

Appendix 6 Ecology field trip 野外生態考察

A study of mangrove ecosystem:

研究紅樹林的生境:

Suggested field site: Muddy beach of To Lo Harbour, 111 Ting Kok Road, Tai Po (midway to Tai Mei Tuk, near the new House - Greencove).

建議考察地點： 大埔吐露港泥灘，汀角道 111 號 (往大美篤途中，近樓盤—映月灣)

Traffic： Take a 75K bus at Tai Po Market Railway Station, prepare to get off after passing Tung Tsz, and get off at the new House-Greencove. The journey takes about 25 minutes.

交通： 在大埔墟火車站乘 75K 巴士，過了洞梓預備下車，在低密度樓盤—映月灣下車。車程約 25 分鐘。

Before choosing the date of field trip (usually on Saturday morning), you should have the tidal information. Tides that are higher than 1 metre is not suitable, for the field site will be flooded with seawater. During the high tides, you simply can't see the mangroves, they are all in the sea. The most suitable time for the field trip thus would be the low tides not higher than 1 metre and is in the morning time, ie. around 7 to 12 o'clock. You may get the predicted whole year tidal information from the Hong Kong Observatory. The web site is: <http://www.hko.gov.hk/tide/cTPKtide.htm>

在擇日往野外考察前(通常都是在星期六早上)，需先獲潮汐漲退資料，潮水高於一米並不適合，因為紅樹林會水浸，高潮時，你甚至看不到紅樹林，因為它在海底，最適合的時間是正值潮退，而時間是在早上七時至十二時，最低潮不高於一米。有關潮水的資料，可在天文台網址找到，它會公佈整年的潮汐漲退資料。

網址是：<http://www.hko.gov.hk/tide/cTPKtide.htm>



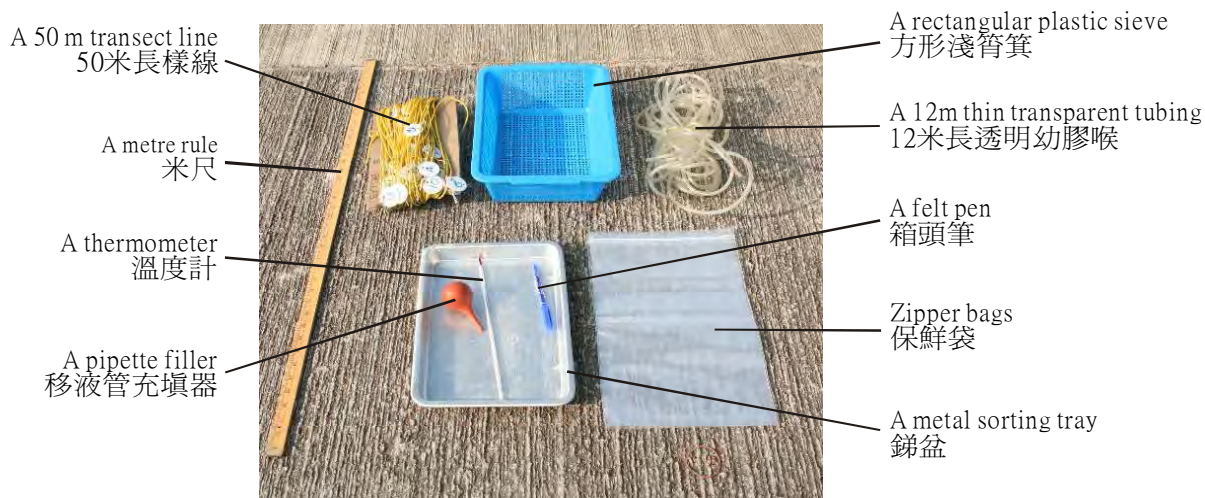
下車地點: 映月灣



汀角道紅樹林

Field trip equipment (per group) 野外考察儀器(每組):

(a) A 50 m transect line 50 米長樣線 1 條	(b) A foldable quadrat - 50 x 50 cm 可摺疊式樣方 1 個 - 50 x 50 cm
(c) A thermometer 溫度計 1 枝	(d) A metre rule 米尺 1 把
(e) Small zipper bag 5 pcs 小保鮮袋 5 個 (裝帶葉枝條)	(f) Large zipper bag 3 pcs 大保鮮袋 3 個 (裝泥土)
(g) Small bucket 3 pc 小膠桶 3 個 (放膠瓶、小蟹、小螺等)	(h) A metal sorting tray 銻盆 1 個 (揀選動物)
(i) A rectangular plastic sieve 方形淺笊箕 1 個(裝泥進海淘動物)	(j) A trowel 小鏟 1 個 (掘泥)
(k) Small vial 5 pcs 小膠瓶 5 個 (裝動物標本)	(l) Large vial 2 pcs 大膠瓶 2 個 (裝動物標本)
(m) Some rubber bands 橡皮圈一些	(n) A felt pen 箱頭筆 1 枝 (在瓶蓋寫位置、樣本編號等)
(o) Water sampling bottle 3 pcs 取水版瓶 3 個 (取泥水或海水回實驗室)	(p) Plastic bags 3 pcs 膠袋 3 個 (超市膠袋) (裝泥、水、膠瓶等)
(q) Hand groves (one for each student) 手套(每人一雙)	(r) A 12m thin transparent tubing with a pipette filler 12 米長透明幼膠喉(金魚缸氣喉) 1 條連充填器
(s) Identification Guide (Seashore animals and plants) 檢索表(岩岸動植物各 1 套)	(t) A fish net 魚網 1 個



1. Study of distribution of organisms:

研究生物的分佈：

(a) Flora - by line transect.

植物相－利用樣線

Run a 50 m long transect line from back shore (land) to middle shore (perpendicular to the coast line). Move down along the transect line from the landward end (the origin 0 m) and note the presence of plants which touch, overlies or underlies the transect line.

從山邊向海拉一條 50m 長的樣線(垂直於海岸線)，從靠地的一邊(源頭 0 m)開始，沿樣線研究在樣線之上、之下或碰到樣線的植物。

For each mangrove, identify and measure its:

對每棵紅木樹均須辨認及量度以下數據：

1. Position along the transect line

位於樣線的位置。

2. Height

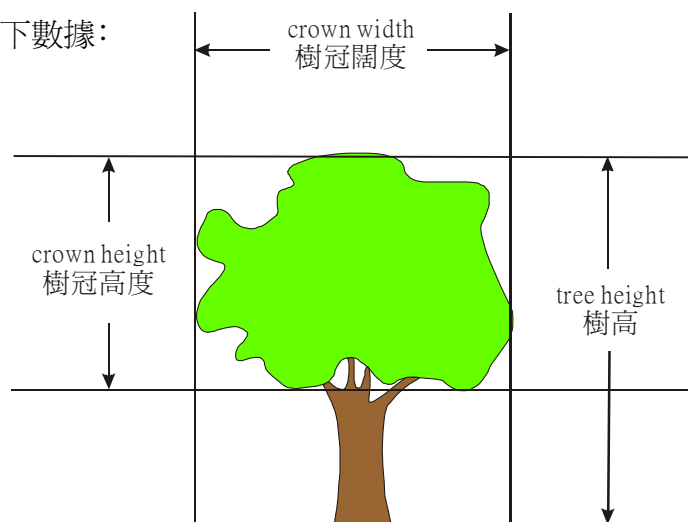
高度

3. Crown height (see diagram)

樹冠高度(看右圖)

4. Crown width (see diagram)

樹冠闊度(看右圖)



Record these on data sheet (5).

將數據紀錄在數據表(5)

Try to see how the plant is adapted to live in the environment. Record all findings on data sheet (5). Continue on until all the plants along the transect line are studied and recorded.

留意植物如何適應它居住的環境，將發現寫在數據表(5)，繼續觀察直至所有沿樣線的植物均已紀錄。

Remove a small leafy twig from each plant species studied and bring them back to the laboratory for further investigation.

摘下一段帶葉枝條，將它放入保鮮袋帶回實驗室進一步研究。

(b) Fauna - sampling by quadrat

動物相－利用樣方

Because of time limit, we use quadrat for quantitative purpose only in 10-meter intervals. Other information is gathered by careful observation. Within each quadrat frame, do the followings:

因為時間有限，我們每隔 10 m 用樣方取數據，其他的資料可憑觀察而得，在每一樣方內均作以下研究：

1. Collect animals situated on the sediment surface. Put them in the metal tray, identify and count them.

收集位於泥土表面的動物，放在錫盆內辨認及數算數量。

2. For stony area, gently lift the stones and find the animals hiding below.

在有石的地方，小心揭起石塊，尋找躲藏在下面的動物。

3. For soft substratum, dig up the top layer to a depth of about 15 cm, put the soil into the plastic sieve. Wash with seawater, sort out the animals, identify and count. For those that cannot be identify at site, put it into the plastic vials and identify in the laboratory. It is important that collection of sediment should be done quickly and quietly because some animals may retreat into their deep burrows even under slight disturbance.

在濕軟的泥土，用小鏟掘起表面的 15 cm 的表土，放在膠筲箕內，用海水淘去泥土，揀出動物，辨認及數算數量，那些不能即時辨認的，放入小膠瓶內帶回實驗室辨認，挖掘泥土時，動作要安靜快捷，不然動物會逃回洞中。

4. Select 3 mangroves along the transect line. They should be as far as possible, being different species. Identify and count all the animals attaching on the mangroves and record their **microhabitats**.

在沿樣線相距較遠的地方，揀選三棵不同品種的紅樹，找尋在樹上的動物，辨認及數算數量，紀錄牠們的**微生境**。

Note the adaptive features of the animals to the environment. Record all findings on data sheet (6)

留意動物對環境的適應構造，將發現寫在數據表(6)。

2. Measurement of abiotic factors:

量度物理因素:

(a) Gradient (slope profile):

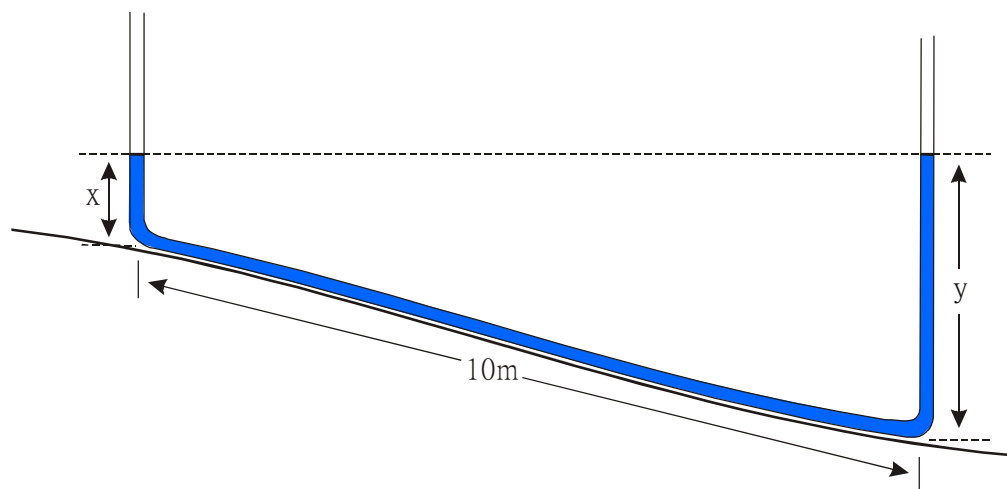
坡度 (地勢的側面圖):

Use a transparent tubing filled with seawater and metre rules to measure the gradient at intervals of 10 metres along the transect line. The relative level between two points is calculated by using the equation below:

用一條充滿海水的透明膠喉(金魚缸氣喉)及米尺沿樣線每隔 10 m 量度泥灘的坡度，兩點間的相對水平可用以下公式計出:

Relative level = Reading of seaward metre rule (y) – Reading of landward metre rule (x)

相對水平 = 向海的米尺讀數 (y) – 向地的米尺讀數 (x)



Method of filling the tubing with seawater:**將海水注入膠喉的方法：**

1. Fill a small bucket with seawater and put it on the upper beach.
把一小桶注滿海水放於泥灘的上方。
2. Run the tubing from the bucket to the seaward direction and immerse one end of it into the bucket of water.
把膠喉的一端浸入水桶內，另一端拉往海邊。
3. With the help of pipette filler, suck water out of the tubing from the open end (seaward end).
利用移液管充填器，在向海的一端開口吸出海水。
4. Water will be siphoned and flow out by itself. Remove any bubbles in the tubing.
一會兒後，水會因虹吸原理自動流出，排除膠喉內的所有氣泡。
5. The tubing will be ready to use when there is no air bubbles.
當膠喉內再沒有氣泡時便可使用。



Record all findings on data sheet (4).

將數據紀錄在數據表(4)。

(b) Temperature:**溫度：**

Use an alcohol-filled thermometer to measure the air temperature above and below **canopy** at intervals of 10 metres along the transect line. Several readings are recorded in data sheet (3)

沿樣線每隔 10 m 用酒精溫度計量度樹冠上及樹冠下的溫度，將數據寫在數據表(3)。

(c) Salinity and pH:**鹽度及酸鹼度：**

Dig into the mud until a small pool of water is trapped. Collect the water sample in a plastic water-sampling bottle and label it with the position of the quadrat. Collect some seawater too. Take the plastic bottles back to the laboratory for determination of salinity and pH.

在利用樣方研究動物相時所掘出的小坑內取水，把水裝入膠瓶內(用完的膠蒸餾水瓶)，若水位太低，可用移液管充填器吸水，在瓶身標示取水的位置，同時取一些海水，將水瓶帶回實驗室內量度鹽度及酸鹼度。

(d) Soil texture:**土壤的性質：**

Collect three samples of soil (300 ml) from regions which show observable differences. Label the samples with the positions on the transect line. Take the samples back to the laboratory for determination of soil texture.

在沿樣線土壤明顯不同的地方，取三個泥土樣本放入保鮮袋內，每個樣本約為 300 ml，在袋面寫上位置，帶回實驗室研究土壤的性質。

3. Data sheets 數據表:

(1) General Information 一般性資料

Group 組別	
Members 組員	
Field site 考察地點	
Date 日期	
Time 時間	

(2) Tides 潮水

	Time 時間	Height 高度
High tides 高潮		
Low tides 低潮		

(3) Temperature 溫度

Position on transect line (m) 在樣線的位置 (m)					
Above canopy (°C) 樹冠上 (°C)					
Below canopy (°C) 樹冠下 (°C)					

(4) Slope profile 地勢

Metre along transect line (m) 在樣線的位置 (m)	0-10	10-20	20-30	30-40	40-50	
Reading of seaward metre rule (m) 向海的米尺讀數 (m)						
Reading of landward metre rule (m) 向地的米尺讀數 (m)						
Difference of seaward and landward reading (m) 兩地讀數的差異 (m)	(a)	(b)	(c)	(d)	(e)	
Distance down shore (m) 離岸距離 (m)	0	10	20	30	40	50
Relative level (m) 相對水平 (m)	(a+b+c+d+e)	(b+c+d+e)	(c+d+e)	(d+e)	(e)	(set zero) 0

(5) Plant data 植物數據

	Plant name 植物名稱 (K, Av, Ac, L, E, Ae)	Position of main stem on transect line 主幹位於樣線的位置	Tree height 樹高	Crown height 樹冠高度	Crown width 樹冠闊度	Adaptive features 適應構造 (KJ, BR, PR, CR, EH, TC)
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

Plant 植物	Adaptive features 適應構造
K Kandelia 水筆仔	KJ Knee joint 根膝
Av Avicennia 白骨壤	BR Buttress root 板根
Ac Acanthus 老鼠勒	PR Prop root 支柱根
L Lumnizera 欖李	CR Cable root 纜狀根
E Excocaria 土沉香	EH Epidermal hairs 表皮有毛
Ae Aegiceras 桐花樹	TC Thick cuticle 厚角質層

(6) Animal data 動物數據

	Animal name 動物名稱	Position of quadrat along transect line 樣方沿樣線的位置	Number 數量	Distribution of animals 動物的分佈 (F, UT, LT, SUB, ON)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

Distribution of animals 動物的分佈	
F Foliage 在樹葉上	SUB In substratum 在泥中
UT Upper part of stem 在樹幹的上部	ON On surface of substratum 在泥土表面
LT Lower part of stem 在樹幹的下部	

(7) Salinity and pH 鹽度及酸鹼度

	Soil water 泥水		Seawater 海水
Position on transect line (m) 在樣線的位置 (m)			
Salinity 鹽度			
pH 酸鹼度			

Specific gravity and salinity relationships at 20°C

在 20°C 比重與鹽度的關係

Specific gravity 比重	Salinity (parts per thousand) 鹽度 (千分一)
1.0037	5
1.0075	10
1.0112	15
1.0150	20
1.0188	25
1.0225	30
1.0263	35
1.0301	40
1.0339	45
1.0376	50
1.0414	55
1.0452	60
1.0490	65
1.0528	70
1.0566	75
1.0604	80
1.0642	85
1.0680	90
1.0719	95
1.0757	100

→ (approximately normal sea water 大約正常海水)

(8) Soil texture 土壤的性質

Position on transect line (m) 在樣線的位置 (m)	Relative proportions of solid particles (%) 各種顆粒的相對數量 (%)					
	Stones 石塊	Coarse sand 粗砂	Fine sand 幼沙	Silt 粉沙	Clay 黏土	Humus 腐殖質

4. Laboratory work:

實驗室的工作：



(a) Soil analysis 土壤分析：

1. Add about 300 ml soil to a 1000 ml gas jar, fill in water until it reaches 600 ml mark.

把約 300 ml 泥土放入 1000 ml 的集氣瓶內，注入清水至達 600 ml 刻度。

2. Cover the mouth and shake vigorously, then let the mixture settle for 2 days.

蓋上蓋子，猛力搖動，然後讓它靜置二天。

3. Estimate the proportion of each component by measuring the total height of soil profile and the individual height of different sediment layers. Work out the Relative proportions of solid particles.

用間尺量度整個泥層的高度，再量度每層沉積物的高度，計算每種泥土顆粒的相對數量。

(b) Water analysis 水質分析：

1. Measure pH of the water samples by pH papers or pH metre.

用 pH 試紙或 pH 計量度各水版的酸鹼度。

2. Measure salinity by a hydrometer.

用密度計量度鹽度。

The salinity may be measured by using the specific gravity method. The specific gravity of the water samples is first measured by a hydrometer and its value can then be converted to salinity by using the salinity table. Please refer to data sheet (7)

鹽度可用量度比重的方法以求得，先用密度計量度水版的比重，再用換算表找出它的鹽度。請參考數據表(7)。

(c) Identification of specimen 辨認樣本：

1. Identify the collected animals and plants by identification guides and photos (P.862).

利用檢索表及相片辨認收集到的樣本(P.862)。

2. By studying body morphology of the living organisms, try to find out any adaptive features. Adaptive features can be found in respiratory organs, feeding organs, organs for attachment and locomotion, organs for defending against enemies and organs for preventing desiccation.

研究生物的外觀，找尋它的適應構造，這可在呼吸器官、攝食器官、附著器官及行動器官、防衛器官及防旱器官等地方找到。

3. For the mangrove leaves collected, cut sections for high power microscopic study and examine adaptive features.

將收集到的紅樹葉片切成薄片，製作玻片放在顯微鏡下觀察以檢視它的適應構造。

For identification guides and photos, please refer to the following book:

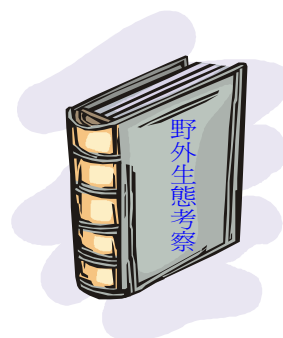
An introduction to ecology of Hong Kong Volume 2, by S.L. Thrower, published by Federal Publications.

5. Writing field trip report:

書寫考察報告:

The report should include the following:

報告須包含以下各項:



1. Aims: To study the mangrove ecosystem.
目的：研究紅樹林的生境
2. Present the data of all the data sheets systematically with description of the studying methods (procedures).
有系統地列出數據，在寫每種數據前先簡介它的研究方法(步驟)。
3. Draw a slope profile diagram indicating the plants with their heights and coverage on the upper part of a large graph paper (2 graph paper join together). (see example below P.866)
使用一大張的方格紙(用2張方格紙接駁)繪畫地勢圖，在圖的上半部顯示出植物的高度及樹冠的覆蓋面(參考後面例子 P.866)。
4. On the lower part of the graph paper, draw **kite diagrams** to show the number of animals and their distribution along the transect line. (see example below P.866)
在圖的下半部繪畫**鸞形圖**以顯示動物在樣線上的分佈及數量(參考後面例子 P.866)。
5. Write discussion and conclusion by referring to the below questions:
參考以下問題書寫討論及結論：
 1. Are the plants evenly distributed along the transect line? If not, what are the patterns of distribution? Can you explain the patterns?
植物在樣線上是否平均分佈？若不，是何種分佈模式？可否加以解釋。
 2. Are the animals evenly distributed along the transect line? If not, what are the patterns of distribution? Do you think distribution of the animals is related to the physical factors? Can you explain the patterns of distribution?
動物在樣線上是否平均分佈？若不，是何種分佈模式？動物的分佈是否與物理因素有關？可否解釋分佈的模式？
 3. What unfavourable factors are the mangroves facing? What adaptive features have you observe which are important for the mangroves to survive under such conditions? Describe how do these adaptive features work.
紅樹林植物須面對何種不利因素？居此的植物有何適應構造以助它們生存，解釋這等適應構造如何運作。
 4. What unfavourable factors are the animals facing? What adaptive features have you observe which are important for the animals to survive under such conditions? Describe how do these adaptive features work.
紅樹林動物須面對何種不利因素？居此的動物有何適應構造以助它們生存，解釋這等適應構造如何運作。
 5. Construct a food web to show the feeding relations between the living organisms.
畫一食物網以示各種生物的進食關係。

6. Describe other relations between the living organisms found, such as commensalism, mutualism and competition. Choose some representative organisms to illustrate.
描述各生物間的其他關係，例如片利共生、互利共生及競爭等，以某些代表性生物以作顯示。
7. Have you observe any human impact to the ecosystem? How important are they? Would you suggest any solution to minimize these impacts?
有否發現人類活動對生態系統的影響？這些影響有什麼重要性？請建議一些方法以減低這些影響。
8. Do you have any conclusion on the mangrove ecosystem you visited?
對這次生態考察有什麼結論？

6. Notes for teachers:

1. Don't give all the equipment to the students at one time. They can't handle such a massive substances and will lose them.
2. Divide the study into 3 parts:
 - (a) Study of abiotic factors (temperature, gradient) and flora: Give only the required equipments and collect it after they finish (about 45 minutes).
 - (b) Study of fauna and collection of soil and water samples. Collect all the equipments and samples right after they finish (about 1 hour 30 minutes).
 - (c) Free time for catching crabs and clams (about 1 hour).
3. Students are required to wear shoes throughout the trip including walking on the dirty mud to prevent injury. In addition to the shoes they wear to the site, they should bring one more pair of cheap or old sports shoes so that they can change it for the field study. Don't wear water boots, it is clumsy and useless when one walks into the sea.
4. Take two 5L bottles of tap water for washing hands and feet.
5. Use a whistle to gather the students.
6. If you want the animals still alive in the laboratory for identification, keep one and only one animal in the vials. Keep in cool place either at home or at laboratory to reduce its metabolic rate.



Some common mangroves found in Hong Kong 一些香港常見的紅木樹:



Acanthus ilicifolius 老鼠簕



Aegiceras corniculatum 桐花樹(蠟燭果)



Avicennia marina 白骨壤(海欖雄)



Kandelia obovata 秋茄(水筆仔)

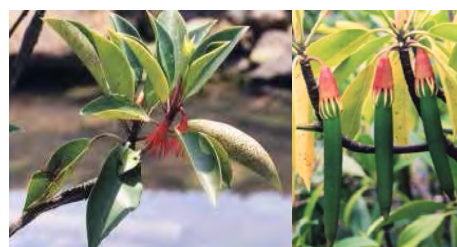


Lumnitzera racemosa 欖李

海漆



木欖



Excoecaria agallocha 海漆和 *Bruguiera gymnorrhiza* 木欖

Some common mangrove animal found in Hong Kong 一些香港常見的紅樹林動物：



Periophthalmus cantonenensis 彈塗魚



Cerithidea rhizophorarum 泥螺



Littorina sp. 溝紋筍光螺



Terebralia sulcata 大紅樹螺



Hermit crab 寄居蟹



Cerithidea cingulata 擬蟹守螺



Littorina articulate 粗玉黍螺



Clithon sp. 彩螺



Geloina erosa 大紅樹蜆



Anomalocardia sp. 蜆



Chthamalus malayensis 紅樹籐壺



Saccostrea cucullate 石蠔



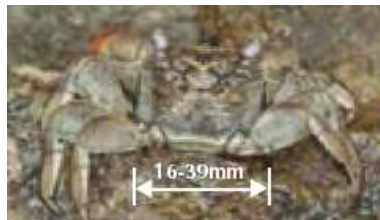
Archaster sp. (sea star) 海星



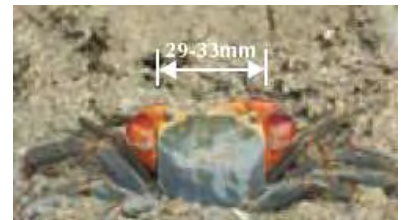
Uca gaimardi 招潮蟹



Parasesarma pictum 斑點相手蟹



Parasesarma affinis 相手蟹



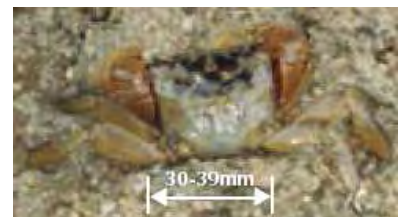
Chiromantes haematocheir 紅螯螳臂蟹



Chiromantes sereni 螳臂蟹



Neosarmatium smithi 粗壯新脹蟹



Chiromantes dehaani 無齒螳臂蟹



Pseudosesarma patshuni



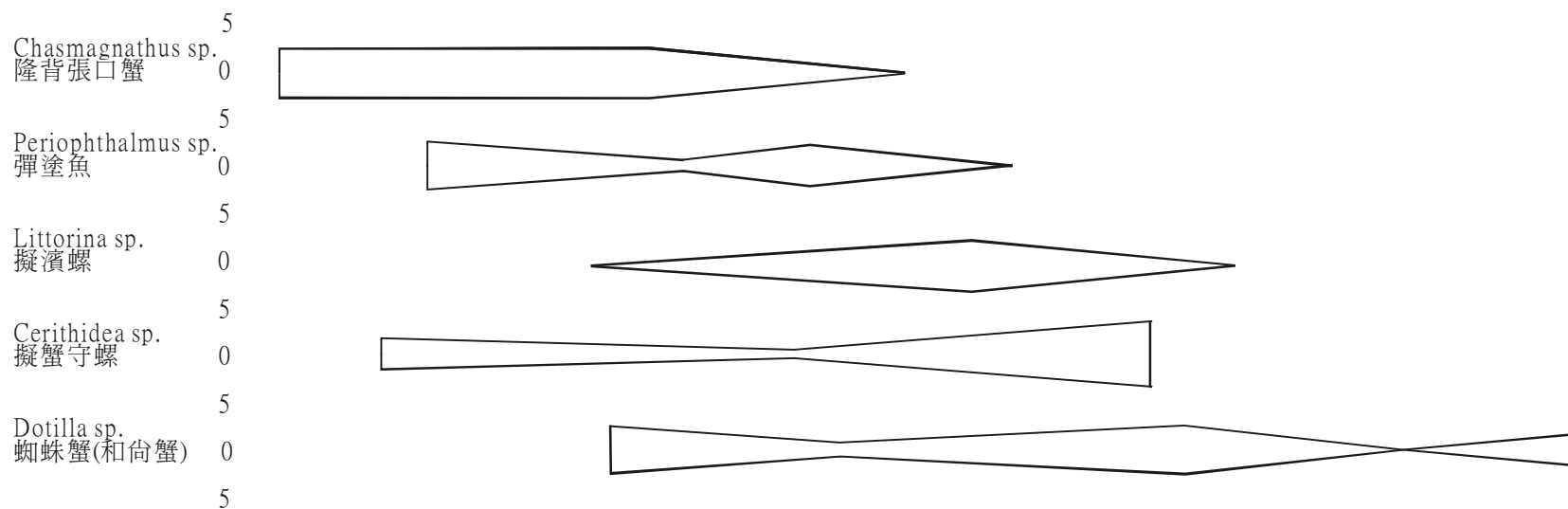
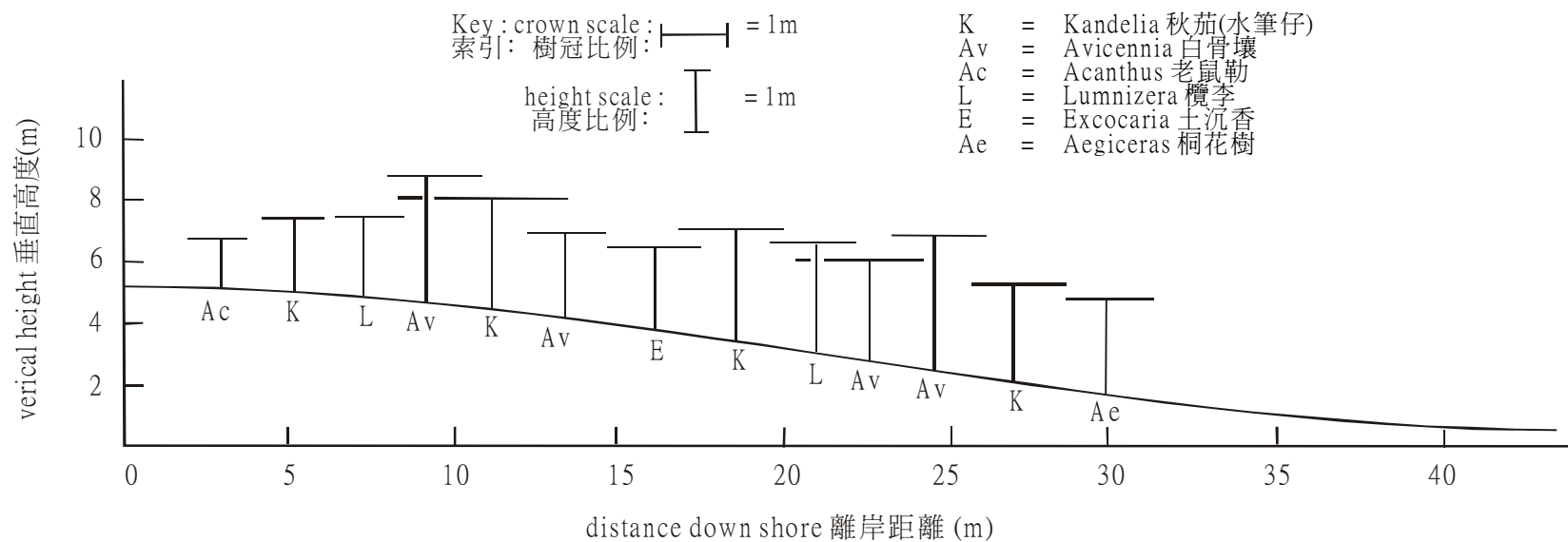
Metaplax elegans
長足長方蟹



Metaplax longipes
秀麗長方蟹



Mictyris brevidactylus (Dotilla) 長腕和尚蟹



Profile diagram through mangrove community at To Lo Harbour
 穿越吐露港紅樹林群落的側面圖