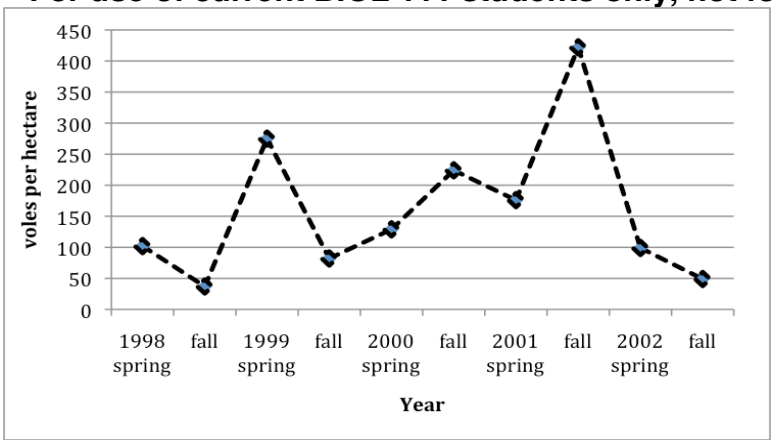
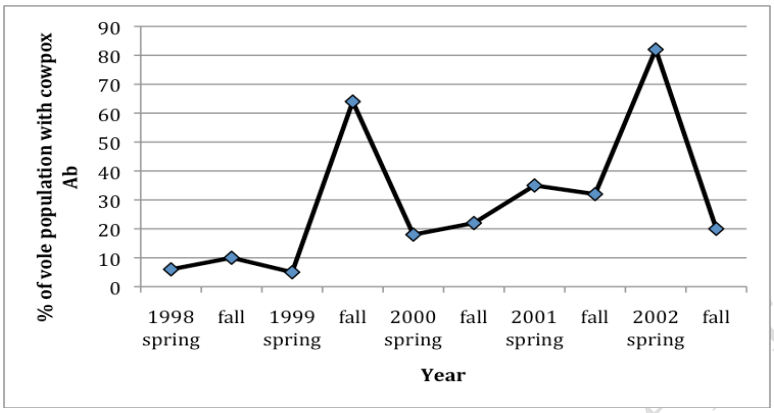
BIOL 111 PRACTICE MIDTERM II #2





1. Voles, *Microtus townsendii*, are a type of small rodent living in local forests. Biologists made a survey of their population density in a local forest over a number of years. The results are shown in the top graph. While surveying the voles, biologists took blood samples and measured what percentage of the population tested positive for the presence of antibodies against the disease cowpox, shown in the bottom graph.

Microtus townsendii

a) Voles live an average of 3-6 months and reproduce continuously. A female vole can have 3 reproductive cycles before dying. In the **top graph** the vole populations were sampled twice each year, first in the spring (April) and then again in the fall. (October)

i) What are two likely causes of the sharp population density increases? (2 marks)

ii) What are two possible causes of the subsequent decrease in the vole population density? (2 marks)

b) Vole populations have been studied for a long time and are known to be cyclic, meaning they have regular increases and decreases within a certain time span. Although this is a limited dataset, based on the **top graph**, explain how long you think an average population cycle would be for *Microtus townsendii*. (One cycle is when the population has time to both increase and decrease) (1 mark)

c) If you were told that the carrying capacity for this vole population was ~300 voles/hectare, name two factors influencing population size which might become more important in the summer and fall of 1999 and in the spring of 2002. (2 marks)

d) The bottom graph looks at the presence of cowpox antibodies in the vole population. What does this measurement imply about the voles? (0.5 marks)

e) Compare the top and bottom graphs.
i) In the fall of 2001 what was the vole population size and what % of the vole population had cowpox antibodies? (0.5 marks)

iii) What about in the spring of 2002? (0.5 marks)

iv) And in the fall of 2002? (0.5 marks)

v) As you compare these two graphs over the entire time period how might you describe the relationship between the vole population size and the % of the population with cowpox antibodies. Consider the timing carefully. (2 marks)

vi) Describe what cause and effect relationships might you infer between the vole population density and the cowpox. (2 marks)

2. The Rippin fur farm, located in Aldergrove, BC has been in existence for 75 years where the mink are raised in individual cages for their fur. In August 2008 a group calling themselves the "Animal Liberation Front" released 6000 mink from their cages. The farm is next to Aldergrove Lake Park that provides over 200 acres of natural water habitat, which, the activists claimed, would allow the mink to return to their natural state. The farmers were able to recapture all but 500 of the mink. The farmers claimed that because the animals have been born and raised in captivity they are not equipped to survive in the wild on their own and releasing was a greater act of cruelty. Wild mink prey on fish, small mammals like rabbits and water birds like small ducks. In turn, mink are preyed on by Great Horned Owls and coyotes. Mink are solitary territorial animals which means they will fight other mink to maintain a territory, either killing other mink or forcing them to leave the area, usually while starving, to search elsewhere for food.

a) Aldergrove Lake Park provides habitat for two very large birds: eagles and great blue herons, both, which are much larger than mink. Suggest how escaped mink might still have a negative effect on these bird populations (1 mark).

b) A study in Denmark found that most mink that escape from mink farms do not survive in the wild more than 2 months. Suggest two possible reasons for this. (2 marks)

c) The same study found that if the escaped mink do survive for 2 months then their survival rate is as high as wild mink. What consequence may the escape of farmed mink have on wild mink populations? (2 marks)

d) On the farm although the animals live in individual cages they are in much higher density than in the wild. Besides having to feed the animals, identify two issues the farmers will have to deal with when keeping the animals in high density that would not be an issue in the wild. (2 marks) (HINT: these are issues for farming any animal)

3. a) In “The Story of Stuff” you learned that our culture puts a priority on shopping but when a buy an item you are likely not considering the true cost. You plan on shopping for a new pair of blue jeans. Consider 5 energy inputs involved in the production of this item to the point where you will purchase it. (2.5 marks)

b) What is your ecological footprint? Identify two ways that you can reduce your ecological footprint starting today. (Be realistic) (2.5 marks)

4. You recently conducted research on a human pathogen. Because of the recent H1N1 pandemic, Health Canada is revising the information available to the public on a number of different diseases and hires to you take part in an information-gathering session on infectious diseases. (Total 14 marks)

a) Identify the pathogen you investigated : _____

b) The public wants to know how H1N1 compares to other diseases and how severe the pandemic is likely to be, compared to possible future outbreaks of other infectious diseases. In a short paragraph compare and contrast the usual means of transmission, how infectious each is and the potential virulence of the two pathogens. Explain which pathogen could potentially kill the most people. (7 marks)
Note: students knew a lot about H1N1 the year this question was given. They knew it was an airborne virus and highly infectious from person to person because the symptoms take time to appear and also the virus survives on hard surfaces for several days. They also knew the main symptoms were fever, aches and coughing. They knew some people died and others were put on ventilators.

c) To ensure the protection of the Canadian people Health Canada wants to provide the public with information about how people can protect themselves from becoming infected and, once infected, how they can be treated effectively. Compare the treatment options between your pathogen and H1N1. (2 marks)

d) Describe what elements of the human immune system fight your chosen disease. Be as specific as possible. If your disease is CJD, instead describe the most likely component or components of the immune system that <u>usually</u> recognize and destroy foreign molecules like proteins (2 marks)

e) Many people like to initially consult Wikipedia when they begin their research. Sources of published or posted information can range from expert or evidence-based (scientific) information to novice or uninformed opinions. Which does Wikipedia more closely resemble and explain why? (2 marks)

g) Most organisms have DNA as their genetic material. Double-stranded DNA molecules are chemically very stable compared to RNA, which can mutate more often. Why it advantageous for the H1N1 virus, to have RNA rather than DNA as its genetic material? (2 marks)

BONUS: Explain your rationale for deciding whether to get the H1N1 vaccine or not. (1 mark)