

EEB 2208 (Introduction to Conservation Biology)

Homework 9: Lectures 1-17

Why is it easier to set up a captive breeding program for plants than animals?

1. Plants can persist with much smaller population sizes than animals. **B**
2. Plants generally require more specialized breeding conditions than do animals. **B**
3. Maintaining plants ex-situ usually requires less space than animals. **A**
4. Double-clutching is easier in plants than animals. **B**
5. Genetic drift is more severe in animals than in plants. **B**

There is no basis for considering Q1 or Q5 to be true. Q2 is also wrong in most cases – for the most part the opposite is true. Strictly speaking, double-clutching refers to organisms that lay eggs, but even if that were not the case, Q4 would not make sense because the advantage of double-clutching only applies to organisms that have parental care.

The black-footed ferret is an endangered species that has been bred in captivity. A new release program is being designed to establish a new population in the wild. Which of the following recommendations would benefit the organizers of the release?

6. Once the release has been done, stay well away from the release site at all times so as to not disturb the animals. **B**
7. Release as few individuals as possible to minimize the risk of something going wrong. **B**
8. Augment populations at regular intervals to simulate immigration. **A**
9. Avoid soft releases. **B**
10. Choose a release site near the periphery of the species' former range. **B**

Q6 is wrong because it would not allow you to do post-release monitoring. Q7 is wrong because larger populations have a better chance of success. Q8 is correct because multiple releases is a good predictor of success in introduced populations, and because it allows one to respond to stochastic issues, such as high mortality due to harsh weather. Q9 is designed to test whether you know the difference between a soft release and a hard one, and that the former is always better if it can be done. And Q10 relates to the recommendation to release near the center of a species' range because the conditions there are likely to be more conducive to the species' long-term persistence.

Recently, some researchers put forward their plans to use genetic techniques to clone passenger pigeons from DNA obtained from museum specimens in order to bring the species back from extinction. Which of the following statements related to this endeavor are correct?

11. Before its extinction the passenger pigeon was perhaps the most common land bird on Earth, with a single flock estimated to contain about 2 billion birds. **A**
12. To produce a viable population of passenger pigeons, the researchers are likely to need genetic material from a lot of individuals. **A**

13. Passenger pigeons went extinct because they were an island endemic. **B**
14. If successful, this would be a first because endangered species have never been cloned before. **B**
15. If cloning is successful, the population should be increased to 500 individuals before it is considered safe from extinction. **B**

I have not talked about this idea in class yet and was testing whether you could apply knowledge from several parts of the class to a new idea (in this case one that has been floating around in the press for a year to two). Q11 and Q13 refer to basic information from the passenger pigeon story that I presented in class. Q12 and Q15 test whether you understand that viable populations of any species need quite a lot of genetic diversity and that they need to be quite large (usually thousands), respectively. You should know that Q14 is wrong because I gave an example of an endangered species (guar) being cloned in class.

Which of the following statements about the global reserve network are accurate?

16. About 4% of the world's land surface is strictly protected. **A**
17. Marine reserves cover a greater area than terrestrial reserves. **B**
18. The rate at which additional land is protected has slowed considerably in the past few decades. **B**
19. In the U.S., all marine protected areas exclude activities such as fishing, oil extraction and recreational boating in order to protect biodiversity. **B**
20. One advantage of captive breeding over the creation of reserves is the reduced cost. **B**

Q16 and Q19 were designed to test whether you understand the distinction between a site being a reserve and it being strictly protected. Q17 tests whether you knew that marine ecosystems have received less protection than terrestrial ecosystems (even if you didn't remember the figure, you could have guessed the right answer as I have mentioned the fact that we have tended to neglect ocean conservation numerous times during the course). Q18 is simply wrong – I showed you a graph that illustrates acceleration in the rate at which we are protecting land. Q20 tests whether you understand that captive breeding, despite having some benefits, is generally much more expensive than protecting species in their natural habitat.

Which of the following statements about the effective population size are true?

21. It is usually 2-3 times greater than the census population size. **B**
22. It is a theoretical measure of how many individuals contribute their genes to future generations. **A**
23. It is affected by the sex ratio, population size fluctuations, and reproductive variation. **A**
24. The smaller the effective population size the smaller the risk of inbreeding. **B**
25. It can be used to estimate the rate at which species richness declines. **B**

These questions just test basic knowledge about N_e . Q21 is wrong because the difference is usually even greater than this. The information in Q22 and Q23 comes directly from my notes.

Q24 is wrong, because close relatives are more likely to breed with one another in a small population, making inbreeding more likely (see also the heterozygosity equation explaining loss of genetic diversity). Q25 is wrong because there is no clear link between N_e and species richness.

Which of the following statements correctly links a concept with an appropriate example? (3 points)

26. Humans are a keystone species. **A**
27. Pandas are flagship species. **A**
28. Beavers are ecosystem engineers. **A**
29. Sea turtles are a type of by-catch. **A**
30. Because albatross are long-lived species even small reductions in their reproductive rates make them vulnerable to extinction. **B**

Q28-30 should be relatively easy because they are examples that were given in class (beavers and albatross have been mentioned several times each). Q26-27 are not examples I've specifically mentioned although I did point out that pandas are the emblem of the Worldwide Fund for Nature and I've mentioned them several other times. By asking about this species I wanted to test whether you could extrapolate from the example I gave you to another similar case. Similarly, I have not explicitly said that humans are keystone species, but you should recognize that – even though the human population is large – we still have a disproportionately big impact on natural systems (altering almost all natural land covers, changing the climate, acidifying the oceans, etc.)

31. Give an example of each of the following. Examples must be individual species, rather than references to groups of species. (5 points)

a) A species that has been the subject of a PVA: In class I presented examples for brown pelican, Hawaiian stilt, and black-footed ferret, but any verifiable answer would do.

b) A species that has been the subject of a captive breeding program: Examples given in class included Panamanian golden frog, California condor, Père David's deer, gaur, whooping crane, African and Asian elephants, panda, any of the plant species that we brought over from the greenhouse, *Powelliphanta augusta* (the New Zealand snail that had an unfortunate freezer accident – yeah, that was a tough one), Mauritius kestrel, gray wolf, Devil's hole pupfish, black-footed ferret, peregrine falcon and pink pigeon. Any other verifiable answer would have been accepted.

c) A species that has suffered from the effects of inbreeding: Examples given in class included Florida panther in the cons genetics lecture, and Indian elephant, zebra and giraffe earlier in the semester. Any other verifiable answer would have been accepted.

d) A species that has undergone seriously population decline due to an invasive species: Any of the species mentioned in the cane toad video, Hawaiian goose (also known as nene, mentioned as

a species affected by mongoose in Hawaii), or any other example you have come across in your reading.

e) A species that has undergone seriously population decline due to by disease: **Tasmanian devil**, **Ethiopian wolf**, **American chestnut**, **gorilla**, and **heath hen** were all mentioned in class. Any other verifiable answer would have been accepted.

32. Golden lion tamarins have been bred in captivity, and since 1984 conservation biologists have been releasing them into the wild. Describe four distinct things that could be done to improve the success of the release program. (4 points)

At the end of lecture 16 I gave a list of 7 things (see the notes) – any 4 of these would have given you the points.

33. Describe the role each of these things plays in conservation biology. (4 points)

a) By-catch – increases mortality of many non-target species marine species affected by fisheries, e.g., turtles, albatross, among many other species.

b) Seed banks – are used as a way to store seeds under cold, dark conditions, for future germination. Many of the world's species are protected in seed banks. (Because the term “seed bank” is also used to refer to natural accumulation of seeds in the soil, answers that referred to that phenomenon would also have received points – as long as they made sense in light of the question.)

c) Brood parasitism – can reduce reproductive success when the young of the parasitic species outcompete the young of the host species, and when the parasitic species increases in number or range, as in the brown-headed cowbird example I gave in class.

d) Cloning – can be used to increase the production of young in endangered populations.

34. What ideas did the following people contribute to conservation biology? (2 points)

a) Greame Caughley – responsible for the “small population” vs “declining population” paradigms in conservation biology.

b) Mark Shaffer – introduced the idea of the minimum viable population size that is defined in terms of a quantitative timeline to extinction and probability of extinction.