



## 考察沙坪生態系統（汀角東） Study of Sand Flat Ecosystem (Ting Kok East)

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. 辨認本港沙坪常見的生物，並將其分類 Classify and identify living organisms commonly found in a local sand flat habitat;
2. 觀察生物如何適應環境 Observe how living organisms adapt to the environment;
3. 識別生態系統中生物與生物之間的關係 Identify interrelationships between living organisms in an ecosystem;
4. 在沙坪量度和記錄非生物因子 Record and measure abiotic factors in a sand flat 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 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 and work together in a scientific investigation;
9. 欣賞自然，尊重生物 Appreciate the wonder of nature and respect living things.

### 程序 Schedule

|               |                               |
|---------------|-------------------------------|
| 09:00 - 10:00 | 簡介 Briefing                   |
| 10:00 - 13:00 | 考察 Field work                 |
| 13:00 - 14:00 | 午膳 lunch                      |
| 14:00 - 14:30 | 實驗工作<br>Laboratory work       |
| 14:30 - 15:15 | 資料整理<br>Data processing       |
| 15:15 - 16:15 | 分組匯報<br>Group presentation    |
| 16:15 - 16:30 | 討論及總結<br>Discussion & summary |

### 儀器和工具 Equipment and tools

|   |                                        |    |                                          |
|---|----------------------------------------|----|------------------------------------------|
| 1 | 寫字夾板 (x1)<br>Clipboard                 | 9  | 50米樣條 (x1)<br>50m Transect               |
| 2 | 光強度計 (x1)<br>Light meter               | 10 | 樣方0.5 x 0.5米 (x1)<br>Quadrat 0.5m x 0.5m |
| 3 | 風速計 (x1)<br>Anemometer                 | 11 | 膠整理盤 (x1)<br>Plastic sorting tray        |
| 4 | 電子溫濕計 (x1)<br>Digital thermohygrometer | 12 | 取水樣瓶 (x4)<br>Water sampling bottles      |
| 5 | 手套 (x2)<br>Gloves                      | 13 | 圖鑑 (x1)<br>Wildlife Pictorial Guide      |
| 6 | 金屬篩 (x1)<br>Metal sieve                | 14 | 平板電腦 (x1)<br>Tablet computer             |
| 7 | 鑷子 (x1)<br>Forceps                     | 15 | 水桶 (x1)<br>Bucket                        |
| 8 | 小鏟 (x2)<br>Trowel                      |    |                                          |

### 你知道嗎？ Do You Know?

中國海岸線長度約1.8萬公里，橫跨了溫帶、亞熱帶和熱帶地區，主要分成三個海岸類型：平原海岸、山地丘陵海岸和生物海岸。海洋生態系統複雜多樣，孕育了超過20,000多種海洋生物。

China has a coastline that stretches for approximately 18,000 kilometers spanning across temperate, subtropical, and tropical regions. The coastline can be categorized into three types: plain coasts, mountainous and hilly coasts, and biological coasts. The marine ecosystems along the Chinese coast are complex and diverse, nurturing over 20,000 species of marine organisms.

### 衣著 Clothing

1. 不應穿著短褲。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。  
Shorts are not recommended. Long-sleeved shirt and trousers for better protection against mosquito and insect bites, as well as preventing sunburn.
2. 不應穿著拖鞋或涼鞋，而應穿著運動布鞋，以減低腳部受傷的機會。  
A pair of plimsolls for preventing injuries. Slippers and sandals are not recommended.

### 安全 Safety

1. 不准涉入水中進行戲水或暢泳等活動。  
Never go into the water for swimming and other activities.
2. 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.





## 1. 海岸生境辨別 Identifying sea shore habitat

考察地點的海岸有著微妙的變化，請仔細觀察並找記錄當中的不同。

The field site has some variations along the coast. Please record the differences by careful observation.

|                                                                                                                          | 石灘 Stony shore | 沙灘 Sandy shore | 河口 Estuary |
|--------------------------------------------------------------------------------------------------------------------------|----------------|----------------|------------|
| 基質組成<br>Substratum composition                                                                                           |                |                |            |
| 乾濕程度 (含水量)<br>Wetness (water content)                                                                                    |                |                |            |
| 微生境類型 Types of microhabitat<br>例如：沙面、石底、石縫、水體等<br>Examples: sand surface,<br>beneath rock, rock gap, water<br>body, etc. |                |                |            |

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

- 由上潮帶拉一條三十米樣線到海邊。每隔十米擺放一個 0.5x0.5 米的樣方，共擺放四個樣方。
  - 在第一個樣方中，盡量不干擾物理環境並辨認和點算移動能力高的生物，然後記錄樣方內的非生物因子。每項參數量度三次，取其平均值。
  - 在樣方內尋找並撿起在基質表面生活的動物，然後放在膠整理盤內；如樣方內有石塊，可揭起石塊，查看藏於石塊底下的動物；利用小鏟，小心掘出沙泥裡的動物。辨認和點算樣方內活著的動物，隨後全部放歸原處。
  - 重覆上述工作，直至完成四個樣方。
- Lay a 30m transect from upper shore to the seaside and place 0.5 m X 0.5 m quadrat at every 10m interval.
  - Identify and count the organisms with high mobility in the quadrat without interfering with the physical environment. Record the abiotic factors of the area sampled. For each parameter, take three measurements and calculate the mean.
  - Pick up the animals found on the substratum within the quadrat and put them into the tray. If there are stones, lift the stones to look for animals hiding beneath. Use a trowel to dig out animals in the soil. Identify and count every living animals. Once the work is finished, return them to their original places.
  - Repeat the above steps until all quadrats are finished.

| 動物名稱<br>Name of the animal | 抵抗捕食者方式 Anti-predation methods<br>1.具硬殼 Bearing hard shell<br>2.偽裝 Camouflage<br>3.警戒色 Warning colour<br>4.反應迅速 Quick reaction<br>5.裝死 Playing dead<br>6.聚集行為 Congregation behaviour<br>7.鑽挖基質 Drill and bore into substratum | 個體數目<br>No. of individuals    |                               |                               |                               |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|
|                            |                                                                                                                                                                                                                               | 樣方一<br>Quadrat 1<br>( ____m ) | 樣方二<br>Quadrat 2<br>( ____m ) | 樣方三<br>Quadrat 3<br>( ____m ) | 樣方四<br>Quadrat 4<br>( ____m ) |
|                            |                                                                                                                                                                                                                               |                               |                               |                               |                               |
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|                  | 氣溫 (°C)<br>Air temperature |  |  | 相對濕度(%)<br>Relative humidity |  |  | 光強度(lux)<br>Light intensity |  |  | 風速(m/s)<br>Wind speed |  |  | 土壤溫度(°C)<br>Soil temperature |  |  |
|------------------|----------------------------|--|--|------------------------------|--|--|-----------------------------|--|--|-----------------------|--|--|------------------------------|--|--|
| 樣方一<br>Quadrat 1 |                            |  |  |                              |  |  |                             |  |  |                       |  |  |                              |  |  |
|                  |                            |  |  |                              |  |  |                             |  |  |                       |  |  |                              |  |  |
| 樣方二<br>Quadrat 2 |                            |  |  |                              |  |  |                             |  |  |                       |  |  |                              |  |  |
|                  |                            |  |  |                              |  |  |                             |  |  |                       |  |  |                              |  |  |
| 樣方三<br>Quadrat 3 |                            |  |  |                              |  |  |                             |  |  |                       |  |  |                              |  |  |
|                  |                            |  |  |                              |  |  |                             |  |  |                       |  |  |                              |  |  |
| 樣方四<br>Quadrat 4 |                            |  |  |                              |  |  |                             |  |  |                       |  |  |                              |  |  |
|                  |                            |  |  |                              |  |  |                             |  |  |                       |  |  |                              |  |  |

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

- 搜尋生活在不同小生境的動物 – 沙泥表面、沙泥內、石塊表面、石塊底下和水邊的動物。可以利用小鏟協助，但記緊把翻起的石塊回復原狀。
  - 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。
- Search for animals living in different micro-habitats - on sand or mud surface, in sand or mud surface, on rock surface, under rock, and waterfront. A trowel may be helpful but remember to restore the overturned sands or mud or stones to their original states.
  - 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<br>Name of the animal | 微生境 Micro-habitat                                                                                                           | 抗旱抗熱 Preventing desiccation and overheat                                                                                                                                |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                            | 1. 沙泥表面 On sandy surface<br>2. 沙泥裡 In sandy substratum<br>3. 石塊表面 On rock surface<br>4. 石塊底下 Under rock<br>5. 水邊 Waterfront | 1. 厚殼和厖 Thick shell and operculum<br>2. 外殼中空 Hollow shell<br>3. 藏身於石塊下 Hide under rocks<br>4. 鑽挖基質 Drill and bore into the substratum<br>5. 聚集行為 Congregation behaviour |
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## 4. 海岸植物調查 Coastal plant survey

在考察地點的後灘位置，分辨出草本植物、灌木及喬木，利用圖鑑嘗試辨認物種。同時，留意這些植物有甚麼適應特徵以克服強烈的海風、猛烈的陽光、不穩定的基質等。

At the back-shore, look for the grasses, shrubs and trees and try to identify them into species with the guide. At the same time, record any adaptation features for them to cope with the strong wind and sunlight, unstable substratum, etc.

| 植物名稱 Name of the plant | 草本 / 灌木 / 喬木<br>Grass / Shrub / Tree | 適應海岸的特徵<br>Adaptation features for coastal environment                                                                                                                                                |
|------------------------|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                        |                                      | 1. 匍匐生長 Creeping growth form<br>2. 節節生根 Roots grow from stem nodes<br>3. 葉表面長有絨毛 Hairs on leaf surface<br>4. 肥厚的葉片及莖幹 Thick leaves and stems<br>5. 革質葉片 Cuticle leaves<br>6. 針形葉 Needle-shaped leaves |
|                        |                                      |                                                                                                                                                                                                       |
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## 5. 取水樣本 Water sampling

利用取水樣瓶在河口和海邊的位置取海水樣本，再帶返實驗室作分析。

Use a water sampling bottle to collect water sample in the estuary and the sea at the shore. Bring the water samples to the laboratory for further analysis.

## 實驗室工作 Laboratory work

- 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。
  - 將水樣本倒進量杯內，用酸鹼值計量度酸鹼值。
  - 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。
  - 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250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濾紙重量，最後計算出總懸浮物量。
- 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.
  - Pour the water sample into a beaker. Use the pH meter to measure the pH value.
  - Add 2-3 drops of water sample on the glass surface of the refractometer to measure the salinity.
  - Weigh a filter paper taken out from the oven by an electronic balance. Filter 250ml 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.

| 溶解氧<br>Dissolved oxygen (mg/L) |                        | 酸鹼值<br>pH       |                        | 鹽分含量<br>Salinity (ppt) |                        | 總懸浮物<br>Total Suspended Solids (mg/L) |                        |
|--------------------------------|------------------------|-----------------|------------------------|------------------------|------------------------|---------------------------------------|------------------------|
| 海水<br>Sea water                | 河口水<br>Estuarine water | 海水<br>Sea water | 河口水<br>Estuarine water | 海水<br>Sea water        | 河口水<br>Estuarine water | 海水<br>Sea water                       | 河口水<br>Estuarine water |
|                                |                        |                 |                        |                        |                        |                                       |                        |