# The Relationship between Mosquito Larvae Amount and Water Quality

Tang, Yong-Jun[1] ； Peng, Shao-Han[2]
Xin-Wu Senior High School, Taiwan

## ABSTRACT

Our school is located at Xin-Wu district, the coast of Taoyuan County, northern Taiwan. Last summer vacation, dengue fever, which usually occurs in southern Taiwan, caused cluster infections in Taoyuan for the first time. Although our school is not the place where the local cases appear, many of school students come from the epidemic area. Dengue fever is likely to spread to Xin-Wu District through people's movement. We tried to find the relationship between water quality and mosquito habitats, eliminate larvae, prevent the spread of dengue fever in Xin-Wu District through GLOBE Protocols and mosquito habitat mapper observations.
We choose three sites located near our school – Cat alley, Green Water, Water alley. Larvae only be found at Cat Alley. Measurements were conducted according to GLOBE Hydrology and Atmosphere protocols. The research had a 1-month duration (from 27 Jan 2021 to 24 February 2021) but suspend the study during Chinese New Year (10 Feb, 2021 to 16 Feb,2021). From the results of the research, it was found that the water at Cat Alley is more polluted than others. The pH value all falls on 3~11 that agreed with other studies' findings. There is no obvious correlation between the number of larvae and the amount of dissolved oxygen, and it is more related to the water temperature. The value of nitrate nitrogen in Cat Alley is higher, and the value of the other two sites is lower. It is speculated that although larvae like clean and still water, water that is too clean is not suitable for larvae to survive. Small fish have been found near the water collection site at Cat Alley, so it is speculated that the larvae may have been eaten by the fish.
.

## INTRODUCTION

**Motivations:**

Last summer vacation, dengue fever, which usually occurs in southern Taiwan, caused cluster infections in Taoyuan for the first time. We tried to find the relationship between water quality and mosquito habitats, eliminate larvae, prevent the spread of dengue fever in Xin-Wu District through GLOBE Protocols and mosquito habitat mapper observations.

**Research questions:**

A. What is the temperature, the Nitrate, the pH and dissolved oxygen level of the ditches or ponds near Xin-Wu Senior High School? Is the water clean or polluted?

B. How water quality, such as water Temperature (T), Dissolved Oxygen (DO), Nitrate Nitrogen(N), pH value, Conductivity (EC) and Total Dissolved Solids (TDS), affects larvae amount at these water bodies?

C. What are the most important water variables to the mosquito larvae amount?

## METHODS AND MATERIALS

Search for larvae sites to measure water quality → Collect water and detect dissolved oxygen, nitrate nitrogen, pH, conductivity and total dissolved solids → Comparing with the other two groups of samples at the site without larvae


**Figure 1: the three study sites map (adapted from google earth)**

**Figure 2.** Site 1-Cat Alley

**Figure 3.** Site-Green Water

**Figure 4.** Site 3-Water Alley

**Figure 5.** measure DO & N, larvae characteristics

| Date | Time | Water | Temperature(°C) | Dissolved Oxygen(ppm) | Nitrate Nitrogen(ppm) | Nitrate(ppm)*4.4 | pH value | Conductivity(μS/cm) | Salt Conductivity | TDS(ppm) | Salt(ppm) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27-Jan | | Green Water | | 10 | 0 | 0 | | | | | | |
| 29-Jan | | Green Water | | 10 | Yellow one grid below 1.0 | | 9.24 | 340 | | 224 | 170 | |
| 29-Jan | | Water Alley(head) | | 7.8 | 0.1 | 0.4 | 7.04 | 310 | | 204 | 155 | Nitrate Nitrogen 0~2 middle |
| 29-Jan | | Water Alley(end) | | 7 | 0.2 | 0.9 | 7.5 | 320 | | 211 | 160 | |
| 1-Feb | 15:00 | Cat Alley | 24.6 | 6.4 | 0.8 | 3.5 | 7.62 | 410 | | 270 | 205 | 126 mosquito larvae |
| 1-Feb | | Green Water | 21.8 | 8 | 0 | 0 | 9.86 | 314 | | 207 | 157 | |
| 1-Feb | 15:40 | Water Alley | 21.8 | 5.8 | 0.1 | 0.4 | 6.7 | 297 | | 196 | 148 | Nitrate Nitrogen 0~2 middle |
| 3-Feb | 14:08 | Cat Alley | 22 | 5.2 | 0.8 | 3.5 | 7.29 | 453 | | 298 | 226 | 10 mosquito larvae |
| 3-Feb | | Green Water | | 8.6 | 0 | 0 | 9.63 | | | | | Dissolved oxygen precipitation is insoluble |
| 3-Feb | 14:50 | Water Alley | 21.4 | 6 | 0.1 | 0.4 | 6.6 | 297 | 626 | 196 | 149 | Nitrate Nitrogen 0~2 middle |
| 5-Feb | 13:33 | Cat Alley | 21.7 | 2 | 1 | 4.4 | 7.5 | 428 | 475 | 282 | 214 | 0 mosquito larvae |
| 5-Feb | 13:45 | Green Water | 21.5 | 10.2 | 0 | 0 | 9.65 | 322 | 700 | 212 | 161 | |
| 5-Feb | 14:06 | Water Alley | 22.1 | 6.2 | 0.1 | 0.4 | 6.58 | 301 | 838 | 198 | 150 | Nitrate Nitrogen 0~2 middle |
| 5-Feb | 14:40 | Cat Alley | 20 | 6 | 1 | 4.4 | 7.34 | 425 | 862 | 280 | 212 | about 7 mosquito larvae |
| 8-Feb | 13:50 | Cat Alley | 20 | 3.4 | 0.8 | 3.5 | 7.45 | 433 | 1140 | 285 | 216 | 0 mosquito larvae |
| 8-Feb | 14:19 | Green Water | 19.6 | 10.2 | 0 | 0 | 9.52 | 318 | 2710 | 210 | 159 | |
| 8-Feb | 14:45 | Water Alley | 19.2 | 6 | 0.1 | 0.4 | 6.62 | 302 | 942 | 199 | 151 | Nitrate Nitrogen 0~2 middle |
| 17-Feb | 13:40 | Cat Alley | 19.2 | 4.6 | 1 | 4.4 | 7.28 | 389 | 1284 | 256 | 194 | 3 mosquito larvae |
| 17-Feb | 14:08 | Green Water | 19.7 | 8.8 | 0 | 0 | 9.04 | 326 | 1163 | 215 | 163 | |
| 17-Feb | 14:33 | Water Alley | 19.7 | 6.2 | 0.2 | 0.9 | 6.8 | 304 | 1219 | 200 | 151 | |
| 24-Feb | 13:44 | Cat Alley | | 5.4 | 0.8 | 3.5 | | | | | | 0 mosquito larvae |
| 24-Feb | | Green Water | | | | 0 | | | | | | |
| 24-Feb | 14:50 | Water Alley | | 10.2 | 0.2 | 0.9 | | | | | | |

**Table 1.** The data collected from 3 study sites

## RESULTS

The Dissolved Oxygen of water was much higher at site Green Water, which has no larvae in the water. The measured values were in the range of 8 ppm up to 10 ppm. The Dissolved Oxygen of Cat Alley ranks second; the least Dissolved Oxygen is Water Alley. Dissolved Oxygen of Cat Alley was the lowest in 5 February.

Because we took the water sample back to the school for testing, we are not doing the experiment immediately after the water sample is collected, so there may be errors in the temperature of the water sample at the measuring station. In Figure4, it is seen that water temperature at all three sites was almost the same.

The value of nitrate nitrogen in Cat Alley is relatively high and the variation is large, while the value of Green Water and Water Alley is very low and the variation is small.

The air temperature range is mostly between 14℃~26℃. On February 1, February 3 and February 17, when there are larvae, the temperature was fall between 19℃~24℃.

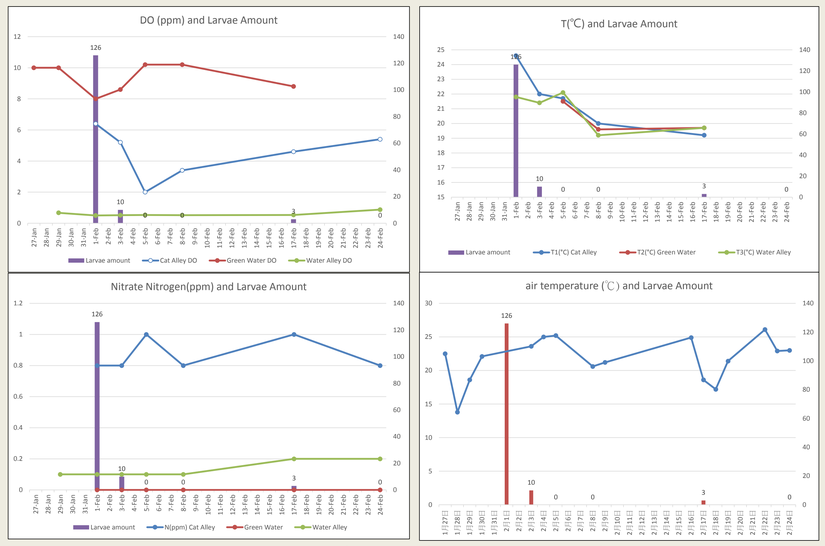


**Chart 1.** Temporal variation of DO(upper left), Water Temperature(upper right), Nitrate Nitrogen(lower left), Air Temperature (lower right)

## DISCUSSION

Comparing the DO data of Cat Alley and the number of larvae collected, there is not much relationship between larvae and the amount of dissolved oxygen.

From time temporal variation of the water temperature at Cat Alley, when the number of larvae was increase, the water temperature is higher. It can be inferred that larvae and water temperature are more related.

For the fig of Nitrate Nitrogen time series, we found that Cat Alley has a higher nitrate nitrogen value. We speculate that it's because people live next to Cat Alley, pollute the water of Cat Alley and cause mosquitoes to breed.

The fig of air temperature shows there is no obvious correlation between the number of larvae and temperature.

## CONCLUSIONS

A. From the results of the research, it was found that the water at Cat Alley is more polluted than others.

B. The pH value all falls on 3~11 that agreed with other studies' findings.

C. There is no obvious correlation between the number of larvae and the amount of dissolved oxygen, and it is more related to the water temperature.

D. The value of nitrate nitrogen in Cat Alley is higher, and the value of the other two sites is lower. It is speculated that although larvae like clean and still water, water that is too clean is not suitable for larvae to survive.

E. Small fish have been found near the water collection site at Cat Alley, so it is speculated that the larvae may have been eaten by the fish.

## REFERENCES

1. Environmental Protection Administration, Executive Yuan, R.O.C. (Taiwan) https://wq.epa.gov.tw/EWQP/zh/Encyclopedia/NounDefinition
2. Grech MG, Manzo LM, Epele LB, et al. Mosquito (Diptera: Culicidae) larval ecology in natural habitats in the cold temperate Patagonia region of Argentina. Parasit Vectors. 2019;12(1):214. Published 2019 May 7. doi:10.1186/s13071-019-3459-y
3. GLOBE Hydrology protocol and atmosphere protocol