Zoology 357 - Evolutionary Ecology - 2nd Exam _____

1. (8 points) **_Briefly_** discuss the relationship between niche overlap, competition, and resource supply. Graph the relationship between the maximal tolerable niche overlap and degree of saturation in the environment (resource demand/supply ratio). Label the points at which competition between 2 species would be the weakest/strongest.

Tolerable niche overlap will decrease as the intensity of competition increases. The intensity of competition depends on the ratio of resource supply to resource demand. When resources are in short supply relative to demand (in a saturated environment) niche overlap is not tolerated (coexistence is not possible; the superior competitor always wins)
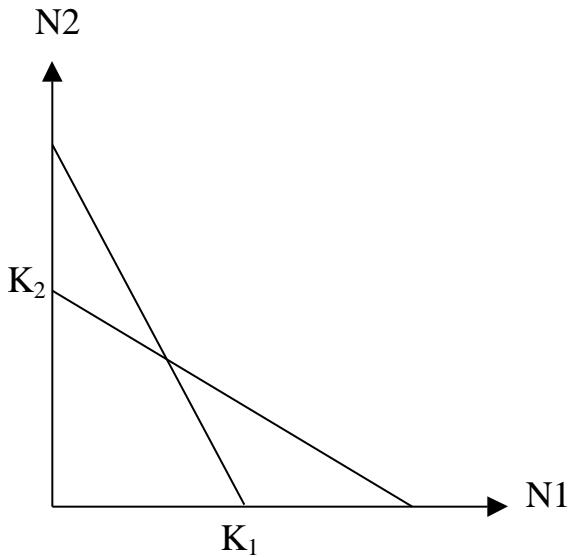
See figure 13.6.

2. (10 points) Write the Lotka-Volterra competition equation for n species (show how the population of species i changes over time when competing with j species). Solve for the equilibrium population density of species i. What happens to the equilibrium population size as diffuse competition increases?

See eq. 9 and 10 (chapter 12).

As diffuse competition increases, the equilibrium population size moves farther from the species' carrying capacity (K).

3. (8 points) What is the outcome of competition in the following graph of the zero growth isoclines for two species: a.) describe in words and b.) draw growth trajectories on the graph. Also, label the joint equilibrium and its stability. What is the outcome when the isoclines cross in the opposite way?

N2

K_2

K_1

N1

See figure 12.3

4. (8 points) What role does Pisaster play in the intertidal community food web? Describe how Paine investigated the role of this species and the conclusions from his classic study.

Keystone predator, see pg 294-295.

5. (6 points) Explain the difference between a species' fundamental niche and its realized niche.

A species' fundamental niche is the entire set of optimal conditions under which a given organismic unit can live and replace itself (the hypothetical, idealized niche in which an organism encounters no enemies and the physical environment is optimal). The realized niche is the actual set of conditions under which an organism exists.

6. (10 points) How are qualitative and quantitative plant defenses to herbivory different? Give one example of each type of defense. Also, describe Feeny's plant apparency hypothesis in relation to plant antiherbivore defense tactics.

Qualitative defenses: chemically inexpensive defenses that should constitute effective evolutionary barriers to herbivory by nonadapted generalist herbivores (e.g. plant secondary compounds such as cardiac glycosides in milkweeds). Found in unapparent plants, which are hard for herbivores to find and hence are protected by escape in time and space.

Quantitative defenses: energetically expensive defenses that pose a significant ecological barrier to herbivores (e.g. tough leaves, thorns, tannins). Found in apparent plants.

7.(10 points) Explain how the challenges facing a parasite differ from those faced
by a predator.

A predator kills its prey outright and consumes it on the spot, whereas a parasite exploits its
host over a period of time. Predators are usually larger and more powerful than their prey, but
parasites are much smaller (microparasites) than their hosts, or at lease smaller
(macroparasites). If a parasites kills its host, it dies itself, so it must have an efficient means of
establishing itself (infecting) new hosts before it kills existing hosts.

8.(6 points) What is "Darwinian Medicine"?

See pp. 328-329

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9. (8 points) How do coniferous trees in the Pacific northwest combat seed predation by *Tamiasciurus* squirrels?

See pp. 333-334.

10. (8 points) Graph the predator and prey isoclines for the Lotka-Volterra predator-prey equations and describe how predator and prey populations change in each quadrant (in words and using vectors). Qualitatively describe the joint equilibrium and solution to this pair of differential equations.

See pp. 304-305.

11.) Define each of the following terms (2 points each, for a total of 18 points):

Area Cladogram

See p. 338

Aspect diversity

See p. 315

Coevolution

See pp. 329-334.

Resource Matrix

A matrix of resource utilization coefficients or electivities that describes resources used by each consumer (See pp. 369-375)

Host altered behavior

See p. 324-325

Independent Contrasts

See pp 340-341

Niche breadth

The variety of resources used by a given consumer (See p. 279-282).

Predator switching

See p. 408

Threshold host population density

See p. 326