Tin Ka Ping Secondary School

Biology

2007-08

Field trip report

Stream

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(17)*

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Introduction

A stream is a body of water with a current, confined within a bed and stream-banks. The most obvious feature of a stream ecosystem is the unidirectional flow of water from upstream to downstream, which is the major factor influencing distribution and the abundance of living organisms.

In order to survive in the water medium, lives in the stream ecosystem can be very different morphologically and physiologically in comparing with terrestrial lives.

Stream is embedded in the terrestrial landscape and links to the terrestrial system in numerous ways. It should not be considered as an isolates system.

Streams are important as conduits in the water cycle, instruments in aquifer recharge, and corridors for fish and wildlife migration.

Therefore, despite despoliation by man, the diversity of lives in many upper streams in Hong Kong is still high. Birds, amphibians, reptiles, fishes, molluscs, crustaceans, insects, vascular plants, mosses, liverworts, algae, fungi, protozoans are all regular residents in the system. It is not difficult to find more than 100 different species of living organisms within 10 meter section of the upper stream.

Apparatus

No.	Equipment	Quantity
1	Water sampling bottle	2 pcs
2	Ruler – 30 cm	1 pcs
3	Light meter	1 set
4	Digital thermometer with probe	1 pc
5	Stream flow meter	1 pc
6	Trowel	1pc
7	Plastic bag	2 pcs
8	Forcep	4 pcs
9	Manifying glass	2 pcs
10	Soft brush	2 pcs
11	Metal sieve	1 pc
12	Plastic tray (white)	1 pc
13	3m transect line	1 pc
14	Rubber gloves	1 pair
15	Aquarium net	2 pcs
16	Compass	1 pc

Study of Stream Ecosystem

School / Group : Tin Ka Ping Secondary School Group 1

Members : Kwan Kai Fung, Lai Wing Yu, Lam Ka Yee, Leung Chun Yin, Mai Yan Yan, Wong Kin Lun

Date of study : 21/2/2007 Time of study : 13:30 - 17:00

Site A.

Position	0 m	0.1 m	0.2 m	0.3 m	0.4 m	0.5 m
Depth (CM)	0	0	0	0	0	0
Remarks						

Position	0.6 m	0.7 m	0.8 m	0.9 m	1.0 m	1.1 m
Depth (CM)	1	3	5	8	8	8
Remarks						

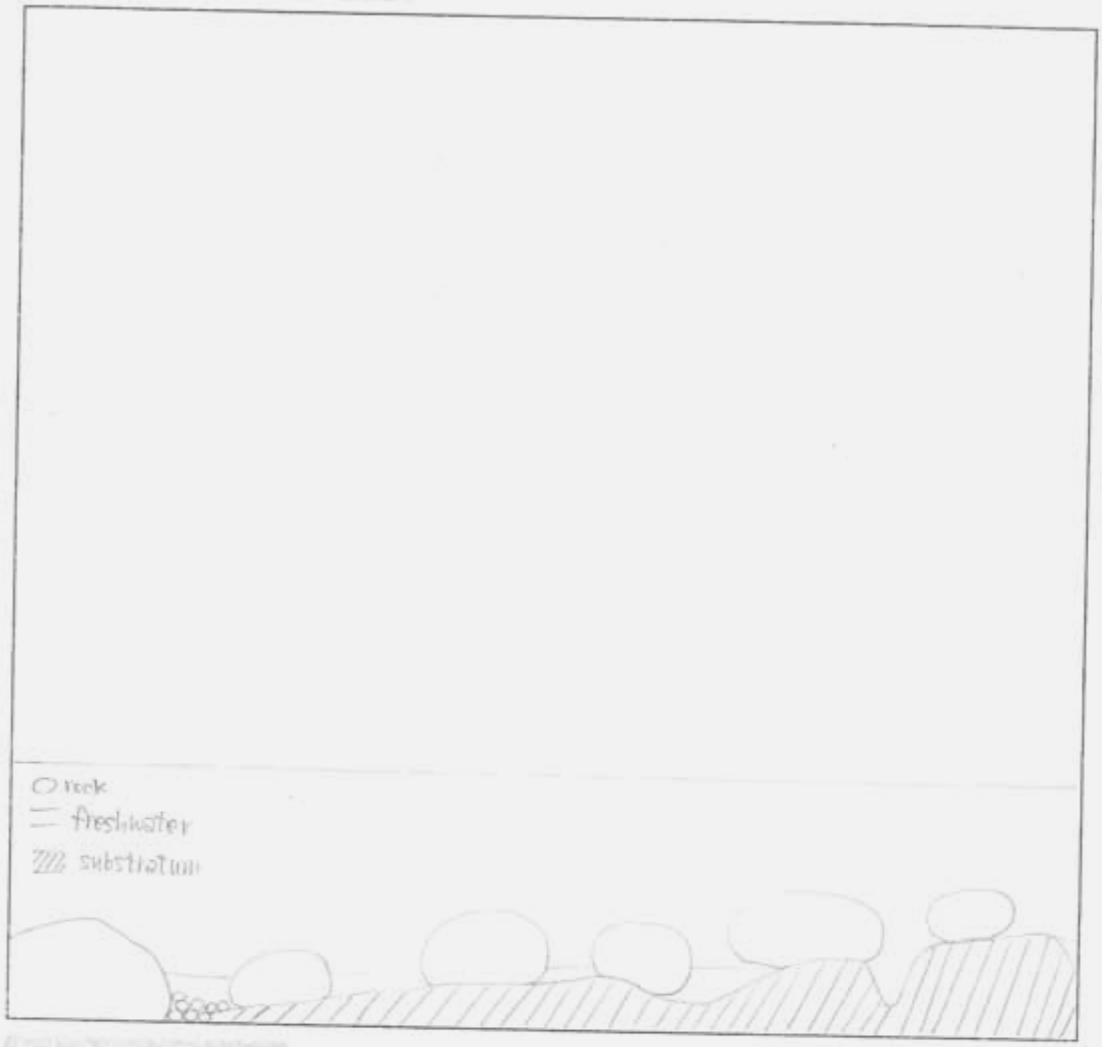
Position	1.2 m	1.3 m	1.4 m	1.5 m	1.6 m	1.7 m
Depth (CM)	9	9	9	10	10	10
Remarks						

Position	1.8 m	1.9 m	2.0 m	2.1 m	2.2 m	2.3 m
Depth (CM)	8	8	7	10	15	16
Remarks						

Position	2.4 m	2.5 m	2.6 m	2.7 m	2.8 m	2.9 m
Depth (CM)	16	10	21	21	23	24
Remarks						

Position	3.0 m	3.1 m	3.2 m	3.3 m	3.4 m	3.5 m
Depth (CM)	19	/	/	/	/	/
Remarks						

A



Slow running, clean water, hard substratum, shaded area

Sunny, warm

		Site A	Site B
Light intensity (Lux)	Surface	43 X100	51 X100
	Bottom	18 X100	3 X100
Temperature (°C)	Air	24	22
	Water	16	19
Average flow rate (ms^{-1})		0	0.9

	polluted water near Site A	Site B
Ammonium content (ppm)	30	
Phosphate content (ppm)	13	
pH	6.57	
Total dissolved solids (ppm)	107	
Total suspended solids (mg/l)	20	
Dissolved oxygen (mg/l)	1.2	
Chemical oxygen demand (mg/l)	52.64	

	Site A	Site B
Nature		
Colour		
Smell		
Gravel (%)		
Coarse sand (%)		
Fine sand (%)		
Silt (%)		
Clay (%)		
Humus (%)		
Remarks		

Name	Site A Micro-habitat	Site A Approx. density	Site A Ecological roles	Site B Micro-habitat	Site B Approx. density	Site B Ecological roles
石菖蒲 Acorus sp.		0			7	
冬青 Ilex asprella		0			3	
自然湖紫藻 Algae		0			2	

Name	Site A Micro-habitat	Site A Approx. density	Site A Ecological roles	Site B Micro-habitat	Site B Approx. density	Site B Ecological roles
鰕虎魚 Rhinogobius sp.		40			25	
擬平鰍 Liniparhomaloptera disparis		10			0	
麥氏擬腹吸鰍 Pseudogastromyzon myersi		1			1	
海南鏡螺 Brotia hainanensis		25			13	
凸旋螺 Ramshorn Snail		10			0	
蚊幼 Chironomous sp.		2			0	
蜻蜓若蟲 Dragonfly Nymph		1			0	
蜉蝣若蟲 Mayfly Nymph		1			0	
異鱲(成魚) Parazacco spilurus		0			3	
黽蝽 Water Skater		0			3	
鋸齒米蝦 Caridina serrata		0			1	
海南沼蝦 Macrobrachium hainanense		0			2	
水錢 Water Penny		0			1	
香港瘰螈(成體) Paramesotriton hongkongensis		0			1	

Field Work

(Refers to the information provided by Ho Koon Nature Education cum Astronomical Centre)

1. **Sectional profile**

   A portion of the stream which was representative was selected.

   A 3 m transect line was run across the stream.

   The nature of the bottom and depth at 0.1m intervals along the line was recorded.

   A cross sectional profile diagram was drawn using the data obtained.

   The work that follows was done near this line.

2. **General description**

   A sketch map of the area in which we have worded was drawn.

   The flow direction, breadth, exposed rocks and positions of the tress which were related to the ecosystem were indicated.

   The nature of the bottom, water colour, any floating material or foam and smell were recorded.

3. **Water sampling**

   Two sampling bottles with polluted stream water near field site A were fully filled.

   The two sampling bottles were brought back to the laboratory for chemical analysis.

4. **Physical factors**

   Light intensity on the water surface and at the bottom was measured by a light probe connected to a light meter.

   Air temperature and water temperature were measure by digital thermogyhrometer.

   Average current speed was measured by a flow meter.

5. Freshwater plants study

Habitats and approximate abundance of the plants (including algae and fungi) which were related to the freshwater ecosystem in the area of our study were recorded. Their roles in the ecosystem were noticed.

Samples of attaching algae, sewage fungi and plankton in the stream water were taken for further microscopic investigation.

6. Freshwater animals investigation

The animals moving on water surface or swimming in water were identified.

The approximate density (e.g. number per m^2) was estimated.

Their ecological roles were recorded.

Only one individual form each species was collected for identification and detailed study.

Stones were lifted from the bottom gently. A soft brush was used to remove the animals attaching on the stone surfaces to the plastic tray.

A trowel was used and the top layer of the sediment was collected. The sediment was transferred to the metal sieve and was stirred gently in the water. The animals were sorted out and transferred to the tray.

The species collected were identified. The number of species was counted and their micro-habitats were recorded.

Laboratory Work

1. Analysis of water sample

1.1. pH

pH meter was used to measure.

1.2. Dissolved Oxygen

The dissolved oxygen was measured by dissolved oxygen meter in mg/l of the water sample.

1.3. Ammonium content

1 ml Nessler's reagent was added to 25 ml water sample. The mixture was agitated for 20 seconds. A yellow colour indicates the presence of ammoniacal nitrogen. The transmittance of the solution was measured by a spectrophotometer and the result was compared with the standard curve.

1.4. Phosphate content

1 drop of ammonium molybdate solution and 1 drop of solution B were added to 25 ml water sample. The mixture was agitated for about 20 seconds. A blue colour indicates the presence of phosphate. The transmittance of the solution was measures by a spectrophotometer and the result was compared with the standard curved.

1.5. Total dissolved solids

The amount of total dissolved solids was measured by the total dissolved solids meter.

1.6. Total suspended solids

A filter paper was dried in an oven. It was then weighed and was used to filter 100-500 ml water sample. The filter paper was dried and weighed again.

1.7. Chemical oxygen demand

5 ml concentrated sulphuric acid and 10 ml 0.005M potassium permanganate solution were added to 100 ml water sample and was shaked well. The solution was put in a 95-100 ℃ water bath for 30 minutes. 100 ml 0.0125 M sodium oxalate was added to the solution. The solution was titrated with 0.01 M potassium permanganate until a light red colour appears. The amount of oxygen required to oxidize the reducing agent in the water sample was found out.

2. Study of living specimens

2.1. The microscope was used to study micro-organisms in the water and in the sediment.

2.2. The living organisms we brought back from the field were studied. Their adaptive features such as nutrition, respiration, locomotion, attachment and defense against predators were notices especially.

Discussion

1. In respect of physical factors and biotic factors, what differences have you found in the two sites? What do you think the causes for these differences?

In site B, the water flow is faster than that in site A, this may lead to different organisms in the two sites. Organisms which lives in sties B need to withstand the water flow to prevent the stream water wash them away.

Besides, the light intensity of the bottom of water in site B is much lower than in site A, this may affect the glowing on algae, which lead to the difference of oxygen content in the stream water. If the oxygen content in stream water is low, animals in the water like fish would have a less amount because of insufficient of oxygen.

Moreover, stream water in site B has higher ammonium content, this may help the growth of bacteria.

2. Provide examples to explain how the plants adapt to their living environment

In order to live in the stream area, the plants there have to develop different features to adapt to their living environment.

We found that the *Equisetum debile* usually grow in the cleavages in between the rocks. Since there are rocks mainly in the stream, and the water flow is fast which limited the growth of the plant in water, the plant can only grow on the rocks. Those plants like *Acorus tatarinowii* can grow in the cleavages in between the rocks as they have the long roots. The roots help them attach to the rocks tightly and absorb water and nutrient from water effectively. So they can grow on the rocks in order to avoid the vigorous water flow.

We also found that the plant live in the stream area all would have large leaves or have numerous leaves. For example, *Acorus tatarinowii* have small, long leaves , but in plenty of number. At their living environment, which is the stream, the light intensity there is relatively low since the trees at the two sides block the sunlight. We all know that plants need photosynthesis to product food for themselves, the low light intensity there will lower the photosynthetic rate of the plants. In order to increase the photosynthetic rate, the plants need to increase the surface area of their leaves as much as possible, so to get more lights and increase the photosynthetic rate.

Those plants living at the stream area will commonly have long root and large surface area of leaves, so they can adapt to the environment they live.

3. Provide examples to explain how do the animals adapt to their living environment?

In the stream ecosystem, we found that there are large amount of Large Stream Snail *(Brotai hainanensis)* and they usually attach to the lower side of the rock surface. As the snails need to protect themselves form water current, they consist of ventral foot to attach to the rock tightly.

In addition, they stay at the low water level and stream to feed on the micro- organisms, which are filtered form the current of water created by themselves. Besides, we found that they cannot be noticed easily because of the protective coloration. The snails have the similar colour to the rock and an exoskeleton, which are used to hide and protect themselves from enemies, for example, small long-armed shrimp and Hong Kong Newt.

3. Briefly describe a few indicator organisms you found in the stream

Since the water quality will affect the distribution of the organism in the stream, we can use the organism there as the indicator to determine the water quality.

In the stream, we found *Paramesotriton hongkongensis. Paramesotriton hongkongensis* can only live in the clean water, and they are sensitive to the pollution in water. They will live and reproduce at the clean water, so they can be a kind of indicator organisms of clean water. As we found them in the stream, it shows the quality of water there is high and the water has not been polluted yet.

Mayfly nymph can also be found in the stream. If the water is clean enough, the mayfly will lay their eggs in the water. So the mayfly nymph can be one of the indicator organisms to show the stream is clean and without any pollution.

From the presences of the above two indicator organisms, we can conclude that the water quality of the stream is good and high enough for those organisms to live there.

5. How do human activities affect the stream directly and indirectly?

In site A, we found that there is discharging of sludge which contain the heavy metal ions and show orange colour. Also, there is milky white water and strange smell around the river. The sludge may be discharged from factories, domestic wastes and restaurant, which is poison to the water lives and contain toxic substances that may be accumulated in their body. Consequently, the water lives may die and the river will be polluted by these human wastes directly.

Title: Diagrams of different sludge

Title: Diagrams of different sludge(2)

Secondly, there are some plastic bags in the stream and the bags may be left by human after their activities. As the plastic bags cannot be decomposed easily, they may left there forever and the water lives may be influenced. For example, some fish may be trapped by the bags and lead to suffocation. So, it is how human activities affect the stream indirectly.

6. Environment affects the living organisms, living organisms change the environment. Is that true?

An ecosystem contains the two member, organisms and environment. They are affecting each other. For example, once the temperature gets higher, organisms will dead because enzymes may work abnormally. Since the dead of organisms, less “object” would release heat energy, air temperature would decrease.

The hold world is under this condition. On one hand, if the environment did not affect the living organisms, there would not have neutral selection and even though evolution. On the other hand, if living organisms did not change the environment, where does the pollutions come from? So it is true that both environment and lining organisms are affecting each other.

7. Is there any limitation of this field study? What would you suggest for further investigation?

During our study, only part of the stream was studied. In this situation, the result we found maybe not accurate enough. For example, the place we studied may be the den of fish, so the amount we counted will be much greater then the average number of the hold stream. To solve this we may study upper, middle and lower stream.

In different time, weather and seasons, organisms we found may be different. If we want to have a better result, we should stream in different time, weather and season.

The more important is, our result may affect by human disturbance. Before we study the field, there must be someone studied already. The data we collected were not really natural. Try to minimize the effect by us like put the stone back after we investigate it. This is not only better for us, but also the wild.

Conclusion

To conclude, stream is an ideal habitat of different types of organisms. In our investigation, stream consists of many micro-habitats which are important for the organisms as they provide the good shelter for the organisms. Moreover, there are the places for the association of the plants and animals, thus the biological diversity can be increased because of their relationships, such as competition and commensalisms.

Finally, stream is the vital ecological system for our environment and human should not affect the natural area. Otherwise, the result will be deserved to ourselves. Therefore, we should protect our own earth and keep it's maintenance for the nest generations.

References Book

No.	Name of Book
1	A Colour Guide to Hong Kong Animals
2	Hong Kong Freshwater Plants
3	Hong Kong Freshwater Fishes
4	Field Study Handbook – Wildlife Pictorial Guide
5	Hillstreams

References Website

http://en.wikipedia.org/wiki/Stream