Study of Stream Ecosystem

Ho Koon Nature Education cum Astronomical Centre
(Sponsored by Sik Sik Yuen)
http://www.hokoon.edu.hk
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Introduction

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 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 isolated system.

Despite despoliation by man, the diversity of lives in many upper stream in Hong Kong is still high. Birds, amphibians, reptiles, fishes, mollusces, 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 a 10 meter section of upper stream.

Remarks

1. Sandals and slippers are not recommended, which cannot protected the feet well. Canvas shoes with adequate tread should be worn.

2. In order to protect the legs from injury and attacks by small invertebrates. Trousers instead of shorts should be worn.

3. No specimen should be brought away from the field site.

4. Be very attentive to slippery rock surfaces.

5. Minimize disturbance to the environment.

FIELD WORK

A. Sectional profile

Select a portion of the stream which is representative. It should not be too deep or too wide as these will make your work dangerous and difficult. Run a transect line across the stream. Record the nature of the bottom and depth at 0.1 m intervals along the line. Use the data obtained, draw a cross sectional profile diagram. The work that follows is done near this line

B. General description

1. Draw a sketch map of the area in which you have worked. Indicate flow direction, breadth, exposed rocks and positions of the trees which are related to the ecosystem. For a polluted stream, indicate also the relative position of the sewage outlet.

2. At the area of your study, record the nature of the bottom, water colour, any floating material or foam, smell and any other information you think relevant.

3. Record recent weather conditions.

C. Water sampling

1. Fully fill two sampling bottles with stream water at your site of study. Bring them back to the laboratory for chemical analysis.

D. Physical factors

Measure:
1. Light intensity on the water surface and at the bottom by a light probe connected to a light meter.
2. Air temperature and water temperature.
3. Average current speed by a flow meter.

For each physical factor, measure at different points and then take the average.)

E. Sediment

Use a trowel to collect about 1kg of sediment (if available) from the bottom of the stream. Place the sample in a plastic bag for further investigation.

F. Freshwater plants

Record habitats and approximate abundance of the plants (including algae and fungi) which are related to the freshwater ecosystem in the area of your study. Notice their roles in the ecosystem. Take samples of attaching algae, sewage fungi and plankton in the stream water for further microscopic investigation.

G. Freshwater animals

For animals moving on water surface or swimming in water, try to identify them and estimate their approximate density (e.g. number per m^2). Record also their ecological roles. If capture is necessary for identification and detailed study, collect only one individual from each species.

For animals living at the bottom or in the sediment :

1. Gently lift stones from the bottom. Look for animals attaching on the stone surfaces. Use a soft brush to remove the animals to the plastic tray.

2. You may see animals moving at the bottom after stones have been removed. Try to catch them for identification. If they move too fast, let them go and keep records.

3. Use a trowel, collect the top layer of the sediment.Transfer the sediment to the metal sieve and stir it gently in the water. Sort out the animals and transfer them to the tray.

4. For each species collected, identify, count the number and record their micro-habitats.

LABORATORY WORK

A. Analysis of water sample

1. pH

Use the pH meter to measure.

2. Dissolved Oxygen

Use the dissolved oxygen meter to measure dissolved oxygen in mg/l of the water sample.

3. Ammonium content

Add 1 ml solution C (Nessler's reagent) to 25 ml water sample (if it is not clear, filter it first). Agitate the mixture for 20 sec.. A yellow colour indicates the presence of ammoniacal nitrogen. Measure the transmittance of the solution by a spectrophotometer and compare the result with the standard curve.

4. Phosphate content

Add 1 drop of solution A (ammonium molybdate/ H_2SO4 solution) and 1 drop of solution B to 25 ml water sample (if it is not clear, filter it first). Agitate the mixture for about 20 sec.. A blue colour indicates the presence of phosphate. Measure the transmittance of the solution by a spectrophotometer and compare the result with the standard curve.

5. Total dissolved solids (T.D.S.)

Use the total dissolved solids meter.

6. Total suspended solids (T.S.S.)

Dry a filter paper in an oven. Weigh it and then use it to filter 100-500 ml water sample. Dry the filter paper and weigh again.

7. Chemical Oxygen Demand

(i) Add 5 ml concentrated sulphuric acid and 10 ml 0.05 M potassium permanganate ($KMnO_4$) to 100 ml water sample and shake well. Put the solution in a 95-100^{0}C water bath for 30 minutes.

(ii) Add 100 ml 0.0125 M sodium oxalate ($Na_2C_2O_4$) to the solution.

(iii) Titrate the solution with 0.01 M potassium permanganate until a light red colour appears.

(iv) Knowing the amount (no. of mole) of potassium permanganate titrated, you can find out the amount of oxygen required to oxidize the reducing agent in the water sample. Record the result in mg/l.

B. Analysis of sediment

1. Put 500 ml sediment into a 1000 ml measuring cylinder. Fill in water until it reaches the 1000 ml mark. Shake the mixture vigorously and let it settles for a few hours. Estimate the proportion of each component - gravel (diameter > 2mm), 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).

2. Record the colour, smell, texture (soft, hard, sticky, loose, etc.) and any other relevant features of the sediment.

C. Study of living specimens

1. Use the microscope to study micro-organisms in the water and in the sediment .

2. Study the living organisms you brought back from the field. Notice especially their adaptive features - nutrition, respiration, locomotion, attachment and defense against predators.

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School / Group : _____

Members : _____ _____ _____

_____ _____ _____

_____ _____ _____

Date of study : _____ Time of study : _____

Profile data

Position	0 m	0.1 m	0.2 m	0.3 m	0.4 m	0.5 m
Depth						
Remarks						

Position	0.6 m	0.7 m	0.8 m	0.9 m	1.0 m	1.1 m
Depth						
Remarks						

Position	1.2 m	1.3 m	1.4 m	1.5 m	1.6 m	1.7 m
Depth						
Remarks						

Position	1.8 m	1.9 m	2.0 m	2.1 m	2.2 m	2.3 m
Depth						
Remarks						

Position	2.4 m	2.5 m	2.6 m	2.7 m	2.8 m	2.9 m
Depth						
Remarks						

Position	3.0 m	3.1 m	3.2 m	3.3 m	3.4 m	3.5 m
Depth						
Remarks						

Sketch map of site ( )

Brief Description

Recent weather conditions

Physical factors

		Site A	Site B
Light intensity	Surface		
	Bottom		
Temperature	Air		
	Water		
Average flow rate			

Chemical factors

	Site A	Site B
Ammonium content (ppm)		
Phosphate content (ppm)		
pH		
Total dissolved solids (ppm)		
Total suspended solids (mg/l)		
Dissolved oxygen (mg/l)		
Chemical oxygen demand (mg/l)		

Sediment

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

Freshwater Plants

	Site A			Site B		
Name	Micro-habitat	Approx. density	Ecological roles	Micro-habitat	Approx. density	Ecological roles

Freshwater animals

	Site A			Site B		
Name	Micro-habitat	Approx. density	Ecological roles	Micro-habitat	Approx. density	Ecological roles

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Questions for discussion

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

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

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

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

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

6. Give examples of symbiotic relations observed in the stream.

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

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

9. Can you make any conclusion of this study ?

Field work equipment

1	Water sampling bottle	2 pcs
2	Ruler - 30 cm	1 pc
3	Light meter	1 set
4	Digital thermometer with probe	1 pc
5	Stream flow meter	1 pc
6	Trowel	1 pc
7	Plastic bag	2 pcs
8a	Forcep - blunt	2 pcs
8b	Forcep - fine	2 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
15a	Aquarium net - large	1 pc
15b	Aquarium net - small	1 pc
16	Compass	1 pc

References

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