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EEB 208: INTRODUCTION TO CONSERVATION BIOLOGY - Test 2 answers

1. A formal definition of a minimum viable population was first proposed in 1981. What were the key conceptual advances made in this definition? (3 points)

- A. It suggested that a viable population should have a 99% chance of persisting.
- B. It suggested that a viable population should have a 90% chance of persisting.
- C. It suggested that environmental stochasticity is a bigger threat than genetic stochasticity.
- D. **It suggested that viability should be expressed over a fixed time frame.**
- E. **It explicitly identified the different types of uncertainty that can contribute to extinction.**
- F. **It included the idea that extinction risk should be expressed as a probability.**

Note that my intention was to grade A as incorrect because it does not refer to the major conceptual advance, which was framing extinction in probabilistic terms, but rather refers to specific details, which are not so important. Almost everyone misinterpreted this question, however, suggesting that I didn't ask it very well. Consequently, we gave points both for circling and not circling part A.

2. Which of these statements about the equation, $H_{t+1} = (1 - 1/2N_e)H_t$, are true? (3 points)

- A. N_e is the number of individuals in the population.
- B. **H_t is a measure of the amount of genetic variation in the population.**
- C. **H_{t+1} is always smaller than H_t .**
- D. An increase in H_{t+1} always causes N_e to decline.
- E. **The equation describes the effect of genetic drift on a population.**
- F. **The equation describes changes in genetic diversity in a population.**

3. Which of the following are characteristics of the “declining population paradigm”, according to Graeme Caughley? (3 points)

- A. Development of techniques helpful in captive breeding settings.
- B. Well developed theory.
- C. A focus on conservation genetics.
- D. **A focus on keeping common species common.**
- E. A focus on dealing with crises.
- F. **A focus on the ultimate causes of biodiversity loss.**

4. Imagine that I have created a demographic model to estimate the extinction risk of spotted salamanders in Connecticut. The model is designed to determine the probability that the current population will go extinct over a 100 year time frame. All of the data for the model come from a detailed, long term study conducted at multiple sites. In my analyses I have conducted 10,000 simulations, and found that the population went extinct in 200 of them. Which of the following statements are true? (3 points)

- A. This model is deterministic.
- B. **The model accounts for uncertainty in the population's trajectory.**
- C. **According to the model, the population has at least a 90% chance of persisting for 100 years.**
- D. According to the model, there is a 20% chance that the population will go extinct.
- E. Environmental stochasticity is a major threat to the persistence of this population.
- F. The species is completely safe from extinction and does not require protection.

5. Which of the following statements about over-harvest are true? (3 points)

- A. **The annual harvest of millions of mourning doves is sustainable.**
- B. Trophy hunting minimizes the impact on a population because it only targets a small proportion of the individuals.
- C. Harvest of species for cultural uses in past centuries has not caused species to become endangered.
- D. **Bush-meat is widely exported from Africa for profit.**
- E. Species with high reproductive rates are most vulnerable to over-harvest.
- F. Over-harvesting tends to affect plants more than animals.

6. Which of these activities are important parts of a GAP analysis? (3 points)

- A. **Identification of areas that are protected.**
- B. Accurately estimating birth and death rates.
- C. **Repeating the process over and over.**
- D. **Determine what biological diversity is present in an area.**
- E. Habitat restoration.
- F. **Determining what aspects of biological diversity should be protected.**

7. Which of the following traits tend to be more common in species that are successful invaders than in those that do not become invasive? (3 points)

- A. Invaders tend to have long generation times.
- B. Invaders tend to be symbiotic.
- C. Invaders tend to have narrow diets.
- D. Invaders tend to be highly inbred.
- E. Invaders tend to be extreme habitat specialists.
- F. Invaders tend to avoid areas with humans.

8. Which of these statements about habitat loss are true? (3 points)

- A. Most habitat loss is caused by urban development.
- B. Loss of coral reef habitat has slowed suggesting that conservation efforts have been successful.
- C. **Habitat loss and degradation affects more endangered species than any other threat.**
- D. More than 90% of wetland habitat in the U.S. (excluding Alaska) has been lost in the last two centuries.
- E. The area of tropical rainforest destroyed each year is about the same as the area of Connecticut.
- F. **Much of the native grassland habitat that remains in mid-western states is found in cemeteries.**

9. Why is it easier to set up a captive breeding programs for plants than animals? (3 points)

- A. Genetic drift is more severe in animals than in plants.
- B. **Plants generally require less specialized breeding conditions than do animals.**
- C. **Plants usually require less space than animals.**
- D. People have been growing plants in ex situ settings for longer than they have been keeping animals in captivity.
- E. Plants can persist with much smaller population sizes than animals.
- F. Technological methods for breeding plants are more sophisticated than for animals.

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10. In class I talked about a study of the different threats faced by endangered species in the U.S. Which of the following statements about that study are correct? (3 points)

- A. Invasive species are the primary cause of endangerment for most species.
- B. Plants are more vulnerable to pollution than are animals.
- C. Over-exploitation affects very few species.
- D. Habitat loss and/or degradation tends to affect animals but not plants.
- E. Most species face threats from multiple sources.**
- F. Disease appeared to be unimportant for plants and invertebrates, but the data might be biased.**

PART TWO

13. What is the basic equation that is used to describe the change in a population's size from one year to the next? Define all of the terms. (4 points)

$$N_{t+1} = N_t + B - D + I - E$$

Population size at next time step = Population size now + Number of births during the time step – Number of deaths during the time step + Number of immigrants during the time step – emigrants during the time step. 1 point for getting the equation exactly right, plus half a point for each correct definition.

Note that just saying “B=Births, D=Deaths”, etc. is only barely acceptable. When defining terms, it is important to say what you mean in full, rather than using this kind of shorthand. In this case it is the number of births, number of deaths, etc. that matters, but the shorthand could be taken to mean something else, such as the birth rate (i.e., number/time). Because I used similar shorthand in my lecture notes, we gave points even for abbreviated definitions on this exam, but on the final I will not be so generous!

14. The following graph shows how (a) mosquito abundance, (b) native forest birds abundance, and (c) the frequency of avian pox infections, change with elevation in Hawaii. Explain the pattern in the frequency of pox infections. (2 points)

Pox frequency is low at low elevations because there are few birds to maintain a viable population of the disease (this is equivalent to there being no “habitat”). Pox frequency is also low at high elevations because there are few mosquitoes to move the disease between hosts. Pox is common at intermediate elevations because both habitat (i.e., bird hosts) and the means for transmission (mosquitoes) are moderately abundant. For both points you needed to identify both why pox frequency is high at intermediate elevations and why it is low elsewhere. Simply describing the graph was not enough to get points, you had to explain the biology behind the patterns.

15. Describe what is meant by a “soft” release. Give examples of things that this technique might include. (3 points)

A “soft” release involves doing things to make it easier for captive bred individuals to survive once released into the wild, especially in the period immediately after release. Examples of the type of thing that this might include are providing supplemental food, providing shelter where animals can rest, putting up pre-release cages for the animals to live in for a period prior to release, timing the release to occur at a time of year when conditions are good, ensuring that some of the released individuals have experience living in the wild, providing behavioral training (e.g., to be afraid of predators) for individuals prior to their release, etc., etc. 1 point was given for the definition and the other 2 points were for any two examples of what might be done.

16. List the major reasons why species get moved from their native ranges into new areas. (4 points)

One point each for any of the following:

- i) Hunting/fishing (both of these does not count as 2 points)*
- ii) Aesthetic reasons*
- iii) Agriculture/horticulture (both of these does not count as 2 points)*
- iv) Accidental transport*
- v) Incidental invasions due to human activities*
- vi) Biological control*
- vii) Translocation to protect them from endangerment in their native range*

If you listed multiple things that contribute to one of these (e.g., multiple reasons why a species might be rare and thus the focus of translocation) you would have only got one point for all of them. Note that acceptable answers line up against the subsection headings in my notes!

17. The discussion papers in this course are designed to help you learn to read articles in the research literature, and to see how the things I talk about in class relate to current research in conservation biology. Tell me one thing that you like about these discussions and one thing that you don't like. (2 points)

Points given for any constructive answers. Thank you very much – your responses were useful and will influence how I teach the class in the future.