

## CHAPTER 5

### Conclusion and Recommendations

#### 5.1. Conclusion

- 5.1.1. To measure the concentration of mercury and arsenic from the biota and the sediment of the test sites, and the reference sites.

Artisanal gold mining in farming communities leads to the mobilization of arsenic and the addition of mercury in to the environment. The release of these metals into the environment ensures bioaccumulation of the pollutants. Although a significant arsenic tissue concentration was not observed a significant mercury tissue concentration was observed higher than the Thailand's standard for food in the frogs. It is especially alarming that concentrations of mercury was detected in the sediment of the reference (control) site as well. This shows that mercury exposure is not limited to the mining sites. Here also the authorities needs to be informed of these findings.

- 5.1.2. The chromosomal aberrations of adult *Fejervarya limnocharis* and *Fejervarya cancrivora* from the field study sites.

Chromosomal aberrations were observed on both *Fejervarya* spp. The percentages of aberrations observed were higher in the mines in comparison to the reference sites. The data shows that the percentage of aberrations increase with the mining activity. Since chromosomal aberrations were observed in both the species without a significant difference between the species, hints at an exposure to all life living in the mining sites including humans which may lead to devastating results in the years to come. The authorities needs to be informed of these results so as to inform, educate and mitigate the farming communities from inevitable future hazard.

5.1.3. To confirm that chromosomal aberrations can be induced by injecting a concentration of mercury derivative and observed in the test sample.

As testing with mercury was limited by the unavailability of mercury products for laboratory testing, and to avoid an exposure event in the lab space. The test had to be carried out with arsenic instead. Acute and chronic impact was tested. This was discussed in detail the chapters above.

i. Impact of exposure to acute and chronic concentrations of mercury

a. Acute Impact

The experiment is limited to arsenic. 4 days of in vivo exposure to increasing concentrations of arsenic resulted in an increase in chromosomal aberration. This experiment shows an increasing relationship between acute exposures of arsenic to that of increasing chromosomal aberrations. Using the specimens as models for humans, we can assume the same impact to acute exposure.

b. Chronic Impact

The experiment is limited to arsenic. The experiment proves that chronic in vitro exposure at 12 days, 16 days, and 20 days to increasing concentrations of arsenic results in chromosomal aberrations. This experiment also shows a gradual increase of the percentage aberrations from day 12 to day 16. However, after day 16, a general decrease was observed. Thus showing that the observable impact was highest on the 16<sup>th</sup> day and confirms a development of tolerance, an inhibition of cell division, and possibly bioaccumulation. The experiment also proves that chronic in vitro exposure to increasing arsenic concentrations will cause chromosomal aberrations.

ii. Induction of Aberrations

The experiment shows that in general exposure to heavy metals in controlled conditions can cause chromosomal aberrations. Hence, chromosomal aberrations can be induced through exposure in lab conditions..

## 5.2. Recommendations and Limitations

### 5.2.1. Recommendations.

- a. The fact that the mercury is often processed in the kitchens and backyards is a major concern. A possibility of this practice is the lack of awareness of the potential risk, they must be informed and this practice must be stopped.
- b. Studies show a relationship with humans with high chromosomal aberrations due to exposure and cancer, the health of the miners must be monitored and reported to prevent further risk.
- c. If vapour concentrations can be detected in the tissue of one species, the chances are other animals will be exposed as well. A recommendation for the communities would be to test, mitigate and remediate.
- d. The mining process is an economic, easy to implement and profitable work. Continuation of this practice may lead to inevitable calamities. Therefore, an alternative to mining mode must be introduced.
- e. Arsenic and other sulphide metals are known to exist together. The field study shows a relationship between mercury and chromosomal aberrations. Furthermore, the experiments prove a connection between arsenic and chromosomal aberrations. Therefore, authorities must monitor the levels of mercury, arsenic and other related metals in the area.
- f. The research does not recommend the continuation of the practice. However, a sudden halt of the practice may lead to a great loss of the major income to the farmers of the area thus resulting in an unwanted social imbalance and allowing for undesirable practices in the farming communities. If ever the study is used for implementing a change for the practices, we recommend

the policy makers to implement gradual changes while providing an alternative mode of income to mitigate social unrest.

#### 5.2.2. Limitations

- a. The ethical principles limited the number of specimens that can be used in the field work as the initial results was not certain. Similarly it also limited the number of specimens in the acute experiment. Using this study, a researcher may use a bit more specimens for the field study and acute experiment for better statistical analysis.
- b. Due to the scope limitation, a through analysis of the sediments, water and plant biota was not possible.
- c. The use of mercury deravatives was not allowed for the current research as planned due to risk of contamination and exposure. Given sufficient time and permits, a researcher may experiment the same impact using mercury deravatives.