



## 考察岩岸生態系統 Study of Rocky Shore Ecosystem

姓名Name: \_\_\_\_\_ 組別Group: \_\_\_\_\_ 日期Date: \_\_\_\_\_

### 學習目標 Learning goals:

完成課程後，學生應能 After the course, students should be able to:

1. 辨認在岸岩常見的生物，並將其分類 Classify and identify organisms commonly found in a rocky shore habitat,
2. 觀察生物如何適應環境 Observe how organisms adapt to the physical environment,
3. 識別生態系統中生物與生物及生物與環境之間的關係 Distinguish interrelationships between living organisms in an ecosystem,
4. 在岩岸量度和記錄非生物因素 Record and measure abiotic factors in a rocky shore ecosystem,
5. 使用簡單取樣工具 Use simple sampling tools,
6. 在實驗室執行簡單水質測試 Do simple chemical analysis of water sample in the laboratory,
7. 組織和分析數據作簡報之用 Analyze and organize data for presentation,
8. 與他人合作進行科學探究 Cooperate with others for conducting a scientific investigation,
9. 欣賞自然，尊重生物 Appreciate nature and respect living things.

### 程序 Schedule

9:00 - 10:00	簡介 Briefing
10:30 - 12:30	野外考察 Field work
13:00 - 14:00	午膳 Lunch
14:00 - 14:50	實驗與數據分析 Lab. work & Data analysis
14:50 - 15:30	準備匯報 Prepare presentation
15:30 - 16:30	匯報與總結 Presentation & summary

### 儀器和工具 Equipment and tools

1	寫字夾板 Clipboard (x1)	9	光照度計 Light meter(x1)
2	膠整理盤 (x1) Plastic sorting tray	10	取水樣瓶 (x1) Water sampling bottle
3	電子溫濕計 (x1) Digital thermohygrometer	11	生物圖錄 (x1) Wildlife Pictorial Guide
4	電子風速計 (x1) Digital anemometer	12	《岩岸生物》(x1) Hard Shore Organisms
5	小鏟 Trowel (x2)	13	《岩岸》Rocky Shore (x1)
6	鑷子 Forceps (x2)	14	手套 Cotton gloves (x2)
7	指南針 Compass (x1)	15	尼龍線 Nylon thread (x1)
8	樣方 Quadrat 0.5x0.5M (x1)	16	30米卷尺 30M Measuring tape (x1)

### 衣著 Clothing:

1. 穿著長袖上衣和長褲能更有效防止蚊蟲叮咬，亦可減低被太陽曬傷的機會，不應穿著短褲。 Long-sleeved shirt and trousers for better protection against mosquito and insect bites, as well as preventing sunburn. Shorts are not recommended.
2. 不應穿著拖鞋或涼鞋，而應穿著運動布鞋。 A pair of shoes for preventing injuries. Slippers and sandals are not recommended.

### 安全 Safety:

1. 要注意安全，不要在斜度大、落差大和海浪衝擊大的岩岸進行考察。不准涉入水中進行戲水或暢泳等活動。 Beware of your own safety, avoid the steep slopes, elevated rocks and wave impounding areas for field study. Never go into the water for swimming and other activities.
2. 小心石面濕滑，慢步踏穩基石行走。 Beware of the slippery rock surface. Move slowly and try footing for each step.
3. 小心邊緣銳利的石蠔和藤壺，可致嚴重割傷。 Beware of the sharp edges of rock oysters and barnacles which can cause serious wound.

長袖上衣  
Long-sleeved shirt

長褲 Trousers

運動布鞋  
Plimsolls



## 1. 岩岸生境辨別 Identifying rocky habitat

考察地點的岩石海岸有明顯分別，請仔細觀察並找出外露岩岸和碎石灘的不同。

The field site has two obvious different rocky habitats, please identify the differences between exposed rocky shore and the pebbles shore.

	外露岩岸 exposed rocky shore	碎石灘 pebbles shore
基質組成 Substratum composition		
受海浪衝擊情況 Wave action effect		
微生境類型 Types of microhabitat		

## 2. 主動搜尋動物 Active searching for animals

i. 記錄依附在岩石表面或一些凹陷面生長的動物。

ii. 查看藏於石塊底下、潛於潮池水中和石縫之間的動物，可以利用小鏟協助，但記緊把翻起的石塊回復原狀。

iii. 可以將動物暫時置於膠整理盤，方便辨認、觀察和拍照記錄，隨後全部放歸原處。

i. Record the small animals attached on the rock surface or some cavities.

ii. Check for the animals beneath the rocks, submerged in rock pools or hidden in the gaps. A trowel may be helpful but remember to restore the overturned stones to their original states.

iii. Animals can be placed temporarily on the sorting tray for identification, observation and photographing. Once the work is finished, put them back to their original places.

動物名稱 Animal name	微生境 Micro-habitat 1. 岩石表面 Rock surface 2. 凹陷處 Cavity 3. 石塊底 Beneath rock 4. 潮池中 In rock pool 5. 石縫間 Between rock gaps 6. 沙泥中 In sandy substratum 7. 沙泥表面 On sandy surface	適應被海浪沖刷的方式 Adaptation to wave actions 1. 體型細小 Small body size 2. 扁平身軀 Flattened body 3. 發達的抓附能力 Well developed attachment ability 4. 分泌物能融合基質 Secretion merged to substratum 5. 絲狀物質相連 Silky filaments for connection 6. 聚集行為 Congregation behaviour 7. 鑽挖基質 Drill and bore into the substratum



### 3. 樣帶動物調查 Belt transect survey for animals

i. 由上潮帶拉一條三十米卷尺到海邊，在每隔十米距離擺放一個 0.5x0.5 米的樣方。先仔細找尋並撿起岩面 / 石面的動物，放在膠整理盤內；如樣方內有石塊，可揭起石塊，查看藏於石塊底下的動物；然後利用小鏟，小心掘出沙泥裡的動物，辨認和點算樣方內找到仍然活著的動物。

ii. 記錄樣方放置位置的非生物因子。

iii. 重覆上述工作直至完成四個樣方。所有生物請放回原處。

i. Lay 30m measuring tape from upper shore to the seaside, place 0.5 m X 0.5 m quadrat at every 10m interval. Pick up the animals found on the rock surface within the quadrat, identify and count in the tray. If there are stones within the quadrat, lift the stones to look for animals hiding beneath. Use a trowel, carefully dig out animals in the soil, identify and count every living animals.

ii. Record the abiotic factors of the area sampled.

iii. Repeat the above procedure until 4 quadrats finished. Once the work is finished, put the living animals back to their original places.

動物名稱 Animal name	抵抗捕食者方式 # Anti-predation methods	個體數目 No. of individuals			
		樣方一 Quadrat 1	樣方二 Quadrat 2	樣方三 Quadrat 3	樣方四 Quadrat 4

# 1. 具硬殼 Bearing hard shell 2. 偽裝 Camouflage 3. 警戒色 Warning colour 4. 反應迅速如逃跑 Quick reaction e.g. fast run 5. 沒有反應如裝死 No reaction e.g. playing dead 6. 附著於硬基質上 Firmly attached to hard substratum

	氣溫 (°C) Air temperature	相對濕度(%) Relative humidity	光強度(lux) Light intensity	風速(m/s) Wind speed
樣方一 Quadrat 1				
樣方二 Quadrat 2				
樣方三 Quadrat 3				
樣方四 Quadrat 4				

#### 4. 取水樣本 Water sampling

利用取水樣瓶在潮池或海邊的位置取海水樣本，再帶返實驗室作化學分析。

Use a water sampling bottle to collect water sample in the rock pool or sea water at the shore. Bring the water sample to the laboratory for further chemical analysis.

### 實驗室工作 Laboratory work

- i. 把水樣瓶樽蓋打開，直接把溶氧量計的探針放進樽內，等讀數穩定後(約30秒)，便可記錄溶氧量，請留意單位。
- ii. 將水樣本倒進量杯內，用酸鹼度計量度酸鹼值。
- iii. 滴2-3滴水樣本於氯化鈉折光儀的玻璃面上，量度鹽分含量。
- iv. 用電子秤先量度從焗爐中取出的濾紙重量，然後利用布氏漏斗和抽氣泵過濾大約100-200毫升的水樣本，再放進焗爐內30分鐘，待濾紙焗乾後，用同一電子秤再量度，得出的相差數值以及過濾水樣本的份量，便可以計算出總懸浮粒子量。
  - a. Open the sampling bottle's cap and put the D.O. meter probe into the bottle directly. Wait for the readings become steady (about 30 sec.) and record the Dissolved Oxygen level with correct unit.
  - b. Pour the water sample into a beaker, use the pH meter to measure the pH value.
  - c. Add 2-3 drops of water sample on the glass surface of the refractometer to measure the salinity.
  - d. Weigh a filter paper taken out from the oven by an electronic balance. Filter 100-200ml water sample using Buncher Funnel and suction pump, then dry the filter paper in the oven for 30mins. Re-weigh the filter paper by the same balance. Calculate the amount of total suspended solids by the weight difference of the filter paper and the amount of water filtered.

溶解氧 Dissolved oxygen (mg/l)		pH		鹽分含量 Salinity (ppt)		總懸浮物 Total Suspended Solids (mg/l)	
海水 Sea water	潮池水 Rock pool water	海水 Sea water	潮池水 Rock pool water	海水 Sea water	潮池水 Rock pool water	海水 Sea water	潮池水 Rock pool water