destruction or fragmentation of habitat, resulting in loss of nesting or breeding sites and food resources; introduces toxins into the forest environment that can poison water sources, contaminate food, and reduce the number of viable offspring surviving to a reproductive age, or cause sterility.
7. Factors may include three of the following:
   - *The number of offspring per reproductive cycle:* The biotic potential is the highest possible per capita growth rate for a population. A high number of offspring per reproductive cycle will, therefore, increase the biotic potential of a population.
   - *The number of offspring that survive long enough to reproduce:* If a high number of offspring survive long enough to reproduce, the population will grow faster than if only a few offspring survive, thus increasing the biotic potential of a population.
   - *The age of reproductive maturity and the number of times individuals reproduce in a lifespan:* If organisms reproduce at a younger age, the population will grow

faster than if sexual maturity is reached later. Similarly, if individuals reproduce more frequently during their lifespan, the population will also grow faster. Both result in an increased biotic potential.

- *Lifespan of individuals:* If individuals live longer, they have more reproductive cycles per lifespan and thus more offspring.

8.



On the logistic growth curve, add an arrow/label pointing to the top curved portion of the S-shape to show the point at which the growth has begun to slow down, and another arrow/label pointing to the flat portion of the S-shaped curve at the top to indicate the point at which the carrying capacity has been reached.

9. Organisms in *r*-selected populations expend energy in order to reproduce rapidly while conditions are favourable, and are hence labelled as opportunistic populations. For instance, the growth rate of infectious bacteria increases rapidly once they enter the body. The bacteria, and other organisms that reproduce close to their biotic potential, employ various life strategies that enable them to take advantage of this window of opportunity, e.g., having an early reproductive age and producing large numbers of offspring. The offspring receive little or no parental care; instead all energy goes into reproduction to create more offspring while favourable environmental conditions such as the availability of food, sunlight, or warm summer temperatures exist.

Populations with *K*-selected life strategies are often referred to as equilibrium populations. This term was likely arrived at because, in contrast to the "boom or bust" lifestyle of *r*-selected populations, a population with *K*-selected life strategies exists close to the carrying capacity of its environment over a long period of time without crashing as a result of depleting its resources, or harming its habitat or itself. Thus, the population is in a stable, or equilibrium, state.