Searching For Nature Stories 2017

Hong Kong Newts

HKMA DAVID LI KWOK PO COLLEGE (R19)

Member list

NG Ying Lam Stephanie	S4	CHAN Ka Pui Andrea	S4
LAM Chun Hin Billy	S4	KUK Charlotte	S4
TJIU Ginny Yee Ni	S4		

Table of Content

ABSTRACT

In our study, we have been to the freshwater stream of Tai Po Kau Country Park for three times between December and April. In our first visit (18/12/2016), we looked for any interesting animals or plants to carry out our investigations and studied the field site. We finally confirmed to study the Hong Kong newts. It is a type of salamander that can be found in the freshwater streams in Hong Kong. In our second visit (18/2/2017), we looked for the presence of Hong Kong newts in order to study their distribution and abundance. We have also performed some pilot tests to study the factors affecting their distribution. In our third visit (20/2/2017), we intended to further study each particular factor on the distribution of the Hong Kong newts. The presence of newts is suggested to be related to temperature, dissolved oxygen level and salinity of the water in a habitat. Also, the presence of tourists may also play a role in the distribution of the newts. Perhaps it is the mating season when the newts move back to land for finding their partners, so that we could find the Hong Kong newts during our first and second visits.

CHAPTER 1. INTRODUCTION

1.1 Introduction to research topic

Hong Kong newt (*Paramesotriton Hongkongensis*) is a type of salamander that can be found in the freshwater streams of Hong Kong. It is believed that this species of salamander is the only tailed-amphibian endemic to Hong Kong. Our team decided to choose Hong Kong newt as our investigating subject because it is an interesting animal to be studied.

In our study, we have been to the freshwater stream of Tai Po Kau Country Park for three times between December and April. In our first visit, we have been walking around the country park to look for any interesting animals or plants to carry out our investigations. We finally confirmed to study the Hong Kong newts at the end of this visit. In our second visit, we walked along the lower stream to the upper stream to look for the the presence of Hong Kong newts in order to study their distribution and abundance. We have also performed some pilot tests to study the factors affecting their distribution. In our third visit, we intended to further study each particular factor on the distribution of the Hong Kong newts.

To minimize the disturbance to Hong Kong newts, most experiments were done on the field sites, although some water samples have been brought back to school for further investigation.

1.2 Objectives

A. To study the factors affecting the distribution and abundance of Hong Kong newts in the freshwater stream inside the Tai Po Kau Country Park.

B. To study the general behaviors of the Hong Kong newts, as well as their external features.

CHAPTER 2. MATERIALS AND METHODS

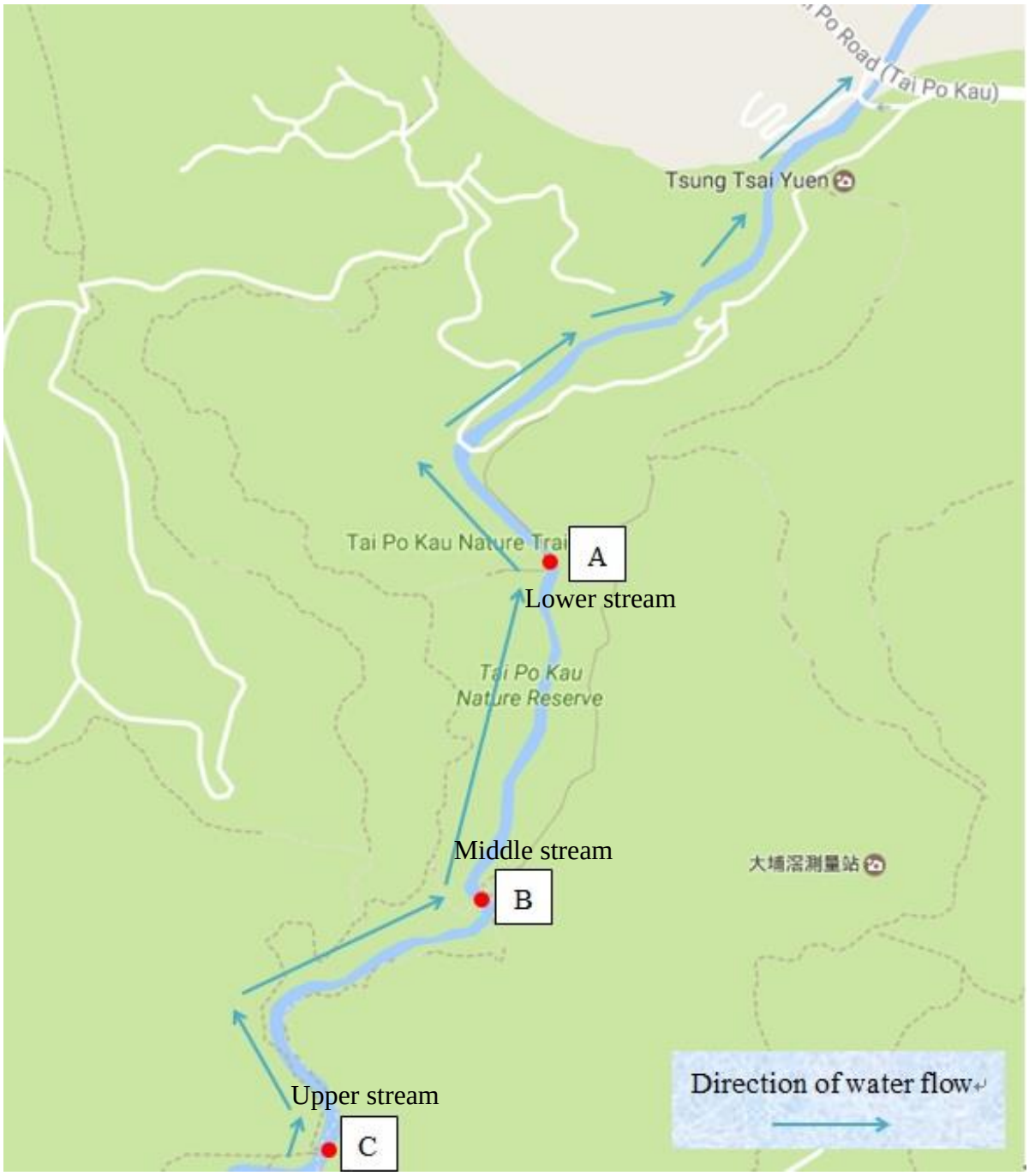
2.1 Materials and equipment used

Tests	Materials and equipment used
pH	pH probe
Conductivity	Conductivity probe
Salinity	Salinity probe
Total dissolved substances (T.D.S.)	T.D.S. probe
Temperature	Temperature probe
Water depth	Meter ruler
Light intensity	Light meter
Dissolved oxygen (D.O.)	D.O. meter
Speed of water flow	Water flow meter
Weight of newt	Electronic balance
Length of newt	Length measuring trap with ruler
Newt capturing	Net Gloves Plastic tray
Preferences of newt	Choice chamber Plastic boards (black and white) Sunlight-blocking boards Stopwatch Shrimp

2.2 Work schedule

Field Trip	Date &Time	Venue	Event
1st Field Trip	18/12/2016 10:00-13:00	Tai Po Kau	● General study in the field site ● Target search
2nd Field Trip	18/02/2017 10:00-17:00	Tai Po Kau - Lower stream (A) - Middle stream (B) - Upper stream (C)	● Environmental data collection ● Newt distribution study ● On-site experiment on newts
3rd Field Trip	20/02/2017 14:45- 17:30	Tai Po Kau - Middle stream (B)	● Environmental data collection ● On-site experiment on newts

2.3 Locations of field site



2.4 Procedure

2.4.1 Temporary capturing of a Hong Kong newt in the field site

- A Hong Kong newt is captured by a net gently without disturbing the surrounding environment.
- The captured newt was kept inside a plastic tray for 15 minutes to let the newt to get used to the new environment.
- The newt was released to its original position after all the experiments.

2.4.2 Recording the data of water quality and environment

- In each of the field site, three points were selected randomly to take the data of different environmental parameters.

- Different probes (including pH, temperature, salinity, conductivity, total dissolved substances (T.D.S.)) connected to a waterproof tester were immersed into the stream water of the three selected points respectively in each field site.
- Dissolved oxygen (D.O.) meter was put in the water of the three selected points to measure the D.O. levels.

- Light meter was put above the three selected points to measure the light intensities.
- Meter ruler was submerged into the water vertically to measure the depth of water.

- Water flow meter was submerged into the water to measure the speed of water flow.
- The values of the above parameters were recorded and the average values were calculated.

2.4.2 Measuring the biochemical oxygen demand (BOD) of water samples

- Three bottles of 100 mL of water samples were collected from the three field sites.

- Initial D.O. levels were measured.
- The caps of the bottles were sealed by the Paraffin film to prevent air leakage.
- The three bottles of water samples were brought back to school laboratory in dark condition and room temperature.
- The bottles were opened and D.O. levels were measured.
- BOD_5 and the percentage changes of D.O. levels were calculated.

2.4.4 Response of a Hong Kong newt in different background colors

- The captured newt was put in the tray with half of the bottom covered with a black paper and half of the bottom covered with a white paper.
- The newt was observed whether it went to the white background or the black background.
- The amount of time the newt stayed on each side was timed by a stopwatch.
- The step above was repeated for 3 times.
- Data were recorded

2.4.5 Response of a Hong Kong newt in different light intensities

- The captured newt was put in the tray with half of the top covered with a black board and half of the top exposed to bright sunlight.
- The newt was observed whether it went to the shaded side or the bright side.
- The amount of time the newt stayed on each side was timed by a stopwatch.
- Data were recorded.

2.4.6 Response of a Hong Kong newt with a shrimp

- A shrimp is temporarily captured from the stream water.
- The captured newt was placed together with the shrimp in the tray.
- Response of the newt was recorded.

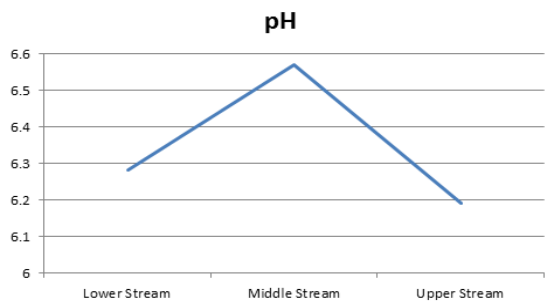
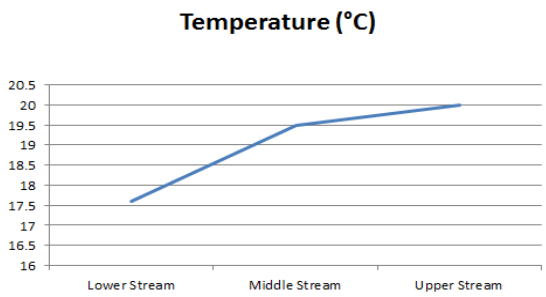
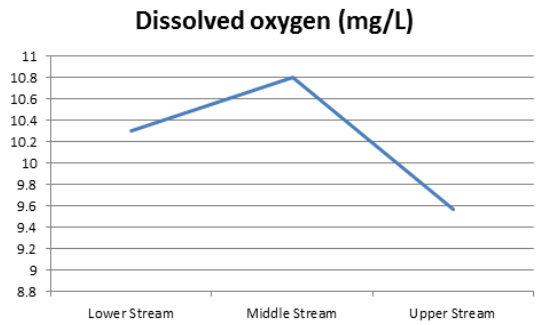
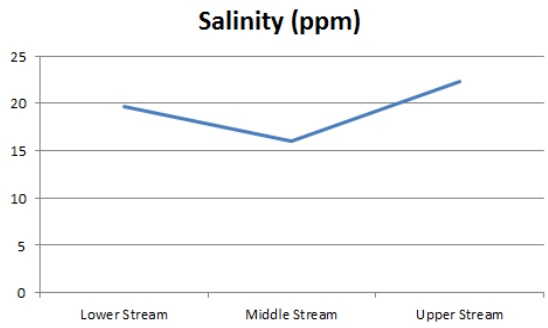
2.4.7 Observing the external features of a Hong Kong newt

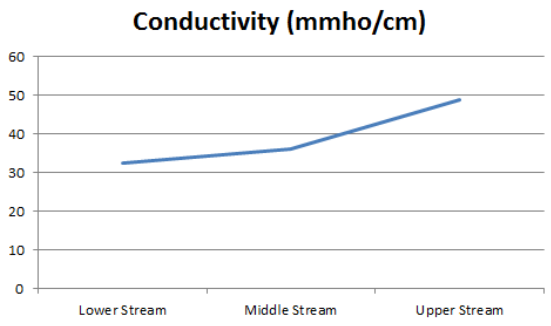
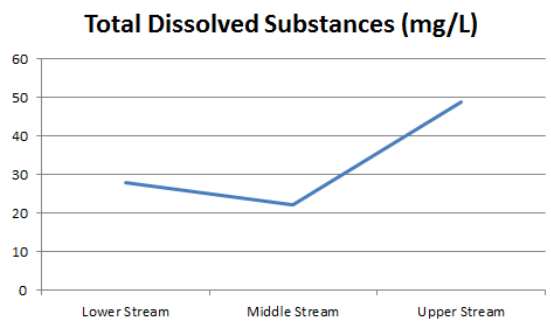
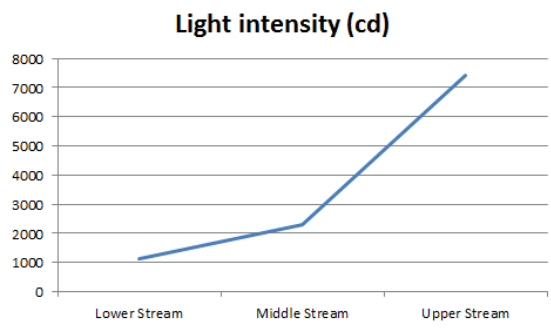
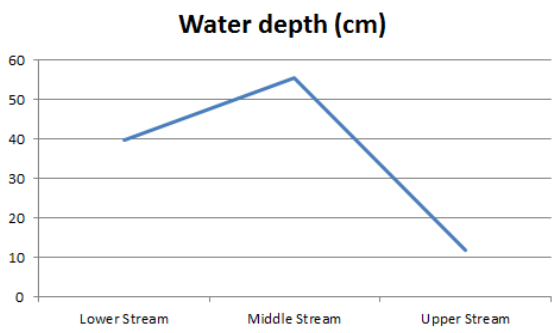
- A pair of gloves was worn.
- The upper part and lower part of the captured newt were examined.
- The head, tail and palm of the newt was examined.
- A diagram was drawn to record the external structures of the captured newt.
- The newt was put on a ruler to measure the length.
- The newt was put on an electronic balance to measure the weight.

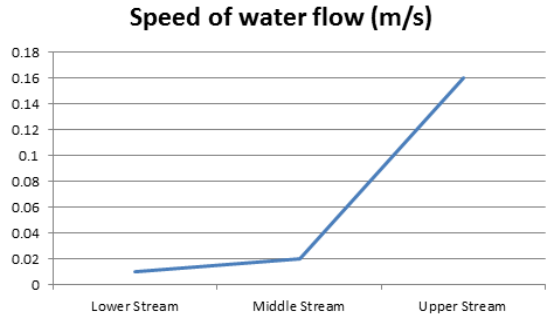
CHAPTER 3. RESULTS

3.1 Environmental data collected during the second visit on 28/2/2017

(Raw data attached on the last page of this report)

Parameter & Graph	Average value in the lower stream (A)	Average value in the middle stream (B)	Average value in the upper stream (C)
	6.28	6.57	6.19
	17.6	19.5	20
	10.3	10.8	9.57
	19.7	16	22.3

Parameter & Graph	Average value in the lower stream (A)	Average value in the middle stream (B)	Average value in the upper stream (C)
	32.3	36	48.7
	27.7	22	26.7
	1123.3	2302.7	7430
	39.7	55.3	11.7

Parameter & Graph	Average value in the lower stream (A)	Average value in the middle stream (B)	Average value in the upper stream (C)
	0.01	0.02	0.16

3.2 Biochemical oxygen demand (BOD_5) of the water samples collected

	Lower Stream (A)	Middle Stream (B)	Upper Stream (C)
Initial D.O. level of water sample (mg/L)	10.3	10.8	9.6
D.O. level of water sample after 5 days (mg/L)	8.6	8.6	8.6
BOD_5 (mg/L)	1.7	2.2	1.0
Percentage change of D.O.	-17%	-20%	-10%

3.3 Number of Hong Kong newts found during the second visit on 28/2/2017

	Lower Stream (A)	Middle Stream (B)*	Upper Stream (C)
Number of Hong Kong newts found in an area of 50 m^2	0	6	0

* Site B was also the field site where Hong Kong newts were found during our *first visit on 18/12/2016*.

3.4 General behaviors of Hong Kong newts

The Hong Kong newts can both swim in water and crawl on the land, although all the Hong Kong newts we discovered in site B laid on top of or under the rocks inside the stream.

3.4.1 Total time of the captured newt staying in the black and white background

Trial (each 60 seconds)	Total time of the Hong Kong newt staying in the	
	black background	white background
1st Trial	0 **seconds**	60 **seconds**
2nd Trial	60 **seconds**	0 **seconds**
3rd Trial	32 **seconds**	28 **seconds**

3.4.2 Total time of the Hong Kong newt staying in the shaded and bright area

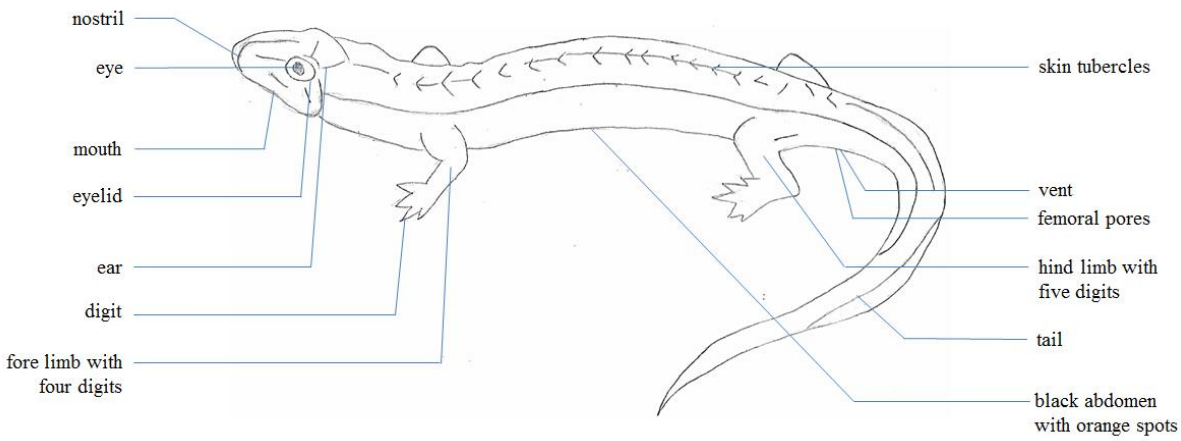
Trial (each 60 seconds)	Total time of the Hong Kong newt staying in the	
	shaded area	bright area
1st Trial	60 **seconds**	0 **seconds**

3.4.3 Response of the captured newt towards a shrimp

No special responses were observed between the captured newt and the shrimp.

3.5 External features of Hong Kong newts

From our observation, Hong Kong newts have fore limbs with four digits and hind limbs with five digits. It is also observed that when a newt move, the motions of its right fore limb and the left hind limb were the same, while that of its left fore limb and its right hind limb were the same. They have moist skin with some slimy mucus on it. The color of Hong Kong newts' back is deep brown and they have black abdomen with orange spots. The one we captured was 12 cm long and weighted 24 g.



External structures of a Hong Kong newt

3.6 Number of Hong Kong newts found during the third visit on 19/4/2017

	Middle Stream (B)
Number of Hong Kong newts found in an area of 50 m^2	0

3.7 Environmental data collected during the third visit on 19/4/2017
(Raw data attached on the last page of this report)

	Average value in the middle stream (B)
pH	6.93
Temperature (℃)	23.3
Salinity (ppm)	26
T.D.S (ppm)	40.7
Conductivity (mmho/cm)	61

CHAPTER 4. DISCUSSION

4.1 Overview on the distribution of Hong Kong newts

On the first and second field visits, only the middle stream (site B) was found to have Hong Kong newts presented. While on our third field visit, no newt could be found in the middle stream (site B) anymore. Some environmental factors may have put some effects on the distribution of Hong Kong newts as discussed below.

4.1.1 Effect of pH on the distribution of Hong Kong newts

The pH of all the sampling points were slightly acidic (between pH 6 to pH 7), which were in the comfort pH for most aquatic life. The pH of site B where newts were found during the first and second visits was closer to pH 7 which is relatively more neutral than the pH of other sampling points. However, during the third visit, even the water pH of site B was even closer to pH 7, no newts can be found. Therefore, we cannot conclude that the difference in pH is the major factor affecting the distribution of the Hong Kong newts.

4.1.2 Effect of temperature on the distribution of Hong Kong newts

The Temperature was found to be 19.5 **℃** in site B during the second visit, where newt was found. While for the third field trip, the water temperature was found to be 23 **℃** in site B. Water temperature has increased about 3.5 **℃**. Rising water temperature maybe an indicator of the end of mating season which newts will move onto land. Explaining the absence of newt on the third field trip. Lower water temperature can increase the capacity for dissolved oxygen, therefore low temperature maybe the major factor account for the presence of newt.

4.1.3 Effect of dissolved oxygen (D.O.) on the distribution of Hong Kong newts

The D.O. level of site B is closer to 11 mg/L, relatively higher compared to site A and site C. As Hong Kong newts use their skin for gas exchange, a higher oxygen concentration is needed to maintain steep concentration gradient of gases. Therefore, newts were only found in site B with higher D.O. level, closer to 11 mg/L. Therefore, high dissolved oxygen content maybe a factor account for the presence of newt. However, during our third visit, we did not intend to measure the D.O. level, so we did not measure it to further confirm this hypothesis.

4.1.4 Effect of salinity on the distribution of Hong Kong newts

During the second visit, the salinity in site B is relatively lower, at about 16 ppm, compared to site A and C. As the skin of Hong Kong newts is permeable to water, high concentration of salt may lead to dehydration of the newt. During the third visit, the salinity in site B was found to be 26 ppm, the salinity has increased about 10 ppm, and no newt was found. Therefore, lower salinity maybe the one of the main factors for the presence of newt in site B.

4.1.5 Effect of water conductivity on the distribution of Hong Kong newts

Water conductivity is the conductivity of water reflecting the amount of ionic compound inside the water samples. The conductivity of site B was in 36 mmho/cm, which is in between the values of that in site A (32.3 mmho/cm) and site C (48.7 mmho/cm). Hong Kong newts were found in site B during the second visit. During the third visit, the average water conductivity of site B was 61 mmho/cm, which was much higher and no newts were found there. Therefore, we may hypothesize that the optimum water conductivity for Hong Kong newts should not be too high or too low. Further analysis is necessary.

4.1.6 Effect of total dissolved substances (T.D.S.) on the distribution of Hong Kong newts

T.D.S of site B (22 mg/L) is relatively lower, compared to site A (27.7 mg/L) and C (26.7mg/L) during the second visit, where newts were found. For the third visit, the T.D.S of site B was found to be 40.7 mg/L, it has increased by about 18 mg/L. Therefore, we may hypothesize that a lower level of T.D.S in water may be one of the factors affecting the presence of newts. However, as the tests were not carefully controlled, our hypothesis needs to be further confirmed in the future.

4.1.7 Effect of light intensity on the distribution of Hong Kong newts

The light intensity of the site B during the second visit is about 2000 cd, which is between site A (~1000 cd) and site C (~7000 cd). The light intensity is relatively lower compared to site C. The lower light environment may facilitate the effect of camouflage for hunt and avoidance of predators. However, even site A has lower light intensity than site B but no newts were found in site there. The results were thus inconclusive which subject to further tests for confirmation. (See 4.2.2)

4.1.8 Effect of water depth on the distribution of Hong Kong Newts

The water depth of site B is about 55.3 cm. The depth is relatively higher compared to site A (39.7 cm) and site C (11.7 cm). The depth of water in site B maybe more suitable for newt, as they can hide easily in deeper water and prevent attack or predate by the animals on the land. Moreover, deeper water may have more living organisms, to ensure newt have enough food to survive and provide energy. Therefore, site B with higher water depth maybe the factor account for the presence of newt. However, no newt was found on the third filed trip, we can conclude that the water depth may not be the major factor for the presence of newts.

4.1.9 Effect of biochemical oxygen demand on the distribution of Hong Kong newts

The values of biochemical oxygen demand (BOD) reflect the amount of microorganisms (e.g. bacteria) in the water samples. Larger the BOD values or higher percentage change in the D.O. level shows that the water sample contains more microorganisms which carry out aerobic respiration or decomposition of organic matters. BOD_5 in site B was found to be the largest among other sampling points, as the D.O. level dropped by 20% in the water sample collected there (compared to site A: -17%; site B -10%). This reflects more microorganisms could be provided for the newts as food in site B, accounting for the larger number of Hong Kong newts found there.

4.1.10 Effect of tourists on the distribution of Hong Kong newts

A lot of tourists were found in site A and site C during our second visit. They splashed water, threw stones into the stream and ran next to the stream. This may disturb and damage the habitat of the newts in site A and site C. However, no tourists were found in site B during our field study. This provided a stable environment and habitat for the newts to live. However, during our third visit, although there were also no tourists in site B, no newts can be found. It is thus suggested that tourists may play a role in the presence of Hong Kong newts, but not the most important factor.

4.1.11 Natural defense system of Hong Kong newts

The lower epidermis of Hong Kong newts secretes toxic mucus and have black abdomen with orange spots, as a warning color to defense themselves. They also showed raised tails and straightened necks when they defended themselves.

4.2 General behaviors of the Hong Kong newts

4.2.1 Color of the background and the behaviors of Hong Kong newts

The result of our experiment in 3.4.1 shows that the newt slightly preferred to stay in dark background rather than bright background, although the difference is not significantly large. They tended not to move when they have been settled.

However, it is believed that the reason why the newts prefer to stay in the darker color background is because of its camouflage skin color at its back which is also in darker color.

4.2.2 Brightness of the environment and the behaviors of Hong Kong newts

The result of the experiment in 3.4.2 shows that the newt preferred to stay in shaded space rather than bright space. The behavior is suggested to be used for protection and hunting. As there might be predator of newt in day time, darker environment can maximize the effectiveness of the camouflage skin color of the newt. On the other hand, as Hong Kong newt is a predatory animal, the concealment helps the newt to hunt for prey in the river by concealing itself, blended in the environment.

However, for this test, we failed to repeat the experiment because the newt we captured was too nervous and it tried to escape from our choice chamber whenever it was placed into our choice chamber. Therefore, our conclusion has to be further confirmed in the future studies.

4.2.3 Putting a shrimp together with the captured newt

Although one of the food source for newt is shrimp, no unusual responses were observed when the captured newt was placed together of a shrimp in our test 3.4.3. The newt maybe too frightened after being captured for a period of time and after our experiments in the choice chamber. It is also possible that the shrimp we found in the stream was not the food of Hong Kong newts or it was not hungry at all.

4.3 Limitations of investigation

4.3.1 On-site Experiments

As the Hong Kong newts are living in the water stream and we do not want to bring back any newts to study away from their original habitat, only on-site experiments can be carried out. We also strictly followed the rule of the Country Park Ordinance, so that the life of the newts was not disturbed in a large extent.

4.3.2 Environmental Factors

A perfect environmental condition could not be provided to the Hong Kong newts. Experiments are carried out in water stream, only temperature are being kept constant, however humidity and wind speed are not a constant, the water on the Hong Kong newt skin may evaporate, which may affect the behavior of the Hong Kong newt and bring minor impacts on the results.

4.3.3 Period time of the project

Hong Kong newts are nocturnal animals. However, we can only go to field trip in day time (10:00-17:00), it increased the difficulties for us to find the Hong Kong newts, so we can only find small numbers of newts during the field trip.

4.4 Improvement & further studies

- In order to improve the reliability of the results, we should visit the field site constantly. To ensure the data is updated.
- At first, we go to field trip during day time (10:00-17:00), since Hong Kong Newt is a nocturnal animals, they always hide behind the rocks or underneath the leaves and this is not the daily life that newt should be. Thus we may go to the field trip at night time, so we may be able to see theirs active movement and improve the reliability of the results.
- Time each trails accurately and try to remove the newt from the choice chamber as soon as possible. If not the results may not be that accurate, since time is also one of the main factor in this experiment.
- More trails can be carried out to minimize human errors and provide more data for data analysis and trend reading.

4.5 Sources of errors

- Human error may be involved in measuring the water depth, since we are using ruler to check the depth of the water, thus it is impossible to get an accurate data.
- Some disturbance in the environment during experiment, such as noise disturbance, shadow- casted from our group members, etc. These factors may cause the newt felt uncomfortable, thus the results may not be that accurate.
- Since the weather and the temperature are not constant during the period of the experiment, these may lead to an insignificant error.
- As newt is a species which active at night, thus if the experiment were done during daytime, an error will occur as the number of the newt is not accurate.

CHAPTER 5. CONCLUSION

The presence of newts is suggested to be related to temperature, dissolved oxygen level and salinity of the water in a habitat. Also, the presence of tourists may also play a role in the distribution of the newts. Perhaps it is the mating season when the newts move back to land for finding their partners, so that we could find the Hong Kong newts during our first and second visits.

In the experiment carried out on-site, it was found that the newts preferred darker background color and shaded environment, although further tests should be done to confirm. The behavior is suggested to be related to the newt's protection and interaction with other organisms.

CHAPTER 6. BIBLIOGRAPHY

1. Leung S.L. (2002). ‘Hong Kong Newt (*Paramesotriton hongkongensis*)’. Retrieved from https://www.biosch.hku.hk/ecology/porcupine/por27/27-glance-newt.htm#index2
2. Myers,G.S. and Leviton A.E. (1962). ‘Paramesotriton hongkongensis’. Retrieved from http://research.amnh.org/vz/herpetology/amphibia/Amphibia/Caudata/Salamandridae/Pleurodelinae/Paramesotriton/Paramesotriton-hongkongensis
3. Myers,G.S.and Leviton A.E. (1962).‘The IUCN Red List of Threatened Species-Paramesotriton hongkongensis’. Retrieved from http://www.iucnredlist.org/details/summary/59460/0
4. Lau M.W.N., Chan B. (2004). ‘Hong Kong Warty Newt; Paramesotriton de Hong Kong’. Retrieved from http://amphibiaweb.org/cgi-bin/amphib_query?query_src=aw_lists_genera_&table=amphib&where-genus=Paramesotriton&where-species=hongkongensis
5. Selfridge L. (2009). ‘Breeding the Hong Kong Warty Newt, Paramesotriton hongkongensis’. Retrieved from http://www.caudata.org/cc/articles/P_hongkongensis_breeding.shtml
6. 翱鵰. (2011). 香港瘰螈的近緣種 ~ 中國瘰螈. Retrieved from http://www.ngensis.com/HKN/HKN.htm
7. Fu V.W.K., Karraker N.E. and Dudgeon D. (2013). ‘Breeding Dynamics, Diet, and Body Condition of the Hong Kong Newt (Paramesotriton hongkongensis)’. Retrieved from http://www.hljournals.org/doi/abs/10.1655/HERPMONOGRAPHS-D-11-00010?code=herl-site
8. Zhang, Y.X. (2011). ‘Mountain ridge and sea: Geographic-barrier effects on genetic diversity and differentiation of the Hong Kong newt’. Retrieved from http://hub.hku.hk/handle/10722/140925
9. 香港生物多樣性訊息系統. (2015). Retrieved from www.nature.edu.hk/articles/defense

RAW DATA

Water quality data collected on 28/2/2017

Lower stream (site A)

Sample number	pH	Temp. (℃)	D.O. (mg/L)	Salinity (ppm)	Conductivity (mmho/cm)	T.D.S. (mg/L)	Light Intensity (cd)	Water Depth (cm)	Speed of Water Flow (m/s)
1	6.44	17	11.6	22	46	33	1550	13	0
2	6.12	18.5	9.5	18	33	26	500	64	0.01
3	6.29	17.3	9.8	19	18	24	1320x10	42	0.01
Average	6.28	17.6	10.3	19.7	32.3	27.7	1123.3	39.7	0.01

Middle stream (site B)

Sample number	pH	Temp. (∘C)	D.O. (mg/L)	Salinity (ppm)	Conductivity (mmho/cm)	T.D.S (mg/L)	Light Intensity (cd)	Water Depth (cm)	Speed of Water Flow (m/s)
1	6.42	19	11.2	21	37	20	246x10	50	0
2	6.50	18.5	10.1	11	34	24	1848	65	0.02
3	6.79	21	11.1	16	37	22	260x10	51	0.04
Average	6.57	19.5	10.8	16	36	22	2302.7	55.3	0.02

Upper stream (site C)

Sample number	pH	Temp. (∘C)	D.O (mg/L).	Salinity (ppm)	Conductivity (mmho/cm)	T.D.S (mg/L)	Light Intensity (cd)	Water Depth (cm)	Speed of Water Flow (m/s)
1	6.33	20	9.2	19	54	23	218x10	7	0.11
2	6.2	20	9.4	23	43	22	163x10	9	0.3
3	6.04	20	10.1	25	49	35	1848x10	19	0.08
Average	6.19	20	9.57	22.3	48.7	26.7	7430	11.7	0.163

Water quality data collected on 19/4/2017

Middle stream (site B)

Sample number	pH	Temp. (∘C)	Salinity (ppm)	Conductivity (mmho/cm)	T.D.S (mg/L)
1	6.78	23.1	21	61	44
2	6.94	23.3	30	61	47
3	7.06	23.4	27	61	31
Average	6.93	23.3	26	61	40.7