# *Study of Stream Pollution*

Name: _____    Group: _____    Date: _____

## Aims:

After the course, students should be able to:

1. make careful observations, ask relevant questions, identify problems and formulate hypotheses for investigations related to pollution;
2. Design, conduct and report on field and laboratory investigations related to water pollution;
3. Record and measure physical and chemical factors in a freshwater stream;
4. identify common biological indicators in a local freshwater stream;
5. do simple chemical and biological analysis of water quality in the laboratory,
6. Analyze and organize data for presentation,
7. Cooperate with others and work together in a scientific investigation
8. aware of the application of ecological knowledge in society and its social, ethical, economic and environmental implications.

## Schedule:

| Time | Activity |
|------|----------|
| 9:00 - 10:15 | Briefing |
| 10:30 - 11:50 | Field work |
| 12:00 - 13:00 | Lunch |
| 13:00 - 14:00 | Lab. work & Data analysis |
| 14:00 - 15:30 | Prepare presentation |
| 15:30 - 16:30 | Presentation & summary |

## Equipment and tools:

| No. | Item | | No. | Item | |
|-----|------|---|-----|------|---|
| 1 | Clipboard (x1) | | 7 | Water sampling bottle (x2) | |
| 2 | Brush pen (x2) | | 8 | Rubber gloves (x2 pairs) | |
| 3 | Metal sieve (x1) | | 9 | Plastic sorting tray (x1) | |
| 4 | Forceps (x2) | | 10 | "Wildlife Pictorial Guide" (x1) | |
| 5 | Small vials (x3) | | 11 | "Hill Streams" (x1) | |
| 6 | Plastic dropper (x2) | | 12 | Biological Indicators for water quality assessment | |

## Clothing:

1. Long-sleeved shirt and trousers for better protection against mosquito and insect bites, as well as preventing sunburn. Shorts are not recommended.

2. A pair of shoes for preventing injuries. Slippers and sandals are not recommended.

## Safety:

1. Avoid stepping on steep and wet rock surfaces. Beware of broken glasses and other sharp objects at the bottom.

2. Never getting into deep water. Avoid direct contact with polluted water.
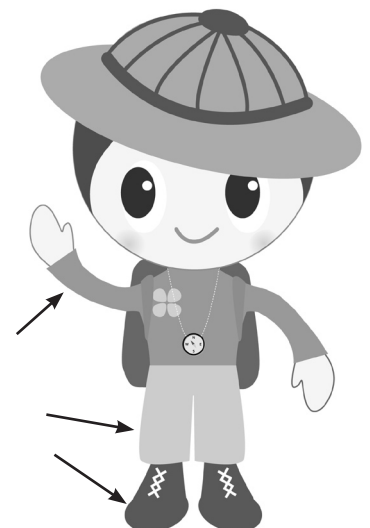
## A. Field sites
Two stream sites would be investigated. Both sites are located in Chuen Lung, one is more influenced by human activities, another is less influenced.

## B. General weather conditions:

_____

## C. Observing physical characteristics
Observe and note down the following physical charcteristics of the stream:
1. Neigbouring habitats and land use. (e.g. woodland, grassland, farmland, abandoned farmland, village...)

_____

2. Human activities which may influence the stream. (farming, domestic effluents, clearing of plants, modifications of stream channel...)

_____

3. Materials floating on the water surface

_____

4. Colour of the water

_____

5. Any odour originated from the stream

_____

6. Nature of the stream bed (hard, soft, muddy, sandy, rocky...)

_____

## D. Water sampling
Use a water sampling bottle to collect water sample (Sample 1) from an representative point in your study area. Collect another water sample from the outlet of domestic effluent (Sample 2). Keep the water samples for further chemical analysis. Use a pair of rubber gloves to prevent direct contact with the polluted water when collecting water sample.

## E. Assessing biological indicators

## 1. On-site observation
a. Observe and note down the water plants growing along the stream sides.

| Plant name and relative abundance | Plant name and relative abundance |
|---|---|
| ☐ few   ☐ many | ☐ few   ☐ many |
| ☐ few   ☐ many | ☐ few   ☐ many |
| ☐ few   ☐ many | ☐ few   ☐ many |
| ☐ few   ☐ many | ☐ few   ☐ many |
| ☐ few   ☐ many | ☐ few   ☐ many |

b. Observe and note down the water plants growing on the water surface.

_____

c. Check the existence and approximate density of the following living organisms in the water:

| | | | | |
|---|---|---|---|---|
| i. Sewage fungi | ☐ none ☐ few ☐ many | xiii. Caddisfly larvae | ☐ none ☐ few ☐ many |
| ii. Filamentous algae | ☐ none ☐ few ☐ many | xiv. Fishfly larvae | ☐ none ☐ few ☐ many |
| iii. Tubifexs | ☐ none ☐ few ☐ many | xv. Water penny | ☐ none ☐ few ☐ many |
| iv. Pond snails | ☐ none ☐ few ☐ many | xvi. Freshwater shrimps | ☐ none ☐ few ☐ many |
| v. Ramshorn Snails | ☐ none ☐ few ☐ many | xvii. Freshwater crabs | ☐ none ☐ few ☐ many |
| vi. Large Stream Snails | ☐ none ☐ few ☐ many | xviii. Hong Kong Newts | ☐ none ☐ few ☐ many |
| vii. Bloodworms | ☐ none ☐ few ☐ many | xix. Gobies | ☐ none ☐ few ☐ many |
| viii. Water skaters | ☐ none ☐ few ☐ many | xx. Sucker-belly loaches | ☐ none ☐ few ☐ many |
| ix. Mayfly nymphs | ☐ none ☐ few ☐ many | xxi. Broken-band Hillstream loaches | ☐ none ☐ few ☐ many |
| x. Damselfly nymphs | ☐ none ☐ few ☐ many | xxii. Predaceous Chubs | ☐ none ☐ few ☐ many |
| xi. Dragonfly nymphs | ☐ none ☐ few ☐ many | xxiii. Freshwater Minnows | ☐ none ☐ few ☐ many |
| xii. Stonefly nymphs | ☐ none ☐ few ☐ many | Others | |

## 2. Microscopic observation

a. Use a large dropper to collect soft sediment with water at the same locations as the two water samples are collected. Keep the samples in sealed vial.

b. In the laboratory, use a small dropper to transfer 1-2 drops of the mixture of water and sediment to a glass slide, cover it with cover slip, observe under microscope. Use the same method to prepare another 4 slides.

c. Check the existence and approximate density of the following micro-organisms on the slides:

| Sample 1 | | Sample 2 | |
|---|---|---|---|
| i. Unicellular algae | ☐ none ☐ few ☐ many | i. Unicellular algae | ☐ none ☐ few ☐ many |
| ii. Paramecium | ☐ none ☐ few ☐ many | ii. Paramecium | ☐ none ☐ few ☐ many |
| iii. Rotifers | ☐ none ☐ few ☐ many | iii. Rotifers | ☐ none ☐ few ☐ many |
| iv. Roundworms | ☐ none ☐ few ☐ many | iv. Roundworms | ☐ none ☐ few ☐ many |
| v. Stylaria worms | ☐ none ☐ few ☐ many | v. Stylaria worms | ☐ none ☐ few ☐ many |
| Others | | Others | |

## 3. *E. coli* culture

Drop 1ml of each water sample onto the middle of the culture plate. Use distilled water as control. Store them in the incubator operating at 35°C for 24 hours. Count the number of colonies coloured blue.

Sample 1: _____        Sample 2: _____        Distilled water: _____

## F. Chemical analysis

1. Do chemical tests of the following parameters of the two water samples:

|  | Sample 1 | Sample 2 |
|---|---|---|
| i. Dissolved oxygen (mg/l) |  |  |
| ii. pH |  |  |
| iii. Total dissolved solids (ppm) |  |  |
| iv. Total suspended solids (mg/l) |  |  |
| v. Ammonium content (ppm) |  |  |
| vi. Phosphate content (ppm) |  |  |

# Questions for discussion

1. Evaluate the degree of human impacts to the freshwater stream habitat. What can be done to improve the situation?

2. What do the records of biological indicators tell? Describe and explain.

3. What do the records of microscopic observation and *E. coli* tell? Describe and explain.

4. How would you compare the chemical parameters of the two water samples? Suggest possible explanations for the differences (if any).