Biology Field Trip Study Report

Seashore Ecosystem

School: C.C.C. Kei San Secondary School

Class: 6B (2008-2009)

Date: From 18-4-2008 to 20-18-2008

Teacher: Mr. Kan Yu Keung

Site: Ho Koon Nature Education cum Astronomical Centre

Student Name List:

6B (2) Chan Yan Yi

6B (6) Leung Pui Sze

6B (8) Pang Chi Chi

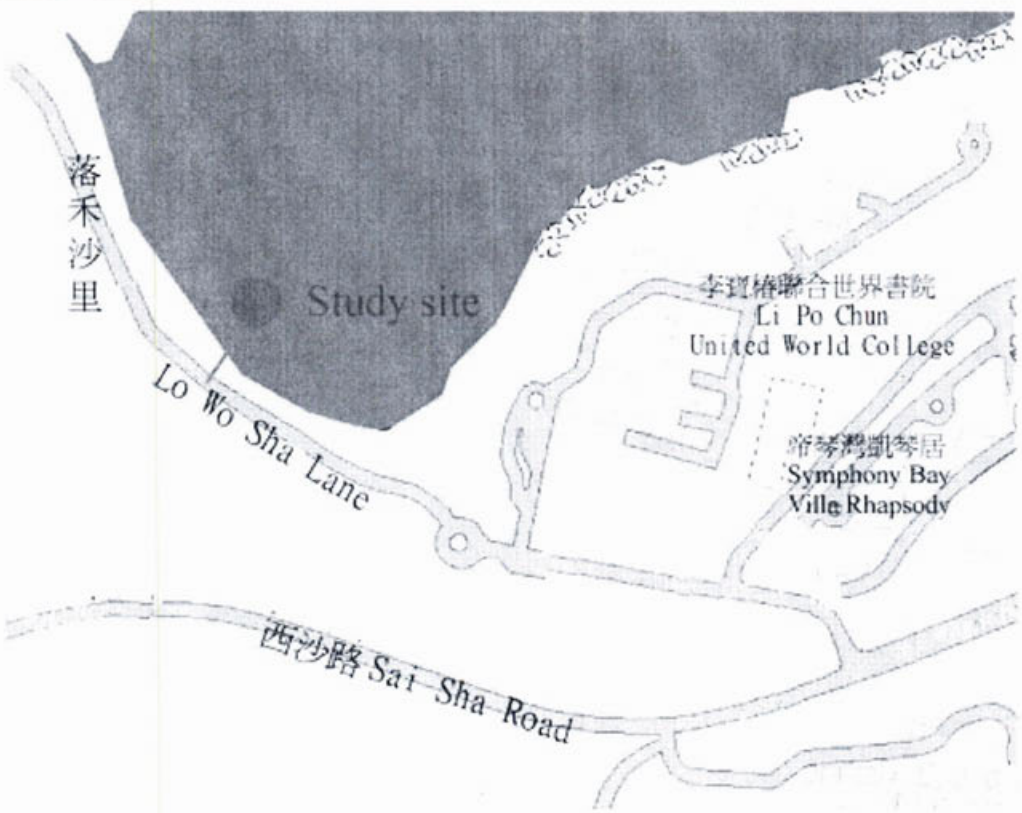
6B (9) Tsang Sin Yi

6B (10) Wong Yuen Ching

6B (20) Lau Ka On

6B (28) Patrice Ting

Introduction



Starfish Bay(海星灣) in Wu Kai Sha has been chosen to study the habitat in seashore,. It is proved as a site of Special Scientific Interest (SSSI) by the government.

The location of the seashore is very special as it is flatten and U-shaped - sheltered by the two sides of land. It is sandy seashore composed of particles remained after tides. The wave action is hence relatively weaker as well as the wind speeds. As the seashore is flat, the seawater will cover the sandy area within a short period of time. The tidal action can affect the ecosystem of the seashore greatly. Therefore, a unique and interesting ecosystem is formed there.

We looked into both the physical and biotic factors that affect the formation of this seashore ecosystem. From the experimental results and the observation made, we have a better understanding in the habitats of the organisms the distributions of the organisms in the micro-habitats, the special adaptation retained from the environment and how they survive. Their relationship between the species can also be deducted.

Method

1. Temperature(picture1)
    - insert a digital thermometer into the mixture to measure the temperature

2. Light intensity (picture2)
    - put a light meter under the light condition to measure the reading(light intensity)

3. Humidity(picture3)
    - put the hygrometer in air to measure the air humidity
4. Wind speed(picture4)
    - put the anemometer in air to measure the wind speed

5. Current speed
    - extend the plastic tube of flow meter, the reading(current speed) is shown on the flow meter

6. Salinity
    - refractometer
7. Dissolved oxygen
    - Put DO meter (rinse the probe, avoid generation bubbles)in the mixture to measure the amount of dissolved oxygen in it
8. pH(picture5)
    - before insert pH meter into the mixture. something should be done to adjust the accuracy of the meter(repeat putting the pH meter into the pH4andpH7 buffer solution,and adjust the meter)

9. Ammonia content
    - pour 25ml of filtrate into a 100ml beaker , add1ml of solution C (nessler's reagent) and swirl the mixture. A yellow colour indicates the presence of ammonium ions. Fill a cuvette to the white mark and measure the ammonium ion concentration by spectrophotometer(425nm)
10. Phosphate content
    - pour 25ml of filtrate into a 100ml beaker, add 1 drop of solution A(ammonium molybdate/H2SO4)and solution B(5%Stannous chloride)respectively and swirl the mixture. A blue colour indicates the

presence of phosphate ions. Fill a cuvette to the white mark and measure the phosphate ion concentration by spectrophotometer(506nm)

11. Chemical oxygen demand(COD)

- pour 100ml of filtrate into a 250ml beaker and add 2ml dilute HCL. Fill 4 test tubes and add KMnO4 as below

Test tube	A	B	C	D
KMnO4(0.004)(drop)	0	1	2	3

- After putting the test tubes into a 95.Cwater bath for 30 minutes, compare the colour with test tube A against a white background

Colour	Degree of oxygen depletion
B, C, D remain pink	no sign of oxygen depletion
B decolourized	sightly depleted
B, C decolourized	heavily depleted
B, C, D decolourized	seriously depleted

12. Total suspended solid(TSS)

Weigh a pre-dried filter paper andfilter 500ml. water sample into another 500ml. plastic bottle. Put the filter paper into an evapourating dish, dry in a 105.C oven overnight and reweigh. TSS(in mg/L or ppm) = increase in weigh (mg) x2

13. Sampling Method

a) Quadrat

- a sampling method in which square areas (quadrats) are randomly selected for sampling
- used to estimate population size/density, frequency or biomass of species in a fairly uniform habitat (e.g. a grassland)
- a square quadrat frame(of known area, such as $0.25m^2$ or $1m^2$) is placed randomly on the ground and organisms inside it are identified and counted
- the sampling is repeated many times at different points until enough samples representative of the habitat are obtained
- confined to the sampling of plants and sessile/very slow-moving animals

Grid quadrat - quadrat divided by string or wire into sections to assist in counting or estimating species numbers/abundance/ percentage cover

[Cover refers to the area of the quadrat occupied by a above-ground parts of a species when viewed from above. Species often overlap and there may be several vertical layers,%cover may therefore add up to more than 100% for an individual quadrat.]

b) Transect

- a sampling method in which samples are taken along a linear direction
- used in studying changes in the distribution (zonation) of species across an area with clear environmental gradient (e.g. a rocky shore, a stream bed,

etc.)

1) Line transect
    - Ecological measurements are taken, continuously or at regular intervals along a straight line
    - a nylon rope (marked and numbered at 0.5 m, or 1m intervals) is laid in the direction of the environmental gradient, organisms touching the line are counted and recorded continuously or at regular intervals
    - used to show how species change along the line/ presence or absence of species along the line
    - ecological measurements are taken, continuously or at regular intervals along a strip of ground with fixed width
    - a transect line is laid out across the ground and a quadrat is placed on the 1st marked point on the line; the plants and/or animals inside the quadrat are then identified and their abundance estimated
    - - the quadrat is then placed at another marked point on the line and sampling is repeated, in this way quadrats can be sampled continuously down the transect line, or at predetermined interval
    - gives information on the changes in abundance of species (in addition to presence or absence) along a linear direction

Observation

Temperature: 26℃

Soil texture: Sandy

Smell: Bad egg smell

From 50m – 0 m , the substrates along the transect line become more and more muddy.

Green algae lay on the surface which was dry and fragile.

Clear water with bubbles.

Soil has 2 layers (colour).

Data

Wave speed

	Time	Position(transect line)
Initial	1:40p.m.	0m
Final	3:11p.m.	50m
Total	1hr31 mins	50m

- Average wave rate ~0.55m/min

Wind

Direction : South-west

Average speed : 1.3m

Light

Average light intensity : 78,000 LUX

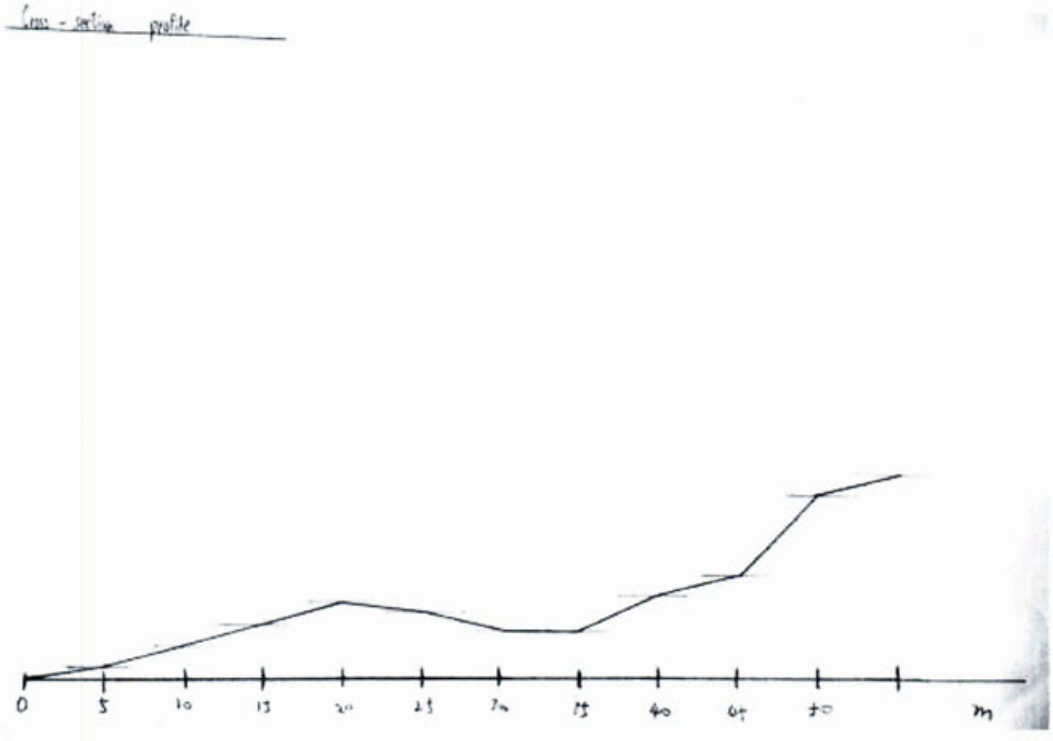
Humidity(2m interval)

44% - 54%

Gradient(5m interval)

m	0	5	10	15	20	25	30	35	40	45	50
	2°	3°	3°	3°	-1°	-1.5°	0°	4°	1°	9°	1°

A cross-section profile of Starfish Bay coastline



Sediment analysis

Colour : Light brown & black

Smell : Bad egg smell

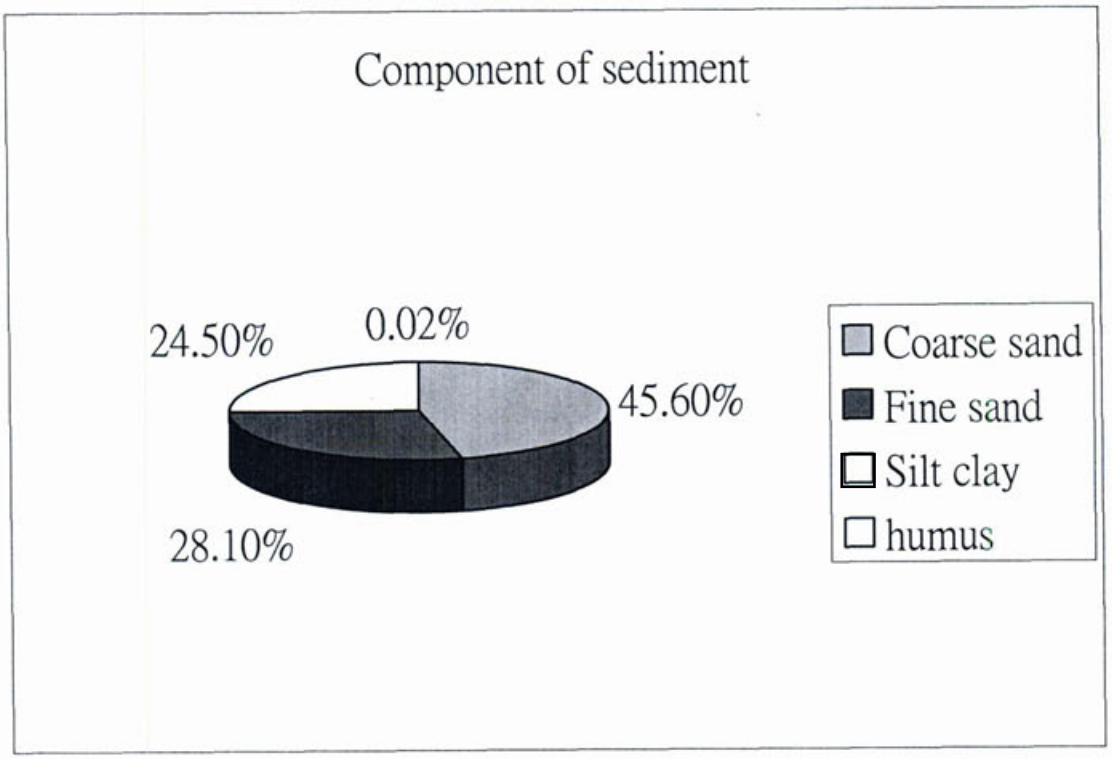
Nature : Soft , sticky

Amount of organic matter : 0.02412g/100g

Component :

Coarse sand 45.6%

Fine sand	28.1%
Silt & clay	24.5%
Humus	0.018%



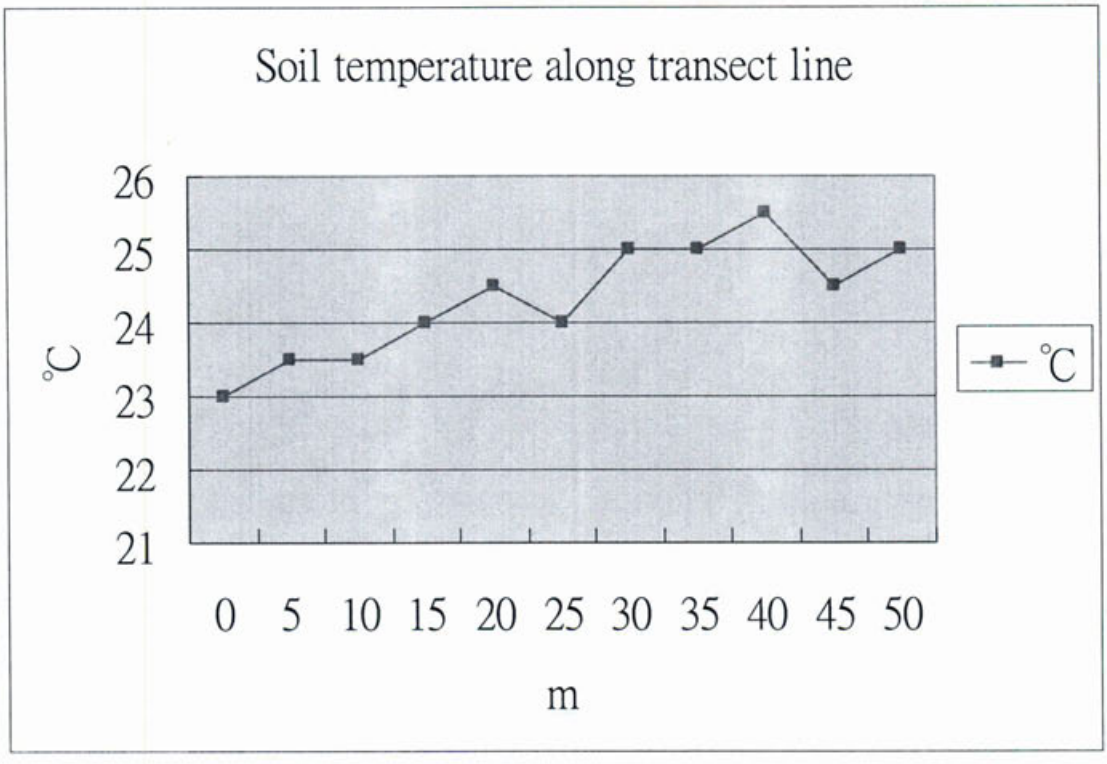
Water analysis

Salinity : 30 ppt

pH : 8.4

Soil temperature along transect line

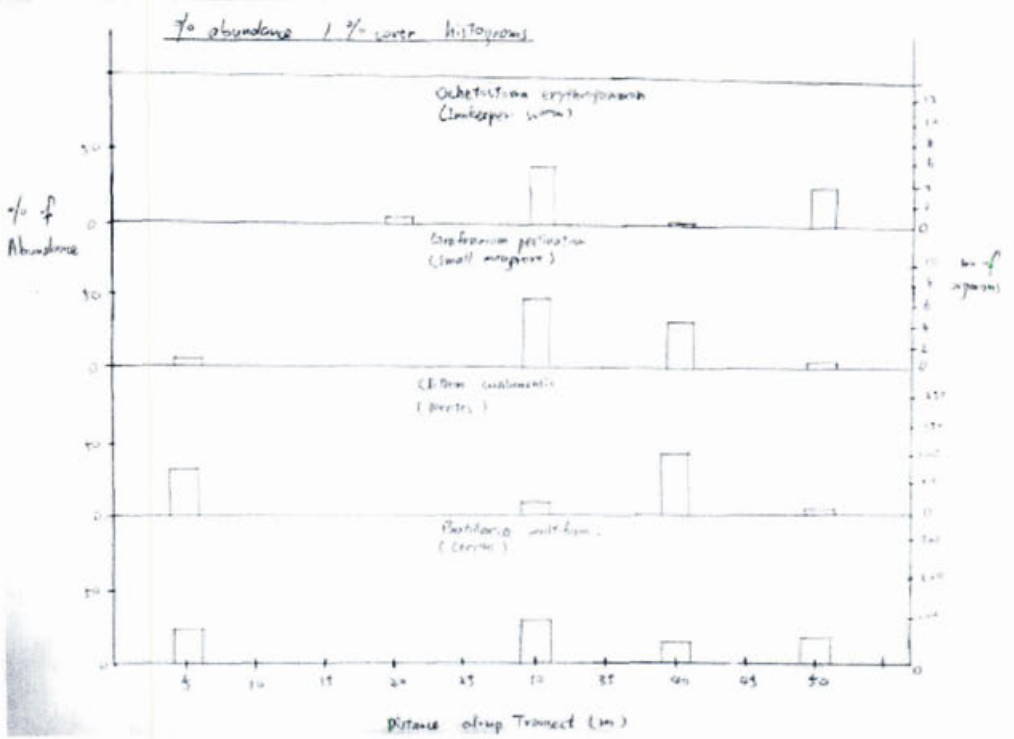
m	0	5	10	15	20	25	30	35	40	45	50
℃	23	23.5	23.5	24	24.5	24	25	25	25.5	24.5	25



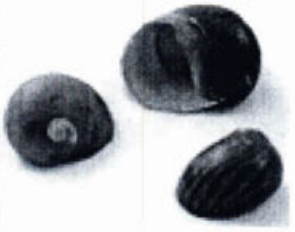
Distribution of Organisms

We have found a variety of organisms in the seashore both over the surface and under the sand, such as crabs, semi-aquatic snail, worms etc. Some of the organisms under the sand, like burrows, were not easy to find as they may protect themselves from predators or from the heat of the sun. We are here to introduce some of the dominant species found in the seashore.

A percentage of abundance against percentage of cover histogram of various species in Starfish Bay



	**Innkeeper worm** (*Ochetostoma erythrogrammon.*) Features: 1. Deep blooded red, non-segmented body with faint bands, tongue-like proboscis 2. Burrow is U-shaped 3. As the host of other animals in commensalisms Special Features: 1. The blood-like body fluid is the respiratory pigment for oxygen transport.
	**Pistol shrimp** (*Alpheus brevicristatus* .) Features: 1. Brownish-grey burrowing shrimp 2. Having a very large right pincer 3. Usually hide in burrows 4. The right chela much bigger than the other one Special Features: 1. The pincer can snap shut, making a loud crack to expel competitors and stun prey.

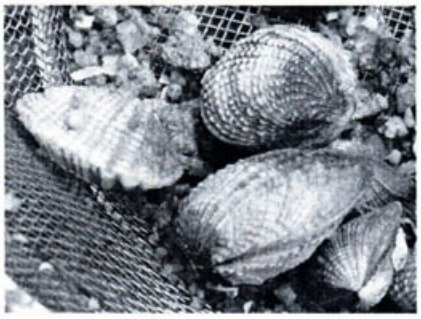
	**Hermit crab** (*Pagurus dubius.*) Features: 1. Plain olive-green with some makings on the pincers 2. Having a very large right pincer 3. Occupy the empty shells of snails 4. Feed on detritus
	**Fiddler crab** (*Uca borealis.*) Features: 1. Commonest on sandy shores. 2. Long eyestalks Special Features: 1. Males have one greatly-enlarged chela which can wave to and fro for sexual and territorial purpoes. 2. Females only have two small pincers.
	**Nerites** (*Clithon oualaniensis* .) Features: 1. Tiny, rounded snail 2. Having different color, from plain brown to pale cream or orange 3. Having variable patterning like spotted, banded, wavy-lined
	**Ceriths** (*Batillaria multiformis* .) Features: 1. Very tall-spired with a rounded aperture 2. Lip is continuous with shell 3. Shell has shallow vertical ridges 4. Usually brown and white

Ribbon worms (*Nemertea*)

Features:

1. Long and thin
2. Often brightly colored
3. Non-segmented with a short proboscis

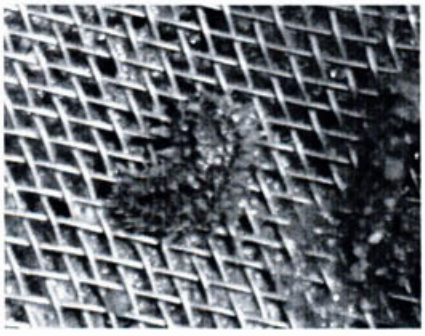
Other species found:



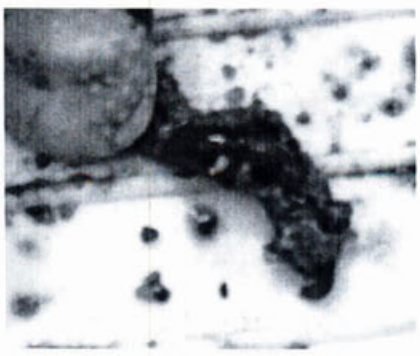
Shells

crabs

crabs



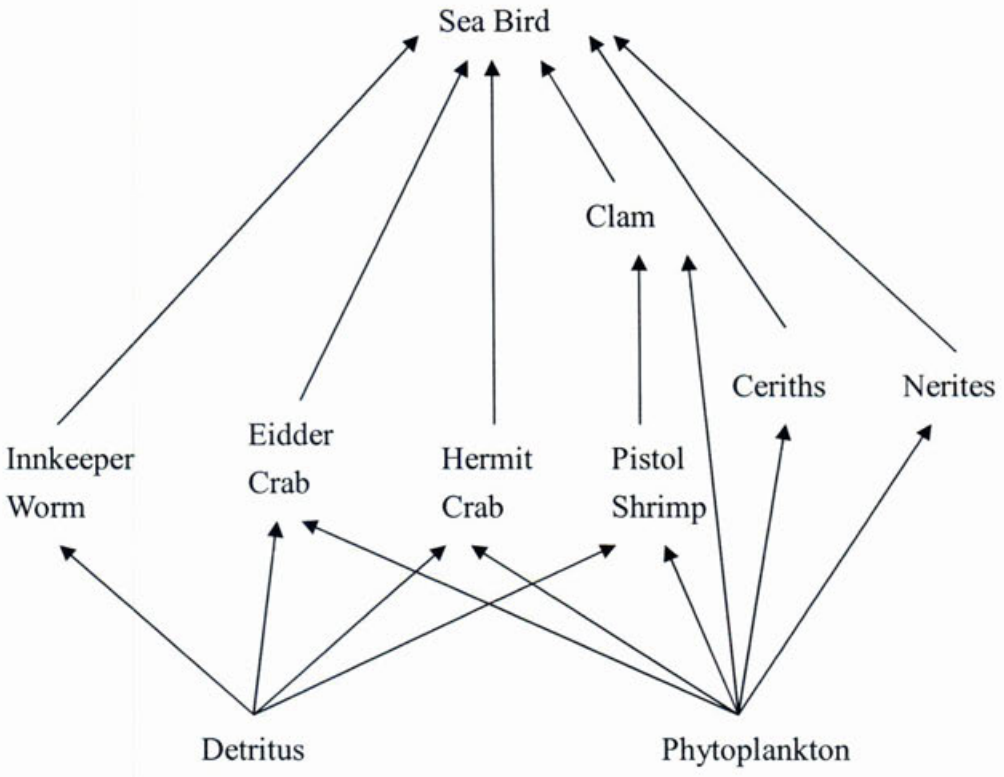
flattened worm



worm

Discussion

Food Web of the organisms in Starfish Bay



Relationship between the organisms found

The Sea bird is the top level consumer in the food web and it predates on the crabs, shrimps and etc. The relationship of predation is established. The Eidder Crab, Hermit Crab and Pistol Shrimp compete for their common food which are detritus and phytoplanktion, which is an interspecific competition. Intraspecific competitionis also occured: The individuals of Hermit Crab would fight for their shelters and food between each other.

Apart from the predation and competition, relationship of commensalisms is also found. After the Ceriths or other hard-shelled organisms are dead, the Hermir Crab can gain their shell as shelters. Sea bird is the highest topic level among the organism in the food web. The relationship between the food web is loosely packed
Hermit crab and other organism except sea bird are competitor on the detritus (Food resources) which is intraspecific competition. The decrease on their population will stimulate the population growth of the other organism.

However it seems unsuitable on this case as the detritus are tremendous in amount. The farther the distance between seas, they are with more organism especially inner keeper. It may relate to the osmosis reaction on their permeable skin.

As the tissue fluid in their body is higher than that of the sea water, they suffer from lack of water. It is fatal to every organism. That is the reason why their movements are predictable during tidal on the bleach

The summary of seashore organism			
	Name of animals	Microhabitat/ Habitat	Adaptations
1.	Innkeeper worm	U-shaped burrow in sand or sandy mud in intertidal or subtidal regions	1. Hemoglobin in body fluid to facilitate O2 transport 2. Ability of swimming makes them able to live in subtidal area
2.	Pistol shrimp	Depth 8 to 10m, bays and lagoons	Snapping effect
3.	Hermit crab	Upper face of rock with moisture	Hide themselves inside empty shell
4.	Fiddler crab	along sea beaches and brackish inter-tidal mud flats, lagoons and swamps	Ability of sifting the sand to aerate the substrate
5.	Nerites	Wet stone	Use sucker like foot to hold themselves on rock
6.	Ceriths	shallow water, amongst sea grass, on mud or sand	1. hard shell to resist wave action 2. operculum for sealing the gap between its shell and the rock → prevent desiccation
7.	Ribbon worms	Sea floor, among seaweeds, rocks, mussel and barnacle beds, or buried in mud, sand, or gravel substrates	presence of an eversible proboscis which is used for catching prey

Analysis on the sand

The lower part of the sand is deeper in color as the anaerobic respiration of microorganism in the environment of insufficient environment The nasty smell is given out in this process and the mineral is then released. The deep color also

contributed by the rusting color of Fe^{+} ions. Thus, the sand without oxygen and abundant of mineral create a special habitat for the organism underneath

Inner keeper worm

It is the typical worms at this layer of sand. Hemoglobin in its body which is affinity to oxygen help to get more oxygen. Majority of its food is detritus which is rich in mineral and other nutrients , and other organism also treat detritus as their main food as its nutritious components

Conclusion

The aims of this field trip were to investigate the differences of distribution of the organisms in the micro-habitats of the organisms and the biological relationship of them. We can successfully outline the main ecosystem of the seashore ecosystem of Starfish Bay. This also provided us a precious opportunity for us to investigate the miracle of the nature from the first-person experience

Limitation:

1. The transect line is not long enough to represent the whole environment for the seashore and the distribution of the organisms.
2. One transect line is not enough for a complete study of the full ecosystem.
3. Its if not long enough to study the actual living style of the organisms within several hours as they may vary in the locations at different time.
4. Only starfish bay is not enough to represent the whole habitat of the seashore.
5. It is difficult to count the number of the organisms and search the organisms in sea water, as they may escape due to the human action.

Improvement:

1. Longer transect lines should used in the field so as to lengthen the area of the study covered.
2. More transect can ensure a larger sample size.
3. Study in the seashore in different time of day and even at different seasons whick can be more representative and objective of the distribution of organisms in different time
4. Study all the other four seashore habitats (stony seashore, muddy seashore, stream seashore, and rocky seashore] , thus we can learn the whole habitat of the beach deeply and analysis the differences distribution of organisms.

Reference

1. **Streams – Study Sites**,
http://ecology.hku.hk/jupas/sandy%20shore/Starfish%20Bay.htm