Review Sheet for Exam 2, Ecology, Spring 2009

Bring a # 2 lead pencil, calculator recommended.

You are responsible for ALL material covered in Lecture, as well as the readings in the syllabus (summarized below). I will use the lecture notes and reading list as guides to the important principles we've covered, so study accordingly. The exam will be cumulative in that you must understand material from last exam to understand the new material. If you think a lack of understanding of an area from the last exam slows your understanding of the new material, work on the old stuff too! See me, I'll be glad to help.

The exam will be a lot like the first exam in its mix of multiple-choice questions and short answers. However, I will ask more "book-based" questions than I did last time -- see the reading guide below for more clues as to where to focus your study. Do not bother memorizing equations - they will be provided. Instead you should be sure you know which equation to use when, and what the equations mean. You'll probably be more comfortable if you have a calculator, though any calculations will be very simple.

Studying from the book: I won't test your memory of species names from the text, or whether you've memorized the details of the examples. Learn the CONCEPTS in the book, don't try to memorize the details. Learn the principles behind each experiment, and be prepared to interpret the results of studies you've never heard of before, as on the last exam.

Be prepared to answer questions based on output from "populus". I could show a graph and ask you to interpret it, etc. Also, be sure you're able to distinguish between terms like population growth rate, per capita growth rate, population size, etc. Know their mathematical symbols too!

One of the following questions will be on the exam. Be prepared to construct well-reasoned and well-written answers to these questions during the exam period, based on information from the book and from lecture. Outline format is not acceptable - your essay should be written out completely, and during class. An "A" answer to each question can fit on one sheet of notebook paper.

Suppose that you are a wildlife biologist with responsibility for managing white-tailed deer in Ohio. Explain why you would be interested in knowing the relative importance of density independent and density dependent factors for these animals. Describe an experiment or observation that might help you determine the extent of density dependence. What sorts of results would support the hypothesis of density dependence? What sorts of results would support the hypothesis of density independence?

Explain how the niche concept helps in understanding competition and the outcome of competition. Feel free to use an example.

Snowshoe hares are hosts to many species of internal parasites (such as nematodes and tapeworms) and external parasites such as ticks and fleas. Outline a research program to determine the effects of parasites on the population dynamics of snowshoe hares.

Chapters and concepts included in this exam (underlining indicates area that you must know, but were not covered in lecture; italics are my suggestions):

Chapter 10. Population dynamics

- The age distribution of a population reflects its history of survival, reproduction, and potential for future growth
- A life table combined with a fecundity schedule can be used to estimate net reproductive rate (R_0), geometric rate of increase (λ), generation time (T), and per capita rate of increase (r).

Chapter 11. Population Growth

- In the presence of abundant resources, populations can grow at geometric or exponential rates
- As resources are depleted, population growth rate slows and eventually stops; this is known as logistic population growth
- The environment limits population growth by changing birth and death rates

Chapter 12. Life Histories

- There is a trade-off between the number and size of offspring
- When adult survival is lower, organisms begin reproducing at earlier ages and invest more in reproduction.
- Life Histories may be classified on the basis of a few population characteristics such as number of offspring, survival, and age at reproductive maturity.

Chapter 13. Competition

- Laboratory and field studies reveal intraspecific competition. *I will not emphasize self-thinning on the exam.*
- The niche reflects the environmental requirements of species
- Mathematical and laboratory models provide a theoretical foundation for studying competition in nature. *Be aware of the general conditions required for coexistence, able to recognize the competition equations and generally familiar with the isocline graphs.*
- Competition can have significant ecological and evolutionary influences on the niches of species

Chapter 14. Exploitation: predation, herbivory, parasitism, and disease

- Exploitation weaves populations into webs of relationships that defy easy generalization.
- Predators, parasites, and pathogens influence the distribution, abundance, and structure of prey and host populations.
- Predator-prey, host-parasite, and host-pathogen relationships are dynamic. *Be able to recognize the predator prey equations and understand their logic.*
- To persist in the face of exploitation, hosts and prey need refuges

Be prepared to analyze and graph (by hand) a simple survivorship or birth curve (make sure to fully label their axes, and use log scales when required)

Be able to recognize and use the following equations and symbols:

$\lambda = N_{t+1} / N_t$

$R_o = \Sigma\, l_x\, m_x$

$N_t = N_o\, \lambda^t$

$N_t = N_o\, e^{rt}$

$dN/dt = rN$

$dN/dt = rN(1-N/K)$

$T = \Sigma x\, l_x\, m_x / R_o$

$dN_1/dt = r_1N_1(1-N_1/K_1 - a_{12}N_2/K_1)$

$dN_2/dt = r_2N_2(1-N_2/K_2 - a_{21}N_1/K_2)$

$dN_h/dt = r_hN_h - pN_hN_p$

$dN_p/dt = cpN_hN_p - d_pN_p$