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DISTRIBUTION OF SOME HEAVY METALS IN WATER AND TWO SPECIES OF FISH IN EUPHRATES RIVER IN NASSIRIYA CITY OF SOUTHERN IRAQ

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Abstract

The heavy metals Cadmium, copper, and lead were determined in the river water of both phases (Dissolved and Particulate), also in the muscles of the fish *Acanthopargus latus* and *Cyprinus carpio*, that are collected from water of Euphrates River, at summer/ 2016. Analysis employing a flam atomic absorption spectrophotometers (FAAS). The mean concentrations of the metals in both phases (Dissolved and Particulate) were Cd (0.12, 13.5), Cu (1.4, 14.25) and Pb (0.24, 20), (ug /L) and (ug /gm dry weight) respectively, and those for fish (*A. latus, C. carpio*) were Cd (0.05- 0.035), Cu (0.4-0.21) and Pb (0.43-0.34) (ug /gm dry weight) respectively. The bioconcentration factor (B.C.F) was calculated for the above studied elements in the fish muscles (*A. latus, C. carpio*), which was as follows: (Cd (417-292), Cu (286-150) and Pb (1792- 1417) times as concentrated in water respectively. The present study showed a difference in concentration of studied metal in different muscles of fish. This due to the nature and the feeding and ability fish or regulating the level of the metals in their bodies during uptake and elimination processes. The result also showed that heavy element concentration in muscles of two the species were in the international acceptable limits, so it can be safety having related to this type of pollutants now days, considered good indicator of accumulation for heavy element in the water.

***Keyword*:** Euphrates river, fish, heavy metals, water pollution.

Introduction

Water is one of the main natural sources of human life and is important for economic and social reasons (Al-Helaly, 2010). Water has a variety of purposes, including for drinking, agriculture, industrial and energy production (Shiklomanov, 1998). Heavy metals are natural constituents for all environments. They are very dangerous materials because of their persistence, toxicity at low concentration and their ability to be incorporated into the food webs and accumulation by aqueous organisms (Windom *et al.,*1999), it's are one of many causes of the autism disease (Farhood, 2018). Upon entering aquatic system, metals move through the water column towards the sediment during which time they can be accumulated by organisms (fish, zooplankton and phytoplankton). The accumulation and distribution of heavy metals in fish organ depend on many factors, concentration of metals, exposure time, temperature and salinity, food habits, physiological condition, growth, age, sex of fish and pollutants interactions (Al-Khafaji, 1996).

Pollution generally effects on the fish either directly or indirectly. The directly acting pollutants create a lethal effect either through their action on the epithelial surfaces of gills or by absorption in the body which affects in the internal structure and metabolism of the fish. Indirect effects are created by the destruction of the food supply, covering the river with inert or oxidisable matter or by the destruction of spawning niche (Chale, 2002). Fish are part of aqueous ecosystem and anything which passive effect this environment is potentially harmful to fish, so they can be used as a bioindicators of water pollution (Mersch *et al.*, 1993). There are some researchers who have studied the effect of heavy metals In some species of fish common in Iraqi waters (Al-Awady, 2012; Lazim, 2013; Farhood, 2015).

The present study aimed to know the differences in the distribution and concentration of some heavy metals in river water and the muscles of two species of fish *Acanthopargus latus* and *Cyprinus carpio* collected from Euphrates river, south of Iraq. And from which they can determine the levels of these elements in the study area.

Materials and Methods

Study of stations

Water samples and fish (*Acanthopargus latus* and *Cyprinus carpio*) collected from the Euphrates river (Fig.1) during the summer of 2016. The current study included two stations in the river water as follows:

- The first station: It was chosen as it is located when entering the river in the center of Nassiriyah.
- The second station: It is located after the river exits the city center (about 5 km from the first station), and the average of these stations was taken.

Water samples were collected using plastic bottles (polyethylene) with capacity of 5 liters per sample, these samples were filtered through 0.45 um Millipore membrane filters. The materials that pass through the filters represent the dissolved phase, while the materials remaining in the filters represent the particles.

The dissolved phase of heavy metals was analyzed according to (Riely and Taylor, 1968). Whereas in particle samples, heavy metals were determined according to (Sturgeon *et al.*, 1982).

Fish samples were taken from river water using 25x25 mm gill nets, then frozen in polyethylene bags, and upon arrival at the laboratory the fish were thawed and rinsed with deionized water, then length and weight were measured to the nearest mm and mg, respectively. The muscle was taken from the posterior left side of each fish (total fish were 200 fish in each plant 50 fish per species of length 18-26 cm). The tissues were then dried with a drying oven below 105 °C for 24 hours, then crushed with a 0.5 mm nylon sieve. And to

digest fish muscle samples, method R.O.P.M.E (1982) was adopted.

In three replications of water and fish samples, heavy minerals were extracted. Cd, Cu and Pb were determined on (FAAS-Model Shimadzu 6300).

The bioconcentration: factor was calculated according to the following equation, (Demina *et al.,* 2009)

$$\text{B.C.F.} = \frac{\text{Conc. of element in Fish}}{\text{Conc. of element in water}}$$

Use the ANOVA test to find the significance difference between metals in fish muscles and element in water.

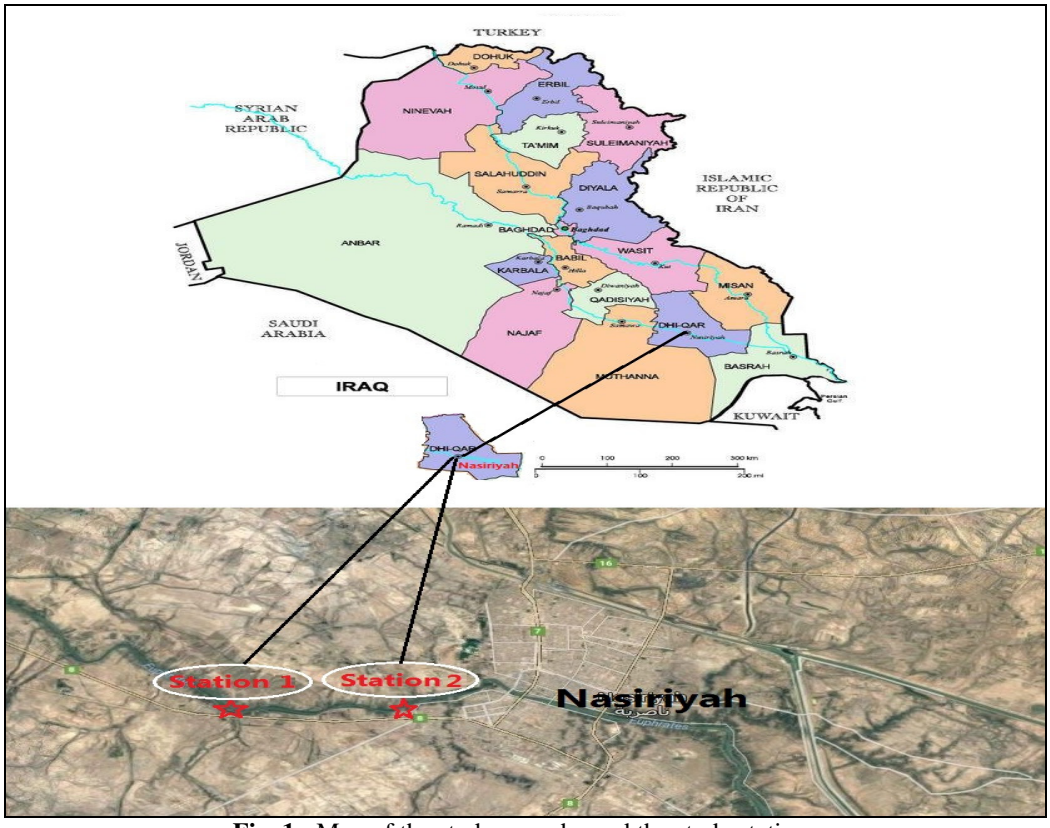

Fig. 1 : Map of the study area showed the study stations

Result and Discussion

Heavy metals in water samples:

In the present study some heavy metals (Cd, Cu and Pb) were discussed. The measured of these pollutants in the studied water sample shown in Table (1).

In the aquatic environment, the metal particles between the dissolved and the suspension determine their ultimate fate, the concentrations of heavy metals studied in all study stations were lower in the dissolved phase than in the particle phase.

The mean concentration of the mentioned in dissolved phase at the study station (1 and 2) was as follow; Cd (0.15, 0.09), Cu (1.6, 1.2) and Pb (0.3, 0.18) ug /L respectively, where as their concentration in the particulate phase was; Cd (15, 12), Cu (16, 12.5) and Pb (25, 15) ug/gm dry weight respectively.

Metals concentration in station (1) were lower than their concentration in station (2), this may be because the city center has been exposed to various types of pollutants such as sewage, oil spill from boats, animal, wastes and chemical used in fishing, because this station was located close to the residential area (Al-Khafaji *et al.,* 2012; Farhood, 2012), as well as we know, the particulate the former mostly Zoo and phytoplankton, while the latter, were mostly, silt and clay, so the high concentration of heavy metals in particulate phase was due to these components.

Bowen (1966) has indicated that planktonic organisms tend to concentrated heavy metals as higher as 10^6 times than their levels in the surrounding water also the concentration of heavy metals in aquatic environment depends on many factors such as water discharge of the river, seasonal variations in quantitive and qualitative of plank ton and suspended material load of river (Nolting, 1986). The results of this study agree with many previous studies (Al-Awady, 2012; Farhood, 2017)

(i) Heavy metals in fish samples

Some heavy metals accumulate in fish from the aquatic environment and can therefore be used as Bioindicators of pollution in water (Al-Najare, 2009; Al-Awady 2012; Farhood, 2015). The current study showed that the muscles of the two types differed in their accumulation of heavy metals (Figure 2).

Fish accumulated heavy metals from their environment, they are excellent organism for the study of some long–term changes of heavy metals in the environment (Radeef *et al*., 2013). The mean concentration of the mentioned metal in Muscle in *A.latus* were Cd (0.05), Cu (0.40), and Pb (0.43), (ug/ gm) dry weight respectively, while in *C. carpio* were Cd (0.035), Cu (0.21) and Pb (0.34), (ug /gm) dry weight respectively.

The concentration of the mentioned metals varied among the fish of the studied species, this may be due to the

species–specific mechanisms (Cross *et al.,* 1973) indicated that the differences in accumulation metals patterns in the organs of the fish species interdependency of uptake and elimination rates of metals.

The present study showed that the concentration of the studied metals in *A. latus and C. carpio* are as follows or the overall order of enrichment for heavy metals in muscle for both species were Pb > Cu > Cd.

This indicate that the difference in the accumulation pattern of Pb and Cd in fish tissues depend on uptake elimination rates of metals (Abdel-Baki *et al*., 2011). The results of the present study agree with (Al-Khafaji *et al*., 2012), low concentrations of heavy metals were recorded in the muscles of both species. The present result agree with those studies by (Raphael *et al*., 2011).

The concentration of most metals in muscle of *A. latus* were higher than in *C. carpio*, which promote the have mentored phenomenon (Windom *et al*., 1973) indicated that difference in metals accumulation in fish bodies may be due to the difference in their diet during the growth of the species.

The present values of metals concentration in the muscle of the studied species in comparison with other species from the same environment (Table 2), which shows that the concentration of the studied metals in the muscle is in the acceptable range in comparison with worldwide studies (Brayn, 1976), knowledge of metals concentration in fish muscle is important both with respect to nature management and human consumption of fish and to determine the most useful bio monitor species for human health. The observed differences can be explained by the fact that, the concentration of heavy metals depend to a great extent on species, sex, biological cycle and on the part of the fish analyzed (Tuzen, 2003). Moreover, ecological factors such as season, location, environment of development, nutrient availability, temperature and salinity of water, may contribute to variation in the metals concentrations in fish (Romeoa *et al.,* 1999).

The present study also, showed that the fish were varied from one to another in their accumulation of heavy metals shown in (Table 2, 3)**.**

Statistical analysis showed significant difference between fish were apparent at the level of P<0.05, also positive significant correlation between concentration all heavy metals in water and its concentration in fish.

A. latus, concentrated metals more than at *C. carpio*, the rate of bio- concentration for Cd (147, 292), Cu (286, 150), and pb (1792, 1417) times respectively, shown in Table (3). The results of this study agree with many previous studies such as (Farhood, 2015).

Conclusions

Clear difference in the concentration for the studied metals in station 1 was compared with station 2, the former was affected by human activities within the river such as sewage discharge, use of chemicals in fishing as well as oil spill from fishing boats ,the trend of metals concentrations was arranged as follows: Particulate > Fish > Dissolved phase.

Also the level of heavy metals in water were in acceptable range according to the National health and medical research council (N.H.M.R.C), observed in muscle tissue containing a lower concentration of these metals, this mean that the heavy metals in the edible parts of *A. latus and C. carpio* were within the safety permission level for Human use in this time, and can considered this fish a good bioindicator for this type of pollutants.

Table 1 : The rang and Mean ± SD of heavy metals concentration in water (dissolved ug/ L and particulate ug/ gm dry weight) and mean con. in the region.

Element	Station one		Station two		Mean concentration in the region of study	
	Dissolved	Particle	Dissolved	Particle	Dissolved	Particle
Cd	(0.05-0.1) 0.09 ± 0.02	(10-15) 12 ± 1.00	(0.1-0.18) 0.15 ± 0.07	(13-18) 15 ± 0.3	0.12 ± 0.045	13.5 ± 0.65
Cu	(1-1.6) 1.2 ± 0.6	(11-14.5) 12.5 ± 1.02	(1.5 - 2) 1.6 ± 0.8	(13 -19.5) 16 ± 2.00	1.4 ± 0.7	14.25 ± 1.51
Pb	(0.12 - 0.22) 0.18 ± 0.7	(13 - 20) 15 ± 1.20	(0.25-0.38) 0.3 ± 0.02	(23.4-30) 25 ± 4.01	0.24 ± 0.36	20 ± 2.61

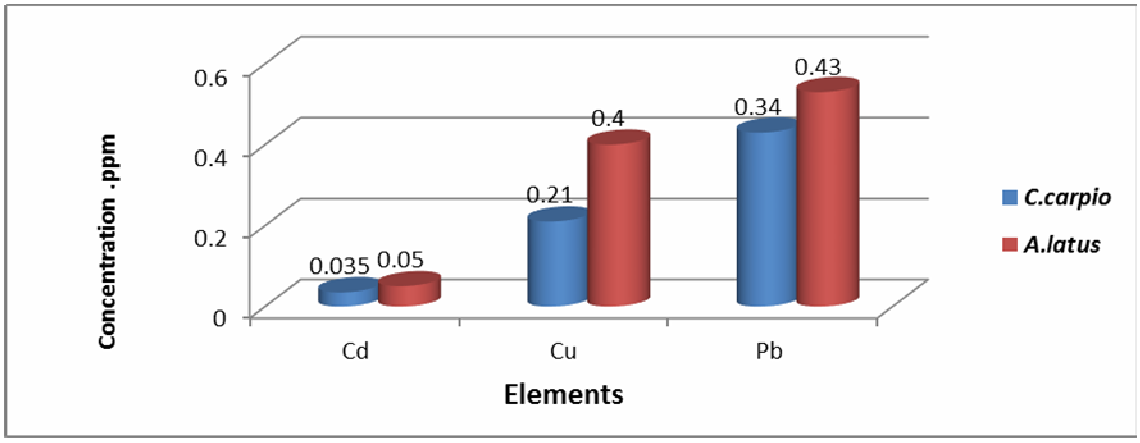

Fig. 2 : Heavy metals concentration in fish muscles of study area

Table 2: Comparison between mean values of heavy metals (ug/gm dry weight) in the muscles of *A. latus* and *C .carpio* with other species of fish.

Species of fish	Cd.	Cu.	Pb.	References
Acanthopargus latus *Cyprinus carpio*	0. 05 0.035	0.4 0.21	0.43 0.34	Present study
Babus latus *Liza abu*	1.25 1.05	1.6 1.2	3.15 2.65	Farhood, 2015
Acanthopargus latus *Cyprinus carpio*	0.005 0.035	0.4 0.21	0.43 0.34	Al-Khafaji *et al.,* 2015
Barbus latus *Cyprinus carpio*	0.14 0.07	0.59 0.30	0.59 0.61	Lazim, 2013
Barbus latus *Cyprinus carpio*	0.05 0.04	12.86 16.65	42.83 35.03	Al-Awady, 2012
Cyprinus carpio	ND	0.07	0.06	Al-Khafaji, 2010
Chalcal burnus	0.2	7.5	ND	Al-Doghachi, 2008
World wide	0.2	3.0	3.0	Bryan , 1976

ND= Not detected

Table 3 : Bioconcentration and concentrations rates of the heavy metals in fish muscles.

Metals	Water	*A . latus* X1000	*C. carpio* X1000	*Bioconcentration of A . latus*	*Bioconcentration of C. carpio*
Cd	0.12	50	35	417	292
Cu	1.4	400	210	286	150
Pb	0.24	430	340	1792	1417

References

Abdel-Baki, A.S.; Dkhil, M.A. and Al-Quraishy, S. (2011). Bioaccumulation of some heavy metals in tilapia fish relevant to their concentration in water and sediment of Wadi Hanifah, Saudi Arabia. African Journal of Biotechnology, 10(13): 2541-2547.

Al-Awady, A.A.M. (2012). Distribution and concentration some trace metals in water, sediments and two species of commercial fish from Al-Masab Alamm river near the Al-Nassiriyah city-south of Iraq. Ph.D. Thesis, College of Science for women, University of Baghdad.

Al-Helaly, S.H.E. (2010). An Investigation of Some Heavy Metals in Water, Sediment and Some Biota of Al-Gharraf River, South of Iraq. M. Sc. Thesis, University of Baghdad.

Al-Khafaji, B.Y. (1996). Trace metal in water, sediments and fishes from Shatt Al-Arab estuary north-west Arabian Gulf. Ph.D. Thesis, College of Education, University of Basrah, 131 pp. (In Arabic).

Al-Khafaji, B.Y.; Dawood, Y.T. and Maktoof, A.A. (2012). Trace metals distribution in fish tissues (*Cyprinus carpio* and *Barbus luteus*) and sediments Al- Marsh south of Iraq. Conference on Environmental Sciences 4th 2012, Babylon University, 180-198.

Al-Najare, G.A. (2009). Seasonal changes to some of heavy metals in the muscles of three species of fish (Cyprindae) from Al- Hawizeh Marsh and south Hammar. M.Sc. thesis, Fisheries and Marine Resources College of Agriculture, University of Basrah (In Arabic).

Bowen, H.J.M. (1966). ˝Trace elements in biochemistry˝ Academic Press, London and New York, 241.

Bryan, G.W. (1976). Metal concentration in the sea. Marine Pollution Bulletin, 7: 353-356.

Chale, F.M.M. (2002). Trace metal concentrations in water, sediments and fish tissue from Lake Tanganyika. Science of the Total Environment, 299(1-3): 115-121.

Cross, F.A.; Hardy, L.H.; Jones, N.Y. and Barber, R.T. (1973). Relation between total body weight and concentrations of manganese, iron, copper, zinc, and mercury in white muscle of bluefish (*Pomatomus saltatrix*) and a bathyl-demersal fish Antimora rostrata. Journal of the Fisheries Board of Canada, 30(9): 1287-1291.

Demina, L.L.; Galkin, S.V. and Shumilin, E.N. (2009). Bioaccumulation of some trace elements in the biota of hydrothermal fields of the Guaymas Basin (Gulf of California). Boletín de la Sociedad Geológica Mexicana, 61(1): 31-45.

Farhood, A.T. (2012). Study of effects of the Nassiriyah Thermal energy power plant on concentration of some trace element in water, sediment and tow aquatic plant species on Euphrates river in Nassyriah city, south Iraq. M.Sc. Thesis, College of Science, University of Thi-Qar. (In Arabic).

Farhood, A.T. (2015). Bioaccumulation of Some Trace elements in muscles of two species of fishes in Euphrates River near the center of Suq Al-Shouyukh city- south Iraq, Journal of science of Thi-Qar 5(2): 3-10.(In Arabic).

Farhood, A.T. (2017). Use the aquatic plant (*Typha domingensis*) as bioindicator to the accumulation of some heavy metals in Abu-Zariq Marsh Southern of Iraq Journal of science of Thi-Qar 6(2): 35-42.

Farhood, A.T. (2018). Levels of some heavy metals in autistic patients in Nasiriya City, Southern Iraq. Journal of Thi-Qar University, 13(4): 74-84.

Lazim, I.I. (2013). Concentration of some trace element in water, sediment and femals of two species of fish in the Euphrates river near the center of Al-Nassiriya city

south of Iraq. MS.c. Thesis. College of Science, University of Thi-Qar. (In Arabic).

Mersch, J.; Dubost, N. and Pihan, J.C. (1993). Comparison of several inert and biological substrata to assess the trace metal contamination in the reservoir of the nuclear power plant in Cattenom, France. In Annales de limnologie. Toulouse 29(3): 325-337.

Nolting, R.F. (1986). Copper, zinc, cadmium, nickel, iron and manganese in the Southern Bight of the North Sea. Marine Pollution Bulletin, 17(3), 113-117.

Raphael, E.C.; Augustina, O.C. and Frank, E.O. (2011). Trace metals distribution in fish tissues, bottom sediments and water from okumeshi river in delta state, Nigeria. Environmental Research Journal, 5(1): 6-10.

Regional Organization for the Protection of the Marine Environment (R.O.P.M.E.) (1982). Manual of oceanographic observation and pollutant analysis Methods. ROPME /P. O. Box 26388, 13124 Safa, Kuwait.

Riley, J.P. and Taylor, D. (1968). Chelating resins for the concentration of trace elements from sea water and their analytical use in conjunction with atomic absorption spectrophotometry. Analytica Chimica Acta, 40: 479-485.

Roméo, M.; Siau, Y.; Sidoumou, Z. and Gnassia-Barelli, M. (1999). Heavy metal distribution in different fish species from the Mauritania coast. Science of the Total Environment, 232(3): 169-175.

Shiklomanov, I.A. (1998). World water resources, A New Appraisal and Assessment for the 21st Century.

Sturgeon, R.E.; Desaulniers, J.A.H.; Berman, S.S. and Russell, D.S. (1982). Determination of trace metals in estuarine sediments by graphite-furnace atomic absorption spectrometry. Analytica Chimica Acta, 134: 283-291.

Tüzen, M. (2003). Determination of heavy metals in fish samples of the middle Black Sea (Turkey) by graphite furnace atomic absorption spectrometry. Food chemistry, 80(1): 119-123.

Windom, H.; Byrd, J.; Smith, Jr, R.; Hungspreugs, M.; Dharmvanij, S.; Thumtrakul, W. and Yeats, P. (1991). Trace metal-nutrient relationships in estuaries. Marine Chemistry, 32(2-4): 177-194.

Windom, H.; Stickney, R.; Smith, R.; White, D. and Taylor, F. (1973). Arsenic, cadmium, copper, mercury, and zinc in some species of North Atlantic finfish. Journal of the Fisheries Board of Canada, 30(2): 275-279.