ANNALS of Faculty Engineering Hunedoara
– International Journal of Engineering
Tome XIII [2015] – Fascicule 3 [August]
ISSN: 1584-2673 [CD-Rom; online]
a free-access multidisciplinary publication of the Faculty of Engineering Hunedoara

[1.] Editha N. DE REGLA, [2.] Marilyn S. DE LEON, [3.] Edwin A.ESTRELLA,
[4.] Butch Stephen C. DUAY, [5.] Edric D.A. ESTRELLA

# LEAD AND CADMIUM CONTENTS OF SELECTED SPECIES OF AQUATIC LIFE IN THE ANGAT RIVER NETWORK IN BUSTOS, BULACAN

[1-5.] Bulacan State University, Bustos Campus, Bustos Bulacan, PHILIPPINES

**Abstract**: This study is a descriptive cross-sectional analysis of the concentration of lead and cadmium in selected species of aquatic life in the Angat River Network in Bustos, Bulacan. Through the use of Flame Atomic Absorption Spectrophotometer, it was established that lead and cadmium concentrations in the head, meat, bone, tail and intestines of Leiopotherapon plumbeus or Lukaok, Glossogobius giuris or Biya, Oreochromis niloticus or Tilapia, Misgurnus fossils or Bulig, Cyprinus carpio or Carpa, and Macrobrachium rosenbergo or Prawn are within the allowable limits set by WHO. To wit, 0.015 ppm for lead and 0.005ppm (5ppb) for cadmium respectively. However, Lukaok, Tilapia and Gurami, among all the species, have a considerable amount of lead concentration in their intestines. But just the same, they are still within the safe limits of toxicity.
**Keywords**: lead, cadmium, selected species of aquatic life

## 1. INTRODUCTION

The Angat River, which is also called the Bulacan River Network, snakes through the municipalities of Doña Remedios Trinidad, Norzagaray, Angat, Bustos, San Rafael, Baliwag, Plaridel, Pulilan, Calumpit, Paombong and Hagonoy which eventually leads to the Manila Bay. The Angat River Network in Bustos, Bulacan is a freshwater aquatic resource that starts from the Bustos Dam watershed and encompasses the barangays of Tibagan, Bonga Mayor, Bonga Menor, Tanawan, Poblacion, San Pedro and Cambaog. This part of the river network harbors diversified freshwater fish, crustaceans and crab species which serve as the livelihood of municipal and subsistence fishermen who live in the outskirts of the river network waterways.

This eight-kilometer fishing ground produces several species of aquatic life endemic in Philippine freshwaters. However, several open garbage dumpsites and pig pens are strategically situated along the riversides. According to Samar (2013) the pollution of the Pampanga River Basin with household garbage, rice field fertilizers and human excreta has been a perennial provincial problem. Discharge of domestic waste such as worn-off batteries, plastics materials, items made of rubber and the likes releases traces of heavy metals. Bioaccumulation of such elements in the river produce that are eventually consumed by humans is a very serious problem that is often left unnoticed. What's worse is that even an accidental ingestion of river water and even skin contact is very harmful, and at times can be fatal.

According to Wikipedia, the Free Encyclopedia in the internet, lead poisoning is a type of metal poisoning and a medical condition in humans and other vertebrates caused by increased levels of the heavy metallead in the body. Lead interferes with a variety of body processes and is toxic to many organs and tissues including the heart, bones, intestines, kidneys, and reproductiveand nervous systems. It interferes with the development of the nervous system and is therefore particularly toxic to children, causing potentially permanent learning and behavior disorders. Symptoms include abdominal pain, confusion, headache, anemia, irritability, and in severe cases seizures, coma, and death. (www.en.wikipedia.org/wiki/lead_poisoning)

Furthermore, Wikipedia also mentions that buildup of cadmium levels in the water, air, and soil has been occurring particularly in industrial areas. Acute exposure to cadmium fumes may cause flu like symptoms including chills, fever, and muscle ache sometimes referred to as "the cadmium blues." More severe exposures can cause tracheo-bronchitis, pneumonitis, and pulmonary edema. Symptoms of inflammation may start hours after the exposure and include cough, dryness and irritation of the nose and throat, headache, dizziness, weakness, fever, chills, and chest pain. Inhaling cadmium-laden dust quickly leads to respiratory tract and kidney problems which can be fatal, often from renal failure. Ingestion of any significant amount of cadmium causes immediate poisoning and damage to the liver and the kidneys. Compounds containing cadmium are also

carcinogenic.(www.en.wikipedia.org/wiki/cadmium_poisoning)Similar to this study is the study of Khalifa et.al. (2010) where heavy metals such as Co, Cd and Pb in all examined tissues in several fish species of the Mediterranean Sea Libyan Coastline were more than the reported literature values (WHO). On the other hand, the concentration of Cu in all the examined tissues in several fish species were less than the reported literature values. The concentration of Fe in all examined tissues were less than the reported values except for two species of fish.

In the study of Tabiri et. al. of heavy metals (Zn, Pb, Cd and Cr) in fish, water and sediments in ten sampling areas in the southern coast of the Caspian Sea during spring of 2008, and using the analysis of variance (ANOVA) statistical treatment, they found out that the highest concentration of heavy metals in water and fish and sediment samples were related to Pb and Zn. The minimal and maximal concentrations of these metals in fishes, water and sediments were 53.67—2360.67 and 50.36—2497.25 for Pb and Zn, respectively. However, the observed heavy metals concentrations in fish, water and sediments were below the recommended limits.

Furthermore, another study by Abida Begum, Harl S. Krishna and Irfanulla Khan in 2008 revealed that in Madivala Lakes of Bangalore, Karnataka, also in India, an appreciable increase in metal concentrations in going from the water to the sediment samples. To wit, the heavy metal concentration in water is as follows, Pb>Cr>Cd.Ni. The heavy metal concentration is sediments is as follows, Pb>Cr>Cd>Ni. The heavy metal concentration for fish muscle is Pb>Cd>Ni>Cr; for fish kidney is Pb>Cd>Ni>Cr; and for fish liver is Pb>Cd>Ni>Cr.

However, in the study of Olaifa et.al. (2004) of an African Catfish purchased from Eleiyele Lake and Zartech fish farm in Ibadan, Nigeria showed that the gills, bone, muscle and water samples collected and analyzed for five elements such as manganese, copper, zinc, iron and chromium by Atomic Absorption Spectrometry were concluded to be within safe limits for human consumption.

## 2. SAMPLING AREA

The two fishermen who harvested several species of aquatic life were given expressed instructions to retrieve river produce within the entire eight-kilometer stretch of the Angat River Network in Bustos, Bulacan that starts from the Bustos Dam watershed and encompasses the barangays of Tibagan, Bonga Mayor, Bonga Menor, Tanawan, Poblacion, San Pedro and Cambaog (Figure 1).

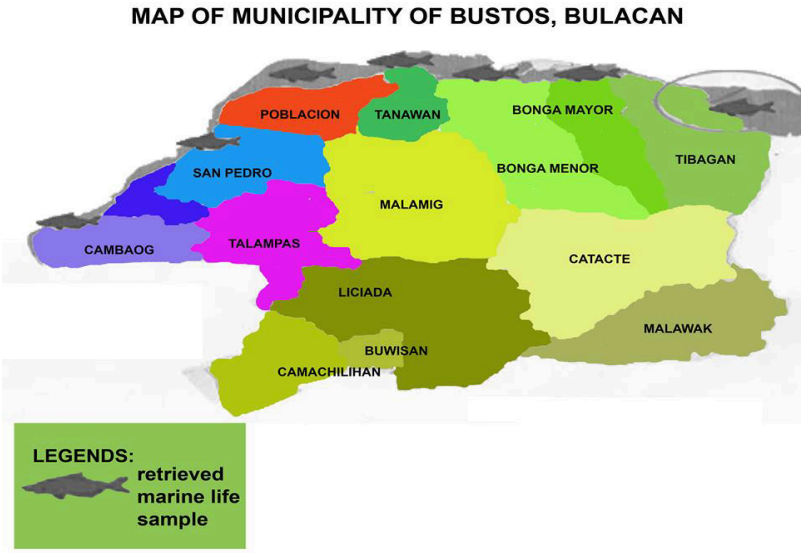


Figure 1. Stretch of the Angat River Network in Bustos, Bulacan where Samples were retrieved

## 3. MATERIALS AND METHODS

The analytic grade nitric acid (500ml) was purchased in Bangbang, Manila. The flame atomic absorption spectrophotometer AA-6300 FAAS (Shimadzu) used in this study was rented from the De La Salle University, Taft, Manila in October 30, 2014.

The aquatic samples were collected from the Angat river network in Bustos, Bulacan, Philippines (Table 1). The samples were put in an ice box then transported to the BulSU-Bustos Chemistry laboratory. The collected aquatic species were cleaned and washed with distilled water. These were dissected to different parts, specifically, the bones, tail, head, intestine and meat, and were left to dry at room temperature for three days. The dried samples were digested with the following procedures (Khalifa et.al., 2010): 1 g of each part was dissolved in 1 M nitric acid and then turn into boiling to complete the dissolution and then filtered. The precipitate was washed with 1 M nitric acid and transferred to 25 mL glass tube and fill up to the level with de-ionized water. Table 2 shows the list of reagents and standard solutions used in this study. Whereas Table 3 reveals the list of aquatic life harvested in the Angat River Network in Bustos, Bulacan.

**Table 1**. List of Tools/Equipment Used in this Study

| Tools/Equipment | Quantity |
|---|---|
| Wash bottle | 1 |
| Dissecting Scissors | 1 |
| Dissecting Tweezers | 1 |
| 1000 ml, 250 ml and 100 ml Beakers | 4 |
| Graduated Cylinder | 1 |
| Fume hood | 1 |
| Goggles | 5 |
| Face mask | 5 |
| Gloves | 5 |
| Stirring rod | 1 |
| Iron stand | 4 |
| Iron ring | 4 |
| Wire gauze | 4 |
| Alcohol lamp | 4 |
| Watch glass | 4 |
| 25 ml glass tubes | 30 |
| Filter paper | 30 |
| Funnel | 4 |
| 25 mL volumetric flask | 5 |
| 1 mL and 10 mL pipette | 2 |
| Aspirator bulb | 2 |

**Table 2**. List of Reagents and Standard Solutions Used in this Study

| Reagents and Standard Solutions | Quantity |
|---|---|
| 2% (v/v) HCl | 1 L |
| 2% (v/v) $HNO_3$ | 1 L |
| 1 M $HNO_3$ | 500 mL |
| De-ionized water | 6 L |
| Working metal standard solution | 40 L |
| 0.10 ppm standard solution | 10 mL |
| 0.25 ppm standard solution | 10 mL |
| 0.50 ppm standard solution | 10 mL |
| 0.75 ppm standard solution | 10 mL |
| 1.00 ppm standard solution | 10 mL |

**Table 3**. List of Aquatic Life Harvested in the Angat River Network in Bustos, Bulacan

| Local Name | Scientific Name |
|---|---|
| Lukaok | Leiopotherapon plumbeus |
| Biya | Glossogobius giuris |
| Tilapia | Oreochromis niloticus |
| Gurami | Trichogaster lalius |
| Bulig | Misgurnus fossilis |
| Carpa | Cyprinus carpio |
| Prawn | Macrobrachium rosenbergii |

## 4. RESULTS AND DISCUSSION

Table 4 shows the concentration of lead detected by the FAAS in the selected aquatic life from the Angat River Network in Bustos, Bulacan. On the other hand, Table 5 shows the concentration of cadmium detected by the FAAS in the selected aquatic life from the Angat River Network in Bustos, Bulacan.

**Table 4**. Concentration of Lead in Selected Species of Aquatic Life in the Angat River Network in Bustos, Bulacan

| Fish Sample Scientific/ Local Names | Heavy Metal Concentration (Pb), ppm | | | | |
|---|---|---|---|---|---|
| | Head | Meat | Bone | Tail | Intestine |
| | Conc. | Conc. | Conc. | Conc. | Conc. |
| Leiopotherapon plumbeus / Lukaok | -0.0071 | -0.0234 | -0.0264 | -0.0253 | 0.0056 |
| Glossogobius giuris/ Biya | -0.036 | 0.0074 | -0.0035 | -0.0416 | -0.0035 |
| Oreochromis niloticus /Tilapia | -0.0434 | -0.020 | -0.0253 | -0.0053 | 0.011 |
| Trichogaster lalius /Gurami | -0.031 | -0.0416 | -0.0343 | -0.038 | 0.0001 |
| Misgurnus fossilis/Bulig | -0.0361 | -0.0216 | -0.0507 | -0.038 | -0.0325 |
| Cyprinus carpio /Carpa | -0.0361 | -0.0561 | -0.0634 | -0.0688 | -0.0398 |
| Macrobrachium rosenbergii /Prawn | -0.0543 | -0.0615 | N/A | N/A | N/A |

**Table 5**. Concentration of Cadmium in Selected Species of Aquatic Life in the Angat River Network in Bustos, Bulacan

| Fish Sample Scientific/ Local Names | Heavy Metal Concentration (Cd), ppm | | | | |
|---|---|---|---|---|---|
| | Head | Meat | Bone | Tail | Intestine |
| | Conc. | Conc. | Conc. | Conc. | Conc. |
| Leiopotherapon plumbeus / Lukaok | -0.0462 | -0.0434 | -0.0461 | -0.0459 | -0.042 |
| Glossogobius giuris/ Biya | -0.0464 | -0.0414 | -0.045 | -0.0484 | -0.0453 |
| Oreochromis niloticus /Tilapia | -0.0431 | -0.0478 | -0.0475 | -0.0484 | -0.0392 |
| Trichogaster lalius /Gurami | -0.0476 | -0.0475 | -0.0484 | -0.0498 | -0.047 |
| Misgurnus fossilis/Bulig | -0.0475 | -0.0453 | -0.0453 | -0.047 | -0.0423 |
| Cyprinus carpio /Carpa | -0.0436 | -0.0475 | -0.0456 | -0.045 | -0.0222 |
| Macrobrachium rosenbergii /Prawn | -0.0442 | -0.0489 | N/A | N/A | N/A |

It can be gleaned from Tables 4 and 5 that the lead and cadmium concentrations in the head, meat, bone, tail and intestines of Leiopotherapon plumbeus or Lukaok, Glossogobius giuris or Biya, Oreochromis niloticus or Tilapia, Misgurnus fossils or Bulig,

Cyprinus carpio or Carpa, and Macrobrachium rosenbergo or Prawn are within the allowable limits set by WHO. To wit, 0.015 ppm for lead and 0.005ppm (5 ppb) for cadmium respectively. However, Lukaok, Tilapia and Gurami, among all the species, have a considerable amount of lead concentration in their intestines. But just the same, they are still within the safe limits of toxicity.

## 5. CONCLUSION AND RECOMMENDATION

Based on the results of this study, it is hereby recommended that the local government unit should adopt and strictly enforce a comprehensive solid and liquid waste disposal system in order to rehabilitate and preserve the water quality in the Angat River Network in Bustos, Bulacan. Furthermore, considering the lead concentration detected in several aquatic life and its danger to human health, periodic monitoring should be strictly undertaken and appropriate measures be implemented on the river maintenance and preservation. Before river waters is used, distributed or fished upon, it should pass the criteria on standard parameters set by the Philippine National Standards for Drinking Water and the World Health Organization.

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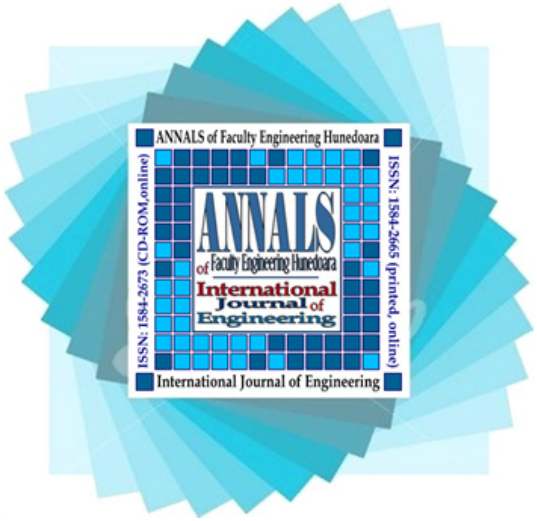


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