University of Thi-Qar Journal of agricultural research
Thi-Qar Journal of agricultural research
ISSN Onlin:2708-9347, ISSN Print: 2708-9339 Volume 13, Issue 2 (2024) PP 100-106
https://jam.utq.edu.iq/index.php/main *https://doi.org/10.54174/utjagr.v13i1.323*

Measurement of pollution of water and sediment of the Al-Hammar Marsh for some heavy elements

[1] Eynas R. Gdawa, [2] Kamil K. Fahad

Department of Animal Production, Faculty of Agriculture and Marshes, University of Thi-Qar, Iraq.

[1]*Email: kamil@utq.edu.iq*

[2]*Email:Enas.post.2022@utq.edu.iq*

Abstract

The study was conducted to determine the monthly changes that occur in environmental factors and pollution levels occurring in the water and sediments of the Al-Hammar marsh in Dhi-Qar Governorate. Samples were collected from the Al-Hammar marsh from November 2023 AD to April 2024 AD. The current study included measuring some physical and chemical characteristics, air temperature and... Water, turbidity, pH, electrical conductivity, dissolved oxygen, and estimation of the concentrations of the heavy elements cadmium (Cu), copper (Cu), and zinc (Zn) in the water and sediments of the Hammar marsh. It turned out that the concentrations of the heavy elements follow the following order: Copper < zinc < cadmium, their concentrations in sediments and bioaccumulation in them follow the following order: zinc < copper < cadmium. The results showed that the Al-Hammar marsh water was suitable for human consumption, but the sediment levels were high.

Introduction

Rivers are exposed to pollution with heavy metals as a result of household and factory waste and agricultural waste, as they affect the ecosystem. Pollution with heavy metals is an important environmental problem due to their ability to accumulate and the difficulty of decomposing them, even if they are in low concentrations (Fahd, 2014). Heavy elements are among the known elements that the body of a living organism needs directly because of their importance in building the body and participating in many metabolic processes in the body and fluid balance, as well as hormones and proteins. They are the key to human health, and the increase in the concentration of heavy elements in the aquatic environment appears through an increase in their concentration in chains. Food and water pollution are among the most prominent pressures on the aquatic environment (Al-Najjar, 2014). The percentage of heavy elements is affected by environmental changes, such as water temperature, high pH, and turbidity (Jawda and Fahd, 2023). Due to the importance of water and the danger of heavy metals, there have been many studies on them, because heavy metals have clear and direct effects on aquatic organisms, especially fish, varying in severity between the acute effect, whose symptoms appear immediately, and the chronic effect, whose symptoms appear after a period of time, and among their effects is the reduction of fish communities and increasing their sensitivity. And its lack of resistance to changing environmental conditions (Vidal, 2009). Heavy metals are the most important sources of pollution in water, and to address this problem, we must know the sources of their pollution and the standards related to them (Al-Shamilawi, 2020).

I. Materials and Methods

The study was conducted on the Al-Hammar Marsh, located within Dhi-Qar Governorate, location coordinates (N° 31,40,30,00, °E 40,47,30,46), south of the Euphrates River, extending from the city of Nasiriyah in the west and extending to the outskirts of the city of Basra in the east, and approximating The area of this water body is approximately 2800-4500 km², and the water depth ranges from 8.1 meters

ISSN Onlin:2708-9347, ISSN Print: 2708-9339 Volume 13, Issue 2 (2024) PP 100-106
https://jam.utq.edu.iq/index.php/main *https://doi.org/10.54174/utjagr.v13i1.323*

in some areas to 5 meters in other areas. The Euphrates River supplies water to Al-Hammar Marsh, and small amounts of water are obtained from the Tigris River (2006, UNEP).

Collect water samples

Water samples were collected from the study site to conduct chemical and physical tests and measure heavy metals in polyethylene plastic containers with a capacity of 250 ml for each sample (APHA, 1985). Take 50 ml of water and put it in a clean 100 ml glass beaker, and add 5 ml of concentrated nitric acid to it. Heat the beaker on a hot plate and leave it on the hot plate to continue heating until the pre-drying stage. Add 5 ml of nitric acid to the sample. The concentrate was continued to be heated to obtain a precipitate, and after cooling, the volume was increased to 25 ml with distilled water free of ions, filtered using a 0.20 µm filtration membrane. Water temperature was measured with a thermometer graduated from 0-100 when taking samples. The thermometer was immersed in water for two minutes to ensure an accurate reading, and the results were expressed in degrees Celsius. Electrical conductivity was measured using a conductivity meter, with the unit of measurement being Siemens/cm. Use a pH meter to measure pH values after calibrating them using Buffer Solution with pH (9.7.4) calibrating every two months. Use an Oxygen meter to measure the percentage of dissolved oxygen and express the results in mg/L. Turbidity was measured using a turbidity meter, and the results were expressed in NTU.

Collect sediment samples

Samples were collected monthly from the bottom of the river at a depth of 20-40 cm. The samples were placed in clean bags and transported to the laboratory. They were dried. To estimate the concentrations of heavy metals in the sediment samples, a weight of 0.5 grams of dry soil was taken in a glass beaker and 5 ml of the digestion solution consisting of sulfuric acid was added to it. Concentrated H2SO4, concentrated nitric acid HNO3, and perchloric acid HCIO4 in a ratio of 1:1:3. A watch bottle was placed on the beaker to prevent evaporation of the concentrated acids. The samples were heated on a convector at 90°C for two hours, and in a hood, they were diluted by adding ion-free distilled water to 25 ml and were ready for measurement using a spectrometer. Flame atomic absorption. Heavy metals were measured in the studied samples using a Flame Atomic Absorption Spectrophotometer (FAAS). Standard solutions of the elements were prepared (Standard Solution APHA, 2003). Conduct statistical analysis of the study data using the ready-made statistical program SAS (Statistical analysis system) (SAS, 2012). The significant differences between the means were compared using the Duncan multinomial test (Duncan, 1955) and using the complete random design (CRD).

Results and discussion

Table (1) shows the air temperature values during the experiment period. The highest value was recorded in the month of April, 31 °C, and the lowest value recorded in the month of January was 17 °C. The results of the current study shown in Table (1) showed that the water temperature values recorded the highest value of 35°C during the month of April and the lowest value of 22°C during the month of February. There was a slight difference in the temperature of the water and air during the study period. This may be due to the fact that the water gains and loses heat more slowly compared to the air, or it may be due to the slow movement of water flow in the study site.

The adopted measurement method is the mercury thermometer, which does not give a clear or accurate impression of the fluctuations occurring in the values of this environmental factor. The results of the current study showed turbidity values between (15-48.9) NTU in the marsh, if the highest value was 48.9 NTU in the month of February and the lowest value was 15 NTU in the month of November. The reason for the decrease may be a result of rainfall and the movement of water currents or due to a decrease in the deposition of organic materials. and inorganic during the cold months (Al-Kanani, 2011). The electrical conductivity values reached the lowest value (2.74) micro-Siemens/cm in the month of December and the highest value (3.15) micro-Siemens/cm in the month of February. The decrease in

University of Thi-Qar Journal of agricultural research
Thi-Qar Journal of agricultural research
ISSN Onlin:2708-9347, ISSN Print: 2708-9339 Volume 13, Issue 2 (2024) PP 100-106
https://jam.utq.edu.iq/index.php/main https://doi.org/10.54174/utjagr.v13i1.323

electrical conductivity values is attributed to the decrease in evaporation rates, which is reflected in the increase and decrease of salts (Al-Tamimi, 2016).). The rainfall that occurred during the months of the experiment diluted the water and reduced the salts. As for the pH values, the lowest value was recorded at 6.94 during the month of January and the highest value was 7.35 during the month of December in the Al-Hammar marsh water. The values were within the light basic range. The reason for this is the presence of aquatic plants that lead to an increase in the effectiveness of photosynthesis and then to the consumption of dioxide. carbon in water,

It was confirmed by a study (Patil et al., 2012) that aquatic plants and phytoplankton consume most of the carbon dioxide dissolved in the water, so the water turns into a basic character. It is clear to us that the pH values fall within the permissible environmental determinants according to the World Health Organization, which was estimated as follows: Between (6.5_8.5) in the aquatic environment (WHO, 2018). Dissolved oxygen values ranged between (1.6 - 8.4) milligrams per liter. The highest percentage reached 8.4 milligrams per liter in November and December, and the lowest percentage reached 1.6 milligrams per liter in December.

The reasons for the decrease in dissolved oxygen values are attributed to the decrease in the water level and the increase in organic decomposition in it, or as a result of the sewage whose water flows into the river, which is loaded with organic materials that are decomposed by bacteria, and thus the percentage of dissolved oxygen decreases (Fahd, 2014). There is a relationship between temperatures and the percentage of oxygen. dissolved so that there is less oxygen in warm water (Boyer et al., 2013). In a study (Salim, 2013), it was found that dissolved oxygen is the factor that most controls the level of organic pollution.

Table (1) Values of the physical and chemical properties of water

Unity	April	March	February	January	December	November	Months / Characteristics
C°	**35**	**26**	**22**	**23**	**27**	**28**	Water temperature
C°	**31**	**25**	**20**	**17**	**24**	**26**	Air temperature
NTU	**30.6**	**26.5**	**48.9**	**34.7**	**25.6**	**15**	Turbidity
mS/cm	**2.91**	**2.74**	**2.75**	**2.99**	**3.11**	**3.15**	Electrical conductivity
mg/l	**4.8**	**5.6**	**5.5**	**1.6**	**7.1**	**7.1**	Dissolved oxygen
-	**7.18**	**7.27**	**7.37**	**6.94**	**7.35**	**7.28**	pH

Heavy metals in water

Results of the current study showed changes in the concentrations of the elements cadmium, copper, and zinc in the water of the Hamar Marsh during the months of the study, as shown in Table (2). The highest value for cadmium was 0.0039 mg/L in the month of November, and the lowest value for cadmium was 0.0015 micrograms/L in the month of March. The results were within the limits permitted by the World Health Organization (2004-2011). Table (2) shows the concentration of copper if the highest value reached 0.0470 mg/L in February, lowest value was 0.0002 mg/L in the months of November. The results of the statistical analysis showed that there were significant differences at the level of ≥P 0.01 between the month of February and the rest of the months, and the results were within the limits allowed by the World Health Organization (WHO) (2004-2011) and the Iraqi limits. For the

University of Thi-Qar Journal of agricultural research

Thi-Qar Journal of agricultural research

ISSN Onlin:2708-9347, ISSN Print: 2708-9339 Volume 13, Issue 2 (2024) PP 100-106

https://jam.utq.edu.iq/index.php/main https://doi.org/10.54174/utjagr.v13i1.323

system and maintenance of rivers and water from pollution (2011). And the concentration of zinc element if the highest value reached 0.0068 micrograms/liter in the month of January and the lowest value was 0.0002 micrograms/liter in the months of November. The results of the statistical analysis showed that there were significant differences at the level of 0.01 P≥P between the month of January and the rest of the months, and the results were... Within the limits permitted by the World Health Organization (WHO) (2011) and the Iraqi specifications for the system and maintenance of rivers and water from pollution (2011). The reason for the decrease in heavy elements in the water is attributed to the continuous flow of water in the river, which helps the elements move or settle at the bottom, and also the amount of rain during the study period, which reduces heavy elements through rising water levels and diluting the elements, in agreement with the study (Hadi and Fahad, 2021). The results of the current study show that the percentage of pollution with cadmium and zinc is greater than with copper. This may be due to the influence of animal and human activities, the waste of which is deposited in the marsh, as well as agricultural activities. Changes in the concentrations of heavy metals during the months of the experiment resulted from a change in temperature during the experiment or as a result of the decomposition of organic matter. Or a decrease or increase in waste during the experiment, Or the presence of phytoplankton, as well as a relationship between physical and chemical factors with the concentrations of heavy elements in the water (Salman, 2011). By analyzing the data in Table (2), it was found that there was very little variation between the months of the study in the concentrations of heavy metals. Concentrations were high in February during the winter compared to other months. The reason may be attributed to the change occurring in some environmental factors, including temperature and temperature. Hydrogen and due to the factor of evaporation and sedimentation, which increases the heavy elements in the water. This was confirmed by a study (Khudair, 2022). Water pollution is not limited to human pollutants only, because heavy elements can reach the river environment from natural sources such as the dissolution of rocks, exposure of the soil to water erosion, erosion factors, dust, etc., in addition to the activities of the population, including untreated sewage and industrial wastewater, to chemical and agricultural water in all its forms (Al-Shorir ,2012). The heavy elements were arranged according to their presence in water as follows: copper < cadmium < zinc, the general rate was 0.0105, 0.0033, and 0.0025 micrograms/liter dry weight, respectively.

Table (2) Heavy elements in water

Overall rate	April	March	February	January	December	November	**Months / Members**
0.0033	**0.0036± 0.00005 a**	**0.0015± 0.00005 a**	**0.0037± 0.00005 a**	**0.0035 ± 0.00005a**	**0.0037± 0.0026 a**	**0.0039 ± 0.00005 a**	**Cadmium**
0.0105	**0.0037 ± 0.0026 cb**	**0.0005 ± 0.00005 cd**	**0.0470 ±0.00005a**	**0.006± 0.00005 b**	**0.0056 ± 0.0000 b**	**0.0002 ± 0.00005 d**	copper
0.0025	**0.0044 ± 0.00005 b**	**0.0021± 0.00005 d**	**0.0030 ± 0.00005c**	**0.0068 ± 0.00005 a**	**0.0008 ± 0.00005e**	**0.0002 ± 0.00005 f**	**Zinc**
	**	**	**	**	**	**ns**	**Moral**

P≤0.01 . Averages with different letters within a column indicate significant differences: Intangible ns**

University of Thi-Qar Journal of agricultural research
Thi-Qar Journal of agricultural research
ISSN Onlin:2708-9347, ISSN Print: 2708-9339 Volume 13, Issue 2 (2024) PP 100-106
https://jam.utq.edu.iq/index.php/main https://doi.org/10.54174/utjagr.v13i1.323

Heavy metals in sediments

The results of the current study showed in Table (3) the rate of changes in the concentrations of the heavy elements cadmium, copper and zinc in the muddy sediments of the Hammar Marsh during the months. The highest value for cadmium was 4.3170 micrograms/liter dry weight in December and the lowest value was 0.0002 micrograms/liter dry weight in month of March. The results of the statistical analysis showed that there were significant differences at the level of ≥P 0.01 between the month of December and the months of the study. And to concentrate copper. The concentrations of copper in the muddy sediments of the Hammar marshes reached the highest concentration of 26.174 micrograms/liter dry weight in April and the lowest value of 6.192 micrograms/liter dry weight in December. The results of the statistical analysis showed that there were significant differences at the level of P≥0.01 between the months April and the rest of the school months. The concentrations of zinc in the muddy sediments of the Hammar marshes reached the highest value of 44.447 micrograms/liter dry weight in the month of March and the lowest value of 15.196 micrograms/liter dry weight in the month of January. The results of the statistical analysis showed that there were significant differences at the level of P≥0.01 between the month of March. And the remaining months of study. The environmental sediments at the bottom are the storage part of heavy elements and various water pollutants that undergo sedimentation and bonding with clay and silt particles and bottom soil grains. Sediments can spread this pollution under different conditions to the rest of the layers of the water body as a result of any changes that occur within the water and increase its movement, whether due to the water circulation movement that occurs when the seasons differ as a result of the difference in thermal distribution, or as a result of the daily movement of aquatic organisms, or because of water currents and other factors. Others (Al-Muthani and Al-Salman, 2009).

Variation is due to physical and chemical properties, as well as the size of the sediment. All of these factors contribute to the high concentration of elements in the sediment. The elements studied were among the Iraqi determinants, but the concentrations were higher than what was recorded in previous studies, and this is a sufficient indicator of the contamination of the marshlands with these elements (Akbar, 2012).

Table (3) Heavy elements in sediments

Overall rate	April	March	February	January	December	November	**Months / Members**
1.306	**0.0±1.102 57b**	**±0.530 .057d**	**1.159 0.057b**	**0.7317 ± 0.057c**	**4.3170±0. 057e**	**0.0002±0.0 0005 e**	**Cadmium**
13.949	**±14.630 0.264 c**	**±26.174 0.057a**	**16.192 ± 0.057b**	**6.846± 0.057e**	**6.129± 0.0577f**	**13.728 ± 0.057d**	copper
27.015	**29.444 ± 0.057c**	**44.447± 0.057a**	**33.329± 0.057b**	**15.196 ± 0.057f**	**18.78430. 057e ±**	**20.890 ± d 0.0577**	**Zinc**
	**	**	**	**	**	**	**Moral**

ISSN Onlin:2708-9347, ISSN Print: 2708-9339 Volume 13, Issue 2 (2024) PP 100-106
https://jam.utq.edu.iq/index.php/main https://doi.org/10.54174/utjagr.v13i1.323

P≤0.01 .Averages with different letters within a column indicate significant differences**

Conclusions

We conclude from the results of the current research that the water of the Al-Hammar marsh has basic characteristics, and most of the variables and heavy elements fall within the limits permitted by the international organizations and bodies concerned with this regard, and based on the values of the total turbidity of the water, it is classified as soft. Thus, it is possible to classify the water of the Al-Hammar marsh as good. For drinking, watering crops and plants, and industrial and household uses, based on the measurements obtained through this study and within the specified study period.

Recommendations

Study the effect of pollutants on other types of fish found in the Hammar Marsh and give more space for these studies. It was recommended to intensify studies on aquatic organisms spread in the Al-Hammar marsh, especially fish of all kinds, and to know the rates of pollution for the purpose of knowing the extent of their contamination with various heavy elements in order to prevent their access to the food chain and to increase environmental awareness.

References

Al-Tamimi, M. M. Hassan (2016). Evaluating the suitability of the water of the Al-Gharraf River in southern Iraq for various uses (using the Canadian Model Water Quality Guide). Master's thesis, College of Education, Dhi-Qar University.

Al-Qusayr, M. K. Khwain (2012) Study of the environmental impact of the discharge of a wastewater treatment project On the water quality of the Diwaniyah River - Iraq. Master's thesis, Department of Life Sciences, College of Science, Diwaniyah University, Iraq.

Al-Kanani, Z. M. Ibrahim (2011). A quantitative, qualitative and environmental study of phytoplankton in the Euphrates River in the city of Nasiriyah. Master's thesis, College of Science – Dhi-Qar University, p. 139.

Al-Shamilawi, A, H, Hussein (2020) Some concentrations of heavy elements in the water and sediments of the Shatt al-Arab in southern Iraq, Master's thesis, College of Science, University of Basra.

Al-Mathnani Abdul Salam Muhammad, and Al-Salman, Ibrahim Mahdi Azouz (2009). Ecosystems1. German Ecosystem, Sebha University Publications, Sebha - Liby

Al-Najjar, G. Hamid and Hantoush A. Adel and Al-Saad, H. Talib and Jaber, S. Al-Karim, Al-Qadisiya University. 1-219 pp. (2014). Evaluating the environmental status of the donkey marsh by measuring some heavy elements, water, sediments and tissues of green perch *Liza subviridis*, King Saud University Journal of Agricultural Sciences 26 (1): 47.67.

Akbar, M. I. Al-Khazali, Azhar Muhammad Ghali (2012), Estimation of heavy metal concentrations in the water and sediments of the Gharraf River – Dhi-Qar, Science Journal, 3 (3): 30-42.

Bowyer, J. N,. M. A. Booth, J. G. Qin and D. A. J .Stone. (2013). Temperature and dissolved oxygen influence growth and digestive enzyme activities of yellowtail kingfish *soriola lalandi* (Valenciennes, 1111/are.12146. 1833) Aquaculture Research. Doi. 10.

Fahd, K, Kadhim (2014) A comparative environmental study of some potential pollutants of the Euphrates River, the general estuary, and the Gharraf River, Dhi-Qar Governorate - Iraq, Al-Muthanna Journal of Agricultural Sciences, 2 (1)-2, p.

ISSN Onlin:2708-9347, ISSN Print: 2708-9339 Volume 13, Issue 2 (2024) PP 100-106
https://jam.utq.edu.iq/index.php/main *https://doi.org/10.54174/utjagr.v13i1.323*

Joudah, S. K. & Fahad, K. K., (2023). Pollution Levels of Three Heavy Elements and some Environmental Factors for Mud Farm Water North of Thi-Qar. IOP Conf. Series: Earth and Environmental Science 1262 (2023) 072067. doi:10.1088/1755-1315/1262/7/072067.

Hadi, A. Riad & Fahd K. K. (2021). Study of the growth of common carp *Cyprinus carpio* L. 1758 In floating cages in the Al-Gharraf River on a local bush north of Shatrah city. University of Thi-Qar Journal of agricultural research. Volume 10, Issue 2 PP 25-32.

Iraqi determinants of the system of protecting rivers and water from pollution. (2011).

Patil, S. G., Chonde, S. G., Jadhav, A. S. and Raut, P. D. (2012). Impact of physico-chemical characteristics of Shivaji university lakes on phytoplankton communities, Kolhapur, Indian. Res. Rec. Sci., 1(2): 56-60.

Khudair, Jabbar Laibi (2022) Levels of some heavy metals and petroleum hydrocarbons in two types of aquatic organisms in the Shatt al-Arab, Master’s thesis, University of Basra, College of Agriculture.

Saleem, F. Mushtaq (2013). Using the Organic Pollution Index (OPI) for descriptive and quantitative assessment of Shatt al-Arab water/Iraq. Master's thesis, College of Science - University of Basra. 97 p.

UNEP and GEMS (United Nations Environment Programme and Global Environment Monitoring System) (2006) water quality for ecosystem and Human health. UN GEMS/water program office c/o National water Research Institute, Burlington Ontario, Canada, 132pp.

World Health Organization. (2018). A global overview of national regulations and standards for drinking-water quality: 104 pp.

World Health Organization. (2011). Guidelines for Drinking- the Water Quality. 4 editions. Geneva 27, Switzerland.