# Study Guide for 1<sup>st</sup> Exam BISC204

In this handout we have put together some questions to think about as you study for the first exam, organized by lecture. This list of questions is *not comprehensive*, and we suggest you review all of your lecture notes, looking to the textbook and other suggested materials for clarification when needed. For the exam, we will also expect you to think about the connections between concepts presented in different lectures.

#### **Global patterns/Biomes**

- What primary factors contribute to global patterns of: temperature, air circulation, ocean circulation?
- Draw a circle to represent the globe with lines showing 0, 30, and 60° latitude. Be able to place, 1) the direction and names of prevailing winds, and 2) the location of deserts, rainforests, and temperate forests. Be able to explain why these patterns occur.
- What causes day versus night? tides? and seasonality? Be able to provide examples of how each influence the ecology of organisms.
- Be able to describe the El Niño southern oscillation (ENSO) in terms of sea surface temperature and atmospheric pressure. What happens in the zone of upwelling along the western coast of S. America, and what organisms and processes are affected?
- Why does the impact of ENSO (El Niño and La Niña) for organisms in the Galapagos Islands depend on whether they live and feed on land or in the ocean?
- Describe in words the biome concept. Be able to plot all 9 major biomes on graph of precipitation (y-axis) versus temperature (x-axis).

# **Population Abundance/Mark-recapture**

- Describe the basic principles involved in a Mark-Recapture study (and review the equation we used in class).
- You want to estimate the population size of pink salmon (*Oncorhynchus gorbuscha*) in the Indian River and use a Mark-Recapture technique to do so. You mark a total of 1500 individuals as they pass under the Lion's Gate Bridge. Two weeks later you recapture 2000 individuals in the Indian Arm, of which 200 have marks on them. What is your estimate of the population size using the approach you learned in class? What assumptions did you have to make to obtain this estimate?

# **Study Design**

- Describe the attributes of a well-designed *experiment*.
- How does an *experiment* differ from a *comparative* study?
- Describe the trade-offs involved in designing an *experiment* with regard to its tractability and the generality that can be derived from the results.
- What are some of the limitations to the *comparative* approach?

# Life History & Populations 1

- Describe the concept of trade-offs for life-history strategies. What are some of the conflicting demands an organism must balance (generally)?
- What is a Lack clutch? How would you test for the trade-offs involved in the fecundity (# eggs/reproductive bout) of birds?
- Describe the concept of *phenotypic plasticity*. How would you test if a life-history trait is "plastic"? Design an experiment that would allow you to determine if a life-history trait changes due to environmental or genetic differences between two populations of the same species.
- Be able to draw a life history "bubble" diagram representing different stages/ages/sizes of an organism's life and the transitions between them from a written description of a species' life history. What do each of the arrows represent?
- Be able to translate the above "bubble" diagram into a life table (what information would you need for a static versus cohort life table?).
- Describe in words what each of the following represent: n<sub>x</sub>, l<sub>x</sub>, s<sub>x</sub>, b<sub>x</sub>, l<sub>x</sub>b<sub>x</sub>, R<sub>0</sub>, G, r<sub>a</sub> (review the equations needed to calculate each).
- What is the difference between a species' *distribution* and *dispersion*? How could you characterize different dispersion patterns?

# Populations 2 & 3

- Describe the difference between *density-independent* and *density-dependent* population growth.
- What do we mean by a populations' *carrying capacity*? What kinds of factors can determine the carrying capacity?

- Describe in words why you would use a *geometric*, *exponential*, or *logistic* population growth model.
- Using the following information, calculate next year's population size (this is to remind you of the important equations for each of these scenarios—spend some time working with them and it will get easier). Imagine also if we gave you population sizes for two different years and asked you to calculate the population growth rate (λ for geometric growth, dN/dt for exponential or logistic).

A population of Northern hairy-nosed wombat reproduces once a year, all at the same time. This year there are 125 individuals counted this year, and based on data from several previous years we estimate,  $\lambda = 1.14$ .

A population of introduced Norwegian rats on a large island reproduces continuously throughout the year. Its population seems to be growing un-checked probably due to a lack of predators. A recent census estimated 50,430 rats on the island, and that the per-capita growth rate, r = 0.31.

A population of land crabs on a small island make their burrows in a narrow band of low-lying scrub occurring ~500m from the ocean. Their population appears to be growing, but you as an observant biologist realize that they are getting crowded in their required burrowing area and suspect this will affect their population growth rate. This year you counted 2187 land crabs, and you estimate that there is only room for ~3000 burrow sites. Based on the initial population growth after land crab harvesting was banned 90 years ago (and the population was near zero) you estimate  $r_0 = 0.011$ .

- Describe what is meant by *depensation*. Can you draw a graph of population density (N) versus population change (dN/dt) for a population governed by density-dependent growth at both low and high population sizes?
- Describe some of the problems that small populations face due to uncertainty, and why these increase the chances of extinction (or alternatively inhibit population growth).