Chapter-wide Learning Outcomes for Life History

Upon completion of *Life History*, students should be able to:

1. Discuss the role of evolution in shaping the variety of life-history strategies exhibited by populations.
2. Describe the principle of allocation as it relates to resource limitation and life-history strategies.
3. Describe and compare some fundamental life-history trade-offs experienced by organisms.
4. Demonstrate how demographic data can be used to inform management decisions for populations of threatened species.

Life History, Part 1: Life Cycles and Life Histories

Upon completion of *Part 1: Life Cycles and Life Histories*, students should be able to:

1. Explain in broad terms why there is incredible diversity in life cycles, providing examples to illustrate this variation.
2. Interpret a life cycle diagram.
3. Explain how constraints limit resource allocation and thus establish the trade-offs that shape life-history strategies.
4. Identify key life-history traits of organisms, such as age of first reproduction, lifespan, and fecundity.
5. Describe the trade-offs underlying three hypotheses that have been offered to explain variation in clutch size of birds.
6. Evaluate the evidence collected by Dijkstra and colleagues supporting the conclusion that kestrels lay fewer eggs than they can rear in a season because doing so increases their lifetime fitness.

Life History, Part 2: Life-History Parameters

Upon completion of *Part 2: Life-History Parameters*, students should be able to:

1. Determine from a population's per capita growth rate whether the population is stable, shrinking, or growing.
2. Estimate the per capita population growth rate, r, as the difference between the average per capita birth rate and death rate over a time period, t.
3. Explain that radically different life histories can be successful in the same environment.
4. Interpret a human population's age pyramid to determine whether the population is likely to be growing, shrinking, or remaining stable.
5. Draw the qualitative shape of the age pyramid predicted for several different populations with different demographics.
6. Explain how an age pyramid depicts the age structure of a population.
7. Generate hypotheses about demographic parameters and/or recent history of a population from its age pyramid.

Life History, Part 3: Life Tables and Survivorship Curves

Upon completion of *Part 3: Life Tables and Survivorship Curves*, students should be able to:

1. Use the information summarized in life-history tables to compare different conservation strategies.
2. Construct a life table from estimates of age-specific births (b_x) and number of survivors (n_x), by calculating age-specific survivorship (l_x) and fecundity (m_x).
3. Identify a species' survivorship curve as Type I, II, or III, and use this information to predict aspects of its life-history strategy.
4. Plot a survivorship curve using life table data.
5. Show how changes in age-specific survivorship and/or fecundity affect a population's net reproductive rate, R_0, calculated as $R_0 = \Sigma l_x m_x$.

6. Show how changes in survivorship, fecundity, and/or the net reproductive rate affect a population's generation time, G, calculated as $G = \Sigma(xl_xm_x)/R_0$.
7. Estimate a population's growth rate, r, from its net reproductive rate, R_0, and generation time, G.
8. Explain a human demographic transition in terms of the changes in birth, death, and population growth rates that typically occur as a country becomes more industrialized.

Life History, Part 4: Trade-Offs and Life-History Evolution

Upon completion of *Part 4: Trade-Offs and Life-History Evolution*, students should be able to:

1. Explain how evolution by natural selection can alter a population's life-history strategy over the course of generations.
2. Contrast how different life-history strategies may be favored in some but not other environments, using examples of costs, benefits, and trade-offs.
3. Draw a graph illustrating an example of a trade-off, such as allocation of resources toward fecundity vs. growth.
4. Discuss selective pressures that could favor the evolution of semelparity versus iteroparity.
5. Describe r-selected and K-selected life-history strategies, and explain the conditions that are expected to favor the evolution of each.
6. Explain the circumstances under which plants with ruderal, stress-tolerant, or competitive life-history strategies should be favored using Grime's life-history classification scheme.
7. Explain the circumstances under which fish with opportunistic, equilibrium, and periodic life-history strategies should be favored using Winemiller and Rose's life-history classification scheme.
8. Provide an example of a species that exhibits different strategies under different conditions (i.e., a species whose life history is plastic).