

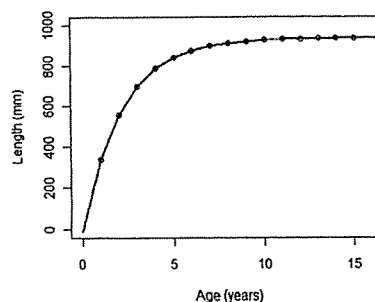
答案請填寫於試卷內，附上題號，並依序作答。可用中文或英文作答。

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）

a) Growth determines the likelihoods of feeding, survival, and reproduction, thus is an important characteristic for individuals and species. Many invertebrates, plants, and fishes display [A] growth, where an organism grows throughout its life. At young ages, growth rates are relatively [B]; upon maturation, growth will [C]. The [D] is a common function for modeling growth trajectories for a variety of species. This model has three parameters: [E], Brody growth coefficients (k), and an intercept (t_0). The figure below shows a model fit of growth data for a fish population.

b) The rates of body growth and maturation schedules are under strong influences of environmental conditions, such as temperatures. For fish, warm temperatures tend to induce relatively fast growth rates and [F] maturation schedules, which, in turn would lead to a relatively short [G] and high [H].

c) At a relatively high density, growth rates tend to decrease due to [I] for food or space and maturation schedules tend to be delayed. This is known as the [J] effects.



Choose the appropriate answers for [A]-[J] from the following candidates.

(1) generation time, (2) maximum length, (3) determinate, (4) late, (5) von Bertalanffy growth model, (6) decrease, (7) competition, (8) environmental stochasticity, (9) indeterminate, (10) maximize, (11) Gompertz growth model, (12) demography, (13) population growth, (14) climate variability, (15) fast, (16) exponential, (17) sharing, (18) regulation, (19) smooth, (20) stop, (21) linear growth model, (22) asymptotic length, (23) reproduction, (24) density-dependent, (25) logistic model, (26) population variability, (27) density-independent, (28) minimum length, (29) early, (30) random.

二、簡答題(每題 6 分，共 30 分)

a) **Fishing gears:** Different fishing gears involve different operation techniques; e.g., there are “active” vs. “passive” devices. Give 2 common fishing gears and describe the operation techniques and size-selectivity of these gears.

b) **Methods for identifying population units:** A population is a unit of management of fisheries. Consequently, it is important to explore different population units of a species within a region. Describe 2 approaches that allow identifying population units.

c) **Food webs:** Food webs represent the feeding relationships among different organisms. Suppose a marine food web comprises primary producers (e.g., phytoplankton), primary consumers (e.g., zooplankton), secondary consumers (e.g., planktivore fish), top predators (e.g., piscivore fish), and fisheries, describe how does the food web dynamics influence fisheries production.

見背面

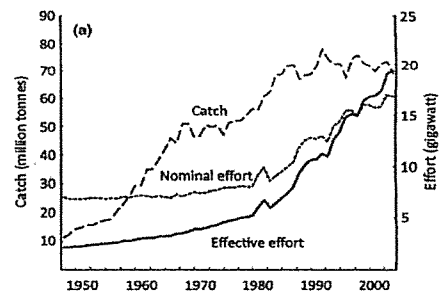
d) **Size truncation:** Sizes of catch for many exploited species are found to decrease over time. Describe 2 mechanisms via which fishing can cause decreases in sizes of fish.

e) **Indirect anthropogenic effects:** Beside fishing, describe 2 examples of how human activities can cause negative impacts on fisheries populations.

三、問答及計算題

a) (10 分) Describe 2 life history characteristics for the r- vs. K-selected fish species and give 1 representative species for the r- and K-types. Which life history type is more vulnerable under fishing exploitation? Provide reasons to support your answer.

b) (4 分) The figure below shows global trends of fisheries catch and effort (measured in fishing power: watts) based on data from the United Nations Food and Agriculture Organization (UN FAO; data source: Watson et al. 2013). Given the temporal patterns of catch and effort, what is the temporal trend of the resource level (indexed by catch-per-unit-effort, CPUE)?



c) (6 分) Regarding b), based on your description of the trends of fisheries resource level, does it make sense to increase fishing effort? What are the potential drivers of increasing fishing effort?

d) (6 分) Fishing can potentially cause changes in food web dynamics. A distinctive example is the “fishing down marine food webs” by Pauly et al. (1998). Describe 2 potential mechanisms of fishing effects on marine food webs.

e) (4 分) Regarding d), a management option for mitigating fishing effects on a marine community involves establishing marine protected areas (MPA). Give an example of MPA and describe how MPA help to restore fisheries resources.

接次頁

f) (10 分) The table below describes age-specific abundance (N), mean length, mean weight, and gonadosomatic indices (GSI) of a fish population. The GSI is the ratio of gonad weight to body weight. Use this table to calculate the gonad weight and gonad biomass (=gonad weight * abundance) of different ages, and determine the total gonad biomass of the population.

Age	N	Length (cm)	Weight (kg)	GSI	Gonad weight (kg)	Gonad biomass (kg)
1	10000	33	0.29	0		
2	4274	45	0.75	0.08		
3	1827	55	1.37	0.16		
4	781	63	2.07	0.22		
5	334	70	2.8	0.25		
6	143	75	3.51	0.27		
7	61	80	4.17	0.27		
8	26	83	4.77	0.28		
9	11	86	5.3	0.29		
10	5	89	5.77	0.28		

Sum = _____

試題隨卷繳回