題號： 96
科目：生態學(B)
節次： 6

國立臺灣大學 104 學年度碩士班招生考試試題

題號： 96
共 2 頁之第 1 頁

※ 注意：全部題目均請作答於試卷內之「非選擇題作答區」，請標明題號依序作答。

答案請填寫於試卷內，附上題號，並依序作答。可用中文或英文作答。

一、選擇題（每題 3 分，共 30 分）

Ecological niche and interspecific interaction

Ecological niche is defined as a range of environmental **(A)** and growth limiting **(B)** in which a species can maintain its **(C)**. When the ecological niche represents the potential ranges of **(A)** and **(B)**, it is called **(D)** niche. When the **(D)** niche is overlapped between two species, the interaction called 'interspecific **(E)**' can occur. In theory, for two species to coexist, the actual range of ecological niche occupied by the species is **(F)** than the **(D)** niche, which is called **(G)** niche. In theory, if the **(G)** niches are completely identical between two species, they cannot coexist, which is called **(H)**. In reality, **(I)** is often observed which relaxes the overlap of the **(G)** niches. When each of two species interacts with different specialist **(J)**, it also facilitates the coexistence despite of their identical **(G)** niche for **(B)**.

Choose the appropriate terms for **(A)-(J)** from the following candidates.

[1] competitive exclusion, [2] ecological position, [3] competition, [4] competitive replacement, [5] character displacement, [6] population, [7] overexploitation, [8] trait convergence, [9] predators, [10] resources, [11] areas, [12] realized, [13] commensalism, [14] normalized, [15] intraguild predation, [16] space, [17] conditions, [18] broader, [19] narrower, [20] fundamental, [21] free, [22] multi-dimmensional, [23] survival, [24] individuals, [25] competitive divergence, [26] parasitism, [27] constraints, [28] ecosystem, [29] mortality, [30] competitors
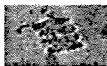
二、簡答（共 15 分）
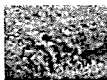
Piscivores
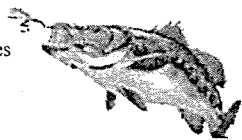
Planktivores

Zooplankton

Phytoplankton

Wastewater

a) (6 分) Based on bottom-up cascade hypothesis, draw arrows to describe changes in abundance for different trophic levels following the eutrophication of ecosystem (i.e., increased nutrient loading by wastewater).

b) (9 分) Based on top-down cascade hypothesis, draw arrows to describe changes in abundance for different trophic levels following fisheries' removal of top predators.

見背面

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三、簡答(每題 7 分，共 35 分)

a) **Biodiversity**: Biological diversity (i.e., biodiversity) is the degree of biological variations in ecosystems, accounting for multiple levels of ecological organizations. In addition to the number of species in a local community, describe two other components of biodiversity.

b) **Latitudinal diversity gradient**: As a general pattern, species richness increases from the poles to the tropics, both in terrestrial and marine ecosystems. Describe one possible mechanism to explain this pattern.

c) **Mutualism**: A famous example of mutualistic interactions is the pair of sea anemone (海葵) and anemone fish (海葵魚). Describe the benefits gained by each of two players.

d) **Ocean Acidification**: As a result of increasing atmospheric carbon dioxide, there are concerns about potential impacts of decreasing pH and associated alterations in seawater carbonate chemistry on the biogeochemical and ecological processes in the ocean. Describe one example of the potential impacts of ocean acidification on marine organisms or communities.

e) **Fishery exploitation**: It has been observed that the average body size of fish decreased in the last decades. Describe one mechanism with which fishing could result in the decline of average body size of fishes.

四、計算題(每題 10 分，共 20 分)

1. **Doubling time:** Consider an asexually-reproducing bacterial population with doubling time of 1.0 day. With the initial density of 100 cells/ml, how many days are necessary for this population to be greater than 1000 cells/ml?

2. **Natural selection:** Consider an idealized diploid population with infinite size (one locus-two allele model). Assume that the fitness (e.g. survival) of the three genotypes *AA*, *Aa*, and *aa* are 0.60, 0.90, and 1.2, and the proportions of the genotype are 0.090, 0.42, and 0.49, respectively, at the generation 0. With these settings, calculate the allele frequency of *a* at the generation 0, and the allele frequency of *a* with the random mating and natural selection at the generation 1.
Hint1: Allele frequency is the proportion of a particular allele (variant of a gene) among all allele copies being considered.
Hint 2: Fitness is the relative contribution of each genotype to the next generation (or more practically to gene pool).

試題隨卷繳回