

可以使用有對數和指數的計算器；可以使用中文或英文回答。

1. (a) A certain mortality causes 25 percent of the population to die each year; what percentage of the initial population is left after 2 years? What is the corresponding instantaneous mortality coefficient?
(b) Two causes of mortality act independently on a population; alone they would cause respectively 20 percent and 30 percent of the population to die within a year. What is the percentage that does die? What is the corresponding instantaneous mortality coefficient? (20 points)
2. What is the "Allee effect"? Is there any relationship between "Allee effect" and "compensation"? (20 points)
3. Please follow the definition of "overfishing" and "overfished", and the description:
Stock assessments attempt, in part, to determine whether overfishing is occurring and whether a stock is in an overfished state. While the two concepts are obviously related, they are not identical. Overfishing occurs when the fishing mortality rate (F) is greater than the fishing mortality threshold ($F_{\text{threshold}}$). A stock is overfished when the stock size (B) falls below the stock size threshold ($B_{\text{threshold}}$).
Then, the biological reference points of current stock size (B), ($B_{\text{threshold}}$), fishing mortality rate (F) and ($F_{\text{threshold}}$) were estimated. Please complete the blanks (i), (ii), (iii) and (iv) to conclude the stock states under the available condition in the following table:

	$F \geq F_{\text{threshold}}$	$F < F_{\text{threshold}}$
$B < B_{\text{threshold}}$	(i)	(ii)
$B \geq B_{\text{threshold}}$	(iii)	(iv)

(20 points)

4. Consider a fishery on a stock for which it is assumed that:

$$\text{Equilibrium yield : } D, \bar{B} = r\bar{B}\left(1 - \frac{\bar{B}}{B_{\infty}}\right).$$

The fishery receives gross revenue equal to $\alpha(\text{CATCH})$ and has costs which are a linear function of effort, say $af + b$. Find the level of \bar{B} which maximizes equilibrium net revenue (gross revenue - cost). How does this value of \bar{B} compare to maximum sustainable yield level with the same model? (20 points)

5. What is the "virtual population", "real cohort" and "pseudo-cohort"? State what happens with that the stock is under variable recruitment? (20 points)