

國立成功大學

112學年度碩士班招生考試試題

編 號：59

系 所：生命科學系

科 目：生態學

日 期：0207

節 次：第 3 節

備 註：不可使用計算機

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

問題 1~3: 選擇； 問題 4~9: 簡答； 問題 10: 解釋名詞 (注意時間分配)

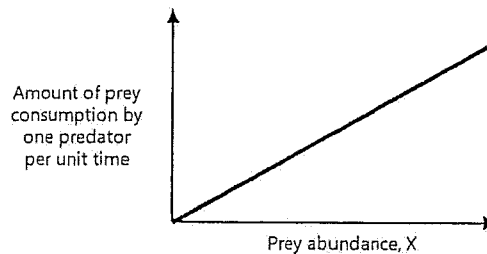
1. Read the text and select appropriate terms from the word options at the end to fill in the blanks (A)-(G). [2% for each; 14 % in total]

Consider the Lotka-Volterra predator-prey model:

$$\frac{dX}{dt} = rX(t) - aX(t)Y(t)$$

$$\frac{dY}{dt} = baX(t)Y(t) - dY(t)$$

where X and Y are the population abundance of the prey and predator, respectively. Each parameter is defined as follows: r is (A), a is (B), b is (C), and d is (D). The predator population decreases the prey abundance by  $aX(t)Y(t)$  per unit time. This means that the prey amount one predator individual can consume per unit time is  $aX(t)$ , which can be plotted against the prey abundance as follows:

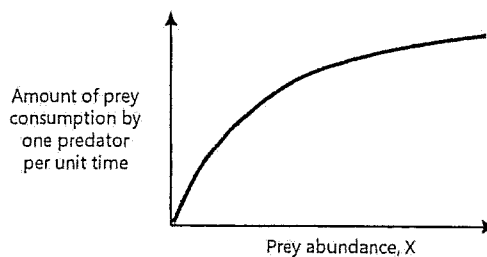


This relationship is called (E). This relationship assumes that predator individuals can eat prey as much as they find. However, this assumption is not reasonable because predators need some period of time to search, catch, and digest prey. Based on this idea, the Lotka-Volterra prey-predator model can be revised as follows:

$$\frac{dX}{dt} = rX(t) - \frac{aX(t)Y(t)}{1 + haX(t)Y(t)}$$

$$\frac{dY}{dt} = \frac{baX(t)Y(t)}{1 + haX(t)Y(t)} - dY(t)$$

where a new parameter h is called (F). Now, the relationship between the amount of prey consumption and the prey abundance becomes more reasonable as follows:



The original model is known to show ever-continuing population cycles. However, the new model doesn't do so because predators cannot effectively suppress the prey population when it is abundant. Therefore, the newly introduced parameter h acts to (G) the prey and predator populations.

**Word options:**

- (1) intrinsic population growth rate, (2) infinite population growth rate, (3) carrying capacity, (4) competition coefficient, (5) predation rate, (6) functional response, (7) density-dependent mortality rate, (8) density-independent mortality rate, (9) extinction rate, (10) colonization rate, (11) dispersal rate, (12) metabolic rate, (13) conversion efficiency, (14) assimilation efficiency, (15) handling time, (16) maturation rate, (17) species turnover rate, (18) increase, (19) decrease, (20) stabilize, (21) destabilize, (22) equalize, (23) randomize, (24) neutralize

2. Some key terms are described below. Select appropriate terms from the word options at the end to fill in the blanks (A)-(E). [2% for each; 10% in total]

- An essential aspect of biodiversity is that species contingents vary in their spatial distribution, making it necessary to explicitly consider the spatial scale at which diversity is analyzed. The most basic, local measure of diversity is (A)\_\_\_ diversity, which consists of the number of species recorded within a given locality. However, the identity of each species varies from locality to locality. Ecologists use the term (B)\_\_\_ diversity to refer to species turnover across different spatial sites. At a larger spatial scale, we observe that the turnover of species within each region determines regional diversity, which corresponds to (C)\_\_\_ diversity. In general, (B)\_\_\_ diversity is defined as (C)\_\_\_ divided by (A)\_\_\_.
- (D)\_\_\_ species are distributed on particular areas. They occur on a variety of spatial scales, from areas as large as continents to small areas as islands or mountain tops. Regions with high concentrations of (D)\_\_\_ species are called (E)\_\_\_ . The alteration or destruction of such regions would bring about the irreplaceable loss of unique products of evolution.

(adapted from Encyclopedia of Ecology, Elsevier)

**Word options:**

(1) genetic, (2) endemic, (3) ecosystem, (4) r, (5) K, (6) spatial, (7) temporal, (8)  $\alpha$ , (9)  $\beta$ , (10)  $\gamma$ , (11) x, (12) y, (13) z, (14) phylogenetic, (15) trophic, (16) functional, (17) endangered, (18) keystone, (19) engineering, (20) top predator, (21) producer, (22) protected area, (23) hot spot, (24) cold spot, (25) species origin, (26) metapopulation

3. Choose either correct one from A to D in each question [2% for each; 6% in total]

3-1. Which statement is an accurate interpretation of the outcome in a community when a major predator is removed?

- A) The remaining community adjusts and quickly becomes stable.
- B) The diversity of the community actually increases.
- C) The diversity of the community decreases since there is an increase in competition.
- D) The diversity of the community decreases because new herbivores move in.

3-2. Why do moderate levels of disturbance result in an increase in community diversity?

- A) Competitively dominant species infrequently exclude less competitive species after a moderate disturbance.
- B) Habitats are opened up for less competitive species.
- C) The resulting uniform habitat supports stability, which in turn supports diversity.
- D) Less-competitive species evolve strategies to compete with dominant species.

3-3. Which is an inappropriate statement about equilibrium model of island biogeography?

- A) Colonization rate into an island decreases with the number of species existing on the island.
- B) Extinction rate on an island increases with the number of species existing on the island.
- C) The change in community composition stops when colonization rate is equal to extinction rate.
- D) When colonization rate exceeds extinction rate on the island, then the species number will increase.

4. Distinguish the following terms: **trophic cascade**, **trophic efficiency**, and **trophic facilitation** (4% each; **12% in total**)
5. Animals may face different kinds of stress in their lives, and high blood cortisol levels are often associated with high stress. For highly social mammals in a group, (a) **which ranking of individuals** (low, medium, high) is expected to have the highest cortisol level, and **why?** (6%); among groups, (b) **which group size** (low, medium, high) is expected on average to have the highest cortisol level, and **why?** (6%) (**total 12%**)
6. (a) What is an **umbrella species** (2%), and what is a **keystone species** (2%); (b) in your opinions what species in Taiwan may be designated as an umbrella species (2%) and a keystone species (2%), and why? (3%) (**11% in total**)
7. Some animals are light-colored, some are dark. Some animals blended into background with cryptic coloration while others might produce conspicuous aposematic coloration. Many factors affect the coat or the color/pattern of animals. **In the context of ecological tradeoffs, describe how the different ecological and physiological requirements of animals affect their color/pattern appearance.** (8%)
8. Without any creditable records for roughly 40 years, the *Neofelis nebulosa brachyura* (Formosan clouded leopard; 台灣雲豹) has most likely gone extinct in Taiwan. There are conflict opinions on whether we should introduce other *Neofelis nebulosa* subspecies into the mountains of Taiwan. **In terms of ecological concepts and principles, argue both in favor and against the re-introduction of such animal.** (8%)
9. Describe the global nitrogen cycle and discuss the human impacts on the global nitrogen circulation. (7%)
10. Explain the following ecological terms. (12%; 3% each)
  - (a) stabilizing selection
  - (b) population growth curve
  - (c) net reproductive rate
  - (d) survivorship curve