



Study of Mangrove Ecosystem

Introduction

Mangroves are amphibious shrubs and trees, regularly immersed in seawater. Mangrove is also a description of a habitat. It is always found on sheltered soft shore. Mangroves are characteristic of the tropics. In subtropical Hong Kong, they are struggling against the unfavourable climate, as well as the rapid land development which encroaches upon their natural habitats.

Mangroves show various physiological and structural adaptations in response to the unfavourable environment such as unstable substrate, water-logged anaerobic soil and salty external medium with low osmotic potential. Because different mangrove species respond differently to unfavourable conditions, you may find them growing in different parts of the bay.

By providing food, shelter and substrate, mangroves support a large community of animals, mainly molluscs and crustaceans. Some of them are also found in other muddy shores, but some of them are unique to mangroves.

Precautions

- 1. Sandals and slippers are not recommended, which cannot protect the feet well. Canvas shoes with adequate tread should be worn.*
- 2. Beware of broken glasses, oyster shells, and other sharp objects.*
- 3. No specimen should be brought away from the field site.*
- 4. Be attentive to tide level. It can change quickly.*
- 5. Minimize disturbance to the environment.*

A. Running the transect

Run a 50 m long transect line from back shore to middle shore (perpendicular to the coast line). Avoid stepping on the area where the transect line is situated. If time permits, run a longer transect.

B. General description

Draw a sketch map of the bay indicating its landscape, aspect, approximate positions of the high tide mark and low tide mark and position of the transect line. Also make notes of recent weather conditions and general features of the habitat. Pay attention to possible human impacts.

C. Animal sampling

1. Starting from 0 m, place a 50 x 50 cm quadrat at intervals of 10 m along the transect.
Within each quadrat frame :
 - a. Collect animals found on the sediment surface. Put them in a tray, identify and count them.
 - b. For stony area, gently lift the stones and look for animals hiding below.
 - c. For soft substratum, dig out the top layer (5 - 10 cm thick), sort out the animals, identify and count them. It is important that collection of sediment should be done quickly and quietly, because some animals will retreat into their deep burrows even with very slight disturbance.
2. Select 5 mangrove tree along the transect. As far as possible, they should be different species and are separate from each other. Identify and count all the animals attaching on the mangroves and record their micro-habitats.
3. Pay attention to any specific behaviour of the animals such as feeding behaviour, defence mechanism, respiration, locomotion, etc.. Also, try to find out any special inter-relationship between the living organisms, for example, competition, mutualism and parasitism.

D. Measuring gradient

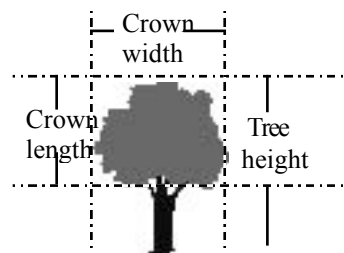
Measure gradient at 5 m intervals by using the abney level in combination with a supporting frame. For uneven slopes, measure at 1 m intervals.

E. Vegetative survey

1. Mangroves which touch , overlie or underlie the transect line are all included in your study.

2. For each mangrove, identify and measure its:

- position along the transect line,
- height,
- crown length,
- crown width.



3. Notice any special feature shown by different mangrove species which is important for their adaptation to the environment.

4. Notice other plants growing along the transect including grasses, lichens, epiphytes and herbs.

5. Collect a few leaves from each plant species for further examination.

F. Physical factors

1. Note the wave action .

2. Record direction of the transect

3. Measure average wind speed by anemometer. Find out wind direction by a thin nylon thread and compass .

4. Measure light intensity above and under the mangrove canopy by using the light meter.

5. Measure sediment temperature at intervals of 5 m by inserting the soil thermometer into the sediment.

6. Measure air temperature and relative humidity above and below the mangrove canopy by using the digital thermohygrometer.

G. Water sampling

1. Collect water sample from the site where transect line runs into the sea.

2. If there is a stream nearby, also collect some stream water.

H. Sediment sampling

1. Collect about 1000 g of sediment sample from an area which is representative and then put it in a plastic bag.

LABORATORY WORK

A. Sediment analysis

1. Examine the colour, smell and text (sticky, hard, soft, loose...) of the sediment.
2. Add about 500 ml of sediment into a 1000 ml measuring cylinder, add water until it reaches the 1000 ml mark. Cover the mouth and shake vigorously, then let the mixture settle for few hours. Estimate the proportion of each component : gravel (diameter > 2 mm), coarse sand (diameter 0.2 - 2 mm), fine sand (diameter 0.02 - 0.2 mm), silt (diameter 0.002 - 0.02 mm), clay (diameter < 0.002 mm) and humus (on water surface).
3. Put the sediment in a weighted crucible (about 3/4 full); then take it in an oven operating at 105 °C. When it is dried, weigh. Then burn it by using the gas burner for about 20 minutes. After it is cooled, weigh again. Calculate the amount of organic matter present in the sediment.

B. Water analysis

1. Measure pH of the sea water by a pH meter.
2. Measure salinity by a refractometer.
3. Filter 100 ml water sample by a dry filter paper; then dry the filter paper and weigh it. Calculate the amount of total suspended solids.

C. Detailed study of specimen

1. Observe micro-organism in the water and in the sediment under a microscope.
2. Identify the collected animals and plants.
3. 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.
4. Cut sections of the mangrove leaves collected for high power microscopic study and examine their adaptive features. Draw diagram(s) of the features.



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Record Sheets

School / group: _____

Members: _____

Date of study : _____ Time of study : _____

A. Sketch map of field site

D. Gradient

Position	0 m							
Gradient								
Remarks								
Position								
Gradient								
Remarks								
Position								
Gradient								
Remarks								

E. Plant data

	Name	Position	Height	Crown height	Crown width
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					

F. Physical factors

1. Wave action : _____
2. Direction of transect : _____
3. Average wind speed and wind direction: _____
4. Light intensity a. above canopy : _____
b. below canopy : _____
5. Sediment temperature :

	0 m	10 m	15 m	20 m	25 m	30 m	35 m	40 m	45 m	50 m
Temperature										

- 6 a. Air temperature (i) above canopy : _____
(ii) below canopy : _____
b. Relative humidity (i) above canopy : _____
(ii) below canopy : _____

G. Sea water

1. pH : _____
2. Salinity : _____
3. Total suspended solids : _____

H. Sediment

1. a. Colour : _____
b. Smell : _____
c. Nature : _____
2. Composition :

Component	Gravel	Coarse sand	Fine sand	Silt	Clay	Humus
%						

I. Ecological information of living organisms in mangrove

	Name	Micro-habitat	Ecological roles	No. found	Behavioural adaptation	Morphological adaptation	Physiological adptation
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
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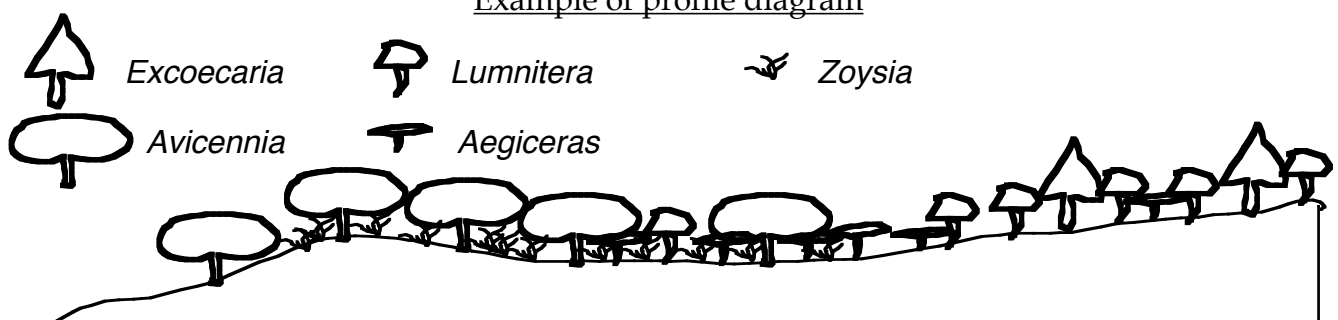
Animal and Plant distribution

1. Use the gradient data and plant data to draw a sectional profile diagram. The diagram should show positions and relative sizes of each mangrove. (see example below)
2. Select several representative animal species and draw diagrams or charts to show their distribution along the transect.

Questions for discussion

1. Are the plants evenly distributed along the transect? If not, what are the pattern of distribution? Can you explain the pattern?
2. Are the animals evenly distributed along the transect? If not, what are the pattern of distribution? Do you think the distribution of the animals is related to the physical factors? Can you explain the pattern of distribution?
3. What unfavourable factors are the plants facing? What adaptive features have you observed? Describe how these adaptive features work.
4. What unfavourable factors are the animals facing? What adaptive features have you observed? Describe how do these adaptive features work.
5. Construct a food web to show the feeding relations between the living organisms.
6. Describe other relations between the living organisms, such as commensalism, mutualism and competition.
7. Have you observed any human impact on the ecosystem? How important are the impacts? Suggest some solutions to minimize these impacts?
8. What is your conclusion of this study?

Example of profile diagram





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Equipment List

1	50 m transect line	1 roll
2	Quadrat - 50 x 50 cm	2 pcs
3	Measuring tape (60 inches)	1 pc
4	Light meter	1 pc
5	Digital thermohygrometer	1 pc
6	Abney level and supporting frame	1 set
7	Trowel	2 pcs
8	Plastic bag	3 pcs
9a	Forcep - blunt	2 pcs
9b	Forcep - fine	2 pcs
10	Magnifying glass	2 pcs
11	Compass	1 pc
12	White plastic tray	2 pcs
13	Blue plastic tray	1 pc
14	Metal sieve	2 pcs
15	Counter	1 pc
16	Map	1 pc
17	Ruler - 30 cm	1 pc
18	Water sampling bottle	2 pcs
19	Digital anemometer	1 pc
21	Soil thermometer	1 pc
22	Thin nylon thread	1 pc

References

1	A Colour Guide to Hong Kong Animals
2	Hong Kong Seaweeds
3	Field Study Handbook - Wildlife Pictorial Guide
4	Estuarine Organisms
5	Hong Kong Coastal Plants