BIOL*2060 (Ecology) Midterm Exam 2015
Answer Key

Section I: Multiple Choice Questions (order may differ)

(1) The scientific method includes all but the following approaches:

D – Subjectivity

(2) Which description of sampling methods is not correct?

A – Haphazard sampling may not be representative and can be difficult

(3) A null hypothesis is used to?

D – All of the above

(4) The North Atlantic Ocean represents an example of a:

B – Divergent plate boundary

(5) Atmospheric circulation and precipitation patterns are not influenced by which of the following?

E – UV radiation

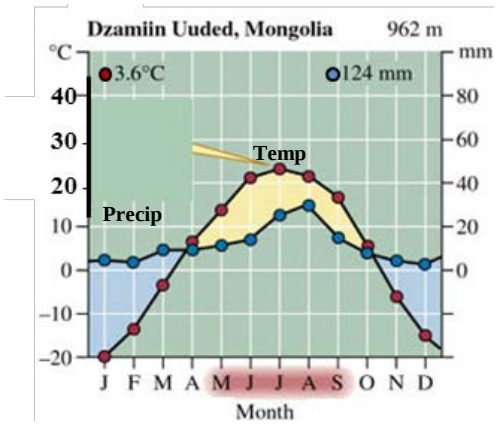
(6) The earth's deserts are typically

B – Located at 30º north and south latitudes.

(7) Most plants drop their seeds near where they grow. Some small seeds (e.g., dandelions) travel longer distances in wind currents or floating on the water. Occasionally, some seeds disperse on or in animals. How would you predict a large-seeded plant (e.g., coconut) to disperse over a high mountain pass?

C – As a sweepstakes route

(8) Based on the following climate diagram when is this region most productive?



E – It is never productive because PET < AET

(9) Which of the following statements is found for species on islands

D – All of the above

(10) A spruce tree is cloned and each of three clones is grown under conditions indicative of (i) a tropical, (ii) a subtropical and (iii) a temperature environment. The number and distribution of leaves on branches was monitored through time and found to differ among environments. This is an example of

E – A (Acclimation) and C (Phenotypic plasticity)

(11) Desert plants and animals can prevent overheating by utilizing all of the following temperature regulating methods except:

C – Increasing evaporative cooling.

(12) All of the following are components that influence a microclimate except:

E – None of the above

(13) How are C_4 plants and CAM (crassulacean acid metabolism) plants similar?

D – They both initially fix carbon into a four carbon molecule.

(14) The best life history strategy would be to mature early, reproduce often, have large numbers of offspring each time you reproduce, and live a long time. Why don't we see this life history in nature?

C – Trade-offs among life-history traits.

(15) Natural selection has shaped fish life histories, consequently

A – Fish species (i) with high adult mortality tend to mature at a younger age and (ii) with high adult mortality tend to invest relatively large amounts of energy in reproduction

(16) The following number of deer mice were recorded alive over the course of 12 weeks: week #1 – 93,week #4 - 64, week #7 – 36, week #10 – 13, week #12 -1. *Deer mice* likely have a _____survivorship curve.

B – Type II

(17) **BONUS:** If the initial population size is 996 plants and the geometric rate of increase is 2.4177, calculate the population size after 10 years for the annual plant *Phlox drummondii*.

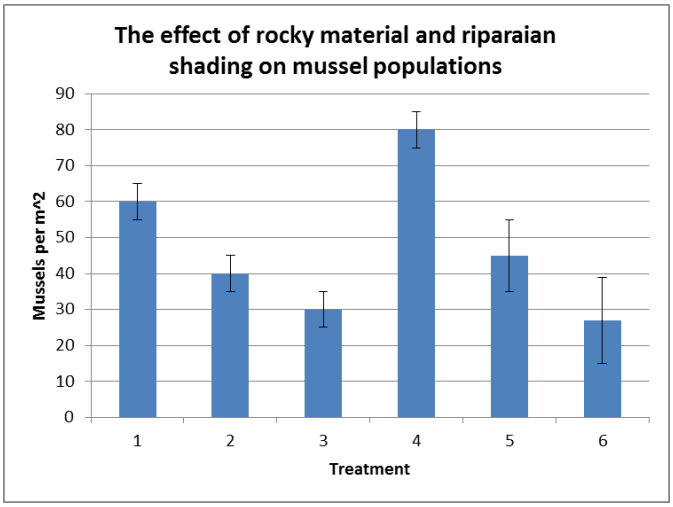
B – 6,796,470

Section II: Short answer questions.

(A) To determine which factors limit the populations of freshwater mussels in southern Ontario, you decide to manipulate the availability of rocky bottom material and riparian shade at a number of river sites across the province. You begin the experiment in the spring of year 1, and after 2 years, you census the mussel populations at each location type. The following results, expressed in terms of the number of mussels m^{-2}, were obtained.

Treatments	Number of mussels m^{-2} (mean ± 95% Confidence Interval)
#1 - Plots with big rocks added:	60 ± 5
#2 - Plots with little rocks added:	40 ± 5
#3 - Plots with riparian shade added:	30 ± 5
#4 - Plots with big rocks and riparian shade added:	80 ± 5
#5 - Plots with little rocks and riparian shade added:	50 ± 10
#6 - Plots without additions (controls):	27 ± 12

Provide a graphical representation for these results (using proper formatting) (2 pts):



- What can you conclude from these results about which factors limit the population of freshwater mussels (1 pt)?

  Mussel populations are limited primarily by big rocks (little rocks on Exam B) in rivers and secondarily by shade in the presence of rocks.

- What is your conclusion(s) based on (1 pt)?

  The 95% CI of treatments with large rocks (#1 and #4) do not overlap with controls (or the other treatments) indicating that they are significantly different from the others

(B) We are studying a population of barnacles, which typically live for 7 years. They become reproductive in their first year when they produce ~ 4500 larvae, they produce ~9000 in their 2nd year, and then ~13,500 larvae per year for the remainder of their lives. Of the 100,000 larvae produced, 62 survive to year #1, 34 survive to year #2, 20 survive through year #4, after which 50% are lost in each successive year.

- Calculate R_0 for the barnacle population, showing your work (2 points).

$R_0 = \Sigma\, l_x m_x$

x	l_x	m_x	
0	1	0	0
1	$0.62 \times \mathbf{10^{-3}}$	4500	2790
2	$0.34 \times \mathbf{10^{-3}}$	9000	3060
3	$0.20 \times \mathbf{10^{-3}}$	13,500	2700
4	$0.20 \times \mathbf{10^{-3}}$	13,500	2700
5	$0.10 \times \mathbf{10^{-3}}$	13,500	1350
6	$0.05 \times \mathbf{10^{-3}}$	13,500	675
7	$0.025 \times \mathbf{10^{-3}}$	13,500	337
8	0	0	0

Σ = 13,612/**1000**

R_0 = 13.612 (10.587 on Exam B due to different m_x)

- Is the population size increasing or decreasing? Describe your reasoning in no more than two sentences (1 pt).

Population size is increasing rapidly because $R_0 >> 1$.

- Should you be concerned about this species if it were to be introduced into a new environment? Describe your reasoning in no more than two sentences (1 pt).

Yes! It has the ability to grow population size quickly and may therefore be an effective invasive species.