TEMPORAL PATTERNS OF MERCURY CONCENTRATIONS IN FRESHWATER AND FISH ACROSS A AL-MUSAYYIB RIVER / EUPHRATES SYSTEM

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Article History: **Received**: 26.07.2022 **Revised**: 25.08.2022 **Accepted**: 16.09.2022

Abstract: Background: Mercury contamination of aquatic systems is a global environmental health threat, and a monitoring program is useful for generating data that can be aggregated over a period of time for broad synthesis to determine the emergence of ecosystem characteristics that influence mercury bioaccumulation in fish..
Results: Total concentrations of (Hg) in water and fish were assessed across the Musayyib River/Euphrates which are sites identified by extreme gradients in habitat structure and water management. All databases were collected at concentrations (Hg) in 30 fish (*Liza abu*, *Cyprinus carpio*) from 10 sites in this region and were used to assess the temporal distribution of fish (Hg) across sites as well as the effects of different species and habitats. High exposure (Hg) sites were identified, and a relative estimate of fish component concentrations was made at the watershed scale that takes into account fish diversity in species, size, and site effects. Hg concentrations in fish muscle ranged from 0.01 to 38.4 g/g, with a geometric mean of 0.01. (0.27) , 40 percent of individual fish samples and 20 percent of the means by sites (0.50 g/g) exceeded the fish tissue standard.
Conclusion: Mercury concentrations in fish were found to be correlated with water mercury concentrations at the watershed level, implying that factors affecting mercury production may be more important in determining fish exposure to mercury. It was suggested that as a result of fish exposure to mercury, the spread of mercury throughout the Musayyib/Euphrates River and all species and habitats of the type should consider an important role in influencing environmental mercury risks in aquatic ecosystems describe general environmental characteristics and has been used in the management of Iraqi water systems.

Keywords: Mercuy, Freshwater, Fish, Pollution of the Environment

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DOI: 10.31838/ecb/2022.11.07.004

INTRODUCTION

Pollution considers is any change in the environment's vital properties and compositions (UNEP, 2004). The main topic of aquatic ecosystem pollutants is the accumulation of various the metals in living of organisms, such as “mercury” (Hg), as a result the biological of interaction, and a consider one of the most dangerous of pollutants that occur in the aquatic of environments and are may it release into environment from a various natural and more human a sources as a bio accumulated in a food web. According to, pathway's trophic primary source of the absorption and of exposure in the aquatic organisms (Harris and Bodaly, 1998). As the first step in a larger of restoration effort, the analysis makes use of a "Geographic Information System" (GIS). “Furthermore, the great challenge and the restoring of hydrological system as a conceptual a good model to describe important role of the hydrology, as a starting point in the climate and basin geomorphology and cold climates contain a less water than the land of evaporation, the separation of important factor in the geomorphological land area according to (United Nations Program Environment, 2001; El-Agamy, 2010).
Fish are a great source of Mercury. Various issues, as like mercury bioaccumulation in the organisms, affect the level trophic and a length of a food web, according to (Campbell, et al., 2008; Ward, et al., 2010). This is described as naturally occurring of the health effects caused by a various circulating of elements clear present in a aquatic of the environment, as well as potential damage caused by low element levels as the result of an organism's in a natural metabolism repair according to (Hong Kong Government, 2013). (Hg) Pollution of the aquatic on ecosystems contributes to (80%) of global fish consumption (USEPA, 2011; Environment Canada, 2015), and has a negative impact on beneficial users and the Territory's ecological health (Selin, 2011). According to Driscoll et al. (2013), the global spread of mercury pollution is

due in part to increased (3-5) atmospheric stability associated with the combustion of fossil fuels over the last 150 years, as well as geographic and local releases from mining and industrial applications (Eckley *et al.* ., 2013; Horowitz et al., 2014, Amos et al., 2015; Beal et al., 2015). The environmental threat, on the other hand, is represented by an element . Despite the fact that recent sedimentation trends have been variable, and in some cases increasing (Weiss-Penzias *et al.*, *2016*), the relationship with Hg concentrations in fish is unambiguous. Although fish do not directly reflect mercury inputs, they are a good indicator of relative availability within food webs as well as toxic risk to humans, wildlife, and the fish themselves. Many applications of fish to assess the spatiotemporal variability of Hg availability within food webs at the landscape scale provide scientists and resource managers with an effective biological assessment tool. The natural variability in Hg concentrations in fish associated with different fish species and sizes looking for the guild and tissues analyzed, on the other hand, can complicate valid interpretations and assessments according to (Peterson *et al.*, 2007; Walters *et al.*, 2010).

Differences in the composition of fish communities across habitats and regions exacerbate efforts to make robust comparisons at large geographic scales. All of these studies came to the same conclusion: even after controlling for sources of inherent variability, Hg concentrations in all fish species showed significant heterogeneity across landscapes. Furthermore, factors such as landscape and habitat influence Hg concentrations in fish according to (Shanley *et al.*, 2012; Drenner *et al.*, 2013), As a result, gradients in all factors are important drivers of heterogeneity. Thus, understanding the distribution and diversity of mercury fish across the Musayyib/Euphrates River is critical in order to inform the public of land and management agencies of the potential risks from mercury to trust resources, such as, in addition to facilitating development in predictive power across all tools, that can help the public manage all resources in a way that minimizes Mercury risk to human health and the environment. This study compiled 30 individual fish Hg records from 10 sites in this region to assess the temporal variability in two types of Hg concentrations from fish across the site. Total concentrations of (Hg) in water and fish assess across the Musayyib River/Euphrates which are sites identified by extreme gradients in habitat structure and water management. All databases collect at concentrations (Hg) in 30 fish (Liza abu, Cyprinus carpio) from 10 sites in this region and use to assess the temporal distribution of fish (Hg) across sites as well as the effects of different species and habitats to find be correlated with water mercury concentrations at the watershed level, implying that factors affecting mercury production may be more important in determining fish exposure to mercury. The primary goals of this assessment study are to help characterize patterns in fish and surrounding waters using cross-site mercury concentrations in order to facilitate an understanding of how ecological breadth and habitat gradients affect mercury concentrations in order to provide all the basis and predictive support for determining concentrations of all factors in fish.

EXPERIMENTAL METHODS

Description of the Study Site

Principal mercury concentration data in fish were obtained and aggregated according to the EPA data source, recording years 1969–2010. The number of Hg records is 13,289. The study area is located on the Euphrates River near the Musayyib power station, in the northern border of Babil Governorate, central Iraq, within the Mesopotamian basin of the precarious cliff (DeLorenzo, et al., 1994), between 32-50 min. 50"N 44˚16'12" H. The study area is characterized by flat terrain covered by a quadrilateral of sedimentation in the periods of flooding of the Tigris and Euphrates rivers. Sedimentary rocks are very thick layers of recent sediments up to about 600 m thick according to (Jacobson, et al., 1987). More previous studies include meteorology for this site, average atmosphere and temperature of 25.50°C. Daily relative humidity values range from 55.50% in the dry season to 60.00% in the rainy season according to (DiLorenzo, et al., 1994).

Temporal aggregation and the data layers

A format of geographic information associated with all log data was entered into (ArcGIS 9, ESRI) for confirmation and standardization of location information, and analyzes were completed for each sample to determine the closest flowline and water feature to the feature in selected data sets according to (USGS, 2014). A 15 km site was examined, where each specific data was represented by a duplicate site, while fish systems in the same body of water within 10 specific rivers were grouped from each other classified from the same sites. The resulting data set included a total of 30 fish from a total of 10 sites.

Sampling Procedure

A choice sampling area include the presence of the following activates industrial effluent discharge and power plant. Water samples for the study were collected in a plastic of the containers, the container with the water sample taken out of the water body. Replacing the lid of the container at the sampled depth excludes air and prevents contamination of the water sample with microorganisms from the environment. Fish "*Liza abu"* (Class: Actinopterygii, Family: Mugilidae)according to (Hickel, 1843) and "*Cyprinus carpio"* (Class: Actinopterygii, Family: Cyprinidae) according to (Linnaeus, 1758)

Preparing the experimental and analysis :

The accuracy of this method as developing the spike retrieval of processes that were a performed on the materials and samples according to (Nascimento *et al.*, 2008, Ataro, *et al.*, 2008;), a reference of materials shown in Table (1) (Gaithersburg, MD, USA). This can usually a made up of an auto sampler with three a different the path lengths (12,16 and 14 mm). The samples were placed in the quartz kiln and the heated to a drying of temperature about 200°C, which establishes a limit of the mercury elution through a catalyst, were used to perform the sample digestions under a controlled energy of same conditions, and the method of plotting of data was used to analyze the agreement between the standard methods all these according to the World "Health Organization" and the "Environmental Protection Agency". The mean Sigma Plot System was used to calculate the 98 percent limits of agreement.

Table 1. The parameter of operating to determine the Hg concentration by DMA-80

Wavelength	Step	Time	CRM and SRM	Type
Auxiliary 0.2	100	15 min	DORM-2	Fish
Nebulizer 0.8	100	10 min	0	Blank
Replicates 5	175-200	One time to each	SRM-1974b	Water
Probe in sample (1)	100	10	0	Blank
Rinse (2)	100	10	0	Blank

RESULTS AND DISCUSSION

Based on the latitude and longitude taken by GPS / Geko 201, a graphic map was chosen for the temporal analysis of all variation of this study based on a natural of environmental biological factors was affected by pollution of the system in the Musayyib / Euphrates River. The most commonly used methods for GIS interpolation are based on the temporal analysis process and interpretation based on environmental characteristics of mercury accumulation in fish and water (RuiminLiu *et al*., 2016; Al, 2010; ESRI, 2012). After sites were validated and matched with all input data, it was used to achieve of level highest prediction in a the food chain. Changes in the environment brought about by other organisms. Fish is being studied as a means of monitoring ecosystems for pollution detection (Rocque,; 2004). Biomarkers are used by fish to assess environmental characteristics such as nutrient requirements and the relationship between environmental factors (Gaillardet et al., .2003; Ammann, 2002; .Favero, et al., 2003; .Wang and Liu, 2003; Zhang et al., ,2008 Al-Ajmi, 2015), Findings of mercury in the water and "fish" types (Liza abu, Cyprinus carpio) note a convergence or similarity of a range mercury concentrations in the water and these organism as in aquatic of the ecosystem monitoring,, determine compliance with a pollution (Rocque,; 2004). In this element, there is no significant difference in the P-value (0.637,0.568), which is consistent with more research (Kannane and Faalandysz,, 1998) that "suggested the possibility of using Hg concentration in fish as an important case describing pollution in water bogs" . These findings are strongly supported by the same findings from (Everaarts, *;et al.,* 1993; Ajmi .,2015). An important indicator of fish for water balance and mercury absorption and accumulation. This discovery is applicable to other researchers (Rama Krishnan, 2003).

There was a significant difference in Mercury results obtained in a muscles of two types dominant fishes in the study. *Liza abu and Cyprinus carpio* are members of one group (0.832 , 0.156) And the difference between Groups is 0.27619. This means that fish have a cumulative response to a mercury concentration minerals present or a deposited from emission sources, depending on their physical properties, structure, feeding quality, fish size, and the nature of their composition. Because there were multiple regressions between two fish species, time gradients for these metals were shown in Groups 1 and 2. (Table).

Table 2. Temporal gradients for these metals in area

Study Areas	Water ppm	*Groups1 Liza abu ppm*	*Groups2 Cyprinus carpio ppm*
1	32.64	0.92	0.42
2	30.21	0.95	0.31
3	32	0.2	0.42
4	25.65	0.38	0.37
5	29.54	0.21	0.29
6	32.12	0.95	0.43
Average	30.36	0.602	0.373
SD	1.21	*0.074*	0.156
P-Value	0.637	1.37	0.071

Distributions and chronological analysis Mercury was chosen by Geographical Information System. (G.IS) to confirm the presence of a mercury in the two groups for this study, and the following figure (1) depicts an equal concentration of mercury in two a variables as in one complementary to other. Thus the water's content in bottom sediments, which can a store large of the amounts on this metal with interactions of fish, consider a good indicator of the mercury contamination and is an important factor for a a cleaner of the environment. (Trudel and.Rasmussen, 2006). At all sites, their concentration and aggregation were relatively similar in terms of water type and fish type. These findings were strongly supported by the same conclusions (Everaarts,, et al., 1993, ,'Ajmi, 2015). The content mercury of fish can vary depending on the season and time of year, especially during the winter dormancy. According to the current experimental results, this concentration was beneficial to bio-minerals. This means that it has the potential to reduce mercury levels. Seasonal variations in mineral concentration at a given location may be due to seasonal changes in organisms rather than absolute mineral content changes (Phillips and Russo, 1978) . An important indicator of fish for water balance and mercury absorption and accumulation. This discovery is applicable to other researchers (Rama Krishnan, 2003).

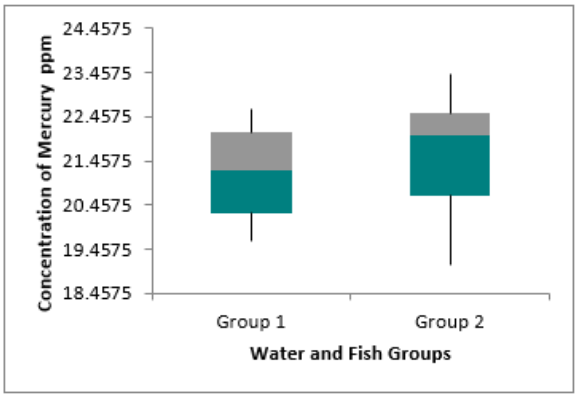

Figure 1. Showed demonstrates of relationship between Water and Fish

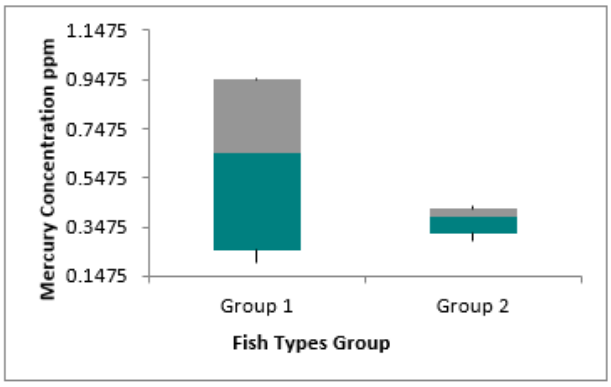

Figure 2. Showed demonstrates relationship for Fish study area

Group1: Water , Group2: Fish

According to the findings of the significant relationship analysis, it experiences mercury bioaccumulation in the bioaccumulation of active transport (Favero et al., 2003, Ajmi, 2010). It is obvious that the fish discoveries protect themselves from high concentrations and toxicity of mercury while also reducing the rate of entry through the permeable surfaces of the absorbers, resulting in an increase in the yield of these metals and the more common ion mechanics (Roberson.. and.Perkins, 1986; Masters and Gilbert, 1991). The reproductive organs determine one's age and life cycle (Favero *et al.,* '2003, Zauke, *et al.,* ,1998). Fish and water are influenced by a variety of external factors, including complex organelle molecules and inorganic factors, as well as physicochemical factors that regulate their metabolism, such as heat, light, oxygen, and nutrients (Scott,;1989. Faveiro et al., ;2003). It Due to its high filtering capacity, it increases exposure to dissolved minerals in the water column (Mouneyrac et al., 1999; Ettajani,et al., 2001; 'Tran et al., ,2001). All study station regions had significantly higher mercury accumulation based on the temporal distribution of these metals. Cyprinus carpio>Liza Abu Different levels of contamination at different sites can be compared using response contamination indicators. There are two methods for spatially analyzing mercury concentrations. fish. This indicates a good indicator of mercury control in fish, which is important for understanding the current risks to consumers and fish quality types in the area, especially when a spatial database of pollutant distribution is available. This study validates the researchers' findings (Stewart et al., 2008). (Ajmi and colleagues, 2010). The Lisa Abo species had the highest mercury uptake but the lowest concentration when compared to the boundary factors (EPA, 1997; WHO, 2001; Stewart et al., 2008; UNEP, 2012). Figure 2 Lisa Abu has been shown to be the best indicator of mercury accumulation in Cyprinus carpio, implying that there may be an exchange mechanism between the concentration of this element in the organism and the concentrations of this element in water, soil, sediment, and fish age. (Liu et al.,, 2007).

CONCLUSION

The use of temporal analysis by GIS systems to combine multiple data sets to obtain unified information has improved the ease and reliability of biomarker models for items that describe general environmental characteristics and has been used in the management of Iraqi water systems. It was measured using DMA 80a Standard Analytical Methods, a newly developed, simple, and fast method for determining mercury concentrations (ppm), and it was found to be within allowable standard limits in all samples. Fish have a protective mechanism against the effects of high mercury concentrations in water, and these processes serve as a balanced indicator of the aquatic ecosystems ecology. There was a significant difference in the results of mercury in muscle in the two types of fish prevalent in the study area, Liza abu>Cyprinus carpio. It was within the standard limits permitted in the research area. In order to create an integrated and comprehensive database, we strongly support increased sampling to represent the spatial distribution of mercury hazards in all regions of Iraqi water systems. Other new technologies, such as telescopes and remote sensing, focus on working spatial information around the idea of relative risk between variables in the environment and biological factors in the food chain. Because mercury is rapidly accumulating as a pollutant in nature, immediate action is required to monitor and control its levels, as well as those of other elements such as vanadium and lead. Furthermore, our government's supervision to control external and internal pollution sources, capacity index, and pollution control to prevent potential health risks. Furthermore, other research should focus on the natural resource requirements in an aquatic ecosystem in order to develop a complete biomarker in an aquatic system.

ACKNOWLEDGMENT

Extremely grateful to the Department of Biology department of Faculty of Science , Mustansiriyah University.

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