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Environmental analysis to estimate the concentration of heavy metals in the tissues of some types of fish growing in the environment of Al-Gibsa Marsh

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***Abstract*---**The environment of Al-Jibsa Marsh is a suitable environment for the growth and reproduction of types of fish, as (13) species of bony fish that have been identified, which belong to (6) fish families, the most important of which are the carp family and (Sparidae), the family of Bayah (Mugilidae), the family of the jerry and the family of (Bagridae) and (Mastacemblidae). Some of these species reside in the marsh environment, others are migratory, some are resident, and some are intruders in the marsh environment. The Concentrations of (7) heavy elements (lead, cadmium, copper, nickel, iron, zinc and aluminum) in tissues (5) were studied. Types of economic fish that are widely consumed in the region by the population, which are fish (carp, skeleton, shank, roughage, and hamri), in addition to the running fish, which were studied as one of the living evidence to determine the level of contamination of marsh waters with heavy elements and determine their suitability for eating, as the research concluded that the fish In the environment of Al-Jibsa Marsh, a large amount of heavy metals accumulate in its tissues that exceed the levels of concentrations in the water in which the fish live, and the reason for their accumulation inside the fish organs is due to many factors, including the metabolism of fish and the degree of contamination of water and sediments And the food available to it, as well as other factors, including temperature, and the difficulty or inability of heavy elements to decompose inside the body of the organism, all of this helps the fish to absorb the heavy elements and collect them inside their tissues in a cumulative manner, from which they are transmitted to the person who feeds on them, where they will These elements accumulate in human tissues, causing many diseases.

***Keywords*---**environment, human tissues, diseases, contamination.

Introduction

The marshes are an integrated ecosystem consisting of water bodies of different depths, sometimes extending to a depth of more than four meters. Their economic activities around this ecological area, where the marsh dwellers who make their living by fishing, hunting birds and ducks, they grow rice, raise animals, especially buffaloes, and do some folk industries. The water, and since Al-Jibsa Marsh in the Al-Hira sub-district, lacks such geographical studies, this study came to contribute to the detection of the types of fish developing in the environment of Al-Gibsa Marsh in terms of their monthly presence and knowledge of their qualitative characteristics in terms of estimating the concentrations of some heavy elements in the tissues of its organs (muscles, gills, liver, and intestines) by withdrawing samples from samples of some fish growing in the environment of Al-Jibsa Marsh and analyzing them in the laboratory, thus evaluating the results of the analyses with global determinants to find out the suitability of fish in the marsh environment for human consumption.

1-The Problem of the Study

The current study tries to address the problem represented in the following question:
What is the concentration of the heavy metals in the tissues of fish growing in the environment of Al-Jibsa Marsh?

2 –The Hypothesis of the Study

The Heavy elements are concentrated in all tissues of fish growing in the environment of Al-Gibsa Marsh, as the amount of concentration varies from one fish to another, from one season to another, and from one organ to another, where the amount of concentrations increases during the summer, and decreases during the winter, and that most types of fish are inedible According to the concentrations of heavy elements in its tissues and exceeded the permissible limits globally.

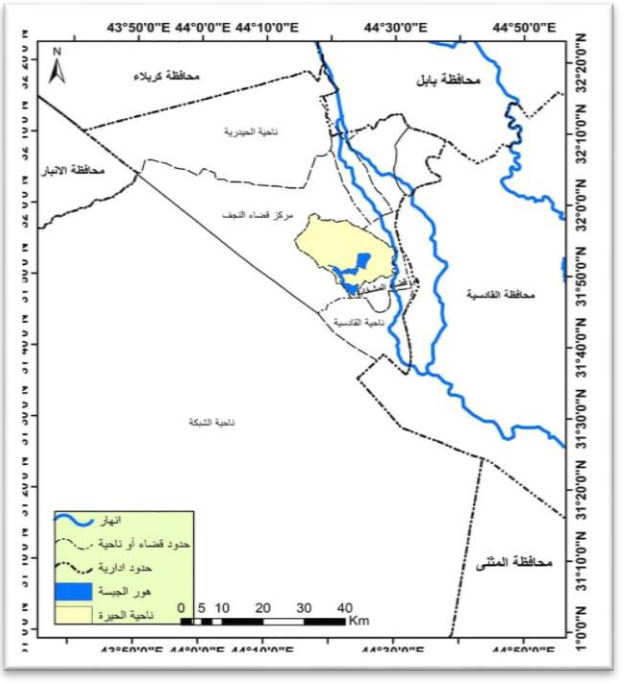
3- The Aims of the Study

The aims behind the environmental analysis process are many and varied, and the researcher sees in analyzing the concentrations of heavy metals in the tissues of fish growing in the environment of Al-Jibsa Marsh, direct and immediate goals and long-term goals, as the researcher strives to detect the types of fish growing in the environment of Al-Gibsa Marsh in terms of their presence month and knowing its qualitative characteristics by estimating the concentrations of some heavy metals in its tissues (muscles, gills, liver, and intestines) by taking samples from samples of some fish growing in the environment of Al-Jibsa Marsh and analyzing them in the laboratory and thus evaluating the results of the analyses with global determinants to find out the extent of the viability of fish in the marsh environment for human consumption, and the researcher aims to ensure a

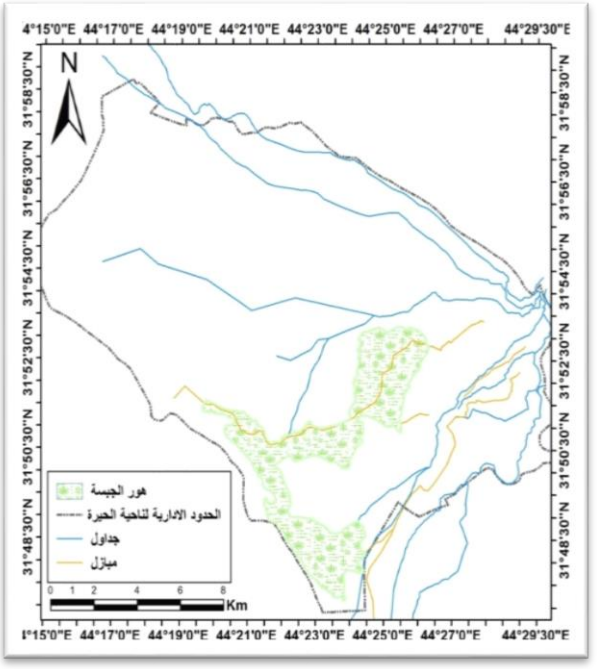
continuous economic development that meets the needs of the present time without detracting from the ability of future generations to meet their own needs, and this is the long-term goal of the process of analyzing and evaluating fish environmentally.

4 - Limitations of the Study

The spatial boundaries of the study are represented by analyzing the concentrations of heavy metals in the tissues of fish growing in the environment of the Al-Jibsa Marsh, which is located in the Al-Hira sub-district and is one of the sub-districts of Al-Manathrah District in Al-Najaf Al-Ashraf Governorate, which is located in the southeastern part of the Governorate(See Map (1)), as for its location in Al-Hira district, which is located in the southwestern edge of Al-Hira, See Map (2) and is surrounded by agricultural lands from all directions. Its area is (28.75) km2 or equivalent to (2875.5188) m^2, as it is bordered on the north by lands and orchards, and on the south it is bordered by the lands and orchards of Hor Al Bejai, Al-Dasm, Al-Shafallah, Damna Al-Janabat and Akrat, and from the west, southwest and northwest, Bahr al-Najaf, and the lands of Al-Shibl and the northern and eastern lands of al- Shibl. See Map (3). As for the temporal limits, which is the time period based on the data used by the study, these include the climatic, hydrological, demographic, agricultural, visual, and map data, extending from (1986 to 2020). In addition to the study period, which started (20/10/2020 up to 17/10/2021). The objective limits of studying the environmental analysis of the concentrations of heavy metals in the tissues of some fish growing in the environment of Al-Jibsa Marsh, and evaluating their suitability for human consumption by comparing them with global determinants.

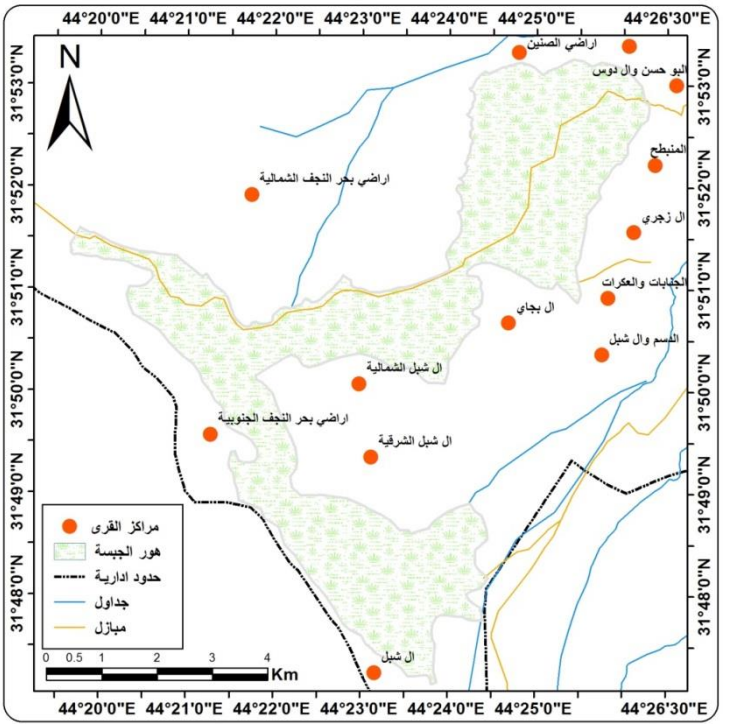


Map (1) The Location of the Al-Jibsa Marsh from Al-Najaf Governorate side



Map (2) The location of Al-Jibsa Marsh from the Al-Hira
Source, F1:- Based on the topographical map of Najaf Governorate at a scale of 1:50000, the General Authority for Survey, Baghdad, 2017, using the 10.5Arq program. Gis.

Source, Kh2:- Relying on the General Authority for Survey, the administrative map of Iraq, 2016 and the satellite visual, the American Land sat, 2018 using the 10.5Arq program. Gis.



Map (3) Al-Jibsa Marsh in Al-Hira sub-district and the surrounding villages
Source: - Based on the General Authority for Survey, the administrative map of Iraq, 2016 and the satellite visual of the American satellite Land sat, 2018 using the 10.5Arq program. Gis.

5- Materials and working methods

The concentrations of heavy metals in the tissues of the fish organs were measured, by dissecting each type of fish under study, and separating the organs of each fish into (muscles, gills, liver and intestines) and they were kept in sterilized plastic boxes, as shown in Picture (1), with the data written For each fish, with the numbering of the boxes, and keeping them refrigerated until use, after that similar samples were taken for each part, then they were dried in the electric oven at a temperature of (100) C, and then a fixed weight was taken for each part and it was ground using a ceramic mortar until it became very smooth Then the samples were digested for each organ separately, using concentrated acids, as (1) gram of each sample was taken and digested by adding (1) ml of acid (perchlorate) at a concentration of (70%) and (5) ml of concentrated nitric acid, and It was placed at a temperature of (80) C with great caution from volatile fumes, and it was heated until the color of the solution disappeared, then the solution was placed in a centrifuge for (30) minutes and under a speed of (3000) revolutions per minute, after which the resulting solution was transferred and added (50)) ml of distilled water, and then the concentrations of heavy metals in

the samples were estimated using an atomic absorption device, according to the wavelength of each element.

Picture (1) Anatomy of the names and the examination of the organs under study
Source: The photo was taken on 18/1/2021.

6- The Biodiversity in fish:

Allah Almighty has endowed Iraq with a large water wealth and vast agricultural land, which is a basis for the development of a large fish wealth and thus supplying local markets with fish throughout the year, and among the widest water bodies in Iraq are the marshes, where the marshes environment constitutes a major source of fish production in Iraq. Because it is one of the most important areas of natural food production for most types of fish to provide suitable conditions for the growth and reproduction of plants, crustaceans, algae and various aquatic insects, through the field study of all monthly fishing samples, using two fishing methods, namely bottom karma fishing and electric wire, as illustrated in Table (1) The emergence of (13) species of bony fish, belonging to (6) fish families, where the Cyprinidae family is superior to the rest of the species, as it includes (8) types of fish, including (3) strange (exotic) species on the environment of Al-Jibsa Marsh, including (the common carp Cyprinus carpio, the Prussian carp Carassius aurats, and the grass carp Ctenthobrama idella), and (5) species of them reside in the marsh environment, (Barbusluteus, shilluk Aspiusvorax)), and the rat (x anthoptrrusBarbus), carp (grypusBarbus), and brown (Barbus sharpeyi), while the rest of the species were distributed into (5) families, with one species per family. Abu Khuraiza (Liza abu) to the Mugilidae family, Triostegus Silurious to the Silurdae family), Shrike (Mystus pelusius covilli) to the Bagridae family,and Mastacembelus mastacembelus to the family.) to the family (Mastacemblidae), as illustrated in Pictures (2), (3), (4), (5), (6) (7), (8) and (9), and the numbers of these fishes, their presence and the intensity of their appearance change from season to season. In terms of the months of the year,

some of them are present throughout the months of the year, some of them are medium in existence and some of them are rare. Among the most common fish in the marsh that are present throughout the months of the year are (common carp, Prussian carp, grass carp, shank, roughy, jerry, Abu al-Zamir and Abu Sulayyan). Where the numbers of these fish increase in March, April, and May.

Table1. The Monthly Appearance of Fish in the Environment of Al-Jibsa Marsh between (20/10/2020 and 17/10/2021)

Dce.	No.	Oct.	Sep.	Aug.	July	June	May	April	March	Feb.	Jan.	Family	Fish Type/Scientific Name	ت
*	*	*	*	*	*	*	*	*	*	*	*	Cyprinidae	*Cyprinus carpio*	**1**
*	*	*	*	*	*	*	*	*	*	*	*	Cyprinidae	Carassius aurats	**2**
*	*	*	*	*	*	*	*	*	*	*	*	Cyprinidae	Ctenthobrama idella	**3**
*	*	*	*	*	*	*	*	*	*	*	*	Cyprinidae	Aspius vorax	4
*	*	*	*	*	*	*	*	*	*	*	*	Sparidae	Acanhopagrus latus	5
*	*	*	*	*	*	*	*	*	*	*	*	Mugilidae	Liza abu	**6**
*	*	*	*	*	*	*	*	*	*	*	*	Silurdae	triostegus Silurious	7
*	*	*	*	*	*	*	*	*	*	*	*	Bagridae	Mystus pelusius covilli	**8**
*	*	*	*	*	*	*	*	*	*	*	*	Mastacemblidae	Mastacembelus	**9**
-	-	*	*	-	-	*	*	*	*	-	-	Cyprinidae	Barbus luteus	10
-	*	*	*	-	-	*	*	*	*	-	-	Cyprinidae	grypusBarbus	1**1**
*	*	*	*	-	-	*	*	*	*	-	-	Cyprinidae	xanthoptrrusBarbus	12
-	-	*	*	-	-	-	*	*	*	-	-	Cyprinidae	Barbus sharpeyi	**13**

Source: - Based on the field study between 20/10/2020 and 17/10/2021, and personal interviews with a number of fishermen in the area.

Source: The photo was taken on 17/5/2021.

Picture (2) *Cyprinus carpio*

Source: The photo was taken on 15/5/2021

Picture (3) Aspius vorax

Source: The photos was taken on 17/5/2021

Picture (4) Acanhopagrus latus, Picture (5) Liza abu

Source: The photo was taken on 17/5/2021

Picture (6) triostegus Silurious

Source: The photo was taken on

Picture (7) Mystus pelusius covilli

Source: The photo was taken on 10/8/2021

Picture (8) Mastacembelus

Source: The photo was taken on 14/8/2021

Picture (8) Barbus luteus

In the months of (September, October, and November), fish under study appear in a high intensity due to the moderation in temperatures and the start of the breeding and spawning season, while their numbers decrease as they appear in an average density during the months of (June, July, August), due to the high temperature, where most of fish go down to the depths to balance their body temperature with the water. Adding to that, the increase in the demand for fishing during those months, while their numbers begin to decrease as they appear in a low density during the months (December, January, February) due to the decrease in temperatures The heat, where most of the fish go down to the depths as well in order to warm their bodies away from the cold surface water, and the most prevalent types of resident fish are (Al-Jari, Abu Al-Zumair and Abu Al-Sulayyan) the reason why the fishermen and the inhabitants of the marsh do not catch them, as they are among the types of fish that are forbidden by Sharia. That is why, these types are out of the population selling or eating preferences. So, they are constantly growing and multiplying differently from the rest of the other fish that are subjected to overfishing, which affects their reproduction, growth and numbers. The environment of Al-Jibsa Marsh, swarms with (hamri and carp) in the months of their appearance and in little presence, as they appear in the months of (March, April, May, June, September and November) except for the carp fish that appear until (November) while they disappear in the rest of the months of the year, as for the fish (flat) it appears in the months of (March, April, May, June, September, October, October, and December), while it does not appear in the rest of the months of the year. As for the brown fish, it is one of the rarest fish where it appears rarely and little during the months (March, April, May, September and October) and disappearing in the rest of the months of the year, and the overfishing and the great demand for these types of fish made them one of the rare and few species in the environment of Al-Jibsa Marsh

The Environmental Analysis of Heavy Metals Concentrations in Fish Tissues:-

Fish is an economic wealth and a widespread food source in the world. It is a cheap and high nutritional value that the human body needs. It is easy to digest and contains high calories and low saturated fatty acids, unlike red meat.

However, the multiplicity of pollution sources has led to the deterioration of this wealth. The economic nature and fish have become more harmful to health than beneficial. Pollution with heavy metals such as iron, zinc, copper, lead, cadmium, nickel and aluminum is one of the most dangerous types of metal pollution, which are commonly and naturally present in most water systems and at low levels, but their concentration has It increases dangerously as a result of many industrial human activities, which lead to the accumulation of large quantities of these minerals within the tissues of living organisms, including fish, as a result of their direct absorption from water by the gill tissue and their transmission by the circulatory system to the various tissues of the body, or may be transmitted through the food chain through Fish feed on aquatic plants and other organisms that already contain different levels of these heavy metals within their environment It is poisoned and thus transmitted to fish, which feed on these organisms within the different food chain, as well as the accumulation or increase in the concentration of heavy metals through the transfer of these elements from the contaminated water medium to the body of the fish directly. Therefore, determining the level of accumulation of these elements is important as It is used as an indicator to know the extent of pollution of the aquatic environment on the one hand, and to avoid the consumption of contaminated fish on the other hand, due to the high level of accumulation of damage to human health, and as a result of the fact that fish are aquatic organisms with direct contact with water pollutants, where they recorded their cumulative capacity of many heavy metals within their tissues. Where these elements are absorbed and collected inside their tissues, and their inability to decompose causes acute and chronic damage to humans and to various organisms that feed on fish, and for this reason, the concentrations of (7) heavy elements in the tissues of (5) types of economic fish that are widely consumed in the region by the population were studied. It is a fish (carp, skeleton, shank, roughage, and hamri), in addition to the running fish. It has been studied as one of the living evidence to determine the level of pollution of marshy water with the heavy elements and to determine the extent of their suitability for eating, and we can show the accumulation of heavy elements in the tissues of each type of fish according to the following: -

1- Accumulation of the heavy metals in the liver tissue:-

The liver is among the organs that has recorded the highest accumulation rates of heavy metal concentrations in it, due to the nature of the liver and its location within the circulatory system. Including heavy elements, which have a great ability to accumulate inside the living cells of the animal, it appears from Table (2) that there is a seasonal variation in the concentrations of heavy elements in the liver tissue of the studied fish, which varies according to the mineral and the type of fish from one season to another in a specific manner and with different concentrations. Because of the different ability of each fish to regulate the level of heavy elements within their bodies according to the nature of nutrition and excretion of waste, where it is noted that the highest concentrations of heavy elements have appeared in the tissue of the liver of running fish, and they vary from one element to another in terms of the amount of concentration, as the iron element recorded the highest concentrations during In the summer, it reached (720.02) µg/g, dry weight.

Table (2) Concentrations of heavy metals in units (µg/g) dry weight in some types of fish

triostegus Silurious		Barbus luteus		Liza abu Picture		Acanhopagrus latus		Aspius vorax		Cyprinus carpio		Fish type	Element
Jan.	July	Jan.	July	Jan.	July	Jan.	July	Jan.	July	Jan.	July		
406.67	450.77	14.86	16.21	6.27	7.79	132.13	172.02	13.10	17.44	16.8	18.30	Liver	Lead
197.39	215.21	6.51	8.92	3.92	4.68	67.18	92.25	8.23	11.32	6.55	10.40	Muscles	
482.20	512.11	13.34	13.32	5.40	6.86	112.77	125.32	1.62	15.40	14.69	15.80	Intestine	
201.63	210.03	12.10	14.11	5.39	6.08	155.11	167.20	13.56	15.21	13.22	17.40	Gills	
311.61	351.20	13.19	15.71	0.172	0.195	16.36	18.13	18.67	21.62	15.77	16.23	Liver	Cadmium
193.46	201.21	7.72	8.67	0.155	0.162	7.52	9.10	6.52	10.32	5.08	7.82	Muscles	
285.62	320.03	11.03	12.21	0.152	0.170	18.97	21.12	15.26	18.09	13.30	13.25	Intestine	
201.25	261.18	11.14	13.16	0.171	0.233	19.67	20.72	14.48	16.30	12.20	14.52	Gills	
141.11	162.13	12.51	13.23	6.92	8.23	11.10	12.81	18.93	22.14	14.08	15.33	Liver	Nickel
90.21	92.33	4.72	6.10	4.52	5.91	6.83	8.03	7.79	11.01	5.65	7.21	Muscles	
121.52	145.06	10.86	11.26	9.17	11.98	8.62	10.30	22.61	25.36	11.75	12.96	Intestine	
101.10	137.29	12.13	14.31	11.02	12.10	11.05	11.67	21.76	23.10	15.79	16.21	Gills	
72.13	87.21	11.96	14.10	0.175	0.192	15.00	16.21	10.18	13.62	14.66	16.26	Liver	Copper
57.35	62.53	4.86	6.36	0.102	0.109	6.97	8.66	7.08	8.77	5.20	6.81	Muscles	
68.61	71.15	11.71	13.63	0.213	1.05	12.81	15.30	10.92	12.81	12.69	14.30	Intestine	
77.36	85.03	13.55	15.21	1.20	1.77	15.37	17.10	11.97	14.21	12.91	14.71	Gills	
675.21	720.02	16.17	18.61	2.76	3.15	201.33	216.03	306.33	336.98	16.01	17.86	Liver	Iron
205.62	297.68	11.03	11.72	1.03	1.77	156.17	182.31	199.82	221.30	10.21	11.70	Muscles	
570.68	672.16	15.23	15.96	3.92	4.45	179.50	210.12	292.10	366.13	13.23	16.13	Intestine	
692.11	701.18	14.29	15.80	3.18	4.16	206.00	277.05	213.68	279.10	14.81	15.63	Gills	
363.55	406.08	115.16	133.07	28.52	32.12	141.13	162.30	121.17	140.62	72.44	77.25	Liver	Zinc
209.77	252.18	56.33	63.12	14.11	16.10	81.80	96.60	75.19	84.66	58.30	63.20	Muscles	
207.51	263.63	143.30	171.20	33.15	36.07	151.17	201.23	136.80	166.30	86.30	91.50	Intestine	
287.21	307.09	97.10	109.01	28.17	32.44	108.16	172.10	148.23	173.20	53.16	65.31	Gills	
92.56	107.21	16.23	18.63	0.153	0.218	8.67	10.91	8.82	11.63	18.72	20.11	Liver	aluminum
71.22	77.23	8.27	10.61	0.101	0.123	6.52	8.76	4.12	5.32	10.08	11.61	Muscles	
131.61	181.15	18.61	20.08	0.192	0.216	24.18	27.10	11.02	13.50	22.50	23.13	Intestine	
103.71	179.17	17.13	19.66	0.203	0.256	11.61	13.51	13.77	15.10	16.63	18.33	Gills	

Source: Based on the field study, on 16/1/2021 for the winter season, and on 17/7/ 2021 for the summer. The analyses have been carried out in the laboratory of the Department of Animal Resources, and the Laboratory of Soil and Water Sciences, College of Agriculture, University of Kufa.

This is due to the nature of the food consumed by fish under analysis, as the running fish is one of the carnivorous fish that feeds on fish, small-sized aquatic animals and dead fish. The Heavy elements in the water during the summer, compared to the winter, in which the concentrations in the liver of the running fish have decreased, reaching (675.21) µg/g, in dry weight. (87.21) and (72.13) µg/g, in a dry weight, for each of them, respectively. As for the lowest species of fish that have recorded lower concentrations of the heavy metals in the liver tissue, it was the rough fish, where the zinc component recorded the highest concentrations in the liver tissue of the fish, as it reached during a season Summer (32.12) µg/g, and dry weight, due to higher concentrations in water compared to winter, when concentrations decreased to (28.52) µg/g, and dry weight, in rough fish liver tissue, while the lowest concentrations of the three elements The copper element recorded the lowest concentrations of heavy metals in the texture of the rough fish, as it reached (0.192) µg/g and dry weight during the month of July, while during the month of January, the cadmium element recorded the lowest concentrations, as it reached (0.175) µg/g, and the weight was 0.175. Dry, and the reason for the low concentrations of heavy metals in the liver of roughage fish is due to the nature of dietary fish being one of the types of fish that feed on plants, algae and phytoplankton, compared to other fish, which recorded different concentrations in the liver tissue for each table fish (2), and through Comparing the results of laboratory analyzes Table (2) with the

determinants of the Organization (WHO) and the Organization (FAO) Table (3). It is noted that the liver of carp, shilluk, shank, red and jerry fish is not fit to eat according to the two standards, for exceeding the permissible limits of the elements under investigation for two seasons, with the exception of copper, where the concentrations of curry, shilluk, shank and hamri did not exceed the permissible limits. As for the rough fish, we note that the concentrations of lead, zinc and nickel have exceeded the permissible limits according to the two standards and for two seasons, while we note that the concentrations of Cadmium, copper, zinc and aluminum did not exceed the permissible limits in fish liver tissue, so the consumption of fish liver by the population and as a result of the concentrations of heavy elements in it will expose them to many diseases resulting from the accumulation of heavy elements in the body, especially cancer diseases.

Table (3) The Permissible Limits for the Concentrations of Heavy Metals in Fish according to the standard of the (FAO) and the standard of the (WHO), µg / g / dry weight

The Permissible Limits of the (WHO)	The Permissible Limits of the (FAO)	Element	no
1.50	**0.5**	Pb	1
8.0	**5.5**	Ni	2
0.5	**0.5**	Cd	3
--	**--**	Fe	4
0.5	0.3	Zn	5
20.0	**30**	Cu	6
0.5	**1**	AL	7

1- Hazrat A, Ezzat K & Muhammad JN (2020) Bioaccumulation of Some Potentially Toxic Heavy Metals in Freshwater Fish of River Shah Alam, Khyber Pakhtunkhwa, Pakistan. *Pak J Zool* 52(2): 603-608.
2 - FAO/WHO (1984), List of maximum levels recommended for contaminants by the Joint FAO/WHO Codex Alimentarius Commission, Second Series
CAC/FAL, Rome 3:1-8.

2- Accumulation of the heavy metals in the intestinal tissue-:

Most of the heavy metals reach the intestines through the food eaten by fish. In the intestine, the process of digestion, absorption and excretion occur. Therefore, a large amount of the elements under study reach fish through the food they eat, in addition to the arrival of some elements from the aquatic medium to the fish directly, which It may cause an increase in the concentrations of heavy metals studied for some seasons, especially during the summer. Table (2) assert that the concentrations of heavy metals in the intestinal tissue varied from one season to another and from one fish to another, and according to the type of element, where the fish recorded Running had the highest concentrations of heavy elements in the intestinal tissue during the summer and winter, compared to the rest of the other fish. Among the highest elements that has recorded a large accumulation in the tissue of the intestines of the running fish was iron, whose concentrations varied from the other season, as the concentrations reached during the summer

(July) (672.16) µg/g, dry weight, this may be due to the nature of the fish's food and source of nutrition, as well as the increase in the concentrations of heavy metals in the water during the summer, compared to the winter, in which the concentrations decreased, reaching (570.68) µg/g, dry weight, while the least heavy metals that recorded low concentrations in the tissue of the intestines of running fish were copper, as the concentrations during the summer reached (71.15) µg/g, dry weight, while they decreased to (68.61) µg/g. Dry weight, during the winter season, while it is noted that the roughage fish recorded the lowest concentrations of the heavy elements studied in the intestinal tissue, and it varies from one element to another. The zinc element recorded the highest concentrations compared to the rest of the other elements, and the other varies from one season to another, reaching Concentrations during the summer season (36.07) µg/g, dry weight, while during the winter they decreased to (33.15) µg/g, dry weight, and the least accumulated element in the intestinal tissue of rough fish is cadmium, as the amount of accumulation during the summer (0.170) µg/g, dry weight, while the quantity decreased to (0.152) µg/g, dry weight, during the winter season, which is low concentrations compared to the rest of the other fish that recorded higher concentrations during the two seasons and this may be due to the nature of the food and the source of food Each fish, and by comparing the results of laboratory analyzes Table (2) m P Determinants of the Organization (WHO) and Organization (FAO) Table (3) confirms the fact that the intestinal tissue is not edible in all studied fish for two seasons, for exceeding the permissible limits according to the two standards, with the exception of copper, which did not exceed the permissible limits in the intestines of each fish Carp, skeleton, shank, rough, and red, so before eating those fish, the intestines must be disposed of well and the fish's belly washed well to get rid of the remnants of the accumulation of heavy elements in its stomach, otherwise eating them without cleaning them well by the population will expose them to many infections One of the diseases resulting from the accumulation of heavy metals in the body, especially cancer or acute poisoning.

3- Accumulation of the heavy metals in the gill tissue

The gills are one of the most important parts of the body that cause heavy metals to enter the bodies of fish, because the gills are in direct contact with water and the concentration of heavy elements in them increases with the increase in the concentration of elements in water causing pollution. Pollution of water does not have a cumulative capacity, unlike the rest of the other organs in which heavy elements accumulate throughout the life of the fish, especially the liver, intestines and muscles, Table (2) show that the accumulation of the heavy elements in the gills of fish It varied from one season to another and from one fish to another, where the running thickness recorded the highest accumulation of heavy elements in the gill tissue, as the iron element came in the first place in terms of the amount of accumulation of heavy elements, as the amount of accumulation during the summer was (701.18) mcg / g , dry weight, due to the high levels of water pollution with heavy metals during this season, compared to the winter season, in which the accumulation decreased to (692.11) µg/g, dry weight, while the least accumulated elements in the gills tissue of fish Irrigation is the element copper, as the amount of accumulation during the summer was (85.03) µg/g, dry weight, while the quantity decreased to (77.36) µg/g, dry weight, during the

winter, due to a decrease due to the low rates of heavy metals concentrations in The water compared to the summer season, while the same table reveals that the least type of fish that recorded the lowest accumulation of heavy elements is the rough fish. It is also noted that there is a discrepancy in the accumulation from one season to another and from one element to another. (32.44) µg/g in dry weight during the summer. However, the same element has recorded a lower concentration during the winter, reaching (28.17) µg/g, in dry weight. The accumulation during the summer season was (0.233) µg/g, in dry weight, while the quantity decreased to (0.171) µg/g, dry weight, during the winter season, while the rest of the fish species recorded varying concentrations according to the type of fish, the nature of nutrition and the season.

By comparing the results of laboratory analyses Table (2) with the standards of (WHO) and (FAO) Table (3) assures that the raw material is not suitable for eating in all fish under investigation for two seasons, for exceeding the permissible limits according to the two standards, with the exception of the copper element. It did not exceed the permissible limits in the intestines of each of the carp, skeleton, shank, rough and hamri fish, and the aluminum element for the gill tissue of the rough fish, as it did not exceed the permissible limits with concentrations of (0.256) and (0.203) µg/g, dry weight for the month of July and January , for each of them, respectively, Table (3), so before eating those fish, their gills must be disposed of well and the fish's head should be washed with running water well to get rid of the remnants of the accumulation of heavy elements in its gills, otherwise eating it without cleaning it well will expose the population to many diseases resulting from the accumulation of heavy metals in the body.

4- Accumulation of the heavy elements in muscle tissue:-

Muscles are the most preferred part of fish. Where muscles are the least tissue that accumulates heavy elements inside them, this may be due to the low amount of fat in the muscle tissue of fish, as well as poor blood circulation in them, as the chemical elements penetrate into the fatty tissue and therefore difficult to get rid of, so muscles are the least parts of the fish An accumulation of heavy elements, and this can be seen from Table (2), which shows the accumulation of heavy elements in the tissue organs of some studied fish in an environment that is gypsum, where it is noted that the muscle tissue recorded the least accumulation of heavy elements than the rest of the other organs. And those accumulations vary from one element to another and from one season to another and from one fish to another, and accordingly, we can classify the trampled fish into several ranks according to the amount of accumulation of heavy strains in the muscle tissue. Iron is the highest accumulation in the muscle tissue of the running fish, as the value of the accumulation during the summer reached (297.68) mcg / g, dry weight, while it decreased to (205.62) mcg / g, dry weight, during the winter, while the lowest accumulating elements in the muscle tissue of the running fish is copper, as the amount of accumulation during the summer was (62.53) µg/g, dry weight, while the quantity decreased to (57.35) µg/g, dry weight, during the winter.

After the running fish, Shank is ranked second in terms of the amount of accumulation of heavy elements in the muscle tissue of fish, and the amount of

accumulation varies from one element to another and from one season to another, as the iron element occupied the highest accumulations in the muscle tissue of the Shank fish, the amount of accumulation during the summer season (182.31) µg/g, dry weight, while it has decreased to 156.17 µg/g, dry weight, during the winter season. (8.03) µg / g, dry weight, while during the winter, the lowest amount of accumulation recorded for the element aluminum reached (6.52) µg / g, dry weight, and shilluk comes in third place in terms of the amount of accumulation of heavy elements in the muscle tissue of fish, It varies from season to season and from one element to another, as iron recorded the highest accumulation of heavy elements in the muscle tissue of shilluk, as the value of accumulation during the summer reached (221.30) mcg/g, dry weight, while it decreased to (199.82) mcg. / g, dry weight, during the winter, the least accumulated elements in In the muscle tissue of shilluk fish is aluminum, the amount of accumulation during the summer reached (5.32) µg / g, dry weight, while during the winter the amount of accumulation decreased to (4.12 µg / g, dry weight, while carp fish occupied The fourth place in terms of accumulation of heavy elements in the muscle tissue of fish, as zinc recorded the highest accumulation of heavy elements in muscle tissue, where the amount of accumulation reached (63.20) mcg / g, dry weight, while during the winter it decreased to (58.30) mcg / g , dry weight, and the least accumulated elements in the muscle tissue of carp fish is copper, where the amount of accumulation during the summer was (6.81) µg / g, dry weight, while during the winter it reached (5.20) µg / g, dry weight, while In the fifth place, the Hamri fish came in terms of the accumulation of heavy elements in the muscle tissue of fish, as zinc recorded the highest accumulations of heavy elements in the muscle tissue of Hamri fish, where the amount of accumulation during the summer reached 63.12 µg / g, dry weight, while It decreased to (56.33) µg/g, dry weight, during the winter season Cadmium is the least accumulated element in the muscle tissue of Hamri fish, as the amount of accumulation during the summer reached (6.10) µg/g, dry weight, while during the winter the amount of accumulation decreased to (4.72) µg/g dry weight, and in The last rank was the roughage fish as the least type of fish accumulating heavy elements in the muscle tissue, and these accumulations vary from one season to another and from one element to another, where the nickel element recorded the highest concentrations in the muscle tissue of the rough fish, where the amount of concentrations during the summer reached (16.10) µg/g , dry weight, while the concentration values decreased to (14.11) µg/g, dry weight, during the winter season. As for the least type of heavy metals accumulating in the muscular tissue of rough sage, it is the copper element, as the concentration values during the summer reached (0.109) µg/ grams, dry weight, while the concentration values decreased to (0.102) µg/g dry weight, during the winter season, and by comparing the results of laboratory analyzes in Table (2) with the determinants of (WHO) and (FAO) Table (3) It is noticed that the muscle tissue of the running fish is not suitable for eating, due to the accumulation of a large amount of food For heavy elements that exceeded the permissible limits according to the two standards, it is also noted that it is not valid to eat the muscles of each of the carp, skeleton, shank and red fish, in terms of the accumulation of heavy elements that exceeded the permissible limits according to the two standards, except for the copper element, which did not exceed the permissible limits, in the tissue of the muscles of fish Previous, what for the thickness of the bristly.

The Conclusion

The present study has found that the accumulation of heavy metals in all tissues of fish growing in the environment of Al-Jibsa Marsh, where the amount of concentration varies from one fish type to another and from one season to another and from one organ to another. Moreover, the amount of concentrations increases during the summer, and decreases during the winter, most of the Fish species are not edible based on the concentrations of the heavy elements in their tissues, which exceed the permissible global limits. In terms of the elements accumulation, the study has shown that the elements of lead, copper and zinc have exceeded the permissible limits for consumption, while the elements of cadmium, nickel and aluminum, the concentration in the muscle tissue of rough fish has not exceeded the limits allowed. Thus, it is better not to eat fish in which the accumulation of heavy elements exceeds the permissible limits for eating, especially running fish and shank, and that the population accepts to eat it, it must be washed well with water to get rid of the accumulation of heavy elements in muscle tissue as much as possible.

References

1. Al-Hasnawi, Wissam Rahim Attia, Study of Concentrations of Some Heavy Metals in the Fish Barbus xanthopterus in Al-Diwaniyah River, College of Veterinary Medicine, Al-Diwaniyah University, undated.
2. Ermatov, N. J. ., & Abdulkhakov, I. U. . (2021). Socio-hygienic assessment of the incidence rate among various strata of the population-based on the materials of appeals and in-depth medical examinations. International Journal of Health & Medical Sciences, 4(3), 309-314. https://doi.org/10.31295/ijhms.v4n3.1758
3. Republic of Iraq, Ministry of Agriculture, Directorate of Agriculture in Najaf Governorate, Agricultural Atlas Project, Agricultural Atlas Committee, map of districts in Al-Hira sub-district.
4. Suryasa, I. W., Rodríguez-Gámez, M., & Koldoris, T. (2022). Post-pandemic health and its sustainability: Educational situation. International Journal of Health Sciences, 6(1), i-v. https://doi.org/10.53730/ijhs.v6n1.5949
5. The field study, during the year (10/10/2020 - 10/17/2021).
6. The researcher relied on the General Authority for Survey, the administrative map of Iraq, 2016 and the satellite video of the American satellite, 2016 using the 10.5Arq program. Gis.