Different ways to invest in offspring

Life-history traits describe the timing of reproduction, offspring production, investment and survival. K-selection and r-selection summarize contrasting patterns along a continuum.

1. COMPARE THE OVERALL PATTERN

Trait	More K-selected	More r-selected
Maturity	Later	Earlier
Offspring per event	Fewer, often larger	More, often smaller
Investment per young	Higher; often extended care	Lower; often little care
Typical lifespan	Longer	Shorter
Typical body size	Larger	Smaller
Reproductive events	Usually repeated	May occur only once

These are tendencies. Reproducing once or many times is not, by itself, enough to classify a species.

2. FINITE ENERGY CREATES TRADE-OFFS

Energy used to make and support offspring cannot simultaneously be used for growth or maintenance. Producing more young often means less investment in each. Producing fewer, better-supported young can increase their individual chances of survival.

Elephants illustrate later maturity, few young and prolonged care. Dandelions illustrate many small, dispersing seeds. An oak combines late maturity and longevity with many acorns: real species can mix traits.

Trait patterns and mixed strategies: College Board, ERT-3.B.1-4.
Energy allocation and reproduction: OpenStax, Biology 2e 45.2.
Elephant, dandelion and oak examples: OpenStax, Biology 2e 45.4.

Scope: College Board AP Environmental Science CED, Topic 3.2, pp. 65-66.

Potential is not the observed result

Biotic potential is a population's maximum reproductive rate under ideal conditions. Early maturity and frequent production of many offspring can raise the potential for rapid increase.

1. WHAT DO THE LETTERS MEAN?

r: intrinsic rate of increase

Connects to the potential for rapid population growth when conditions permit.

K: carrying capacity

Population size an environment can support over time with its available resources.

2. READ A SET OF REPRODUCTIVE TRAITS

Illustrative species	Species A	Species B
Age at first reproduction	24 months	2 months
Young per reproductive event	2	40
Parental care	Extended	None

Invented teaching data. B is more r-like; A is more K-like. The combination of traits is stronger evidence than offspring number alone.

3. MORE BIRTHS DO NOT GUARANTEE MORE SURVIVORS

Species B produces 40 / 2 = 20 times as many young per event, but that is not a 20-fold population growth rate. You also need event frequency, survival, age structure and other demographic information. Food shortage, disease, predation and competition can keep growth below its potential.

K is not permanently fixed: resource supply and habitat conditions can change. Even a population with high biotic potential cannot grow without limits.

Biotic potential: College Board, ERT-3.B.3.
Intrinsic increase, carrying capacity and limits: OpenStax, Biology 2e 45.3.

Scope: College Board AP Environmental Science CED, Topic 3.2, pp. 65-66.

Reproduction shapes recovery

Rapid reproduction can help a population exploit newly available resources. Slow maturation and few offspring can make replacing lost breeding adults take much longer.

1. CONNECT CONDITIONS TO STRATEGY

Relatively stable, crowded habitat

Strong competition near carrying capacity can favor investment in survival and competitive ability.

K-like tendency

Disturbed habitat with open resources

Early reproduction and many offspring can help colonists increase while opportunities are available.

r-like tendency

2. LOSS OF BREEDING ADULTS CAN BE HARD TO REVERSE

For a slow-maturing animal with few young, removing adults eliminates both those individuals and their future reproduction. Newborns may take years to replace them as breeders. A fast-reproducing population may recover sooner if suitable habitat and resources remain.

3. INVASIVE SPECIES: A COURSE PATTERN, NOT IMMUNITY

APES associates many invasive species with r-selected traits and greater vulnerability of K-selected populations. Fast reproduction can help an introduced population spread; slow replacement can worsen losses in affected populations. However, r-selected native species can also be harmed, and not every invader is r-selected.

An invasive species is non-native and causes, or is likely to cause, harm. Being non-native or reproducing rapidly alone is not enough. Reproductive strategy is also different from niche breadth: r-selected does not simply mean generalist.

Invasions and strategy patterns: College Board, ERT-3.B.5.
Competition, regulation and limits of the framework: OpenStax, Biology 2e 45.4.
Definition of invasive species: National Park Service.

Scope: College Board AP Environmental Science CED, Topic 3.2, pp. 65-66.