

國立中山大學八十八學年度碩博士班招生考試試題

科目：普通生物學(海洋生物所)

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I. Choose one answer to each question. (20%)

1. Worldwide, the amount of stratospheric ozone is (a) increasing (b) remaining the same (c) decreasing (d) exponentially increasing (e) none of the above.
2. Energy flow through an ecosystem is (a) in a linear direction (b) from the sun to producer (c) from the producer to consumer (d) from the consumer to decomposer (e) all of the above.
3. The species with "r" life history strategy often has (a) large body size (b) long life span (c) low growth rate (d) one reproduction during lifetime (e) all of the above.
4. Fertilization in humans generally takes place in the (a) cervix (b) endometrium (c) oviduct (d) vagina (e) ovary.
5. The change in communities over time is known as (a) evolution (b) succession (c) character displacement (d) symbiosis (e) competition.
6. The process of an animal regulates its fluid content is (a) thermoregulation (b) electricoregulation (c) glucoregulation (d) osmoregulation (e) endoregulation.
7. The senses of taste and smell depend upon (a) mechanoreceptors (b) chemoreceptors (c) photoreceptors (d) thermoreceptors (e) electroreceptors.
8. Animals that have pharyngeal gill grooves at some time in their life cycle are (a) bony fishes (b) amphibians (c) reptiles (d) birds (e) all of the above.
9. Red tides are caused by population explosions of (a) euglenoids (b) foraminiferans (c) dinoflagellates (d) water molds (e) diatoms.
10. Mushroom is a kind of (a) fungi (b) viruses (c) bacteria (d) protists (e) plantae.
11. DNA differs between/among species is in its (a) order of base pairs (b) types of sugars in the nucleotides (c) chemical bonds between base pairs (d) phosphate numbers (e) histone structure.
12. If two heterozygous organisms are crossed, and the trait being studied displays complete dominance, the type of phenotypic ratio in the offspring is (a) 2:2 (b) 1:2:1 (c) 3:1 (d) 9:3:3:1 (e) 6:6:3:1.
13.  $A \xrightarrow{\text{Enzyme 1}} B \xrightarrow{\text{Enzyme 2}} C \xrightarrow{\text{Enzyme 3}} D$ , As a result, Enzyme 1 is inhibited. This is a (a) competitive inhibition (b) irreversible inhibition (c) feedback inhibition (d) hydrolytic inhibition.
14. Cellular components that contain digestive enzymes are (a) lysosomes (b) mitochondria (c) cilli (d) cell wall (e) nucleolus.
15. Cells help maintain appropriate pH by using (a) nonelectrolytes (b) buffers (c) salts (d) organic compounds (e) trace metals.
16. Essential elements for organism survival are (a) oxygen (b) iodine (c) calcium (d) zinc (e) all of the above.
17. Water (a) has a weak surface tension (b) exists with four forms (c) density is greatest at 4°C (d) is non-polar molecules (e) none of the above.

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18. Bacteria and fungi function ecologically as (a) producers (b) consumers (c) autotrophs (d) heterotrophs (e) decomposers.
19. The *Paramecium* is a (a) multicellular plant (b) multicellular animal (c) single-celled plant (d) single-celled animal (e) none of the above.
20. Fleming was able to discover penicillin because (a) the penicillin mold was not in his culture dish (b) he observed that bacterial colonies did not grow near the mold (c) he was a physiologist (d) he cultured fungi (e) he did not clean his petri dish.

II. Choose one answer to each question. (80%)

1. An increase in body temperature above the normal range will result in (a) vomit (b) decrease circulation of blood in the skin (c) blood vessels dilation (d) talktive (e) all of the above.
2. The binomial system of nomenclature is (a) the Sowerby system (b) a species basic unit (c) established in the 19th century (d) used in Canada (e) all of the above.
3. The energy currency of the cell is (a) maltose (b) protein (c) steroid (d) DNA (e) ATP.
4. Biological membranes contain (a) proteins (b) phospholipids (c) glycoproteins (d) cholesterol (e) all of the above.
5. The formation of ATP is a (a) mammal energy transformation reaction (b) dephosphorylation reaction (c) extracellular reaction (d) hydrolysis reaction (e) none of the above.
6. (a) Enzymes are organic catalysts (b) Most enzymes are highly specific (c) Many enzymes require cofactors (d) Enzymes can be denatured (e) all of the above.
7. According to the chemiosmotic model, (a) energy from the electron transport chain is used to pump electrons across the inner mitochondrial membrane (b) protons accumulate in the intermembrane space between the two mitochondrial membranes (c) ATP is synthesized when electrons flow through the inner mitochondrial membrane (d) ATP synthetase accumulates in the mitochondrial matrix (e) none of the above.
8. The part of photosynthesis that actually produces glucose is (a) noncyclic photophosphorylation (b) cyclic photophosphorylation (c) light-dependent reactions (d) the Calvin cycle (e) photochemical reaction.
9. Meiosis has (a) one nuclear division (b) diploid number of chromosomes (c) usually without crossing-over (d) two nuclear division (e) none of the above.
10. Down syndrome is (a) a X-linked inheritance (b) absence of melanin (c) a non-genetic disease (d) a plant disease (e) caused by the abnormality in chromosome number.
11. A sequence of triplets in DNA -AAA-CGG-TAC- corresponds to what sequence

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of codons in mRNA ? (a) -TTT-GCC-ATG (b) -UUU-GCC-AUG- (c) -UUU-TAA-CTG- (d) -TTT-TAA-GCT- (e) -UUU-ATT-CGT.

12. Gene regulation in prokaryotes primarily involves control of (a) translation (b) post-translational processing (c) transcription (d) mRNA processing (e) none of the above.

13. The polymerase chain reaction (a) cleaves DNA at specific nucleotide sequences (b) splices DNA fragments together (c) makes a cDNA complementary to mRNA (d) uses a tiny amount of DNA to make millions of copies in a test tubes (e) reconnects DNA fragments together.

14. Which is involved in Darwin's theory of evolution (a) survival to reproduce (b) variation (c) inheritance of genetic traits (d) limits on population growth (e) all of the above.

15. Which of the following causes changes in allele frequencies ? (a) mutation (b) natural selection (c) genetic drift (d) gene flow from migration (e) all of the above.

16. Macroevolution is (a) a slowly divergent event (b) concerned with large phenotypic changes above the species level (c) a continuous and constant process (d) supported by many transitional forms of species (e) all of the above.

17. Evolutionary trend in plants is toward (a) dominant gametophyte generation (b) naked seeds (c) with vascular tissues (d) fertilization mediated by water (e) all of the above.

18. The body cavities in animals of nematode, flatworm and fish are (a) pseudocoelomate, pseudocoelomate, coelomate (b) pseudocoelomate, coelomate, coelomate (c) coelomate, pseudocoelomate, coelomate (d) pseudocoelomate, coelomate, acoelomate (e) pseudocoelomate, acoelomate, coelomate.

19. Storage, secretion, and photosynthesis are the functions of (a) periderm (b) parenchyma tissue (c) sclerenchyma tissue (d) collenchyma tissue (e) stomata.

20. Stomatal opening and closing is controlled by the movement of (a) K ions (b) Na ions (c) Mg ions (d) Cl ions (e) Ca ions.

21. Water enters the roots of plants by the process of (a) guttation (b) pressure flow (c) osmosis (d) active transport (e) facilitate transport.

22. Place the following events in the correct order, starting with pollination. (1) pollen tube grows into ovule (2) insect lands on flower to drink nectar (3) embryo develops within the seed (4) fertilization occurs (5) pollen carried by insect drops onto stigma. (a) 1-2-3-4-5 (b) 2-4-5-3-1 (c) 3-1-4-2-5 (d) 2-5-1-4-3 (e) 2-5-4-3-1.

23. Muscle contraction is (a) energy independent (b) sodium-activated actin involved (c) activated by nerve impulse (d) complete by cross linkage (e) none of the above.

24. Which of the following contribute to the resting potential of the neuron ? (a) presence of anions inside the cell (b) sodium-potassium pumps (c) outward

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diffusion of potassium ions (d) non-diffusible negatively charged large molecules (e) all of the above.

25. During clotting, fibrinogen is converted to fibrin by the action of (a) K ions (b) lymphocytes (c) thrombin (d) leukocytes (e) globulins.

26. Cells that are important for a secondary response to occur are (a) helper T cells (b) suppressor T cells (c) cytotoxic T cells (d) memory cells (e) B cells.

27. In humans, carbon dioxide is mainly transported as (a) CO<sub>2</sub>-hemoglobin (b) bicarbonate ions (c) monocarbonate ions (d) CO<sub>2</sub> (e) none of the above.

28. The structure where filtration takes place is the (a) loop of Henle (b) urethra (c) Bowman's capsule (d) ureter (e) proximal tubule.

29. ADH acts on the (a) collecting ducts (b) cortex (c) glomerulus (d) ureter (e) Bowman's capsule.

30. Hormone secretion is regulated by (a) positive-feedback mechanisms (b) negative-feedback mechanisms (c) corepressor mechanisms (d) repressor mechanisms (e) operator mechanisms.

31. Which of the following is responsible for secondary sexual characteristics in the female? (a) testosterone (b) progesterone (c) FSH (d) estrogens (e) HCG.

32. Maternal and fetal blood normally (a) do not mix (b) mix only in the placenta (c) mix throughout the maternal and fetal circulations (d) flow together only in the umbilical capillaries (e) mix only the allantois.

33. Chemical signals that convey information between members of a species are (a) hormones (b) pheromones (c) neurotransmitters (d) photodetectors (e) amino acids.

34. The maximum rate of a population could increase under ideal conditions is known as (a) carrying capacity (b) fertility (c) biotic potential (d) zero population growth (e) climax.

35. A harmless or edible species resembles another species that is harmful or distasteful is known as (a) batesian mimicry (b) symbiosis (c) mullerian mimicry (d) commensalism (e) predation.

36. The greenhouse gas is (a) CO<sub>2</sub> (b) CFC (c) CH<sub>4</sub> (d) O<sub>3</sub> (e) all of the above.

37. Although there are many reasons for declining biological diversity, the most important one is (a) sport hunting of animals (b) habitat loss (c) pollution of aquatic ecosystems (d) pest and predator control (e) greenhouse effect.

38. Current models predict that a doubling of atmospheric CO<sub>2</sub> will cause an increase in worldwide temperature (°C) of (a) 2-5 (b) 5-10 (c) 10-15 (d) 15-20 (e) 20-25.

39. Effective methods of birth control include (a) hormonal contraceptives (b) intrauterine devices (c) condoms (d) sterilization (e) all of the above.

40. An individual that can produce both eggs and sperm is known as (a) parthenogenesis (b) diecious (c) hermaphroditic (d) fragmentation (e) budding.

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科目：動物生理學 (海生所 選考)

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壹、解釋名詞 (每題 3 分)

1. oxidative phosphorylation
2. essential amino acid
3. blood-brain barrier
4. inhibitory postsynaptic potential
5. spatial summation
6. positive feedback
7. down regulation
8. major histocompatibility complex
9. countercurrent multiplier system
10. excitation-contraction coupling

貳、問答題 (每題 7 分)

1. Define and differentiate between molar concentration and osmolar concentration.
2. Differentiate between nicotinic receptors and muscarinic receptors.
3. Describe the resting membrane potential and the potassium equilibrium potential, and give the reason why they are not the same.
4. Contrast "long-loop" with "short-loop" negative feedback in the control of hormone secretion.
5. Describe the role of calcium and the role of regulator proteins, troponin, and tropomyosin in contraction.
6. Compare the effects of arterial oxygen and carbon dioxide on ventilation.
7. Describe the neural reflex pathway by which GRF is regulated.
8. Describe the role of the sympathetic nervous system in the regulation of plasma glucose and fatty acid concentrations.
9. Describe the location and list the functions of the Sertoli cells.
10. State the functions of the lymph nodes, spleen and the thymus.

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科目：普通植物學 (海生所選考)

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A. EXPLANATION: (90%)

1. cell (3%)
2. cell wall (3%)
3. chloroplast (3%)
4. ion channel (3%)
5. compartmentation (3%)
6. photosynthesis (3%)
7. photosynthetic pigments (3%)
8. accessory pigments (3%)
9. Rubisco (3%)
10. phytochrome (3%)
11. tropism (3%)
12. limiting factor (3%)
13. essential nutrient (3%)
14. growth curve (3%)
15. life cycle (3%)
16. enzyme and its kinetic properties (3%)
17. *in vivo* and *in vitro* (3%)
18. signal transduction and second messenger (3%)
19. plant communication (3%)
20. stress and adaptation (3%)
21. higher plants (3%)
22. halophyte (3%)
23. seaweed (3%)
24. opportunistic algae (3%)
25. genomic DNA (3%)
26. PCR (3%)
27. gene knock out (3%)
28. electrophoresis (3%)
29. protoplast (3%)
30. electronic Journal (3%)

B. If you get a "thing" from deep sea (on earth), what are the steps you will take to show whether it is some kind of plant life belonging to earth? (10%)

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科目：生態學 (海生所選考)

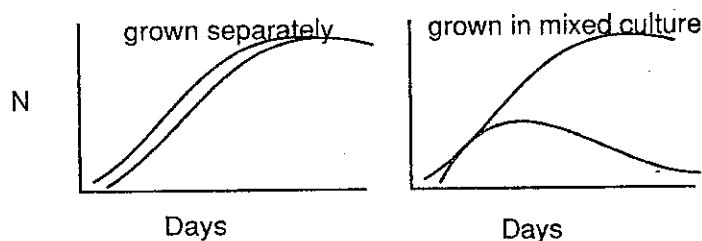
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Choose one most appropriate answer for question 1-36 (2% each).

1. Overweight and underweight new birth have higher mortality rates than those with median weights. This is a form of a) directional selection b) stabilizing selection c) disruptive selection d) kin selection e) group selection

Communities	Abundance of Species				
	J	K	L	M	N
a)	100	100	100	100	0
b)	300	33	33	33	0
c)	80	80	80	80	80
d)	200	200	0	0	0
e)	1500	150	15	1	0

2. Which of the above communities has the highest species richness  
 3. Which of the above communities has the highest species diversity  
 4. "Green house effect" is least related to a) [CO<sub>2</sub>] increase in the atmosphere b) fossil fuel burning c) deforestation d) hydrofluoro-carbon release e) CH<sub>4</sub> increase in the atmosphere  
 5. Demography is the study of a) soil composition and chemistry b) bacterial composition and actions c) plant dispersal and speciation d) population structure and dynamics e) community structure and succession  
 6. The big-bang reproduction of salmon is referred to as a) semelparity b) iteroparity c) pleiotropy d) epistasis e) allochthonous  
 7. Adaptive radiation has nothing to do with a) divergence of species b) radio isotope c) niche separation d) speciation e) natural selection  
 8. a) Detritus food chain b) Herbivorous food chain c) Assimilatory food chain d) Pyramidal food chain e) Longitudinal food chain is the major pathway of energy flow in most terrestrial ecosystems  
 9. Which of the following is likely to accumulate in the food chain a) energy b) nutrient c) heavy metals d) glucose e) H<sub>2</sub>O  
 10. Which of the following energy source in nature does not necessarily originate from the sun a) coal b) petroleum c) wood d) glucose e) beef and pork (hint: deep thermal vent)



11. The above figures are related to a) Gause's law b) Morgan's discovery c) Darwin's finches d) Fisher's rule e) Hutchinson's ratio  
 12. The organisms used in the above experiment were two species of a) Paramecium b) Drosophila c) birds d) Tilapia e) Calanus

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科目：生態學

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13. The above experiment led to the formulation of a) competitive exclusion principle b) survival of the fittest c) particulate inheritance d) biological magnification e) ecological efficiency f) all above
14. The difference in assumption between the logical growth curve and the exponential growth curve is a) presence/absence of predators b) dependence/independence of growth rate on density c) 0/1 as the initial number d) high/low carrying capacity e) large/small size of organism
15. a) R b) K c) C d) X e) E is conventionally used to represent the biological carrying capacity
16. Huffaker's experiments involving oranges, rubber balls and different species of mites were used to elucidate a) the exponential growth curve b) prey-predator relationship c) principle of competitive exclusion d) 3-dimensional niche overlap e) climax f) none above
17. Courtship happens between a) parents and offspring b) brothers and sisters c) predator and prey d) opposite sexes of the same species e) different species exploiting the same resource
18. Using ABO blood types as a criteria, human populations are a) monomorphic b) polymorphic
19. The effect of inbreeding at the population level is a) eliminating bad allele b) eliminating good allele c) increasing homozygosity d) increasing heterozygosity e) all above f) none above
20. Which of the following is the best indicator of primary productivity a) standing crop b) total biomass c) length of food chain d) chlorophyll a content e) light intensity f) carbon content
21. "Succession" is a term often used in a chapter about a) selection and adaptation b) population dynamics c) community organization d) species interaction e) evolution
22. The most important mechanism behind "character displacement" is a) predation b) competition c) parasitism d) symbiosis e) decomposition
23. "Changes in populations characteristics over a geographic area, usually related to a corresponding environmental change" is referred to as a) climax b) coexistence c) coevolution d) continuum e) cline f) convergent evolution
24. An endemic species is one that a) lives inside the guts of its host b) parasitize the skin of its host c) is confined to a certain geographic region d) specializes to a narrow niche e) lives for a short period
25. "Functional response" is a term dealing with a) mating courtship b) acclimation c) searching image d) prey density change e) parasitic infestation
26. Migration and spore/seed dispersal may have the same function in a) gene flow b) genetic drift c) genetic feedback d) genetic load e) genetic assimilation
27. Eutrophication is likely to occur in a) high mountains b) lake c) open ocean d) desert e) the Arctic



28. A hermaphrodite a) lives for a long time b) has the reproductive organs of both sexes c) is heterozygote of all its loci d) reproduces earlier in the reproductive season than other individuals e) produce offspring of two kinds
29. Competition is the highest between a) individuals of the same population b) individuals of the same species c) individuals in different species of the same genus d) individuals in different phylum e) all the same
30. Sibling species a) interbreed in nature b) look the same c) have distant evolutionary relationship d) are results of convergence e) all above
31. Spring overturn occurs in a a) rain forest b) boreal forest c) temperate lake d) river e) desert

California sea otter

The sea otter was hunted by fur traders to near extinction by 1900. The few remaining populations were protected by international treaty in 1911, and the California sea otter was believed to be extinct at that time. In 1914 a small population was discovered at Point Sur in central California. Since then, otters have increased in numbers and expanded their geographic range to reoccupy areas from which they had been exterminated in the nineteenth century. The rate of spread of the sea otter is easy to estimate because it lives along the coastline in a linear habitat. The southern range expanded 3.1 kilometers per year between 1938 and 1972, and the northern range expanded 1.4 kilometers per year. These differences could result from the southern otters moving more as individuals, or the northern otters suffering more mortality (excerpted from Krebs, 1994).

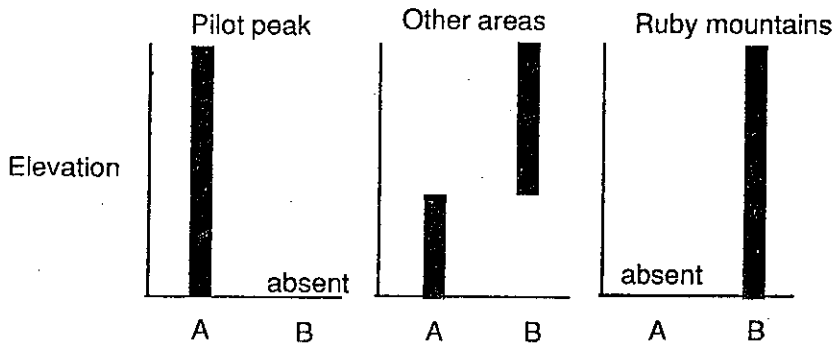
32. Recolonization of California coast by sea otters may be called a) diffusion b) jump dispersal c) secular dispersal d) osmosis e) none above
33. It is legal to hunt sea otters a) outside of California b) outside of USA c) outside North America d) after 1972 e) before 1911
34. Which of the following is not among the diet of sea otters a) sea urchins b) abalones c) fishes d) macroalgae e) shell fishes
35. Sea otters are a) reptiles b) fishes c) mammals d) crustaceans e) birds
36. Which of the following organizations (or agencies) aims to conserve biological species a) OPEC b) NATO c) CITES d) APEC e) NSF f) MOEA

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37. The above figures are ranges of distributions of two species of chipmunks, *Eutamias dorsalis* (A) and *E. umbrinus* (B) in three areas of the Great Basin area of Nevada (Data from Hall, E.R., 1946). What is your story? Write a short essay explaining the possible mechanisms causing the pattern. (5%).

	Plot 1		Plot 2	
	Sparrow/acre	Sawfly/acre	Sparrow/acre	Sawfly/acre
1955	-		3.2	235000
1956	-		2.9	33400
1957	1.4	21387700	2.3	40000
1958	0.5	879400	2.5	41200
1959	0.4	437800	2.2	27300
1960	0.2	354300	2.2	54600
1961	0.5	199900	2.3	15000
1962	1.1	191800	5.0	3200
1963	0.2	366800	0.3	3900

38. The above table is the number of sparrow and its prey in Manitoba (Buckner and Turnock, 1965). Do a simple analysis of your choice and draw a conclusion. (10%)

39. Describe a published ecological study in Taiwan and mention the following: Aim of the study, hypotheses to be tested, brief description of the method, major results, significance of the study, persons and institutions carrying out the study, journal of the publication. (13%)

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科目：水產生物學 (海生所選考)

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水產生物學

甲. 是非題 (請以 "T" 表示 "是", 以 "F" 表示 "非") (30分)

(每小題三分, 答錯倒扣一分)

1. \_\_\_\_\_ 漁業資源研究一定要先鑑定好生物物種之後才有可能進行。
2. \_\_\_\_\_ 高緯度海域的魚群種類通常較低緯度海域為多。
3. \_\_\_\_\_ 一般上濾食性生物資源比其它生物更容易受到環境污染的影響。
4. \_\_\_\_\_ 熱帶海域的魚類由於生長快速, 其年齡形質比較不容易辨認。
5. \_\_\_\_\_ 浮游性魚種通常產卵很多, 是爲了適應海洋中比較多變化的環境。
6. \_\_\_\_\_ 所謂單位魚群 (unit stock) 是指作爲資源管理對象且具有生物學上相似性的魚群。
7. \_\_\_\_\_ 水產生物產量由低至高的順序爲: 外洋, 湧昇流區, 河口, 大陸棚。
8. \_\_\_\_\_ 體型長大至可被網具捕撈時的魚群就稱爲進入了補充群。
9. \_\_\_\_\_ 底棲性魚類的生殖策略比較傾向於  $r$  選擇。
10. \_\_\_\_\_ 單位努力漁獲量 (CPUE) 愈大通常表示投入之作業時間愈少。

乙. 問答計算題

1. 請說明甲殼類水產動物的生物特性。(15%)
2. 何謂深散射層 (DSL) (deep scattering layer)? 與漁業有何重要之關聯? (15%)
3. 假設某魚群自滿二歲起平均每年自然死亡率 25%, 現在池中放養二歲魚 10,000 尾。如果均無生殖及漁獲行爲, 則兩年半 (30個月) 後清池魚數應爲多少?  
(必須以算式寫出各推算步驟) (15%)
4. 請以台灣漁業爲例, 在下面四大類水產生物中各舉出一種漁業並說明有關之內容, 包括魚種、漁具漁法、魚群分布狀況等。  
    遠洋漁業真骨魚類  
    近海漁業頭足類  
    近海漁業甲殼類  
    沿岸養殖漁業軟體動物 (25%)