

CHAPTER SIX

CONCLUSION

This study shows that :

a) From the principal component analysis carried out on the 16 water samples, rainwater samples had a comparatively higher concentration of Zn and weight of suspended solids compared to the rest of the water samples. The stagnant water samples showed a higher concentration of Co, Cr and Sn compared to the rest of the water samples. The river water samples showed a higher concentration of Mn, Fe and Mg compared to the rest of the water samples.

b). River water at Sungai Keroh (Point E) possessed a higher concentration of Mn and As compared to the rest of the water samples. This is attributable to low water pH which corroded trace and heavy metal elements leading to the higher concentrations of these heavy metals including Cd, Cu and Pb. The high content of As may be enhanced by the presence of Mn which enables As to exist in a trivalent state. *A. aegypti* bred in this water sample showed increased mortality. However, further study is necessary to determine the individual effect of As and Mn on the mortality rate of this mosquito.

c). Eggs of *A. aegypti* had a high hatching rate in all of freshwater sources collected from the rain, river and stagnant pools. The percentage of eggs hatching into larvae were in the range of 70 - 98%. Therefore any of these freshwater sources are potential egg-laying areas for *Aedes* mosquitoes.

d). Although *A. aegypti* is always known to breed in stagnant water, it is found that even in controlled laboratory conditions, the completion of its life-cycle to the adult stage is low (40-60%) in the stagnant water samples compared to the rainwater and river water sources.

e). The rainwater collected from Cheras showed the highest concentration of Cd compared to the rest of the water samples. Therefore, high mortality at the pupal stage for rainwater collected in Cheras may be related to high Cd content.

f). Mortality of *A. aegypti* at different phases of development are different in each water sample. The highest percentage of mortality at the embryonic phase is shown in the water sample collected from Sungai Keroh (Point E) with 21% mortality. This river water sample is shown to have a comparatively higher concentration of As and Mn compared to the rest of the water samples. At the larval phase, a comparatively higher percentage of mortality was observed in the stagnant water samples with the highest percentage of mortality being in Point I (water sampled from ditches in an

abandoned land) (52.34%) followed by Point VI (pondwater)(36.46%). At the pupa stage, the highest percentage of mortality is shown in stagnant water samples Point IV (59.93%) and Point II (water sampled from pools at a construction site) (46.84%). The Cheras rainwater sample also showed a high rate of mortality at the pupa phase. (44.25%).

g). Mortality at different stages seems to be correlated to the concentrations of different heavy metals. A significant positive correlation ($p < 0.05$) existed between mortality at the embryonic phase (eggs) and the concentration of As in the water sample. There was also a significant positive correlation ($p < 0.05$) between mortality at the larval stage and the concentration of Sn in the water sample. Mortality at the pupal stage was significantly correlated to the concentrations of Co, Cr and Cd. Thus the failure of *A. aegypti* pupae to emerge into the adult mosquito may be related to higher concentrations of Cd, Cr and Co in the water samples.

h). The multiple regression analysis showed that prediction of mortality at the embryonic (egg) phase was influenced by the concentration of independent variables As, Cd and Pb (Egg Mortality= $0.87 + 43.99As - 2159.27Cd + 14.98Pb$). Mortality at the larval phase was predicted by the concentrations of Sn and Mg and the weight of the suspended solids (SS) (Larva Mortality = $9.13 + 339.51Sn + 17.12 Mn + 22.5SS$). At the pupal phase, mortality could be predicted by the

independent variables Cd, Zn and As and weight of suspended solids (Pupa Mortality = $6.5 + 4204.43Cd - 5.2Zn - 41.06As + 32.6SS + 0.16ROF$).

In this preliminary study, the six month period was evidently insufficient to conduct a thorough and comprehensive investigation. However, it does prove that certain water quality parameters do have an effect on the breeding and survival of juvenile *A. aegypti* and the information obtained is important for the environmental management of the mosquito. Therefore, this project warrants further investigation especially in the following areas :

- i). the effect of varying concentrations of As and Mn on the mortality rate of *A. aegypti* at the egg, larva and pupa stages.
- ii). the effect of varying concentrations of Sn on larval mortality
- iii). the effect of varying concentrations of Cd on pupal mortality
- iv). the cause of larva and pupa mortality in stagnant freshwater.
- v). the effect of other water quality parameters such as total organic content (TOC), dissolved oxygen (DO), biological oxygen demand (BOD), chemical oxygen demand (COD) and other properties that could also be responsible in hindering the development of *A. aegypti* at different stages.