ISSN: 0975-8542

Journal of Global Pharma Technology

Journal of Global Pharma Technology
Scopus coverage years: from 2010 to Present
Publisher: Journal of Global Pharma Technology
ISSN: 0975-8542

http://www.scimagojr.com/journalsearch.php?q=19700200708&tip=sid&clean=0

September 27, 2018

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TITLE: HEALTH RISK ASSESSMENT OF SOME HEAVY METALS POLLUTION IN MUSCLES OF *BARBUS XANTHOPTERUS (HECKEL, 1843)* IN AL-GHARRAF RIVER SOUTHERN OF IRAQ

Received on: September 06, 2018

Accepted on: September 27, 2018

Plagiarism %: %

Date of publication: Vol:11 (No.05-06) to get release in Jun 2019.

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Health Risk Assessment of Some Heavy Metals Pollution in Muscles of *Barbus xanthopterus* (Heckel, 1843) in Al-Gharraf River Southern of Iraq

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Summary

One sampling station were selected to conduct the study in Al-Gharraf River in Kut -Al-Haay city. The samples were taken from the study station at once every month from June of 2017 until May 2018 for year. The study results showed that the mean concentrations heavy metals are vary seasonally in their levels and analyses of muscles indicate that Ni occupied the first position and revealed the highest levels, in general. The minimal recorded accumulative values (0.187 ppm) was in Spring and the highest (0.251 ppm) in summer. Zinc occupied second accumulation levels and showed the minimal (0.039 ppm) in spring, whereas Cd, by no means, exhibited the minimal concentrations and the lowest value (0.0053 ppm) was in winter.

Keywords: Heavy Metals, Fish, Water Pollution, Al-Gharraf River.

Introduction

Among the inorganic contaminants of river water, heavy metals are getting importance for their non-degradable nature and often accumulate through tropic level causing a deleterious biological effect (1). The term "Heavy Metals" refers to any metallic chemical elements that have a relatively high specific gravity and toxic or poisonous ability at low concentrations. These elements are natural components of the Earth's crust and cannot be degraded or destroyed to a small extent (2). Heavy metals have long been recognized as serious pollutants of the aquatic environment (3). They cause serious impairment in metabolic, physiologic, structural, and all other systems when present in high concentrations in the milieu (4).

Fishes represent the peak of consumers in water system. Fishes have ability to collect these metals in concentrations higher than water and sediments due to feed on organic materials in aquatic environment (5). The common name of *B. xanthopterus* fish is Ghattan fish that attributed to herbivorous Cyprinidae family; they are major component of Eurasian temperate fresh water fauna (6). The role of this family within fresh water ecosystems is therefore central and to date. The genus of Barbus constitutes

is dominant component of Cyprinids family, with more than 800 species spread over Europe, Africa, Asia (7).

Materials and Methods.

Study Area Description.

Al-Gharraf River as shown in Fig. (1), is situated in the southern of Iraq, its the major branch of Tigris River, flows from the right bank of Tigris at Al-Kut Dam to the Euphrates basin passing Wasit and Dhi-Qar governorates and ends in Al-Hammar marsh north of Nassyria City.

The location of sample collection is situated at distance 53 km from Kut Dam and affected by discharge of municipial, agriculture annd indusrial wastes from the Al-Kut, Al-Muwaffaqiyah, Al-Haay, Al-Basha'er cities and many green heavy populated villages within Wasit governorate. The River width at sampling position is 49 m and depth 11m (8). Quite few aquatic vegetations were detected in the region including Phragmites australis, Typha sp., Potamogeton sp., Ceratophyllum demersum, and Vallisineria spiralis. Some Crustaceans and mollusks were also found such as Sesarma boulengeri, Unio tigridis , Melnoides tuberculata and Melanopsis nodosa, as well as , about 8 fish species were recovered from sampling location.

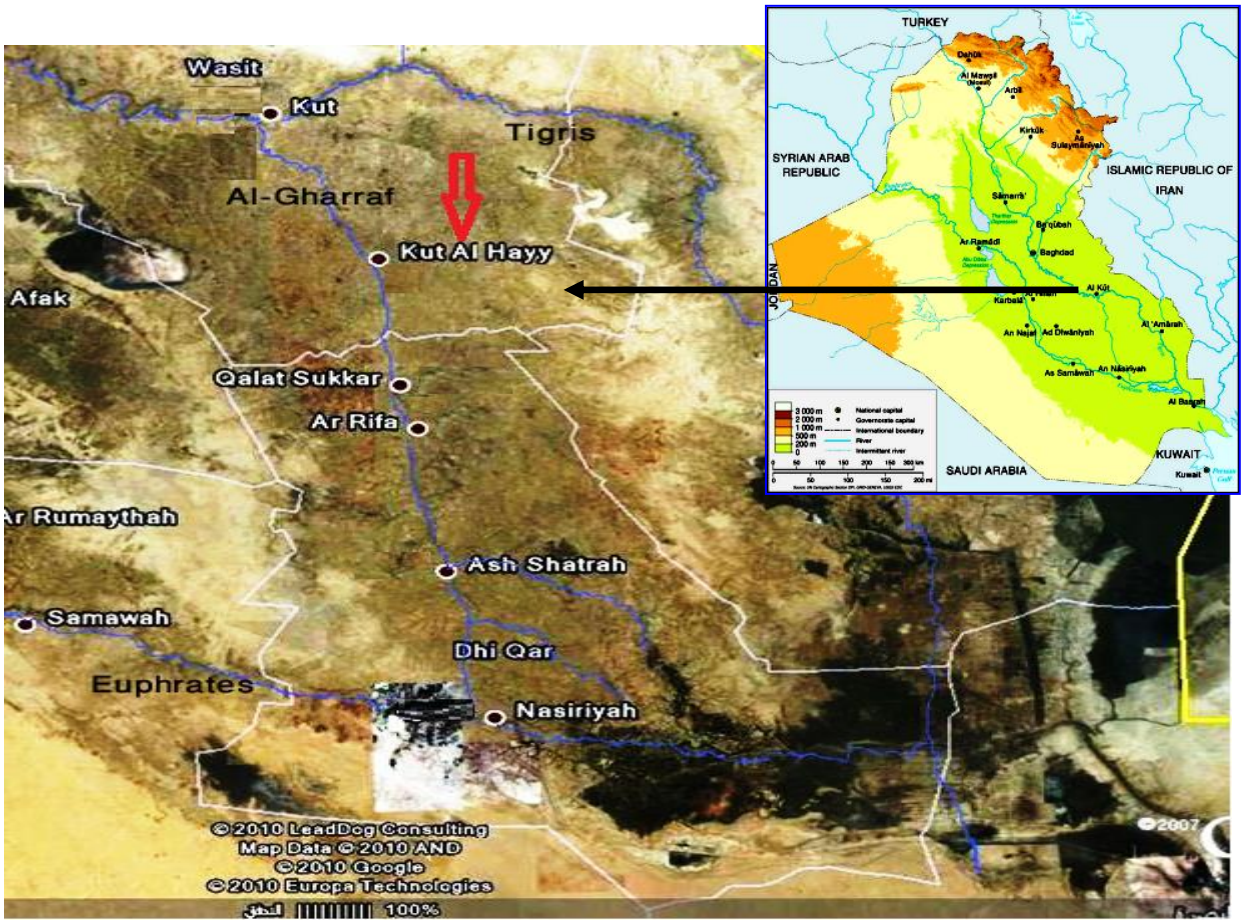

Figure (1): Display the sampling location in Gharraf River.

Extraction of heavy metals from fish.

Fish (*B. xanthopterus*) specimens of study area dissected for muscles. About 50 gm of native organ were taken into crucibles and dried for 2 hr. at 700C in oven. Then burned by Muffle furnace at 450-5000C for 4 hr. 1 gm of samples ash was putted into the beaker. 6 ml of concentrated HNO3 and 2 ml of concentrated HCL were added into beaker, and then warmed into water bath at 700C for one hour with stirring to accelerate reaction to ensure complete digestion. The productive mass was cooled in room temperature and filtered by using filter paper (0.45 µm). The filtered solution completed to 25 ml with de-ionized water and finally kept in polyethylene container for analysis by flameless atomic absorption spectrophotometer (9) and (10) . Measuring finale concentration:

Econ =

Econ: concentration of metal in sample (µg/g)

A: concentration of metal in calibration curve (mg/l)

B: final volume of sample (ml)

D: dry weight of sample (g).

Results and Discussion.

Heavy metals are the serious aquatic pollutants and their uptake and accumulation in the aquatic ecosystems, beyond safe limits, would cause direct consequences to the aquatic food chain and ultimately to the man (11). Fish have been used for many years to indicate whether water is clean or polluted. It is excellent biological markers of metals in waters (12).

In this study heavy metals results demonstrated that maximum concentration of nickel (0.251 ppm) which was recorded in muscles of fish in summer (July), 2017, and the minimum concentration 0.187 ppm was in spring (April), 2018 as show in Table (1). While Cu value ranged between 0.052 to 0.017 ppm and Zn ranged between 0.173 to 0.039 ppm as presented in Table (1). On other hand, the concentration of Cadmium is varied from lowest value was 0.0053 ppm and the highest value was 0.0071 ppm , all the year round, altogether.

The study also indicate that annual mean of Ni 0.219 ppm was the highest, but that of Cd 0.0062 ppm was the lowest. Seasonal variations in levels of Cu were fluctuating, but the highest 0.052 ppm was in spring and the yearly means was 0.0345 ppm. It is evident that the maximum seasonal concentration of Zn 0.173 ppm was in autumn and the yearly mean was 0.106 ppm.

Figure (1): Display seasonal variations in concentrations of heavy metals in tissues of fish (*B. xanthopterus*). Values were found to vary among elements and within the same element at different seasons. The maximum 0.251, 0.173, 0.052 and 0.0071 ppm for Ni, Zn, Cu and Cd respectively encountered in summer, autumn, summer and spring in the same order and the minimum were 0.187, 0.039, 0.017 and 0.0053 ppm for the above items in the same order. However, elements recovered from fish (*B. xanthopterus*) muscles can be arranged as follows: Ni>Zn>Cu>Cd.

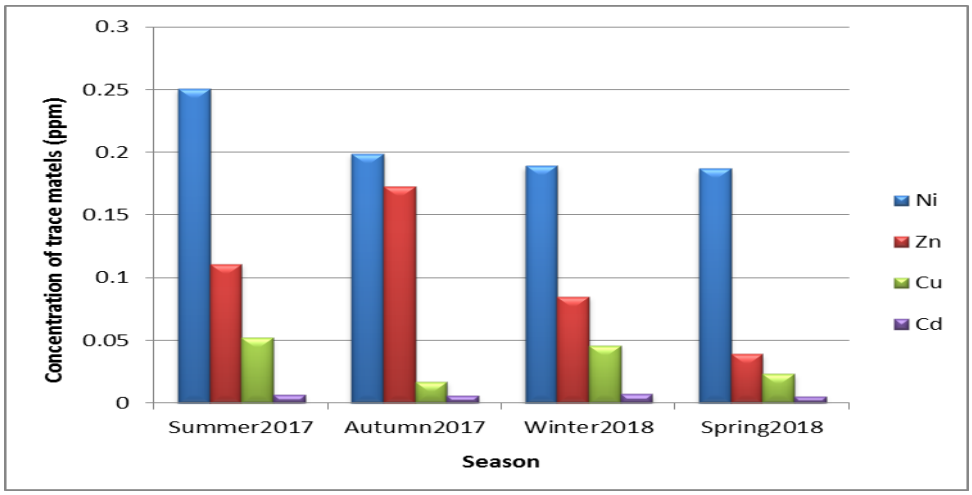

Figure (1): Seasonal changes in levels of the four selected heavy metals in muscles of fish (*B. xanthopterus*) from Al-Gharraf River.

It was noticed, from the figures above; that the highest metal concentrations (except for Zn) was found in hot and warm seasons were because chemicals become more soluble in high temperature, the metabolic rate of aquatic organisms increase, growth rate will also increases with the decomposition of organic matter (13). Heavy metals found to vary seasonally in their levels of accumulation in muscles of fish (*B. xanthopterus*) collected from Al-Gharraf Rivr during the study period as presented in Table (1).

Table (1). The statistical summary, of annual mean concentration and standard deviation (S.D), with minimum and maximum value of the heavy metals in muscles of fish (*B. xanthopterus*).

Trace element	Mean ± SD	Minimum value	Maximum value	Replicates
Ni (ppm)	0.219±17.04	0.187	0.251	12
Zn (ppm)	0.106±48.5	0.039	0.173	12
Cu (ppm)	0.0345±10.8	0.017	0.052	12
Cd (ppm)	0.0062±0.39	0.0053	0.0071	12

The increase in concentrations of metals in fish could be mainly due to metal contaminated diet, which comes from discharge of effluents in to rivers from different industries and other sources in the form of particulates and solution (14) and (15). Accumulation of trace elements in aquatic organisms is one of the most striking effects of pollution in aquatic systems (16). The mechanism of trace metals bioaccumulation in fish is complex and diversified, varying with their chemistry, mode of action and metals types (17) and (18) . The accumulation of heavy metals in fish depends upon the concentration of the metals, exposure time, physiological condition of fish and environmental factors especially pH and hardness of water (19) and (20).

Furthermore, heavy metal concentrations indifferent fish species might be a result of different ecological needs, metabolisms, and feeding pattern (21) and (22).These elements are known to produce adverse effects on aquatic biota and human health. Effects of these metals in fish include reduction of growth and reproductive capacity, swimming imbalance and inability to capture the prey (23) and (24).

Conclusion.

The present research work reveals that the health status of Al-Gharraf River, with respect to Ni, Zn, Cu and Cd toxicity in fish was significantly higher that showed variable accumulation patterns of these metals in fish body organs. And indicate a high risk of metals except Zn to the people of the Kut - Al-Haay city. Moreover, potential of metallic toxicity danger may become more severe in future depending upon the extent of industrial and domestic wastewater influx into the Al-Gharraf River due to man-made activities in the adjacent areas.

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