



## 考察紅樹林生態系統（西徑） Study of Mangrove Ecosystem (Sai Keng)

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. 辨認本港紅樹林常見的生物，並將其分類 Classify and identify living organisms commonly found in a local mangrove 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. 在紅樹林量度和記錄非生物因子 Record and measure abiotic factors in a mangrove 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 Laboratory work
14:30 - 15:15	資料整理 Data processing
15:15 - 16:15	分組匯報 Group presentation
16:15 - 16:30	討論及總結 Discussion & summary

### 儀器和工具 Equipment and tools

1	寫字夾板 (x1) Clipboard	9	手套 (x2) Gloves
2	光強度計 (x1) Light meter	10	樣方0.5 x 0.5米 (x1) Quadrat 0.5m x 0.5m
3	風速計 (x1) Anemometer	11	膠整理盤 (x1) Plastic sorting tray
4	電子溫濕計 (x1) Digital thermohygrometer	12	取水樣瓶 (x4) Water sampling bottles
5	土壤溫度計 (x1) Soil thermometer	13	圖鑑 (x1) Wildlife Pictorial Guide
6	金屬篩 (x1) Metal sieve	14	平板電腦 (x1) Tablet computer
7	鑷子 (x1) Forceps	15	水桶 (x1) Bucket
8	小鏟 (x2) Trowel	16	50米樣條 (x1) 50m Transect

### 你知道嗎？ Do You Know?

在50年代初，中國的紅樹林面積約為5萬公頃。但由於人類活動的影響，紅樹林面積急劇下降，在2000年僅剩下2.2萬公頃。中國國家林業和草原局推出了《紅樹林保護修復專項行動計劃（2020-2025年）》，積極修復紅樹林，希望能扭轉紅樹林面積減少的趨勢。

Due to human activities, the area of mangroves in China has rapidly decreased from nearly 50,000 hectares in the early 1950s to 22,000 hectares in 2000. In response, the National Forestry and Grassland Administration of China has launched the "Special Action Plan for the Protection and Restoration of Mangrove (2020-2025)" to actively restore mangrove forests and hopefully reverse the declining trend in their coverage.



### 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. 避免踏進泥土過度鬆軟的區域。蠔殼可致嚴重割傷，必須小心。  
Avoid stepping onto slimy areas. Beware of oyster shells which could cause serious wound.
2. 留意潮水，當潮水漲至膝蓋時，從速離開。  
Leave the area once the knees were submerged by the incoming tide.



## 1. 記錄環境因素 Recording environmental factors

- 描述紅樹林周邊的環境，包括附近生境類型、土地用途、村落位置和各種可能的人為干擾等  
Describe the physical environment near the mangrove habitat, such as nearby habitat types, land use, location of village and possible human impacts.

## 2. 取水樣 Water sampling

利用取水樣瓶在最接近考察位置的地點取海水樣本，帶返實驗室作分析。

Use a water sampling bottle to collect seawater sample at the location closest to your study area. Bring the water sample to the laboratory for further analysis.

## 3. 觀察土壤 Observing soil

找一處有軟泥的地點，用小鏟垂直向下插入約10厘米，並掘出土壤，細心觀察各層泥土的顏色和性質。

Select an area with soft substratum. Dig vertically of around 10cm into the soil by a trowel and notice the nature and colour of the soil layers from top to bottom.

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

透過仔細觀察，搜尋生活在不同小生境的動物 — 沙泥表面、石塊表面、石塊底下、紅樹根部、紅樹葉和枝幹上等。留意動物的各種適應特徵。用攝影或攝錄，記錄各種動物的外貌和行為特徵。

By careful observation, search for animals living in different micro-habitats - on sand or mud surface, on rock surface, under rock, on mangrove root, on mangrove leaf surface or branch. Pay attention to various adaptive features equipped by the animals. Use photography and videography to record the external features and behaviour of the animals species.

動物名稱 Name of the animal	微生境 Micro-habitat 1. 沙泥表面 On sand or mud surface 2. 沙泥裡 In the sand or mud 3. 石塊表面 On rock surface 4. 石塊底下 Under rock 5. 紅樹根部 On mangrove root 6. 紅樹葉上 On mangrove leaf 7. 紅樹枝幹上 On mangrove branch	抗旱抗熱 Preventing desiccation & overheat 1. 厚殼和厝 Thick shell and operculum 2. 外殼中空 Hollow shell 3. 棲身於紅樹下 Hide under mangrove canopy 4. 藏身於石塊下 Hide under rocks 5. 藏身於泥土中 Burrow into the soil	攝食模式 Mode of feeding 1. 濾食性 Filter feeding 2. 沉積食性 Deposit feeding 3. 吞食性 Bulk feeding 4. 肉食性 Carnivorous 5. 植食性 Herbivorous 6. 腐食性 Detritivorous



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

- 由下潮帶拉一條三十米樣線到紅樹林。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；如樣方內有碎石，可揭起碎石，查看藏於碎石底下的動物；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 the seaside to the mangrove 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 rubbles, lift the rubbles 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 Name of the animal	抵抗捕食者方式 Anti-predation methods 1. 具硬殼 Bearing hard shell 2. 偽裝 Camouflage 3. 警戒色 Warning colour 4. 反應迅速 Quick reaction 5. 裝死 Playing dead 6. 附著於硬基質上 Firmly attached to hard substratum 7. 鑽入基質 Drill in substratum	個體數目 No. of individuals			
		樣方一 Quadrat 1 ( ____m )	樣方二 Quadrat 2 ( ____m )	樣方三 Quadrat 3 ( ____m )	樣方四 Quadrat 4 ( ____m )

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



## 6. 記錄植物 Recording plants

- 辨認3種真紅樹物種（通常生長在較接近海水位置）和2種類紅樹物種（通常生長在較近陸地位置）。  
Identify 3 species of true mangrove plants (usually growing closer to the sea) and 2 species of associated mangrove plants (usually growing at the back shore far away from the sea).
- 細心觀察並記錄每種紅樹和類紅樹的適應特徵。  
Observe carefully and record the adaptive features of each mangrove and associated mangrove species.

植物名稱 Name of the plant	有助紅樹於鬆軟基質上 固定的根部特徵 Root features enhancing better anchorage on unstable substratum	有助紅樹於缺氧基質進 行氣體交換的根部特徵 Root features enhancing better gaseous exchange in water-logged soil	有助於紅樹調節植物組 織內含鹽量和水份的 葉部特徵 Leaf features related to regulation of water potential and salt content in plant tissue	有助紅樹減低海潮對種子散播的衝 擊的生殖系統特徵 Modifications of reproductive system to minimize impact of tide on seed dispersal
○ 真紅樹 True mangrove ○ 類紅樹 Associated mangrove				
○ 真紅樹 True mangrove ○ 類紅樹 Associated mangrove				
○ 真紅樹 True mangrove ○ 類紅樹 Associated mangrove				
○ 真紅樹 True mangrove ○ 類紅樹 Associated mangrove				
○ 真紅樹 True mangrove ○ 類紅樹 Associated mangrove				

## 實驗室工作 Laboratory work

### 7. 水質測試 Water test

- 用折光儀量度海水樣本及自來水的鹽度。  
Use a refractometer to measure salinity of the water sample and tap water.
- 以過濾法量度海水樣本及自來水的總懸浮物。  
Use filtration method to measure the number of total suspended solids in the water sample and tap water.

鹽度 Salinity (ppt)		總懸浮物 Total suspended solids (mg/L)	
海水 Sea water	自來水 Tap water	海水 Sea water	自來水 Tap water

### 8. 觀察紅樹葉結構 (延伸活動) Observation on structure of mangrove leaves (Extended activity)

將紅樹和類紅樹的葉橫向切片,置於顯微鏡底下觀察。  
Do cross sections of the mangrove leaves and examine under the microscope.