EEB 2208 (Introduction to Conservation Biology)

Homework 5: Lectures 1-10

Why did heath hens go extinct?

1. Because no land was protected for them. **B**
2. Because their habitat was destroyed. **A**
3. Because they are a long-lived species, with high reproductive rates. **B**
4. Because a harsh winter killed many individuals. **A**
5. Because they were hunted. **A**

Answering this question correctly is mostly a matter of knowing the story. Even if you don't know the story, though, you should be able to use the information in class to infer that Q2 is correct (because most species are affected by habitat loss), that Q3 is wrong (because long-lived species usually don't have high reproductive rates), and – if you remember that a heath hen is a type of game bird – that Q5 is right (because large vertebrates are often adversely affected by hunted). In other words, an understanding of the basic concepts surrounding extinction risk should get you a passing grade, but knowledge of specifics would be needed to raise that to a higher grade.

Which of these statements about habitat loss are true?

6. The area of tropical rainforest destroyed each year is about the same as the area of Connecticut. **B**
7. About half of the wetland habitat in the U.S. (excluding Alaska) has been lost in the last two centuries. **A**
8. Most habitat loss is caused by urban development. **B**
9. Well over half the coral reef habitat in the world has been lost or severely damaged. **B**
10. Habitat loss and degradation affects more endangered species in the US than any other threat. **A**

This set of questions was primarily designed to test whether you have a general idea of the magnitude of habitat losses. For Q6, it is sixteen times the area of CT; for Q8, most loss is due to agriculture (if you think about it, relatively little of the world's land is actually urban); for Q9, it is <30%.

One of the best studies to examine the characteristics of successful invading species involved birds introduced to New Zealand. In this study, what were the best predictors of invasion success?

11. The number of individuals released. **A**
12. Reproductive rates. **B**
13. The number of potential competitors. **B**
14. Life spans. **B**
15. The number of introduction attempts. **A**

In lecture, I presented a number of general factors that have been associated with invasion success. I then presented the New Zealand example, saying that it was one of the best and that it found that most of those general factors were not especially important (suggesting, perhaps, that they have been identified due to spurious correlation). Q11 and Q15 give the things that are unambiguously important – collectively referred to as "propagule pressure". This set of questions tests whether you can differentiate between general patterns that seem to make sense, and may even be correct in some cases, and specific knowledge that derives from important case studies (i.e., predictors for which there is strong evidence). This question also relates to ideas discussed in the "use of statistics" lecture.

Which of the following statements correctly link a species with the factors that threaten it?

16. Sea turtles are threatened because they are poor dispersers. **B**
17. Red-cockaded woodpeckers are threatened because they require specific habitat conditions that are rare. A
18. Large blue butterflies are threatened because they are extreme habitat specialists. A
19. Flattened musk turtles are threatened because they hybridize with other turtle species. **B**
20. Vultures are threatened by overuse of painkillers in farming. A

Mostly, knowing these examples is simply a matter of being in class. I do not expect you to remember every example I give in class, but some level of factual knowledge matters and it is important to know an example or two for each major concept. Here, I focus on some of the main examples that I talked about recently, Q16 is one you could probably guess, but the others require that you know the specific examples I talked about.

Which of the following statements about over-harvest are true?

21. Species with high reproductive rates are most vulnerable to over-harvest. **B**
22. Over-harvest tends to affect endangered US plants more than animals. **B**
23. Bush-meat is exported from Africa for profit. **A**
24. Many marine species are threatened by over-harvest even though they have no commercial value. **A**
25. The annual harvest of millions of mourning doves is sustainable. **A**

This set was also fairly straightforward and designed to test your factual knowledge. Some of the answers should be possible to work out logically though. In Q21, a species with a high reproductive rate is going to be able to replace individuals lost to any form of mortality (including harvest) relatively easily and hence will be relatively invulnerable to this threat (contrast this with what I've said about albatrosses). Q22 relates to a table I've shown in the past 4 lectures (this repetition is a sign that I think it is important). Note that I don't expect you to know the exact numbers in the table, just the general patterns that it shows. Q23 was designed to test whether you understand that, although bush meat is primarily taken for subsistence, it is increasingly being used in commerce as well – and even being shipped overseas via the black market (which makes finding solutions for the problem even more complex). Q24 is correct because of the effects of by-catch. Finally, Q25 tests whether you understand that hunting does not always cause species declines and that sustainable harvest is possible. The contrast between mourning dove and passenger pigeon (two very closely related species) is important and worth thinking about in light of all I have told you in the past few classes.

Which of these statements about the following figure are accurate (note, parts B and C are not included and are not relevant)?

26. The data in the figure show that smaller patches have fewer species. B
27. As time goes by species, evenness declines. B
28. Large habitat patches have more species than smaller habitat patches. A
29. The more isolated a patch is the fewer species it has. B
30. The rate of local extinction is higher for large patches. A

Q26 is wrong because the figure does not show any actual data (it shows predictions based on the statistical model described in the paper, and referred to in the legend). Q27 and Q29 are both designed to test whether you know what the axes on the figure are actually showing: neither evenness nor patch

isolation are plotted (the x-axis gives time since isolation, not how isolated a patch is). Q28 is correct because lines for larger patches lie higher on the graph, implying more species remaining, and Q30 is right because the lines for larger patches are steeper (indicating a higher rate of species loss).

The figure below describes factors relating to the incidence of avian pox in Hawaii, where it is an introduced disease that is transmitted to birds by mosquitoes. Which of the following statements about the figure are true?

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31. This figure shows that birds are uncommon in the lowlands. **A**
32. This figure shows that birds can effectively control introduced mosquito populations. **B**
33. This figure suggests that pox infections are highest where the mosquito vector is most common. **B**
34. This figure shows that pox infections are more common than mosquitoes at mid-elevations. **B**
35. This figure suggests that high elevations provide a refuge where birds are safe from disease. **A**

This is not a figure I have shown you in class, but all of the information you need to answer the questions is available. Q31 and Q33 simply involve reading information off the graph. Q35 requires a little interpretation, but since you know that mosquitoes and pox are both required for birds to get the disease (given in the question), and that these are both low at high elevations, where bird densities are high (from the graph), the inference in Q35 makes sense. Q32 is harder because it is possible that the low mosquito densities at high elevations arise because birds control mosquito numbers, but the figure certainly doesn't show that this is the case. Given that the question tells you that mosquitoes transmit a disease that affects birds, it is more likely that the correct interpretation is that the high abundance of mosquitoes helps to reduce bird numbers in the lowlands (note that answers to real world problems are often not black and white and the ability to make informed judgments is an important skill). Finally, Q34 is wrong simply because you have no way of judging which is more common – because the axes are not labeled you do not know which axis refers to which line, nor what any of the units are.

36. In 1998, Wilcove et al. published a summary of the different threats faced by endangered species in the U.S. Describe the relative importance of the different threats they considered, and compare the results for vertebrates, invertebrates, and plants. (6 points)

This answer would get all 6 points: 1. Habitat loss is the greatest threat for all three groups, affecting the majority of endangered species. 2. Alien species and pollution each affect a large proportion of endangered species; about half in some taxonomic groups in each case. 3. Invertebrates tend to be affected less by alien species, however, and few plants are affected by pollution. 4. Over-exploitation affects about a quarter of both animal groups, but a much smaller proportion of endangered plant species. 5. Finally, disease affects about 1 in 10 vertebrate species, but very few invertebrate or plant species. 6. Some of the differences among taxonomic groups, however, could arise from biases in existing knowledge. E.g., the low number of endangered invertebrates affected by disease may just reflect a lack of research on invertebrate diseases.

37. Define the following terms. (3 points)

By-catch: Non-target species that are caught (and often killed) as a by-product of fisheries harvest. See lecture on over-exploitation.

Propagule pressure: A measure of the number of individuals entering a new area; in the context of this class, the term was used in reference to introduced species. See lecture on invasive species.

Genetic bottleneck: This term refers to a situation where a population has been reduced to a very small size at some point in its past. Usually, this population reduction results in a loss of genetic diversity. See notes on causes of population decline.

38. Give four distinct ways in which roads negatively affect species. (4 points)

See notes for Lecture 8. The 4 things must be distinct (i.e., mortality of barn owls and mortality of elk would not count as 2 things).

39. Beavers have been introduced to southern Chile, where no similar mammals exist, and their populations have undergone considerable growth. Given what you have learned in the class, what effects would you expect to see? (2 points)

Here I was looking for you to connect the issue of invasive species to the ecosystem engineer concept I discussed early in the class (1 point for each concept). The introduction of beavers has resulted in widespread forest destruction as they cut down trees. Unlike northern hemisphere forests, however, the trees in southern Chile did not evolve with beavers and do not grow back quickly – consequently the forest is being affected quite differently from where beavers are native. (Note I would not have expected you to know these specific details – only that it is likely that beavers are really changing forest ecosystems because they are an invasive ecosystem engineer.)