

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(每格 3 分，共 30 分；答案請填寫於試卷內，勿於試題上作答)

1~4) The size of marine animals is usually recorded as a "standard length", an index that can be easily and accurately measured. Definitions of the standard lengths vary among species: _____ length is for a lobster; _____ length for a bivalve mollusc; _____ length for a squid; _____ length for a fish. Please fill the correct answer in the space.

- A) shell
- B) total
- C) carapace
- D) mantle

5~6) If the initial number of age 0 fish is N_0 , the number of age t fish, N_t , in the population after t years is given by the exponential decay equation: $N_t = N_0 \exp[-Zt]$ where Z is the conventional symbol for the instantaneous rate of total mortality. Instantaneous rates may be converted to annual survival rate ($S = \exp[-Z]$) and mortality rate ($D = 1 - \exp[-Z]$)

Based on the above definition:

Z value _____ one;

- A) should be equal to
- B) could not larger than
- C) could be larger than

D value _____ one;

- A) should be equal to
- B) could not larger than
- C) could be larger than

7) The _____ of fishing gear in relation to a particular species is often examined by means of a graph which relates the probability of capture to fish size.

- A) mortality
- B) selectivity
- C) availability

8) Stock-Recruitment Relationship describes the concept that the number of recruitment entering a population is related to the spawning stock size. Which definitions of the recruitment is not correct?

- A) Number of egg spawned by all matured females
- B) Age 1 fish
- C) The smallest category of age or size in the survey gear

9~10) In the expected Stock-Recruitment Relationship.

_____ model assumes that mortality rate of eggs and juveniles is proportional to the initial stock size;

- A) Beverton-Holt
- B) Gompertz
- C) Ricker

_____ model assumes that survival depends upon the density of the cohort at any time

- A) Beverton-Holt
- B) Gompertz
- C) Ricker

見背面

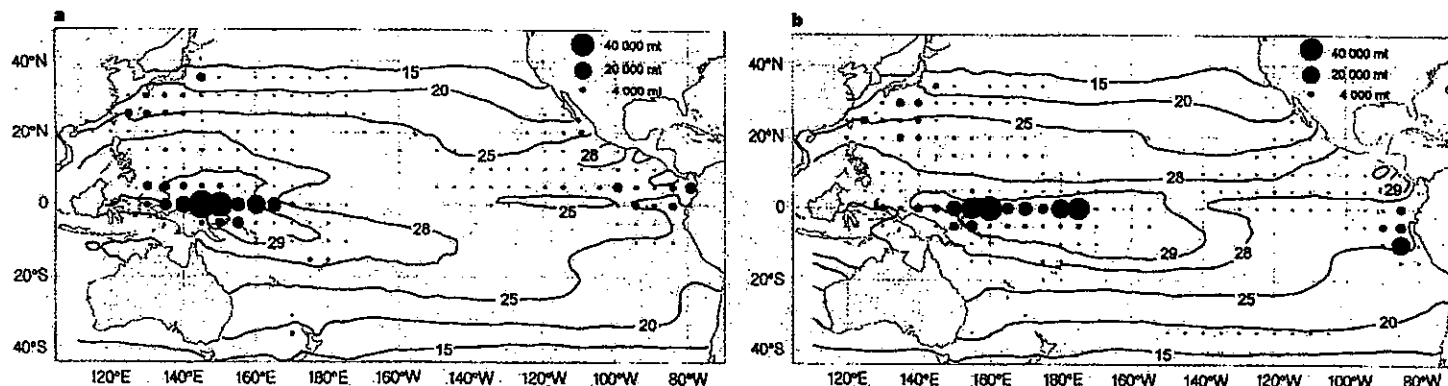
二、解釋名詞(每題 5 分，共 25 分)

- 1) Otolith Ageing
- 2) Exclusive Economic Zone
- 3) Fisheries Assessment
- 4) Fishing Effort
- 5) Marine Protected Areas

三、簡答及計算題(共 45 分)

1) (10 分) Due to the overexploitation of the world's fisheries in the 1980s, many fish stocks have experienced severe declines in abundance. Based on the concept of "Allee effect", what is your expectation of the rate of increase for the exploited fish populations?

2) (10 分) The following figures show two years of data on the distribution of skipjack tuna catch (black circles, unit in tonnes) and mean sea surface temperature (SST, black contours, unit in °C) in the Pacific Ocean. a, In the first half of 1989 (La Niña period). b, In the first half of 1992 (El Niño period). Please describe the El Niño Southern Oscillation (ENSO) and explain how climate variability affects the fish distribution based on these figures.



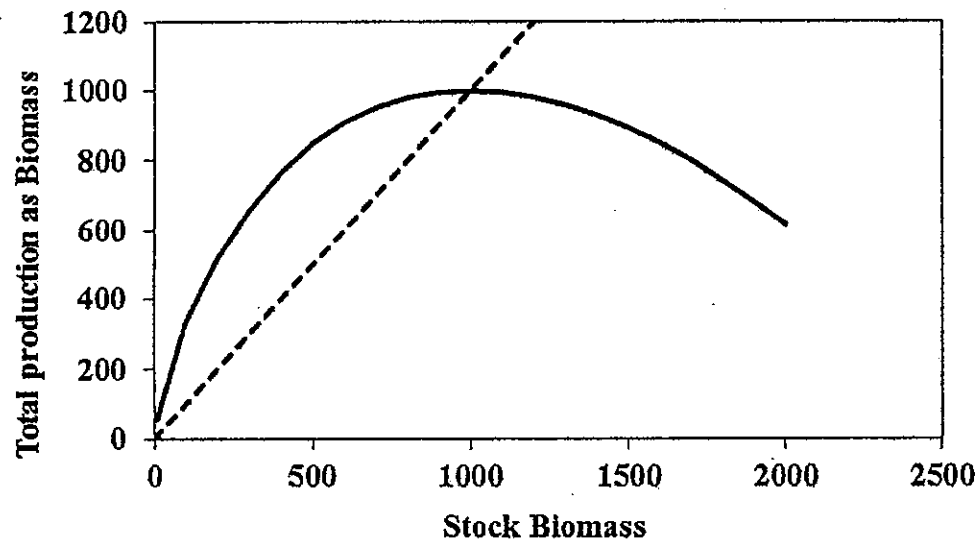
3) (15 分) Beverton and Holt (1956) suggested the following relationship between total mortality, Z and mean length:

$$Z = K \left[\frac{(L_{\infty} - \bar{L}_c)}{(\bar{L}_c - L_c)} \right]$$

where L_c is the mean length at first capture, and \bar{L}_c is the mean length of fish in the catch. One species has a growth coefficient of $K = 0.1 \text{ yr}^{-1}$, asymptotic length of $L_{\infty} = 40 \text{ cm}$, and $L_c = 10 \text{ cm}$ by the fishery. What are the total mortality rates (Z) for a heavily exploited fish stock with $\bar{L}_c = 15 \text{ cm}$ and a lightly exploited stock with $\bar{L}_c = 20 \text{ cm}$? Please explain why there is a decrease in the mean length of fish in the catch as a fish stock becomes more heavily exploited.

4) (10 分) Schaefer (1957) applied the logistic curve as a description of the production to eastern Pacific yellowfin tuna. In the figure below, the solid curve describes total production for a fish stock, and the diagonal dashed line is the line of replacement. Please draw two lines on this figure to indicate 1) the stock biomass equivalent to the carrying capacity, and 2) the stock size that achieves the maximum surplus production, respectively.

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試題隨卷繳回