The relationship between water flow rate and the biodiversity of animals

Bought to you by Group 6:

Chong Man Yui (7)

Ho Chak Tim (9)

Kwok Long Kiu (14)

Lam Hiu Fai (15)

Mak Yat Long (24)

Wan Ho Lam (29)

Wong Tsz Yu (33)

Independent variable and measurement methodology

- Independent variables :

    1. Velocity of water flow

- Methods of measurement

    - Water flow meter

① Set the water flow meter in the middle of the quadrat

② Take the results for four times with a 5 second interval

③ Take the mean of the results

Dependent variables and measurement methodology

Dependent variable:

1. Number of species
2. Number of individuals

- Methods of measurement
  - Counting
    - ① Set a quadrat at the designated location
    - ② 5 mins sight surveying
    - ③ 25min of searching under rocks

Controlled variable and control methodology

- Controlled variables

    1. Light intensity
    2. Temperature
    3. pH value of stream water
    4. Composition of river bed

Controlled variables and control methodology

- **Method to control**
  - **Light meter**

① Set the light meter in the middle of the quadrat

② Take the results for four times with a 5 second interval

③ Take the mean of the results

  - **Digital thermometer**

① Set the digital thermometer in the mid of the quadrat

② Take the results for four times with a 5 second interval

③ Take the mean of the results

Controlled variables and control methodology

- **pH meter**
  - ① Take water sample at the each quadrat
  - ② Use the pH meter to measure the pH value of stream water
- Composition of river bed: sight surveying

How to control?

- Survey areas with similar light intensity, temperature and pH.
- Temperature: ±1 °C
- Light intensity: ±5%
  - With similar distribution of trees nearby
- pH: ±0.5
- Composition of river bed: all stones

Assumptions

- The pH value of the whole water stream does not varies significantly
- 30 mins of surveying is representative of the whole

Results

0 m/s

Species	Number
Caddisfly Larva	5
Dragonfly Nymph	0
Large Stream snail	10
Mayfly Nymph	12
Pond snail	3
Water Penny	2
Water skater	0
Stonefly Nymph	1

0.67 m/s

Species	Number
Caddisfly Larva	2
Dragonfly Nymph	0
Large Stream snail	21
Mayfly Nymph	5
Pond snail	0
Water Penny	1
Water skater	4
Stonefly Nymph	3

1.1 m/s

Species	Number
Caddisfly Larva	4
Dragonfly Nymph	3
Large Stream snail	10
Mayfly Nymph	0
Pond snail	0
Water Penny	0
Water skater	0
Stonefly Nymph	0

Results & Analysis

Water Flow Rate	No. of Species	No. of individuals	Simpson's diversity index
0 m/s	6	33	0.763
0.67 m/s	6	36	0.802
1.1 m/s	5	17	0.367

- At stationary and intermediate water flow rate, results are similar.
- Both stationary and intermediate flow rates have almost double the number of individuals and diversity index.

Water Flow Rate	0 m/s	0.67 m/s	1.1 m/s
Dissolved oxygen (mg/L)	6.04	6.16	6.32

- The concentration of dissolved oxygen increases with the water flow rate

Analysis

- **How is biodiversity affected by water flow rate?**
  - At stationary water flow(or very low):
    - The concentration of dissolved oxygen will be lower (for respiration)
    - Less food and nutrients will be carried to the location
      - These cause a smaller biodiversity
    - However, the large occurrence of plants and algae in the surveyed area compensates for the loss and contributes to the large biodiversity
    - Slow flow rate also provides a stable environment for organisms

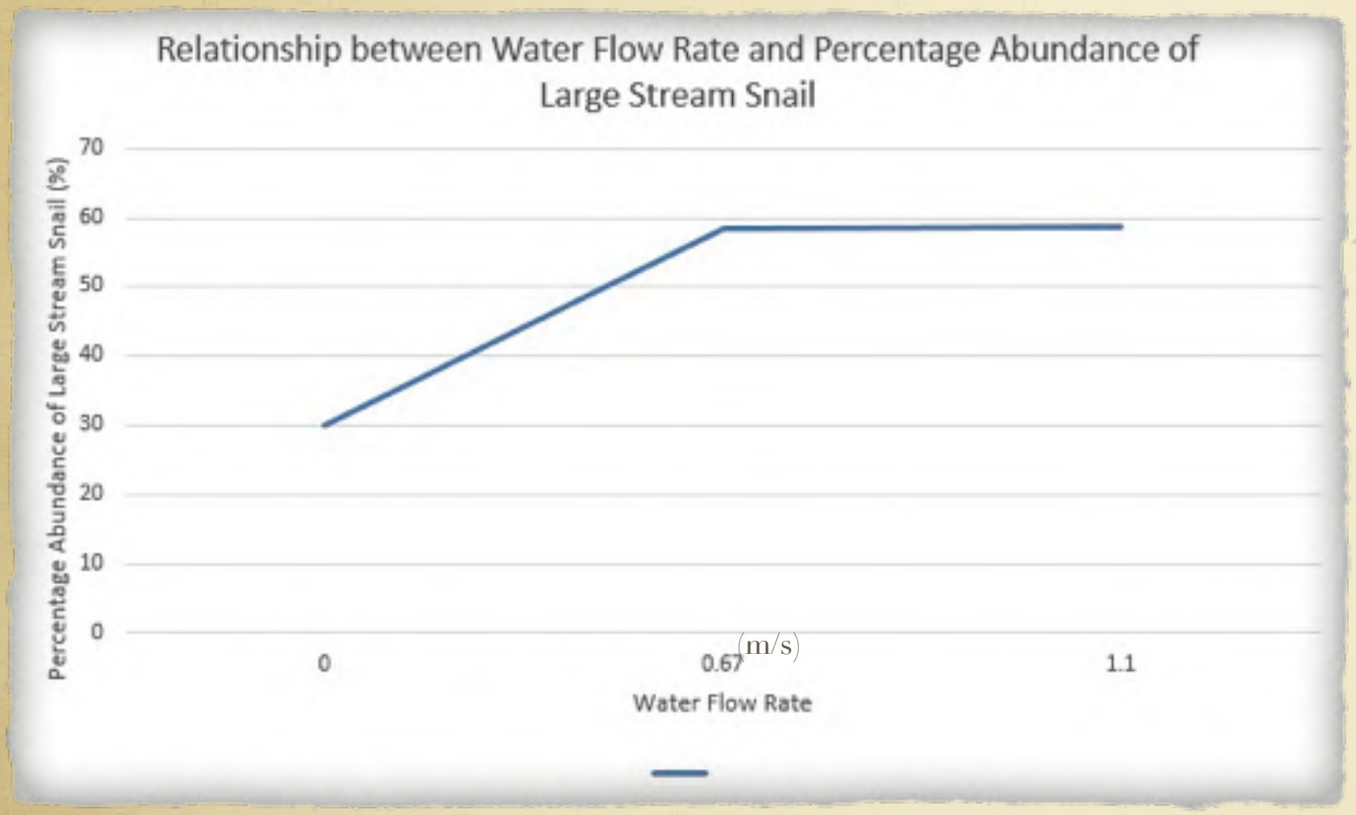
Analysis

- **How is biodiversity affected by water flow rate?**
  - At high flow rate:
    - Food and nutrients are quickly washed away
    - Organisms are constantly under the threat of the strong water current
  - These cause a smaller biodiversity
- Some organisms well adapted to the high flow rate are able to survive in the condition with less competition (examples will be mentioned later)

Analysis

- **How is biodiversity affected by water flow rate?**
  - At intermediate flow rate:
    - Food and nutrients are constantly supplied
    - Most organisms are adapted to this flow rate
  - These cause a large biodiversity

Brotia hainanensis (Large Stream Snail)



Water flow (m/s)	% Abundance (%)
0	33.3
0.67	58.3
1.1	58.8

- At high and intermediate flow rates, the % abundance of Large Stream Snail is similar
- At high and intermediate flow rates, the % abundance is ~75% more than that of low flow rate
- Large Stream Snail is a dominant species at intermediate and high flow rates

Brotia hainanensis (Large Stream Snail)

- Large Stream Snail is well adapted to quick streams
  - **Filter feeding**

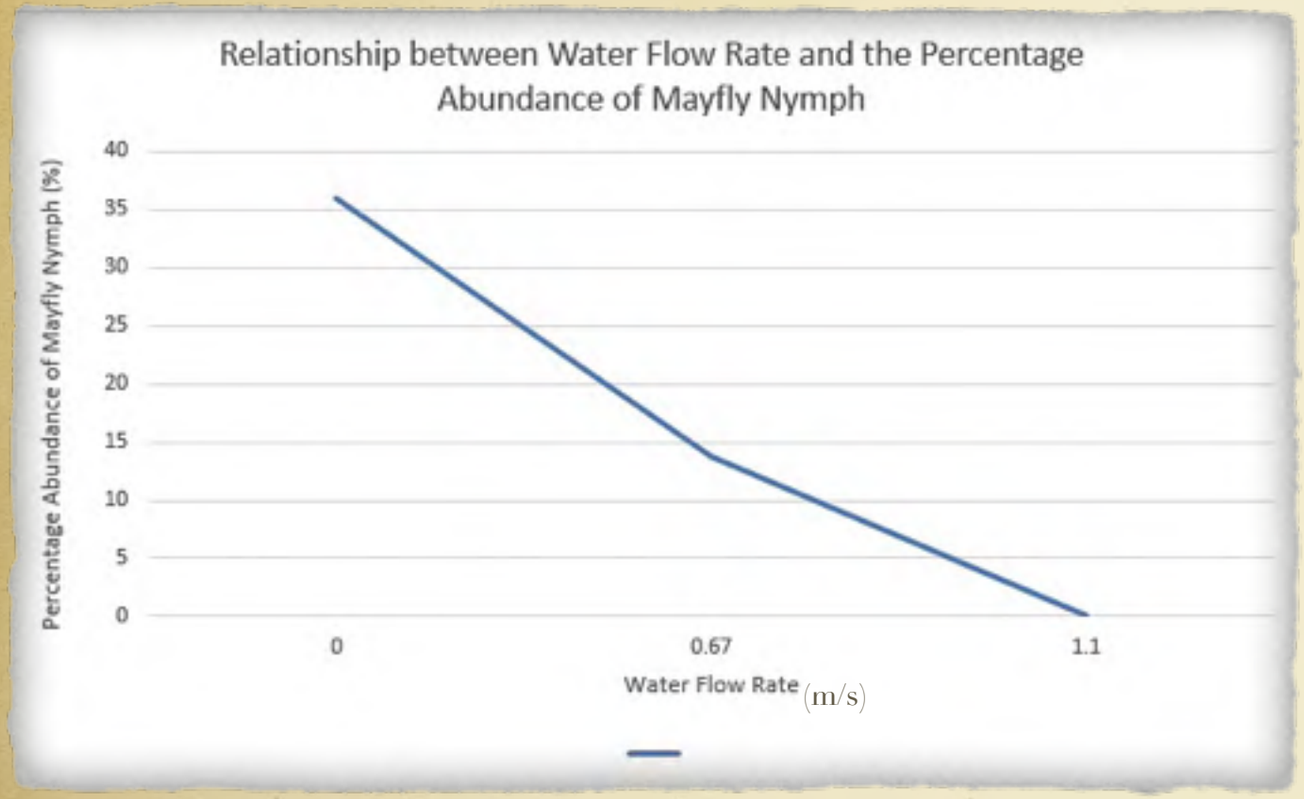
    -> can obtain food easily from a high flow rate stream

    -> more competitive
  - **Streamlined shaped shell**

    -> reduce the impact of water current + protection
  - **Strong muscles**

    ->attach to surfaces of the rocks tightly
- Less predators in the high flow rate areas

Mayfly Nymph



Water flow (m/s)	% Abundance (%)
0	36.6
0.67	13.8
1.1	0

- Mayfly nymph is well adapted to quick streams
  1. Flattened body
  2. Strong muscular legs
  3. Streamlined body shape

- However, the predators for mayfly nymphs are present under high water flow

  e.g. Dragonfly nymph, caddisfly larva

Conclusion

- From stationary, when the water flow rate increases, the biodiversity enlarges.
- Upon reaching a certain flow rate, the biodiversity reaches maximum and decreases gradually.
- Possible factors affected by the water flow rate that will affect the biodiversity

  1. Food supply
  2. Dissolved oxygen
  3. Threats from the environment

~The End~

Thank you~