EEB 2208: INTRODUCTION TO CONSERVATION BIOLOGY - Midterm

Below each set of questions I've added some explanation of the answers and the rationale for the question (i.e., what I was trying to test). If I have not written anything then most people got the answer right and/or it was just a matter of reproducing information from the lecture material.

Which of the following statements about ecosystem services are correct?

1. Protection of ecosystem services ensures protection of high biodiversity. B
2. Bird-watching is an example of a cultural service. A
3. Corn production for food is an example of a supporting service. B
4. Wood production for fuel is an example of a provisioning service. A
5. The flood control value of wetlands is an example of a regulating service. A

Which of the following are examples of invasive species?

6. Cichlid fishes in Lake Victoria. B
7. Mongoose in Hawaii. A
8. Rabbits in Europe. B
9. Earthworms in New England. A
10. American chestnut blight. A

Most people got most of these correct. Q9 was the hardest, but is an example I spoke about in class. Q6 was included to test whether you knew which species was introduced to Lake Victoria and which were affected. Q10 was designed to test whether you knew that disease organisms can be invasive species.

Which of these statements about habitat fragmentation are true?

11. Habitat fragmentation tends to affect area sensitive species. A
12. Building dams is a serious cause of habitat fragmentation. A
13. Power-lines are a serious cause of habitat fragmentation. A
14. The brown-headed cowbird is a species that has benefited from habitat fragmentation. A
15. A single large clear-cut is likely to reduce forest biodiversity less than lots of small clear-cuts that cover the same total area. A

The graph below shows change in the economic value provided by ecosystem services in an area of mangrove as more of the area is converted to shrimp farms. Which of the statements can be supported by the graph?

16. Shrimp aquaculture inevitably results in a reduction in the value of the ecosystem's services. B
17. Loss of mangrove habitat reduces biodiversity. B
18. The flood protection services of intact mangrove are more valuable than the economic benefits of farming shrimp across the entire area. A

19. The value of mangrove as fish habitat is always greater than the value provided by its wood. A
20. There is a trade-off between shrimp farming and flood protection. A

Which of the following statements about climate change are accurate?

21. Average global temperatures have increased about 5° C since the 1950s. B
22. Climate warming due to increased atmospheric carbon dioxide was predicted over a hundred years ago. A
23. Climate warming is predicted to be most severe near the equator. B
24. A 2011 analysis of temperature data by a group of researchers skeptical about climate change found almost identical trends to those found in three previous analyses. A
25. Increases in atmospheric carbon dioxide since the industrial revolution are similar to fluctuations recorded by ice core data over the past 400,000 years. B

Which of these conservation actions would be considered representative of the small population paradigm?

26. Captive breeding black-footed ferrets. A
27. Moving Tasmanian devils to a disease-free area. A
28. Identifying biodiversity hotspots. B
29. Helping farmers develop agricultural practices that reduce pesticide use. B
30. Creating a reserve for the last remaining heath hens following widespread population decline. A

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

31. It suggested that viability should be expressed over a fixed time frame. A
32. It suggested that environmental stochasticity is a bigger threat than genetic stochasticity. B
33. It suggested that a viable population should have a 99% chance of persisting for 100 years. B
34. It explicitly identified the different types of uncertainty that can contribute to extinction. A

35. It included the idea that extinction risk should be expressed as a probability. A

Q32 was wrong because the definition simply identifies the different types of stochasticity, and says nothing about their relative importance. Q33 is wrong, not because the numbers differ from those in the definition, but because the numbers themselves do not matter – i.e., they are just details, not conceptual advances. Even if you got this question right make sure you understand why it would still have been wrong if I had put 1000 years.

Tropical forest destruction endangers many species, but exactly how many is not known. Why do we not have good estimates of the number of affected species?

36. Because we lack information on the range sizes of tropical forest species. A
37. Because species-area curve methods do not work in the tropics. B
38. Because the number of species that occur in tropical forests is not well known. A
39. Because rates of forest destruction are uncertain. A
40. Because we do not know what the background extinction rate is for tropical areas. B

Q39 was wrong because the rate of habitat loss greatly affects the number of small-range species that will go extinct. Q40 was wrong because the background rate is not relevant to the calculation.

Which of the following activities fall within the field of conservation biology?

41. Developing human medicines from rainforest plants. B
42. Documenting extinctions caused by climate change. A
43. Developing legislation to prevent the sale of potentially invasive garden plants. A
44. Breeding disease-resistance into crop plants. B
45. Monitoring chemical pollutants that cause human birth defects. B

This set of questions tested whether you understood that conservation biology is focused on protecting biodiversity and is distinct from topics that are focused primarily on human well-being. Consequently, Q41, 44 and 45 were all incorrect.

Which of the following statements refers to an effort designed to limit the effects of introduced species?

46. Fishing for introduced Nile perch in Lake Victoria. B
47. Releasing all of the birds mentioned by Shakespeare into North America. B
48. Treating ballast water to kill all the organisms that live in it. A
49. Causing the space craft Galileo to crash into Jupiter. A
50. Introducing the moth *Cactoblastis* into Australia. A

As discussed in class, people fish for Nile perch as a food source not to control its population, so Q46 was wrong. Q49 was correct because the crash was based on concerns about microbes being introduced to a moon thought to have water on it – this is the example I introduced the topic with.

In 1998, Wilcove et al. published a summary of the threats faced by endangered species in the U.S. Which of the following statements about their study are correct?

51. Invasive species threaten the greatest number of endangered species. B
52. Disease threatens more endangered plants than endangered animals. B
53. Most species are threatened by habitat loss alone. B
54. Over-exploitation threatens more endangered animals than endangered plants. A
55. Climate change was the most serious threat studied. B

Q53 was wrong because, although habitat loss affects the greatest number of species, most species are also threatened by multiple things.

Which of the following statements about statistical interpretations are correct?

56. The middle value of a set of numbers is the mean. B
57. Precisely measured data cannot show bias. B
58. The high correlation between stork numbers and human births in Germany is likely spurious. A
59. The mean, mode, and median for a set of numbers are always different. B
60. Medians are more affected by extreme values than means. B

Which of the following statements about extinction are correct?

61. A good way to define extinction is that it has not been detected for 50 years. B (or A)
62. The term extinction debt refers to extinctions that are expected to happen due to past actions. A
63. In the Singapore extinction study discussed in class, extinction rates were uniformly very high across habitats and taxonomic groups. B
64. One way to determine whether a species is likely to be extant is to look at the length of the time gaps between past sightings. A
65. The co-extinction study discussed in class, suggests that for every well documented extinction there are probably about 5 co-extinctions. B

Q61 was poorly worded because I inadvertently dropped a couple of word while editing it – it should have referred to a species not being detected for 50 years (and old definition that is generally not used any more). Consequently, so we gave everyone a point regardless of their answer (the majority still got it right though). Q63 was designed to test whether you understand that, although extinction rates are high they are far from uniform – this leads into the idea that extinction risk is at least somewhat predictable based on a species' characteristics. Q65 was wrong because the estimated number of co-extinctions is about an order of magnitude lower (<1 per extinction).

Which of these statements about mass extinctions are correct?

66. Current extinction rates are below those of past mass extinctions. B
67. Currently, about 1 in a million species go extinct every year. B
68. Projected extinction rates suggest that a sixth mass extinction is likely. A
69. Extinction rates are currently very high, but are starting to slow down. B
70. During past mass extinctions, at least 3 out of every 4 species have gone extinct. A

Which of the following statements about commercial fisheries are true?

71. Over half of the world's 200 most commercially valuable fish species are over-harvested. A
72. Long-lining eliminates the problem of by-catch. B
73. Substantially reducing current fishing levels would have little impact on the human food supply. B
74. The shrimp fishery has a relatively low by-catch compared to other fisheries. B
75. Coral reef loss is the main cause of endangerment for commercially valuable fishes. B

Which of the following statements about the species that remain to be described by scientists are true?

76. Very few species remain to be described. B
77. New species continue to be described in the United States. A
78. New species of mammals continue to be described. A
79. Most species that remain to be described are plants. B
80. At least two-thirds of the Earth's species remain to be described. A

Which of these statements about hotspots are accurate?

81. Richness hotspots are the focus of conservation biologists because they contain the greatest number of endangered species. B
82. Endemism hotspots are places with a lot of species found nowhere else. A
83. High overlap between taxonomic groups is a strength of the hotspot approach. B
84. Hotspots tend to be found in tropical areas. A
85. Richness hotspots would be expected at high elevations in temperate areas. B

Q83 was incorrect because there is often little overlap between the hotspots for different groups (see the example given in class).

Which of these definitions are correct?

86. Propagule pressure is the endangerment of species due to low birth rates. B
87. Edge effects are caused by the slow erosion of species ranges through local extinctions. B
88. Rivet-popping relates to the unpredictable collapse of ecosystems following species extinctions. A

89. Deep ecology is an environmental philosophy that advocates placing greater value on protecting biodiversity through changes in personal attitude, life style, and even societies. A

90. Species evenness relates to the relative abundance of individual species within a community. A

PART TWO: 3 short answer questions. In each case I have given plenty of space to answer the question, so you don't need to write pages to give adequate answers. The number of points is given at the end of each question.

91. Give an example of each of the following. In each case you must be specific to get the points. Listing lots of options will get no points unless all are correct. (3 points)

In all of these cases, you needed to give specific answers, as noted in the question. References to "plants", "fish", etc. are not specific examples.

One problem caused by invasive cane toads: Anything mentioned in the movie Cane Toads (or the published research literature) is acceptable. E.g., that they are poisonous and so kill any native predators that try to eat them. If you got this question marked wrong, but believe your example is valid, then I will consider a regrade if you can provide convincing evidence to support your claim.

An invertebrate that has been overharvested: Any verifiable example. Lots of options here, but among those discussed in class are medicinal leeches, cone snails, and scallops. Shrimp (and various other marine organisms that form by-catch) would also be acceptable. Again, I will consider a regrade if you can provide convincing evidence to support your claim.

A species that has declined severely due to pollution and the pollutant that caused the decline: Any verifiable example. In class, I described the decline of three species of Asian vultures due to diclofenac. I also stressed the importance of reading the pollution section of the text book, where other examples are given (e.g. various birds of prey affected by DDT). Half a point was given for the species and half for the pollutant. Again, I will consider a regrade if you can provide convincing evidence to support your claim.

92. The graph below plots the winning times of Olympic runners in the 100 m. What does the graph predict will happen in 2156? How would you judge that prediction, and why? (3 points)

For this question, we awarded 1 point for knowing that the graph predicts that the male and female winners of the 100 m will win their races with the same speed; 1 point for knowing that this is a poor prediction; and 1 point for saying that it is poor because it requires one to extrapolate far beyond the data range (or something similar that implies that you recognized that problem – e.g., that the lines would eventually hit zero because they are linear). The problem was not one of spurious correlation. Answers referring to physiology or genetic limitations were not correct because we do not know what changes remain possible for human bodies (e.g., a few decades ago a 10 s win was considered truly remarkable, but is now not so unusual). Moreover,

those factors do not relate specifically to the prediction made in the graph or to what I talked about when I showed the graph in class. Some of you may have noticed that the male and female labels were on different lines from those in the real figure that I presented in class. This switch was not intentional, but it also did not affect the answers in any way – i.e., the answer is the same however the lines are labeled. I was concerned that my mistake may have created some confusion so I re-read all answers to this question after noticing the error to ensure that it was not the cause of any lost points.

93. The graph below illustrates the relationship described by the equation $S = c*A^z$. Label the graph to indicate how the terms in the equation relate to the figure. Explain (by drawing on the figure if necessary) how you would use this graph to determine how many species would be lost from a patch if its size were reduced due to habitat destruction. (4 points)

Two points were available for labeling the figure. For full points you needed to get at least four of these five things right: labels for (a) area on the x axis, (b) species count on the y axis, (c) z as a constant describing the slope of the dotted line, (d) log c (just c was also acceptable) as the point of intersection between the dotted line and the y axis, and (e) recognizing that area and size should be plotted on log scales.

The other two points were for showing that you can plot the starting patch size (A_1) on the x axis, then go up to the dotted line, and then left to the y axis to figure out the expected species richness (S_1). You can repeat this for the reduced patch size (A_2) to get the species richness after habitat loss (S_2). The difference ($S_1 - S_2$) is the amount of species loss due to habitat destruction.