

Ning Po College
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Freshwater stream

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Content

Introduction

Physical factors

Chemical factors

Condition of Site A & B

Compare the Site A & B

1. Physical factor of the two sites
2. Chemical factor of the two sites
3. Distribution of organisms of the two sites
 - A) Plants
 - B) Animals
4. Explain how the physical and chemical factors affect the distribution of organisms

Conclusion

Introduction

During 28th – 30th April 2008, 11 of us from the Ning Po College visited the Tai Tso Stream at Chuen Lung, Tsuen Wan. On 28th April, 2008, the aim of this study is to find out the relationship between the environment, the human activities and the living things, and understand more about the ecosystem in freshwater stream.

We have studied the upper water stream and the lower water stream, with the length of 3m respectively in the afternoon (around 1400-1630). The weather on that period of time was cloudy and rainy without air movement, and the temperature was about 23°C.

We have studied the major factors influence the distribution and the abundance of living organisms at the upstream and the downstream.

We mainly studied on the physical factors (The light intensity, temperature and the average current speed) and the chemical factors (Ammonium and phosphate content, pH, total dissolved solids, total suspend solids, dissolved oxygen chemical oxygen demand) in two sites (site A and site B).

We derive the data from two sites and the organisms live there, so as to find out the how those factors affecting the distribution of organisms, and the adaptation of the plants and animals in these two sites.



Upper Stream Site B

Much narrow

High current speed

Much large rock.



Lower Stream Site A

Open area

Small rock

Low current speed

Physical factors

1. Light intensity
2. Temperature
3. Current speed

1. Light intensity

This is relay on the fluctuation of surface the freshwater stream

On the still water surface, the parallel light rays enter the stream without diverging. Therefore, the light intensity can be higher. On the fluctuated water surface, the light rays will be diverged but not parallel, and the light intensity is lowered. It is due to the light is reflect and refract by the water. Then, less light can penetrate into the water.

Different light intensity affects the growth of the aquatic plant to grow. This is because the aquatic plant growth is depended on the light that light energy is required for them to carry out photosynthesis.

2. Temperature

It is directly proportional to the light intensity. Most of the aquatic organisms are cold-blooded and their body temperature changes with the environmental temperature. Thus, when the water temperature is relatively high, the enzymes activities of the aquatic organisms may not be controlled, and the organisms may die. When the water temperature is too low, the enzymes of the aquatic organisms may be inactivated and the metabolism may be stopped. Hence, the water temperature can affect the activity of the aquatic organisms.

Moreover, the still water surface allows a longer duration of insulation which heat up the water molecules. So, the still water temperature is higher.

On the other hand, the fluctuated water temperature is lower due to the light energy lost by the continuous water flow.

3. Current speed

It is the most affective factor that affect many factors in the stream. It is the most affective factor that affect many factors in the stream. When the current speed is low, the nutrients, such as phosphate and ammonia, can accumulate in the stream without flowing away, more aquatic organisms can grow as there is a lot of nutrients for them to absorb for their growth. Therefore, more organisms can be found in the slow-running freshwater stream. However, there is only less amount of microscopic food can be driven up for the microorganisms to eat, thus there is less microorganisms can be found.

On the other hand, when the current speed is fast, the nutrients is driven away and only less amount of nutrients is supplied for the organisms to growth. However, more microscopic food can be driven up by the current for the microorganisms to eat, so that we can find more species of organisms here. At the same time, more suspended solids are driven up and the turbidity of the water stream increases.

Chemical factors:

1. Dissolved oxygen(DO)
2. pH
3. Total suspended solid
4. Conductivity
5. Phosphate and ammonia content

1. Dissolved oxygen(DO)

The amount of Dissolved Oxygen (DO) in water is expressed as a concentration. The DO concentration in a stream is the mass of the oxygen gas present, in milligrams per liter of water. Milligrams per liter (mg/L) can also be expressed as parts per million (ppm).

The dissolved oxygen content in the fast running water is higher than that in the slow running water, because:

- i. The fast running water area has a greater surface area because the higher the stream flows the steeper the gradient of the water is and the larger the water surface area is. As a result, it increases the diffusion rate of the atmospheric oxygen into the water.
- ii. Less oxygen is consumed by organisms in the aerobic respiration since fewer organisms are present in the fast running water.

How human activities affecting DO:

- It will lower oxygen concentrations because sediments and other pollutants increase the amount of suspended and dissolved solids in stream water.
- Organic wastes and other nutrient inputs from sewage and industrial discharges, septic tanks and agricultural can result in decreased oxygen levels. More nutrient often lead to excessive algal growth. When the algae die, the organic matter is decomposed by bacteria. Bacterial decomposition consumes a great deal of oxygen.

2. pH

pH is an important limiting chemical factor for aquatic life. If the water in a stream is too acidic or basic, the H⁺ or OH⁻ ion activity may disrupt aquatic organisms' biochemical reactions by either harming or killing the stream organisms.

In our study, the pH of both fast and slow running water only has a subtle difference. The pH value in slow running water is lower than that in fast running water but both of the pH values are slightly acidic. This is because the carbon dioxide (CO₂) in air dissolves in the freshwater and form carbonic acid (H₂CO₃), which is a weak acid. And due to the site with slow running water we studied is away from the human activities, so there is less carbon dioxide (CO₂) exhaled and thus the pH value in there is a bit higher than in the fast running water stream.

The effect of pH value of the water stream to the organisms:

Enzyme functions efficiently in a narrow pH range and the optimum pH is the one at which the maximum rate of reaction occurs. A slight change in pH can result in denaturation of enzymes and affect the catalytic activity of the enzyme. Since enzymes control the metabolic activities of organisms, a suitable pH range is vital for the living of them.

In addition, acidic pH increases the solubility of heavy metals such as Fe, Al, Mn and Hg, which are usually toxic to plants. Therefore, the population of consumers will decrease as the population of producers decreases. Moreover, the toxic substances will be accumulated along the food chains if the plants are consumed by the consumers. Therefore an optimum pH range of the freshwater stream is essential and it should be around pH 6-7.

3. CONDUCTIVITY

The conductivity of water in the fast running freshwater stream is higher than that in slow-running freshwater stream. The first reason is that the conductivity in the freshwater stream depends on the amount of heavy metal ions and minerals present in the water. There are more suspended heavy metal ions floating in fast running freshwater stream. Moreover, there are more plants present in fast running water. Then more minerals are absorbed by plants for growth. Thus, the conductivity of fast running water is higher.

Physical factor of the two sites

The table of the physical factors of two sites

Physical factors	Position	Site A	Site B
Light intensity	Surface	795 X 10	563 X 10
	Bottom	795 X 10	563 X 10
Temperature (°C)	Air	23	21
	Water	20	19
Current speed (ms ⁻¹)	River	0	0.07

As we mention before, site A is a slow running stream in an open area, the light intensity is relatively high. That high light intensity influence the water temperature, and also the air temperature. Therefore, we can find many animals there but less micro-organisms. It is due to the slow current speed and the inter-specific and intra-specific competition.

Site B is a fast running stream in an open area, the light intensity is relatively low, that affect the water temperature and the air temperature. The temperature is relatively low. However, the species of the animals there is smaller than that site A. It is because the lower temperature and the faster current speed.

Chemical factor of the two sites

The table of the different chemical factor between two sites

	Group	pH	D.O (mg/l)	Ammonia (ppm)	Phosphate (ppm)	T.D.S. (ppm)	T.S.S. (mg/l)	C.O.D. (mg/l)	Remarks
Pollute	1	6.96	5.2	2	24	64	12.9	10.4	
	8	6.59	4.82	4	115	122	13.3	25	
Site A	3	6.59	5.56	1.7	20	55	4	8.40	
	5	6.75	6.14	1.4	25	58	6.7	6.64	
	7	6.86	4.50	1.75	25	48	16.67	11.76	
Site B	2	7.05	6.40	1.7	16	63	7.5		
	4	6.90	6.11	2	17.5	204	5	9.44	
	6	6.84	6.28	1.3	33	96	4.85	7.44	

Distribution

Upper stream









Lower Stream

Possible errors

Possible errors and Recommendation for improving the stream ecological study

Firstly, the water current speed in particular area such as in site A does not represent the current speed in downstream. To have a more accurate data collected, it is necessary to choose a few more places to determine the current speed.

Secondly, the change of weather will affect the data we collected. For example, nutrient content. Before we investigated the stream life in site A, it had been raining. Raining may wash away the nutrient in water and this will affect the accuracy of the data we collected.

Moreover, raining affects the dissolved O₂ content in the water.

To avoid these problems, we should investigate the stream life in a better condition (stable weather).

Thirdly, the amount of animals in the area we investigated does not represent the true value of animal in that stream. The area we investigated in site A is near sewage, the number of animals will rather smaller. Therefore, we can investigate a few more area in Site A so as to get more data. After getting the number of animals in each area, we take the average. This ensures the data to be accurate enough.

Conclusion

After this investigation, we do understand more about the habitat of freshwater stream, and the physical, chemical and biotic factors, which affect the number and distribution of the freshwater organisms. During the fieldwork, we used some equipment and apparatus to measure the factors and get the data for analysis. In this way, we can know more about the methods of investigation and hence can enhance our memories. Therefore, this trip is a good chance for us to gain more experience.

In fact, the Ho Koon Centre is a good place for us to study all these biology. The apparatus in the centre is very advanced. All we just need is to research in the field site and carry out the experiment in the laboratory. The experimental apparatus and materials are all available to make our study more easily.

What can we study in this two site is the different of the upper water stream and the lower water stream.