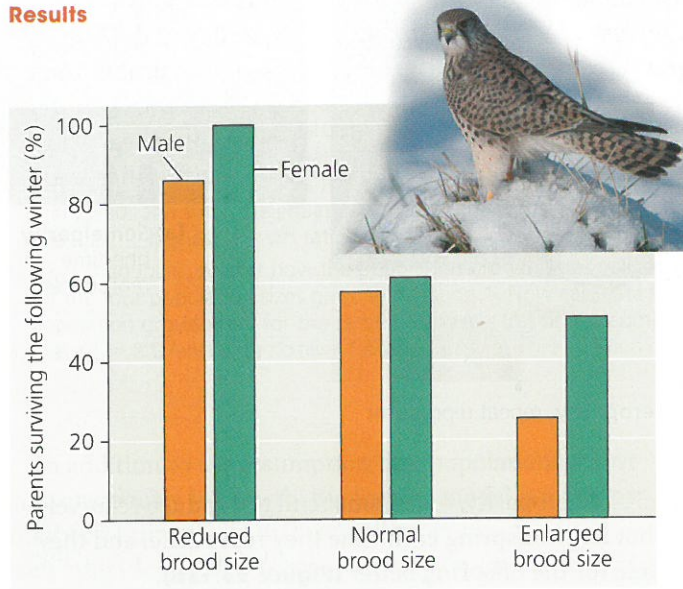


How does caring for offspring affect parental survival in kestrels?

Experiment Cor Dijkstra and colleagues in the Netherlands studied the effects of parental caregiving in Eurasian kestrels over five years. The researchers transferred chicks among nests to produce reduced broods (three or four chicks), normal broods (five or six), and enlarged broods (seven or eight). They then measured the percentage of male and female parent birds that survived the following winter. (Both males and females provide care for chicks.)

Results



Conclusion The lower survival rates of kestrels with larger broods indicate that caring for more offspring negatively affects survival of the parents.

Source: C. Dijkstra et al., Brood size manipulations in the kestrel (*Falco tinnunculus*): effects on offspring and parent survival, *Journal of Animal Ecology* 59:269–285 (1990).

INTERPRET THE DATA The males of some bird species provide no parental care. If this were true for the Eurasian kestrel, how would the experimental results differ from those shown above?

survival. **Figure 53.14** describes a study of Eurasian kestrels that demonstrated a survival cost to parents that care for a large number of young. In another study, in Scotland, researchers found that female red deer that reproduced in a given summer were more likely to die the next winter than were females that did not reproduce.

Selective pressures influence the trade-off between the number and size of offspring. Plants and animals whose young are more likely to die often produce many small offspring. Plants that colonize disturbed environments, for example, usually produce many small seeds, only a few of which may reach a suitable habitat. Small size may also increase the chance of seedling establishment by enabling the seeds to be carried longer distances to a broader range of habitats (**Figure 53.15a**). Animals that suffer high predation

rates, such as quail, sardines, and many other organisms, produce many offspring.

In other organisms, extra investment in offspring greatly increases the offspring's survival. Walnut and Brazil nut trees produce offspring with nutrients that help the seedlings survive (**Figure 53.15b**). Primates generally produce a few offspring at a time; parental care and learning in the first several years of life greatly increase offspring fitness. Such provision of care can be especially important in habitats with high population densities.

Ecologists have attempted to construct a general life history model discussed in Concept 53.1 that are sensitive to population density. Selection for high densities is known as **K-selection**. In contrast, selection for productive success in uncrowded environments (high mortality rates) is called **r-selection**, or density-independent selection. These names follow from the variation in population density. **K-selection** is said to operate



(a) Dandelions grow quickly and release fruits, each containing a single seed. This strategy ensures that at least some will grow in a new location and produce seeds themselves.



(b) Some plants, such as the Brazil nut tree (right), produce a moderate number of large seeds in pods (above). Each seed's large endosperm provides nutrients for the embryo, an adaptation that helps a relatively large fraction of offspring survive.

▲ **Figure 53.15** Variation in the size of offspring