REPRODUCTIVE STRATEGIES AND POPULATION FLUCTUATIONS

So far, we have talked about population growth as if all organisms reach a stable population when they reach the carrying capacity. That is an appropriate way to begin to understand population changes, but the real world is much more complicated.

K-Strategists and r-Strategists

Species can be divided into two broad categories based on their reproductive strategies. **K-strategists** are organisms that typically reach a stable population as the population reaches the carrying capacity. K-strategists usually occupy relatively stable environments and tend to be large organisms that have relatively long lives, produce few offspring, and provide care for their offspring. Their reproductive strategy is to invest a great deal of energy in producing a few offspring that have a good chance of living to reproduce. Deer, lions, and swans are examples of this kind of organism. Humans generally produce single offspring, and even in countries with high infant mortality, 80 percent of the children survive beyond one year of age, and the majority of these will reach adulthood. Generally, populations of K-strategists are controlled by density-dependent limiting factors that become more severe as the size of the population increases. For example, as the size of the hawk population increases, the competition among hawks for available food becomes more severe. The increased competition for food is a density-dependent limiting factor that leads to less food for the young in the nest. Therefore, many of the young die, and population growth rate slows as the carrying capacity for the area is reached.

The **r-strategists** are typically small organisms that have a short life, produce many offspring, exploit unstable environments, and do not reach a carrying capacity. Examples are bacteria, protozoa, many insects, and some small mammals. The reproductive strategy of r-strategists is to expend large amounts of energy producing many offspring but to provide limited care (often none) for them. Consequently, there is high mortality among the young. For example, one female oyster may produce a million eggs, but of those that become fertilized and grow into larvae, only a few find suitable places to attach themselves and grow into mature oysters. Typically, populations of r-strategists are limited by density-independent limiting factors. These factors can include changing weather conditions that kill large numbers of organisms, habitat loss such as occurs when a pond dries up or fire destroys a forest, or an event such as a deep snow or flood that buries sources of food and leads to the death of entire populations. The population size of r-strategists is likely to fluctuate wildly. They reproduce rapidly, and the size of the population increases until some density-independent factor causes the population to crash; then they begin the cycle all over again. (See figure 7.8.)

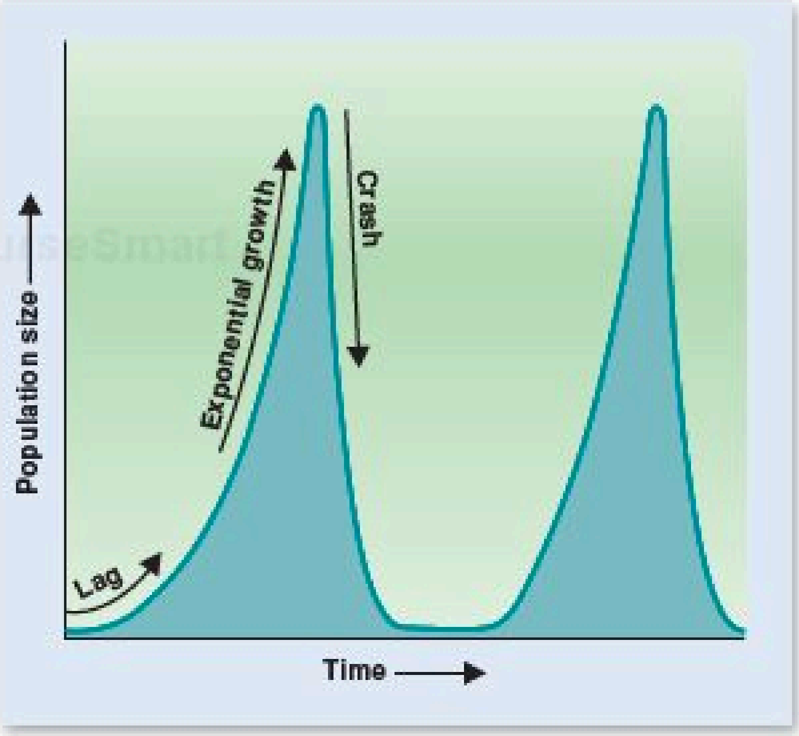

FIGURE 7.8 A Population Growth Curve for Short-Lived Organisms Organisms that are small and only live a short time often have the kind of population growth curve shown here. There is a lag phase followed by an exponential growth phase. However, instead of entering into a stable equilibrium phase, the population reaches a maximum and crashes.

The concepts of K- or r-strategists describe idealized situations. (See table 7.1.) (The letters *K* and *r* in *K-strategists* and *r-strategists* come from a mathematical equation in which *K* represents the carrying capacity of the environment and *r* represents the biotic potential of the species.) In the real world many organisms don't fit clearly into either category. For example, many kinds of mammals provide care for their offspring but have short life spans. On the other hand, many reptiles such as turtles may live for many years, but they produce large numbers of eggs and do not care for them.

TABLE 7.1 A Comparison of Life History Characteristics of Typical K- and r-Strategists

Characteristic	K-Strategist	r-Strategist
Environmental stability	Stable	Unstable
Size of organism	Large	Small
Length of life	Long, most live to reproduce	Short, most die before reproducing
Number of offspring	Small number produced, parental care provided	Large number produced, no parental care
Primary limiting factors	Density-dependent limiting factors	Density-independent limiting factors
Population growth pattern	Exponential growth followed by a stable equilibrium stage at the carrying capacity	Exponential growth followed by a population crash
Examples	Alligators, humans, redwood trees	Protozoa, mosquitoes, annual plants