Chapter-wide learning goals:

1. Provide an example of a predator-prey system with clear, well-defined population cycles similar to those predicted by the Lotka-Volterra predator-prey equations.
2. Predict the behavior of a two species predator-prey system using the Lotka-Volterra predator-prey equations.
3. Analyze a given scenario to determine whether the assumptions of the Lotka-Volterra predator-prey equations are met and, if not, which assumptions are violated.

Section 1: Natural History of Exploitation

1. Describe the 6 distinct types of two-species interactions (i.e., competition, amensalism, commensalism, mutualism, exploitation, and neutral) using the framework of **+/0/-** interactions.
2. Distinguish between a parasite, an herbivore and a predator.
3. Provide examples of the three major types of exploitative interactions.
4. Provide examples of endoparasites, ectoparasites, parasitoids, hyperparasites.
5. Provide examples of the ways parasites can affect individuals and populations.
6. Describe some of the different ways a predator may catch its prey.
7. Distinguish between the four main mechanisms of plant defense against herbivory.
8. Distinguish between grazers, browsers, frugivores and granivores.
9. Provide examples of the ways herbivores can affect individual plants, populations, and/or communities.
10. Provide examples of some of the tactics animals employ in an attempt to avoid predation.
11. Interpret data from experiments on predators, parasites, herbivores and their prey to determine the effects of particular exploitative interactions on the prey.

Section 2: Predator-Prey Dynamics

1. Describe why populations of predators and their prey might be expected to cycle.
2. Choose an appropriate model to describe the growth of a given population.
3. Describe each of the terms and assumptions in the Lotka-Volterra predator-prey equations.
4. Predict how changes in the parameters of the Lotka-Volterra predator-prey model will affect predator-prey cycles.
5. Show how the equation for exponential growth can be modified to produce the Lotka-Volterra equation describing the growth rate of a prey population that is being limited by predation.
6. Show how the Lotka-Volterra equation for the growth of prey can be modified to produce an equation showing the growth of the predator.

Section 3: Lotka-Volterra and Beyond

1. Explain the conditions that increase the likelihood of predators driving their prey to extinction.
2. Explain the implications of Huffaker's experiments with mites and oranges.
3. Discuss how a prey species may be affected by interactions between predation and resource competition using insights from the Lotka-Volterra predator-prey model.
4. Predict qualitatively how changing key traits of predator and prey (e.g., density-dependent prey, density-dependent predators, and/or refuges) affect the outcome of their interactions using phase plots based on the Lotka-Volterra predator-prey equations (including their isoclines).
5. Draw a line graph of population size vs. time for two populations, given a description of how they have changed over some period of time.
6. Draw the trajectory in phase space showing how the populations of two species change with respect to one another, given a time series for the two species.
7. Draw the approximate trajectory as predator and prey populations move through phase space from the point representing their initial population sizes to the appropriate outcome (cycling, stable equilibrium, prey only, system crash) as determined by the location of their respective isoclines.

8. Draw isoclines for each species, given a phase portrait showing a predator-prey relationship between two species.
9. Describe what would happen to the population of both predator and prey in the next instant of time, given their initial population sizes and a phase plot with their respective isoclines.
10. Draw how predator-prey isoclines would be modified to incorporate more realism (e.g., density-dependent prey, density-dependent predators, and/or refuges) in the model.

Section 4: Functional Responses to Exploitation

1. Explain using a graph the three classic predator functional responses (I, II, and III) that show how predation rate varies with changes in prey density.
2. Differentiate a predator's functional and numerical response to changes in prey density.
3. Provide examples of species that exhibit each of the three functional responses (I, II, and III).
4. Explain why filter feeders, like spiders and baleen whales, tend to exhibit a Type I functional response.
5. Explain why most mobile predators, including lynx, exhibit a Type II functional response.
6. Explain why generalist predators (i.e. seals that engage in prey switching) tend to exhibit a Type III functional response.
7. Explain how a predator's hunting strategy, morphology, and or physiology affect its functional response to changes in prey density.
8. Deduce the type of functional response of a predator from data on feeding rate vs. prey density.
9. Explain how a predator's functional response can affect the magnitude of predator-prey cycles and thus the stability of the system.
10. Provide examples of how changes in environmental conditions can affect the shape of a predator's functional response curve.

Section 5: The Evolutionary Arms Race

1. Describe the mechanism by which exploitative interactions can produce a coevolutionary arms race.
2. Discuss why genetic diversity tends to be favored in coevolutionary systems.
3. Provide examples of studies demonstrating a coevolutionary arms race between predators and their prey and/or parasites and their prey.
4. Describe some of the trade-offs associated with alleles that improve the efficiency of predators and/or their prey.
5. Explain why, according to the Red Queen Hypothesis, sexually reproducing species are expected to have an advantage in a coevolutionary arms race.
6. Draw reasonable conclusions from the data of an experiment that tests the Red Queen Hypothesis among two species.