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Research Article

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Assessment of Some Environmental Pollutants In Wadi El-Rayan Lake–Fayoum Governorate

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Abstract The effect of Seasonal variation on the concentration of seven metals: cadmium (Cd), lead (Pb), iron (Fe), manganese (Mn), zinc (Zn) and copper (Cu) was evaluated in water, two species of most consumed fishes(Tilapia nilotica & Claries lazera) , an aquatic plant (Ceratophillyum demersum L), and soil sediments in Wadi Al Raiyan lakes, El-Fayoum, Egypt . Samples were collected in summer and winter 2010-2011. Metals concentrations were measured by Atomic Absorption Spectroscopy. The studied metals were detected in all the examined samples. Zn had the highest concentration among the metals detected in water.Pb, Cd, Zn, Fe, Cu, Mn concentrations were below the Egyptian permissible limit. Cu, Pb and Cd concentrations in water samples during summer season is much higher than their concentrations in water during winter season, while the Zn and Fe concentrations in water samples during winter season is much higher than there concentrations in water during summer season. Mn concentration in water samples were the same during winter and summer seasons. Iron concentration in Ceratophyllum demersum L. was above the Egyptian permissible limit. In addition, Cd, Zn, Cu and Pb concentrations in plant samples during summer season were higher than the concentrations in winter season. Fe concentration in plant samples during winter season was higher than the concentrations in summer season. The investigated metal concentrations in the soil sediment and tissues of Tilapia nilotica and Claries lazera fish samples were above the Egyptian permissible limits. The significance of these findings is discussed.

Keywords Heavy Metals, Aquatic environment, Wadi EL-Rayan lake

Introduction

Wadi Al Raiyan lakes are three man-made lakes in a depression connected to the agricultural drainage system of El-Fayoum province near Cairo. The first lake covers an area of about 58 kmand lies 10 m below sea level while the second is a connection canal between the first and third lakes. The third lake covers an area of about 50 km and lies 18 m below sea level [1].

The lakes-wetland complex is a spatially and temporally dynamic system in which the water quality of lakes depends on both weather conditions and polluting parameters. Wadi El-Rayan lakes receive the agricultural waste water drainage from El-Wadi drain and vary in their physical and chemical characters [2].

Heavy metals such as cadmium, lead, copper and more specifically mercury are potentially harmful to most organisms even in very low concentrations and have been reported as hazardous environmental. Pollutants able to accumulate along the aquatic food chain with severe risk for animal and human health. Toxic heavy metals contamination mostly occurred in aquaculture farms and frequently occurs in ground water, rivers, estuaries, wetland and coastal areas. Of particular concern are the highly toxic non-nutrient elements such as lead (Pb), and cadmium (Cd) so the fish has the tendency to bioaccumulate heavy metals in a polluted environment [3].

The aquatic environment with its water quality is considered the main factor controlling the state of health and disease in both cultured and wild fishes. Pollution of the aquatic environment by inorganic and organic chemicals is a major factors posing serious threat to the survival of aquatic organisms including fish [4].
Ceratophyllum demersum plant is a native to North America. It now has a worldwide distribution, even in the cold regions [5] at least in part due to the aquarium and pond trade. It is a submerged aquatic plant which is capable of forming dense mono specific beds, excluding other plant species, causing problems to recreational activities on water ways and in some cases causing blockages at hydroelectric power stations. C. demersum plant can spread rapidly, and grows in a large range of aquatic habitats and the tissues of Ceratophyllum demersum plants have the ability to adsorb heavy metal concentrations and can be used to purify the polluted water [6]**.**
Sediments have been reported to form the major repository of heavy metal in aquatic system while both allochthonous and autochthonous influences could make a concentration of heavy metals in the water high enough to be of ecological significance. Bioaccumulation and magnification is capable of leading to toxic level of these metals in fish, even when the exposure is the presence of metal pollutant in fresh water is known to disturb the delicate balance of the aquatic ecosystem. Sediments play an important role in the physical movement, chemical partitioning and biological fate of trace metals [7].
Fish is often at the top of the aquatic food chain and may concentrate large amount of these metals from the surrounding waters. Most heavy metals find their way into water bodies via, chemical weathering of rocks and soil agricultural runoffs, industrial waste discharge, mining batteries, lead based paint and gasoline and improper domestic waste discharge into water ways [8].
The aim of this work was to estimate the distribution of some metals in different compartments of the aquatic environment in the Wadi El-Rayan lakes throughout the province of El-Fayoum, Egypt. For this purpose, concentrations of Pb, Cd, Zn, Fe, Cu and Mn were measured in surface water, Ceratophyllum demersum aquatic plant, sediment and in addition to muscles of Tilapia nilotica and Claries lazera fish. The detection & estimation of this metals in previously digested samples were carried out by Atomic Absorption Spectroscopy (AAS) M6 and the estimation of daily intake (gm/kg body weight/day) for the Tilapia nilotica and Claries lazera fish which are collected from Wadi El-Rayan lakes in El-Fayoum Governorate during winter and summer seasons in comparable with the permissible limits.

Materials and Methods

Sampling site:

Wadi El-Rayan lakes throughout the province of El-Fayoum, Egypt.

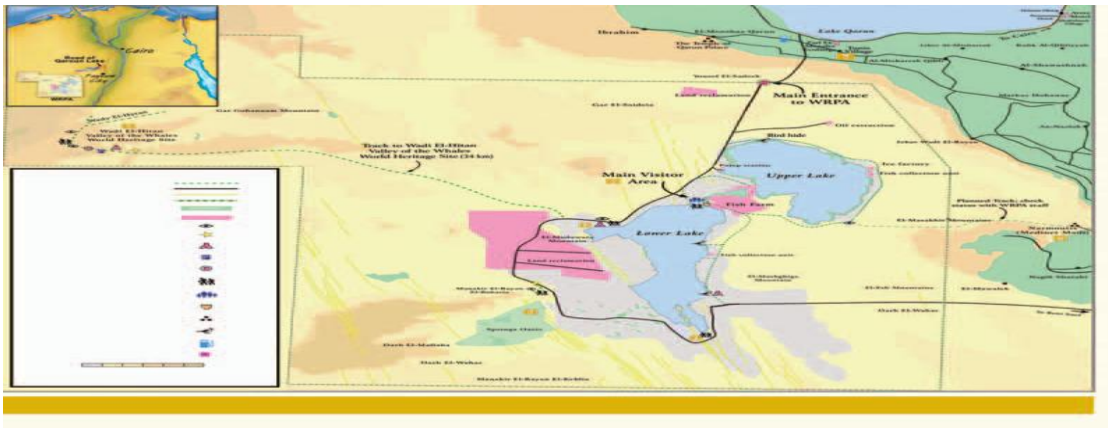

Figure 1: Map of Wadi El-Rayan Lakes

Sampling and sample preparation:

A total of 162 samples of surface water, aquatic plant (C. demersum), sediment and of Tilapia nilotica & Claries lazera (forty sample of each except twenty sample for sediment and twenty two sample for catfish) were collected from Wadi El-Rayan lakes throughout the province of El-Fayoum, Egypt during winter and summer seasons in the period 2010-2011. Water were taken using 0.5 liter bottles pre-cleaned with polyethylene and acidified with 5 ml of concentrated HNo3 and stored approximately at refrigerator. The water samples digested by using equal volumes of a mixture of nitric and perchloric acids. All digested samples were (pH) adjusted and volumetrically recorded [9]. C. demersum samples were packed in labeled clean plastic bags in deep freezer (-

20 ºC) for chemical analysis. Plant samples were digested according to the method described by Chapman and Pratt, (1982) [10] using an acid mixture of 750 ml of concentrated nitric acid, 150 ml of concentrated sulfuric acid and 300 ml of 60-62% perchloric acid. Sediment samples were put in air-sealed plastic bags, all sediment samples were mixed well before heavy metal levels determination. Sediment samples were allowed to defrost, then were air-dried in a circulatingoven at 60°C. A total digestion for one gram sediment was carried out according to the method of Jackwerth and Würfels [11] as follow: A weighed portion of each sample (2 g) was put into a kjeldahl flask containing 5 ml of conc nitric acid and 1 ml perchloric acid (80%), a blank of 10 ml digestion mixture was prepared in a second Teflon beaker, the mixture was heated until the solution become colourless and the samples were diluted to 50 ml with Bi-distilled water. Tilapia nilotica and catfish samples were collected with nets by professional fishermen. The samples were brought to the laboratory on the same day. The body length of the fish was ranged from 35-40 cm and the body weight was ranged from 500-600 gm. Approximately 2 g of the epaxial muscle on the dorsal surface of the fish washed with distilled water, dried in filter paper, weighed, packed in polyethylene bags and kept at −20°C until analysis for metals concentrations determination. Samples were digested using mixture of nitric acid and perchloric acid according to method applied [12].

Samples Analysis:

The metal analyses of the previous digested samples (Cd, Pb, Fe, Mn, Zn and Cu) were carried out using Atomic Absorption Spectroscopy M6, Thermo scientific 2009 [13]. The concentrations of heavy metals are expressed as mg/kg wet weight of tissues. The absorption wavelength values were 228.8 nm for Cd; 0.5 nm for Pb; 228.8 nm for Fe; 279.5 nm for Mn; 213.9 nm for Zn and 488 nm for Cu.

Statistical procedures:

Statistical analyses were performed using the statistical software package GraphPad InStat Version 2. The 0.05 level of probability was used as the criterion for significance.

Results

Table 1 : Metal concentrations (ppm) in surface water, Ceratophyllum demersum, sediment, Tilapia nilotica and Claries lazera samples collected from Wadi El-Rayan lakes throughout the province of El-Fayoum, Egypt in winter season

Districts	**Pb**	**Cd**	**Zn**	**Fe**	**Cu**	**Mn**
Water	0.001±0.00007	0.0007±0.00007	0.200±0.034	0.026±0.0025	0.001±0.00006	0.002±0.0003
Aquatic plant	0.189±0.036	0.049±0.008	5.082±0.892	36.22±3.797	0.373±0.040	30.95±4.362
Sediment	0.085 ±0.011	0.035 ±0.003	2.611±0.967	5.254 ±0.299	0.153 ±0.008	1.274 ±0.058
Tilapia nilotica	0.003±0.0003	0.003±0.0007	0.458±0.079	1.530±0.169	0.014±0.002	0.038±0.013
Claries lazera	0.006±0.0003	0.002±0.0002	0.795±0.123	0.319±0.067	0.011±0.0006	0.009±0.001
References						
WHO, 1993 water	0.01 ppm	0.01 mg/L	0.01 mg/l	0.01 ppm	4 mg/l	2 mg/l
US-EPA, 1998 water	0.01 ppm	0.05 ppm	0.30 mg/l	0.10 mg/l	0.30 mg/l	0.05 mg/l
EOS, 1993 water	0.01 mg/l	0.1 mg/l	0.3 mg/l	--	5 mg/l	1 mg/l
US-EPA,1997 sediment	30.2 µg/g	0.68 µg/g	124 µg/g	-	18.7 µg/g	-
EOS, 1993 fish	2 µg/g	0.5 µg/g	40 µg/g	30 µg/g	20 µg/g	-

Data expressed as Mean ± S.E and N=40 for each, 20 for sediment and 18 for catfish.

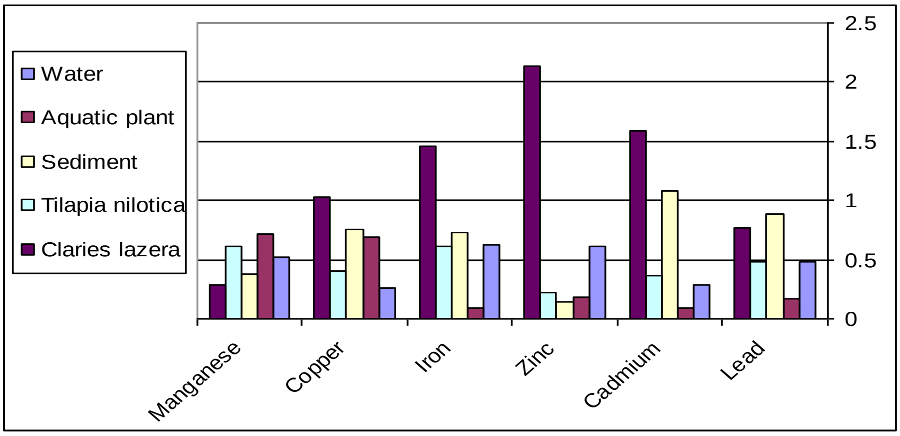

Figure 2: Metal concentrations (ppm) in surface water, Ceratophyllum demersum, sediment, Tilapia nilotica and Claries lazera samples collected from Wadi El-Rayan lakes throughout the province of El-Fayoum, Egypt in winter season

Table 2: Metal concentrations (ppm) in surface water, Ceratophyllum demersum, sediment, Tilapia nilotica and Claries lazera samples collected from Wadi El-Rayan lakes throughout the province of El-Fayoum, Egypt in summer season

Districts	Pb	Cd	Zn	Fe	Cu	Mn
Water	0.0014±0.00009	0.001±0.00006	0.056±0.026	0.019±0.004	0.002±0.0005	0.002±0.0004
Aquatic plant	0.611±0.136	0.133±0.012	5.463±0.359	34.931±4.024	0.717±0.091	19.08±3.602
Tilapia nilotica	0.005±0.0003	0.004±0.0002	0.199±0.026	0.629±0.171	0.019±0.0014	0.015±0.008
Claries lazera	0.005±0.0006	0.006±0.0009	0.401±0.265	0.295±0.097	0.009±0.001	0.009±0.002
References						
WHO, 1993 water	0.01 ppm	0.01 mg/L	0.01 mg/l	0.01 ppm	4 mg/l	2 mg/l
US-EPA, 1998 water	0.01 ppm	0.05 ppm	0.30 mg/l	0.10 mg/l	0.30 mg/l	0.05 mg/l
EOS, 1993 water	0.01 mg/l	0.1 mg/l	0.3 mg/l	--	5 mg/l	1 mg/l
EOS, 1993 fish	2 µg/g	0.5 µg/g	40 µg/g	30 µg/g	20 µg/g	-

Data expressed as Mean ± S.E and N=40 for each, and 4 for catfish.

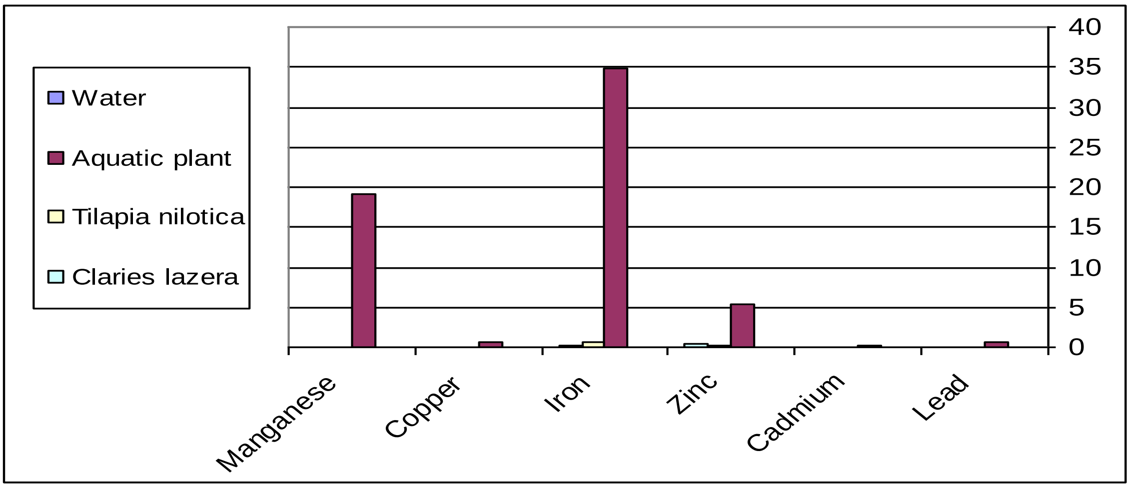

Figure 3: Metal concentrations (ppm) in surface water, Ceratophyllum demersum, sediment, Tilapia nilotica and Claries lazera samples collected from Wadi El-Rayan lakes throughout the province of El-Fayoum, Egypt in summer season

Table 3: Metal concentrations (ppm) in surface water samples collected from Wadi El-Rayan lakes throughout the province of El-Fayoum, Egypt in summer and winter seasons

Seasons	**Metals elements**						
		Pb	**Cd**	**Zn**	**Fe**	**Cu**	**Mn**
Summer	Mean ± SE	0.0014± 0.00009	0.001± 0.00006	0.056± 0.026	0.0199± 0.004	0.002± 0.0005	0.002± 0.0004
	Range	0.001-0.002	0.001-0.0015	0.0005-0.336	0.008-0.074	0.0005-0.007	0.000-0.005
	Median	0.002	0.0015	0.006	0.0135	0.001	0.0008
Winter	Mean ± SE	0.0013± 0.00007	0.0007± 0.00007	0.200± 0.034	0.026± 0.0025	0.0013±0.00 006	0.002± 0.0003
	Range	0.001-0.002	0.000-0.001	0.01-0.484	0.002-0.048	0.001-0.002	0.000-0.005
	Median	0.001	0.0008	0.211	0.025	0.001	0.002
Permissible limits							
WHO, 1993	0.01 ppm		0.01 mg/L	0.01 mg/l	0.01 ppm	4 mg/l	2 mg/l
US-EPA, 1998	0.01 ppm		0.05 ppm	0.30 mg/l	0.10 mg/l	0.30 mg/l	0.05 mg/l
EOS, 1993	0.01 mg/l		0.1 mg/l	0.3 mg/l	-----	5 mg/l	1 mg/l

Data expressed as Mean ± S.E, Range and Median.
N=40 sample.

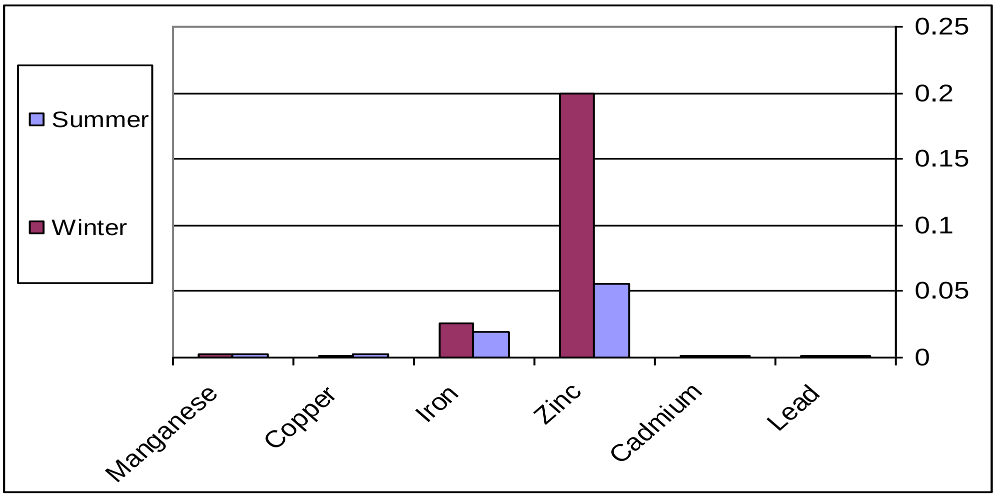

Figure 4: Metal concentrations (ppm) in surface water samples collected from Wadi El-Rayan lakes throughout the province of El-Fayoum, Egypt in summer and winter seasons

Table 4: Metal concentrations (ppm) in Ceratophyllum demersum aquatic plant samples collected from Wadi El-Rayan lakes throughout the province of El-Fayoum, Egypt in summer and winter seasons

Seasons	**Metals elements**						
		Pb	**Cd**	**Zn**	**Fe**	**Cu**	**Mn**
Summer	Mean ± SE	0.611± 0.136	0.133± 0.012	5.463± 0.359	34.931± 4.024	0.717± 0.091	19.08± 3.602
	Range	0.05-1.85	0.049-0.198	3.382-8.1	8.3-58.077	0.15-1.7	3.14-46.65
	Median	0.25	0.146	5.535	41.896	0.781	9.285
Winter	Mean ± SE	0.189± 0.036	0.049± 0.008	5.082± 0.892	36.22± 3.797	0.373± 0.040	30.95± 4.362
	Range	0.000-0.446	0.000-0.098	0.000-18	1.04-59.604	0.149-0.922	7.673-57.9
	Median	0.099	0.05	5.023	40.594	0.368	19.65
Permissible limits							
WHO, 2003	-------		-----	----	15-20 ppm	------	------

Data expressed as Mean ± S.E, Range and Median.
N=40 sample.

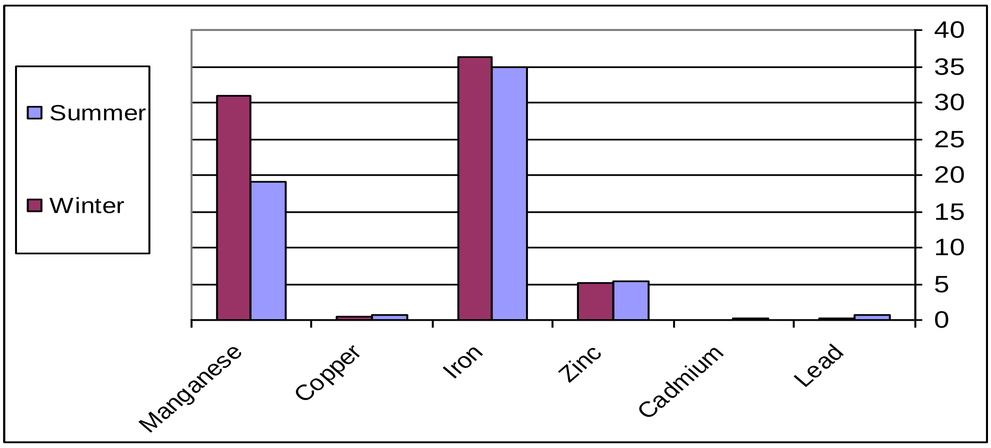

Figure 5: Metal concentrations (ppm) in Ceratophyllum demersum aquatic plant samples collected from Wadi El-Rayan lakes throughout the province of El-Fayoum, Egypt in summer and winter seasons

Table 5: Metal concentrations (ppm) in sediment samples collected from Wadi El-Rayan lakes throughout the province of El-Fayoum, Egypt in summer and winter seasons

Seasons		**Metals elements**					
		Pb	**Cd**	**Zn**	**Fe**	**Cu**	**Mn**
Summer	Mean ± SE	----	----	----	----	----	----
	Range	----	----	----	----	----	----
	Median	----	----	----	----	----	----
Winter	Mean ± SE	0.085± 0.011	0.035± 0.003	2.611± 0.967	5.254± 0.299	0.153± 0.008	1.274± 0.058
	Range	0.047-0.212	0.023-0.062	0.413-16.40	1.45-7.464	0.12-0.247	0.92-2.141
	Median	0.061	0.024	1.138	5.152	0.145	1.284
Permissible limits US-EPA, 1997 For chronic and acute guidelines	30.2 and 112 µg/g		0.68 and 4.21 µg/g	124 and 271 µg/g	------	18.7 and 108 µg/g	Persaud et al., 1990 PL: 460-1110 µg/g dry wt.

Data expressed as Mean ± S.E, Range and Median.
N=20 sample.

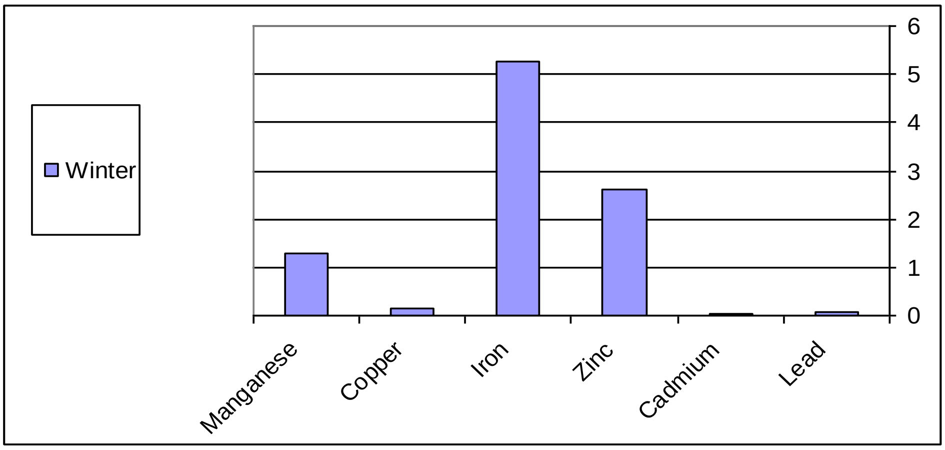

Figure 6: Metal concentrations (ppm) in sediment plant samples collected from Wadi El-Rayan lakes throughout the province of El-Fayoum, Egypt in summer and winter seasons

Table 6: Metal concentrations (ppm) in Tilapia nilotica fish samples collected from Wadi El-Rayan lakes throughout the province of El-Fayoum, Egypt in summer and winter seasons

Seasons	**Metals elements**	**Pb**	**Cd**	**Zn**	**Fe**	**Cu**	**Mn**
Summer	Mean ± SE	0.005± 0.0003	0.004± 0.0002	0.199± 0.026	0.629± 0.171	0.019± 0.0014	0.015± 0.008
	Range	0.002-0.006	0.002-0.006	0.034-0.379	0.009-2.33	0.004-0.028	0.000-0.152
	Median	0.006	0.004	0.220	0.271	0.019	0.005
Winter	Mean ± SE	0.003± 0.0003	0.003± 0.0007	0.458± 0.079	1.530± 0.169	0.014± 0.002	0.038± 0.013
	Range	0.002-0.006	0.002-0.004	0.198-1.323	0.152-2.504	0.008-0.034	0.002-0.269
	Median	0.004	0.002	0.315	1.753	0.001	0.025
Permissible limits							
FAO/WHO, 1999		2µg/g	0.5µg/g	40 µg/g	30 µg/g	20 µg/g	2-9 µg/g

Data expressed as Mean ± S.E, Range and Median.
N=40 sample.

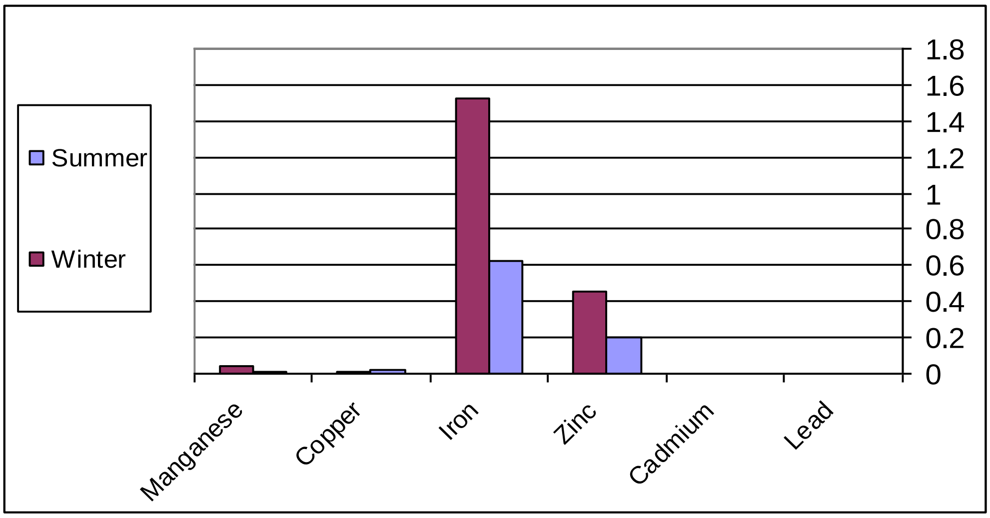

Figure 7: Metal concentrations (ppm) in Tilapia nilotica fish samples collected from Wadi El-Rayan lakes throughout the province of El-Fayoum, Egypt in summer and winter seasons

Table 7: Metal concentrations (ppm) in Claries lazera fish samples collected from Wadi El-Rayan lakes throughout the province of El-Fayoum, Egypt in summer and winter seasons

Seasons	**Metals elements**	**Pb**	**Cd**	**Zn**	**Fe**	**Cu**	**Mn**
Summer	Mean ± SE	0.005± 0.0006	0.006± 0.0009	0.401± 0.265	0.295± 0.097	0.009± 0.001	0.009± 0.002
	Range	0.004-0.006	0.004-0.008	0.065-1.184	0.13-0.572	0.008-0.012	0.004-0.014
	Median	0.005	0.007	0.076	0.242	0.006	0.008
Winter	Mean ± SE	0.006± 0.0003	0.005± 0.0006	0.795± 0.123	0.319± 0.067	0.295± 0.097	0.009± 0.001
	Range	0.004-0.008	0.004-0.006	0.002-1.557	0.096-1.31	0.13-0.572	0.006-0.02
	Median	0.006	0.005	0.699	0.211	0.242	0.006
Permissible limits							
FAO/WHO, 1999		2µg/g	0.5µg/g	40 µg/g	30 µg/g	20 µg/g	2-9 µg/g

Data expressed as Mean ± S.E, Range and Median.
N=22 sample.

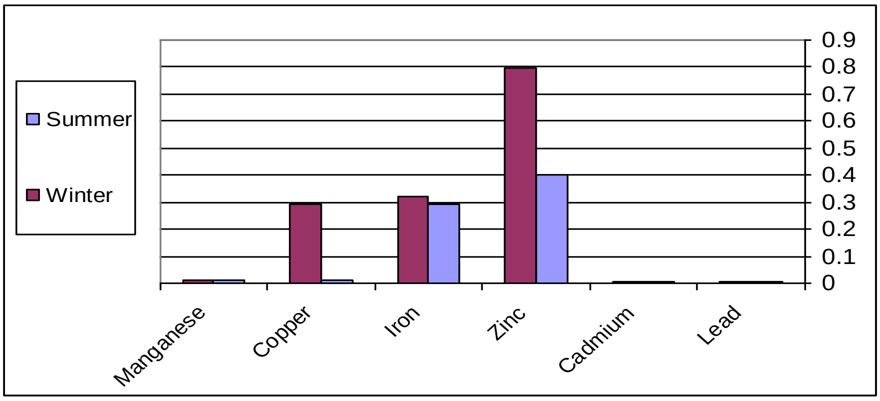

Figure 8: Metal concentrations (ppm) in Claries lazera fish samples collected from Wadi El-Rayan lakes throughout the province of El-Fayoum, Egypt in summer and winter seasons

Discussion

Metal concentrations in water:

The concentrations of the metals (Pb, Cd, Zn, Fe, Cu, Mn) which determined in the surface water of Wadi El-Rayan Lakes in El-Fayoum Provience during winter and summer seasons were below the permissible limit reported [14].

The lead concentration in water samples during summer season is much higher than the lead concentration in water samples during the winter season that may attributed to resolution of the lead from the sediment into the water during summer season under the effect of the temperature factor. The results were supported by Abdel-Satar et al., (2010) [15] who reported that the analysis of water samples collected from El-Bats and El-wadi drains effluents of Lake Qarun in El-Fayoum Province, Egypt revealed that water contains lead in a level of (146.147 µg/l) and (149.64 µg/l) during the winter season and summer season respectively. It was found that the mean lead concentrations in seasonal water samples collected at six sites from (Wadi El-Rayan Protected area in El-Fayoum Provience, Egypt) in the first and second lakes during period from February (winter) to November (autumn) 2006 and analyzed for the presence of lead. The results showed that the average lead concentrations (µg/l) were ranged from (45-86 and 47-83), (110-135 and 93-129), (38-80 and 64-97) and (95-129 and 82-136) in winter, spring, summer and autumn respectively in water samples. The lead concentrations also were determined in samples collected from (Wadi El-Rayan Drain effluent) and the records were 120, 77, 80 and 9.6 (µg/l) in winter, spring, summer and autumn respectively [16].

Also, the results were supported by Abdou, (2005) [17] who investigated that the concentration of lead in 50 water samples collected from (Wadi El-Rayan Protected Area lakes, in El-Fayoum provience, Egypt were in average of (0.032 ±0.004 ppm) respectively.

The given results illustrated that cadmium levels were detected in water samples which are collected from Wadi El-Rayan Lakes in El-Fayoum Goverenrate during winter and summer seasons were shown in table 1. and figure 2. The cadmium concentration in water samples collected from Wadi El-Rayan Lakes in El-Fayoum Goverenrate during winter and summer seasons were in average of 0.0007±0.00007and 0.001±0.00006 ppm respectively. These recorded limits of cadmium were below the limit recorded by Egyptian Organization for Standardization (EOS), (1993) (0.1 ppm) [14].

The cadmium concentration in water samples during summer season is much higher than cadmium concentration in water samples during the winter season that may attributed to resolution of the cadmium from the sediment into the water during summer season under the effect of the temperature factor. Our results were similar to that obtained with Abdel-Satar et al., (2010) [18] who reported that the analysis of water samples collected from El-Bats and El-wadi drains effluents of Lake Qarun in El-Fayoum Province, Egypt revealed that water contains cadmium in a level of 45.0, 10.5 , 77.33 and 10.0 µg/l in winter, spring summer and autumn respectively.

Sayed and Amaal, (2009) [16] found that the mean cadmium concentrations in seasonal water samples collected at six sites from (Wadi El-Rayan Protected area in El-Fayoum Provience, Egypt) in the first and second lakes during period from February (winter) to November (autumn) 2006 and analyzed for the presence of cadmium. The results showed that the average Cd concentrations (µg/l) were ranged from (8-15and 9-20), (22-53 and 39-71), (11-20and 11-24) and (19-51and 51-61) in winter, spring, summer and autumn respectively in water samples.

Cadmium concentrations also were determined in samples collected from Wadi El-Rayan Drain effluent and the records were 13, 9, 11 and 14 (µg/l) in winter, spring, summer and autumn Respectively. The results are in greement with the results recorded by Abdou, (2005) [17] who found that the concentration of Cd in 50 water samples collected from Wadi El-Rayan Protected Area lakes in El-Fayoum provience, Egypt was in average of 0.073 ±0.012 ppm respectively.

The given results illustrated that zinc levels were detected in water samples which are collected from Wadi El-Rayan Lakes in El-Fayoum Governorate during winter and summer seasons were shown in table 1. and figure 2. The zinc concentration in water samples collected from Wadi El-Rayan Lakes in El-Fayoum Governorate during winter and summer seasons were in average of 0.200±0.034 and 0.056±0.026 ppm respectively. And these recorded limits of zinc were below the limit recorded by Egyptian Organization for Standardization (EOS), (1993) (5 mg/l). The results showed that the zinc concentration were much higher in winter season than that of summer season [14].

As seen in table 1, zinc concentration in water samples showed a highly significant difference at $P<0.01$ from the permissible limit set by Egyptian Organization for Standardization (EOS), (1993) [14] (5mg/l) during winter and summer seasons. This results agree with the results of (Sayed and Amaal, 2009) [16] who stated that zinc concentration in water (µg/l) samples collected from (Wadi El-Rayan Protected area in El-Fayoum Provience, Egypt) in the first and second lakes were ranged from (44.0-96.1 and 52.0-100.0), (72.0-81.0 and 56.0-98.0), (29.1-40.0 and 35.2-48.0) and (45.0-98.2 and 55.0-69.0) in winter, spring, summer and autumn respectively.

Mansour and Sidky, (2003) [19] who recorded that Zn concentrations were determined in water samples collected from Lake Qarun and Wadi El-Rayan wet land (Egypt) and Ali and Abdel-Satar, (2005) [20] who stated that the Zn concentration (mg/l) in water samples collected from Wadi El-Rayan Protected Area lakes, in El-Fayoum provience, Egypt was 0.061 to 0.069 ppm.

The given results illustrated that iron levels were detected in water samples which are collected from Wadi El-Rayan Lakes in El-Fayoum Governorate during winter and summer seasons were shown in table 1,2 and figure 2,3. The iron concentration in water samples collected from Wadi El-Rayan Lakes in El-Fayoum Goverenrate during winter and summer seasons were in average of 0.026±0.0025 and 0.0199±0.004 ppm respectively. And these recorded limits of lead were below the limit recorded by Egyptian Organization for Standardization (EOS), (1993) (0.3mg/l) [14]. The results showed that the iron concentration were much higher in winter season than that of summer season.

Iron concentration in water samples showed a highly significant difference at $P<0.01$ from the permissible limit set by Egyptian Organization for Standardization (EOS), (1993) (0.3ppm) [14] during winter and summer seasons. Also, the results were supported by Ali and Amaal, (2005) [16] who found that the average concentration of iron in water (µg/l) samples collected from some fish farms in El-Fayoum provience, Egypt (El-shoura, Gouda 1, Gouda 2, Shalakani, Dayer El-Berka and El- Wadi Drain) were (2020, 1652, 1088, 1271, 2581 and 2329) respectively.

Saeed and Shaker, (2008) [4] stated that the iron levels were determined in water mg/l samples collected from the Northern Delta Lakes (Edku, Borollus, Manzalah) and the analysis revealed that the iron concentration in the samples ranged as (0.570, 0.425 and 1.416) respectively. Also, the given results were agree with Sayed and Amaal, (2009) [16] who found that the iron levels in seasonal water samples which are collected at six sites from (Wadi El-Rayan Protected area in El-Fayoum Provience, Egypt) in the first and second lakes during period from february (winter) to November (autumn) 2006 and the average results were ranged from (315-831 and 380-822), (361-1502 and 465-828), (275-767 and 323-387) and (345-422 and 340-493) in winter, spring, summer and autumn respectively. The average iron concentration in water samples collected from (Lake Qarun in El-Fayoum Province, Egypt) were (733, 664.5, 434.2 and 683.8 µg/l) in winter, spring, summer and autumn respectively [18].

The given results illustrated that copper levels were detected in water samples which are collected from Wadi El-Rayan Lakes in El-Fayoum Goverenrate during winter and summer seasons were shown in table 1,2 and figure 2,3 The copper concentration in water samples collected from Wadi El-Rayan Lakes in El-Fayoum Goverenrate during winter and summer seasons were in average of 0.0013±0.00006 and 0.002±0.0005 ppm respectively. And these recorded limits of copper were below the limit recorded by Egyptian Organization for Standardization (EOS), (1993) (1 mg/l) [14]. Copper concentration in water samples showed a highly significant difference at $P<0.01$ from the permissible limit set by Egyptian Organization for Standardization (EOS), (1993) (1 ppm) during winter and summer seasons [14].

The copper concentration in water samples during summer season is much higher than copper concentration in water samples during the winter season that may attributed to resolution of the copper from the sediment into the water during summer Season under the effect of the temperature factor. The results were supported by Abdel-Satar et al., (2010) [18] who reported that the analysis of water samples collected from El-Bats and El-

wadi drains effluents of Lake Qarun in El-Fayoum Province, Egypt revealed that water contains copper in a level of (65.17, 56.5, 55.0 and 21.0 µg/l) in winter, spring summer and autumn respectively.
Sayed and Amaal, (2009) [16] found that the mean copper concentrations in seasonal water samples collected at six sites from (Wadi El-Rayan Protected area in El-Fayoum Provience, Egypt) in the first and second lakes during period from February (winter) to November (autumn) 2006 and analyzed for the presence of copper. The results showed that the average copper concentrations (µg/l) were ranged from (11-24 and 13-19), (43-70 and 59-73), (8-10 and 18-23) and (24-57 and 44-52) in winter, spring, summer and autumn respectively.
Copper concentrations were determined in samples collected from (Wadi El-Rayan Drain effluent) and the records were 33, 66, 25 and 32 (µg/l) in winter, spring, summer and autumn respectively. The results were supported by Abdou, (2005) [17] who investigated that the concentration of copper in 50 water samples collected from Wadi El-Rayan Protected Area lakes, in El-Fayoum provience, Egypt) were in average of (0.245±0.033) respectively.
It was found that the Cu levels in water samples which are collected from Brollus Lake were ranged as 0.003 to 0.015 mg/l while Abdel –Satar, (2005) [18] was found that the mean copper concentration in water samples collected from Wadi El-Rayan Protected Area lakes, in El-Fayoum provience, Egypt was 0.028 to 0.034 (mg/l).
The given results illustrated that Manganese levels were detected in water samples which are collected from Wadi El-Rayan Lakes in El-Fayoum Governorate during winter and summer seasons were shown in table 1,2 and figure 2,3 The manganese concentration in water samples collected from Wadi El-Rayan Lakes in El-Fayoum Goverenrate during winter and summer seasons were in average of 0.002±0.0003 and 0.002±0.0004 ppm respectively. And these recorded limits of manganese were below the limit recorded by Egyptian Organization for Standardization EOS, (1993) (0.5 mg/l) [14].
As seen in table 1,2 the manganese concentration in water samples showed a highly significant difference at $P<0.01$ from the permissible limit set by Egyptian Organization for Standardization (EOS), (1993) [14] (0.5 mg/l) during winter and summer seasons .the concentrations of manganese in water is the same during winter and summer seasons .the obtained results were agree with Ali and Amaal, (2005) [21] who status that the distribution of manganese in water (µg/l) samples collected from some fish farms in El-Fayoum provience, Egypt (El-shoura, Gouda 1, Gouda 2, Shalakani, Dayer El-Berka and El- Wadi Drain) were determined and the results revealed that the manganese levels were (113, 93, 71, 83, 231 and 197) respectively.
Water samples collected from Lake Qarun in El-Fayoum Province, Egypt were analyzed for the presence of manganese and the analysis revealed that the manganese levels were 131.83, 60.5, 93.5 and 31.0 µg/l in winter, spring, summer and autumn respectively [18]. While the seasonal water (µg/l) samples collected from (Wadi El-Rayan Protected area in El-Fayoum Provience, Egypt) in the first and second lakes were analyzed for the presence of manganese and the determined records were ranged from (32-122 and 30-104), (39-102 and 55-154), (15-65 and 30-50) and (22-57 and 42-54) in winter, spring, summer and autumn respectively.
The manganese concentrations also were determined in samples collected from (Wadi El-Rayan Drain effluent) and the records were (30, 65, 34 and 39µg/l) in winter, spring, summer and autumn respectively [16]**.** In the same way, manganese concentration in water mg/l samples collected from the Northern Delta Lakes (Edku, Borollus, Manzalah) were 0.024, 0.194 and 0.513 respectively [4].
The obtained results were supported by Ali and Fishar, (2005) [22] who recorded that the average manganese concentration in water samples collected from Lake Qarun during summer season at 7 stations in El-Fayoum Provience, Egypt were ranged from 78.30 to 39.10 µg/l in the east, middle and west sites of the Lake respectively.

Metals concentrations in plant:
The concentrations of lead in the Ceratophyllum demersum aquatic plant samples of Wadi El-Rayan Lakes were shown in Table 1,2 and Figure 2,3 The obtained results revealed that the concentration of lead in Aquatic plant samples (Ceratophyllum demersum aquatic plant) which are collected from Wadi El-Rayan Lakes during winter and summer seasons were in average of 0.189±0.036 and 0.611±0.136 ppm respectively and these limits of lead were much higher during summer season than that of winter season because the concentrations of lead were above 10 µg/g in plant tissues the plant is considered to be an indicator of chemical contamination because this limit is bigger than the critical level of toxicity in plant tissues of Ceratophyllum demersum aquatic plant [23].
In the same way, the analysis of lead concentrations in Ceratophyllum demersum aquatic plant at four locations (Snabis beach, Al-Nasra beach, Marine Cornish, North Al-Qatif and Al-Shatek district) in Al-Qatif district, east of Saudi Arabia were (7.1-8.9), (4.7-7.2), (7.2-10.8) and (3.9-6.8) respectively [6].
Also, the obtained results were agree with the records which obtained by Lila and Abbas, (2005) [24] who investigated that the lead concentrations in Macrophytes plant (Ceratophyllum species) samples collected from different areas of (Edku Lake) were 1.64 and 2.04 mg/kg from eastern and western areas of the lake respectively.

Also, the given results were supported by Khadiga, (2010) [25] who found that the average concentrations of lead in Ceratophyllum demersum aquatic plant samples which are collected from nine districts in Beni suef Governorate were 3.107, 6.307, 3.235, 21.431, 6.032, 7.549, 2.214, 6.202 and 1.219 in (Beni-Suef City, El-fashn district, Beba district**,** Somosta district, Ehnasia district, El-wasta district, Naser district, Bayed El-arab district and Sanor district) respectively.

The concentrations of cadmium in the Ceratophyllum demersum aquatic plant samples of Wadi El-Rayan Lakes were shown in table 1 and figure 2. The obtained results revealed that the concentration of cadmium in aquatic plant samples (Ceratophyllum demersum aquatic plant) which are collected from Wadi El-Rayan Lakes during winter and summer seasons were in average of 0.049±0.008 and 0.133±0.012 ppm respectively and these recorded limits of cadmium were much higher during summer season than that of winter season.

In the same way, the analysis of cadmium concentrations in Ceratophyllum demersum aquatic plant at four locations (Snabis beach, Al-Nasra beach, Marine Cornish, North Al-Qatif and Al-Shatek district) in Al-Qatif district, east of Saudi Arabia were (0.63-0.74), (0.77-0.95), 0.54-0.61) and (0.86-0.92) respectively [6].

Our results were in agree with the records which obtained by Khadiga, (2010) [25] who found that the average concentrations of cadmium in Ceratophyllum demersum aquatic plant samples which are collected from nine districts in Beni Suef Governorate were 1.095, 0.245, 0.751, 0.028, 0.986, 0.511, 0.896, 0.355 and 0.655 ppm in Beni Suef city, El-fashn district, Beba district**,** Somosta district, Ehnasia district, El-wasta district, Naser district, Bayed El-arab district, Sanor district respectively.

The concentrations of zinc in the Ceratophyllum demersum aquatic plant samples of Wadi El-Rayan Lakes were shown in Table 1 and Figure 2. The obtained results revealed that the concentration of zinc in aquatic plant samples (Ceratophyllum demersum) which are collected from Wadi El-Rayan Lakes during winter and summer seasons were in average of 5.082±0.892 and 5.463±0.359 ppm respectively. These recorded limits of zinc were much higher during summer season than that of winter season.

In the same way, the analysis of zinc concentrations in Ceratophyllum demersum aquatic plant at four locations (Snabis beach, Al-Nasra beach, Marine Cornish, North Al-Qatif and Al-Shatek district) in Al-Qatif district, east of Saudi Arabia were (77.4-120), (118-129), (92-112) and (125-160) in Ceratophyllum demarsum plant samples in Al-Qatif district, east of Saudi Arabia respectively [6].

The obtained results were agree with the records which obtained by Lila and Abbas, (2005) [24] who found that the zinc concentrations in Macrophytes plant (Ceratophyllum species) samples collected from different areas of (Edku Lake) were 11.34 and 12.37 mg/kg from eastern and western areas of the Lake respectively.

Also, the given results were supported by Khadiga, (2010) [25] who found that the average concentrations of zinc in Ceratophyllum demersum aquatic plant samples which are collected from nine districts in Beni Suef Governorate were 16.934, 19.726, 18.114, 18.173, 19.095, 17.424, 17.503, 17.454 and 18.266 ppm in (Beni Suef city, El-fashn district, Beba district**,** Somosta district, Ehnasia district, El-wasta district, Naser district, Bayed El-arab district and Sanor district) respectively.

The concentrations of iron in the Ceratophyllum demersum aquatic plant samples of Wadi El-Rayan Lakes were shown in Table 1 and Figure 2. The given results revealed that the levels of iron in the plant samples were much higher in winter season than that of summer season and these recorded limits were above the limits recorded by World Health Organization (WHO), (2003) (15-20 ppm). As seen in table 1. The iron concentrations in the plant samples showed a highly significant difference at $P<0.01$ from the permissible limit set by World Health Organization (WHO), (2003) (15-20 ppm) during winter and summer seasons [26].

The obtained results revealed that the concentration of iron in aquatic plant samples (Ceratophyllum demersum) which are collected from Wadi El-Rayan Lakes during winter and summer seasons were in average of 36.22±3.797 and 34.931±4.024 ppm respectively and these recorded limits of iron were much higher during winter season than that of summer season. In the same way, the analysis of iron concentrations in Ceratophyllum demersum aquatic plant at four locations (Snabis beach, Al-Nasra beach, Marine Cornish, North Al-Qatif and Al-Shatek district) in Al-Qatif district, east of Saudi Arabia were (4298-4373), (4319-4450), (5216-5229) and (5519-5539) in Ceratophyllum demarsum plant samples in Al-Qatif district, east of Saudi Arabia respectively [6].

Also, the obtained results were agree with the records which obtained by Nada et al., 2010 [27] who status that the iron levels in Ceratophyllum demarsum plant samples collected from the Fish pond Ecka, Republic of Serbita was 8919.94 mg/kg. Also, the given results were supported by Khadiga [25] who found that the average concentrations of iron in Ceratophyllum demersum aquatic plant samples which are collected from nine districts in Beni Suef Governorate were 1.670, 22.255, 1.472, 5.768, 1.439, 1.553, 1.657, 3.364 and 2.689 ppm in Beni Suef city, El-fashn district, Beba district**,** Somosta district, Ehnasia district, El-wasta district, Naser district ,Bayed El-arab district and Sanor district) respectively.

The concentrations of copper in the Ceratophyllum demersum aquatic plant samples of Wadi El-Rayan Lakes were shown in table 1,2 and Figure 2,3. The obtained results revealed that the concentration of copper in aquatic plant samples (Ceratophyllum demersum) which are collected from Wadi El-Rayan Lakes during winter and summer seasons were in average of 0.373±0.040 and 0.717±0.091 ppm respectively and these recorded limits of copper were much higher during summer season than that of winter season.

In the same way, the analysis of copper concentrations in Ceratophyllum demersum aquatic plant at four locations (Snabis beach, Al-Nasra beach, Marine Cornish, North Al-Qatif and Al-Shatek district) in Al-Qatif district, east of Saudi Arabia were (118-128), (105-118), (79-86) and (70-83) (mg/kg) respectively [6].

The obtained results were agree with the records which obtained by Khadiga, (2010) [25] who found that the average concentrations of cadmium in Ceratophyllum demersum aquatic plant samples which are collected from nine districts in Beni Suef Governorate were 20.243, 15.828, 20.640, 19.525, 22.311, 21.180, 20.589, 13.427, 11.21 ppm in Beni Suef city, El-fashn district, Beba district**,** Somosta district, Ehnasia district, El-wasta district, Naser district, Bayed El-arab district, Sanor district) respectively.

The obtained results were agree with Nada et al., (2010) [27] who investigated the copper levels in Ceratophyllum demersum samples collected from Fish pond Ecka, Republic of Serbita were 28.25±0.54 (mg/kg). In the same way, Cu values were determined in Macrophytes plant (Ceratophyllum species) samples collected from different areas of Edku Lake and the average concentrations were 4.5 and 5.18 mg/kg from eastern and western areas of the Lake respectively [24]**.**

The concentrations of manganese in the Ceratophyllum demersum aquatic plant samples of Wadi El-Rayan Lakes were shown in table 1,2 and Figure 2,3. The obtained results revealed that the concentration of manganese in aquatic plant samples (Ceratophyllum demersum aquatic plant) which are collected from Wadi El-Rayan Lakes during winter and summer seasons were in average of 30.95±4.362 and 19.08±3.602 ppm respectively and these recorded limits of manganese were much higher during winter season than that of summer season.

In the same way, the analysis of manganese concentrations in Ceratophyllum demersum aquatic plant at four locations (Snabis beach, Al-Nasra beach, Marine Cornish, North Al-Qatif and Al-Shatek district) in Al-Qatif district, east of Saudi Arabia were (3755-4308), (2966-3010), (4210-4328) and (2938-3010) respectively [6]**.**

Also, the obtained results were agree with the records which obtained by Lila and Abbas, (2005) [24] who investigated that the Mn concentrations in Macrophytes plant (Ceratophyllum species) samples collected from different areas of Edku Lake) were 1.64 and 2.04 mg/kg from eastern and western areas of the Lake respectively.

The given results were supported by Khadiga, (2010) [25] who found that the average concentrations of Mn in Ceratophyllum demersum aquatic plant samples which are collected from nine districts in Beni Suef Governorate were 209.240, 209.438, 208.756, 209.639, 209.358, 209.221, 209.182, 209.489 and 209.369 ppm) respectively in (Beni Suef city, El-fashn district, Beba district**,** Somosta district, Ehnasia district, El-wasta district, Naser district, Bayed El-arab district and Sanor district) respectively.

The given results were supported by Nada et al., (2010) [27] who investigated that the average concentration of Mn (mg/kg) in Ceratophyllum demersum plant samples collected from the Fish pond Ecka, Republic of Serbita were 1864.52±123.12 (mg/kg).

Metal contents in sediment:

The concentrations of lead metal determined in the sediment samples which are collected from Wadi El-Rayan Lakes in El-Fayoum Goverenrate during 2010/2011 were shown in Table 1 and figure 2. The concentrations of lead in the sediment samples which are collected from Wadi El-Rayan Lakes in El-Fayoum Governorate during 2010/2011 were in average of (0.085 ± 0.011 ppm).

The obtained results in our study revealed that the lead levels were above the limit recorded by United State Environmental Protection Agency (USEPA), (1997) [28] (30.2 µg/g). As seen in table 1, the lead concentrations sediment samples showed a highly significant difference at P<0.01 from the chronic quality guidelines (30.2 µg/g) by United State Environmental Protection Agency, (1997) [28].

In the same manner, lead levels were determined in sediment samples collected from Wadi El-Rayan Lakes in El-Fayoum Goverenrate during 2010/2011 and the lead concentrations were in average of (60.8±34.7), (42±21.5), (23.5±11.0), (37.8±19.1), (38.8±23.7) and (28.8±13.8 mg/g) in sites 1,2,3,4,5, and 6 respectively [16]. Also, the results were supported by Abdou, (2005) [17] who investigated that the concentration of lead in 50 sediment samples collected from (Wadi El-Rayan Protected Area lakes, in El-Fayoum provience, Egypt) were in average of 0.037±0.045 ppm respectively.

Abdel-Satar et al., (2010) [18] investigated that the mean lead concentrations in sediment samples collected from Lake Qarun in El-Fayoum Province, Egypt were 37.0, 52.3, 64.0, 38.5, 76.8 and 56.0 µg/g in site 1, 2, 3, 4, 5 and 6 respectively.

The concentrations of cadmium determined in the sediment samples which are collected from Wadi El-Rayan Lakes in El-Fayoum Governorate during 2010/2011 were shown in Table 1. and figure 8. The concentrations of cadmium in the sediment samples which are collected from Wadi El-Rayan Lakes in El-Fayoum Governorate During 2010/2011 were in average of 0.035±0.003 ppm.

The obtained results in our study revealed that the cadmium levels were above the limit recorded by United State Environmental Protection Agency (USEPA), (1997) [28] in case of chronic and acute quality guidelines (0.68 and 4.21 µg/g). Cadmium sediment concentrations in Wadi El-Rayan Lakes showed higher levels than chronic quality guidelines (0.68 µg/g), that be attributed to contamination of the sediment by the domestic municipal waste [15, 19] where Cd is present as an impurity in several products, including phosphate fertilizers and detergents [29].

As seen in table 1, cadmium concentrations in sediment samples showed a highly significant difference at $P<0.01$ from the chronic quality guidelines set by United States Environmental Protection Agency (USEPA), (1997) [28] (0.68 µg/g). In the same manner, cadmium levels were determined in sediment samples collected from Wadi El-Rayan Lakes in El-Fayoum Goverenrate during 2010/2011 and the cadmium concentrations were in average of 11.0, 9.0, 5.8, 6.5, 6.0 and 5.5 in sites 1,2,3,4,5 and 6 respectively [16].

Also, the results were supported by Abdou, (2005) [17] who found that the concentration of cadmium in 50 sediment samples collected from (Wadi El-Rayan Protected Area (WRPA) lakes in El-Fayoum provience, Egypt) were in average of (0.295 ± 0.071 ppm) respectively.

Abdel-Satar et al., (2010) [18] investigated that the mean cadmium concentrations in sediment samples collected from (Lake Qarun in El-Fayoum Province, Egypt were 5.8, 7.3, 11.5, 9.0, 9.5 and 6.0 µg/g in site 1,2,3,4,5 and 6 respectively.

The concentrations of zinc metal determined in the sediment samples which are collected from Wadi El-Rayan Lakes in El-Fayoum Governorate during 2010/2011 were shown in Table 1. and figure 2. The concentrations of zinc in the sediment samples which are collected from Wadi El-Rayan Lakes in El-Fayoum Governorate during 2010/2011 were in average of (2.611 ± 0.967 ppm).

The obtained results in our study revealed that the zinc levels were above the limit recorded by United State Environmental Protection Agency (USEPA), (1997) in case of chronic and Acute quality guidelines (124 ,271 µg/g). As seen in table 1. the zinc concentrations in sediment samples showed significant difference at $P<0.05$ from the chronic quality guidelines (124µg/g) set by United State Environmental Protection Agency, (1997) (124 µg/g) [28].

In the same manner, zinc levels were determined in sediment samples collected from Wadi El-Rayan Lakes in El-Fayoum Goverenrate and the concentrations were 250.3, 161.8, 139.8, 135, 131.5 and 76.0 in sites 1,2,3,4,5 and 6 respectively [16]**.**

Also, the average concentration of zinc in sediment (µg/g), samples collected from some fish farms in El-Fayoum provience, Egypt (El-shoura, Gouda 1, Gouda 2, Shalakani, Dayer El-Berka and El- Wadi Drain) were determined and the average concentrations were (139.5, 166.0, 138.8, 188.5, 263.3 and 217.8) respectively [21]**.**

Abdel-Satar et al., (2010) [18] found that sediment samples collected from (Lake Qarun in El-Fayoum Province, Egypt revealed that zinc levels in the samples were 161.3, 145.5, 190.3, 143.0, 115.8 and 131.0 µg/g in site 1,2,3,4,5 and 6 respectively.

The present results showed elevated zinc concentrations during winter season which exceeding the acute and chronic guidelines cited by United States Environmental Protection Agency (USEPA), (1997) [28] for marine sediment (124µg/g) where Zn are mainly associated with fertilizers and pesticides**.**

The concentrations of iron metal determined in the sediment samples which are collected from Wadi El-Rayan Lakes in El-Fayoum Governorate during 2010/2011 were shown in Table 1. and figure 2. The concentrations of iron in the sediment samples which are collected from Wadi El-Rayan Lakes in El-Fayoum Governorate during 2010/2011 were in average of 5.254±0.299. In the same manner, iron levels were determined in sediment samples collected from Wadi El-Rayan Lakes in El-Fayoum Goverenrate in average of 2.834, 2.729, 2.446, 2.723, 2.502 and1.900 in sites 1,2,3,4,5,and 6 respectively [16].

Abdel-Satar et al., (2010) [18] recoreded that the mean iron concentrations in sediment samples collected from Lake Qarun in El-Fayoum Province, Egypt were 2.69, 2.69, 2.7, 2.59, 2.63 and 2.73 µg/g in site 1,2,3,4,5 and 6 respectively. While the given results were agree with Ali and Fishar, (2005) [22] who investigated that the iron concentration in sediment samples collected from Lake Qarun during summer season at 7 stations in El-Fayoum Provience, Egypt were ranged from the highest values to the lowest one as the following (26. 38 to 11.19 µ g/g) in the east, middle and west sites of the lake respectively.

Iron levels in sediment (µg/g) samples collected from some fish farms in El-Fayoum provience, Egypt (El-shoura , Gouda 1, Gouda 2, Shalakani, Dayer El-Berka and El- Wadi Drain) were 4930, 3800, 2830, 2930, 6570 and 6680 respectively [21]**.** Mansour and Sidky, (2003) [19] recorded that iron concentrations in sediment samples collected from Lake Qarun and Wadi El-Rayan wet land (Egypt) was 814.5(µg/g) .

The concentrations of Cu determined in the sediment samples which are collected from Wadi El-Rayan Lakes in El-Fayoum Governorate during 2010/2011 were shown in table 1 and figure 2. The concentrations of copper in the sediment samples which are collected from Wadi El-Rayan Lakes in El-Fayoum Governorate during 2010/2011 were in average of (0.153 ±0.0081 ppm). The obtained results in our study revealed that the copper levels were above the limit recorded by United State Environmental Protection Agency (USEPA), (1997) in case of chronic and acute quality guidelines (18.7 and 108 µg/g) [28].

As seen in table 1 the copper concentrations sediment samples showed a highly significant difference at $P<0.01$ from the chronic quality guidelines (18.7 µg/g). Cu levels were determined in sediment samples collected from Wadi El-Rayan Lakes in El-Fayoum Goverenrate and the copper concentrations were in average of 71.5, 36.3, 25.3, 33.0, 28.3 and 11.3 in sites 1,2,3,4,5 and 6 respectively [16]**.** Also, the obtained results are in agree with that recorded by Abdou, (2005) [17] who found that the concentration of copper in 50 sediment samples collected from Wadi El-Rayan Protected area lakes, in El-Fayoum provience, Egypt) were in average of 2.03 ppm respectively

Abdel-Satar et al., (2010) [18] who found that the mean copper concentrations in sediment samples collected from Lake Qarun in El-Fayoum Province, Egypt were 70.8, 59.8, 79.3, 54.8, 38.8 and 85.5 µg/g in site 1,2,3,4,5 and 6 respective. While the obtained results were agree with Amaal and Geneid, (2009) [30] who status that the average concentration of Cu in sediment in different sites of Lake Manzalah, Egypt were 24.57, 45.06, 66.13, 90.99, 45.79, 29.44, 27.27 ,26.41 and 34.62 mg/g in 9 sites respectively.

In the same manner, Cu concentration in superfacial sediment µg/g samples collected from the Northern Delta Lakes (Edku, Borollus, Manzalah) were 36.77, 47.49 and 315.36 respectively [4]**.**

While the copper levels were determined in sediment (µg/g) samples collected from some fish farms in El-Fayoum provience, Egypt (El-shoura, Gouda 1, Gouda 2, Shalakani , Dayer El-Berka and El- Wadi Drain) and the results revealed that the mean copper concentrations were 30.5, 30.0, 26.9, 27.0, 46.5 and 39.2 respectively [21].

Also, the results were supported by Ali and Fishar, (2005) [22] who status that the mean copper concentration in sediment samples collected from Lake Qarun during summer season at 7 stations in El-Fayoum Provience, Egypt were ranged from 54.50 to 23.76 µg/g in the east, middle and west sites of the Lake respectively.

The concentrations of manganese determined in the sediment samples which are collected from Wadi El-Rayan Lakes in El-Fayoum Governorate during 2010/2011 were shown in table 1. and figure 2. The concentrations of manganese in the sediment samples which are collected from Wadi El-Rayan Lakes in El-Fayoum Governorate during 2010/2011 were in average of (1.274±0.058 ppm). The obtained results in our study revealed that the manganese levels were above the permissible limit recorded by Persaud et al., 1990 [31] (460-1110 µg/g dry wt). As seen in table 1. the manganese concentrations in sediment samples showed a highly significant difference at $P<0.01$ from the permissible limit recorded by Persaud et al. (1990) [31] as 460-1110 µg/g dry wt.

In the same manner, manganese levels were determined in sediment samples collected from Wadi El-Rayan Lakes in El-Fayoum Goverenrate and the manganese concentrations were in average of 1197.5, 779.3, 602.0, 658.8, 646.8 and 198.3 in sites 1,2,3,4,5,and 6 respectively [16]**.** Also, the obtained results agree with the records which are obtained by Abdel-Satar et al., 2010 [18] who investigated that the mean manganese concentrations in sediment samples collected from Lake Qarun in El-Fayoum Province, Egypt were (1097, 989, 606.3 ,741.8 ,727.3 and 492.3 µg/g in site 1,2,3,4,5 and 6 respectively).

The manganese concentration in superfacial sediment µg/g samples collected from the Northern Delta Lakes (Edku, Borollus, Manzalah) (1390, 850 and 419) respectively [4]**.** In the same manner, the mean concentration of manganese (mg/kg) in sediment samples collected from Wadi El- Rayian natural wet land in El-Fayoum provience, Egypt were determined and the average concentrations were 394 [19].

Also, the distribution of manganese in sediment (µg/g) samples collected from some fish farms in El-Fayoum provience, Egypt (El-shoura, Gouda 1, Gouda 2, Shalakani, Dayer El-Berka and El- Wadi Drain) were determined and the results revealed that the manganese levels were 617, 468, 334, 402, 637 and 584 respectively [21].

Sediment samples collected from (Burullus Lagoon and nearby Mediterranean Sea in many stations) were analyzed for the presence of manganese and the records were ranged from 56.27 to 85.14 (µg/g) [32]**.** Also, sediment samples collected from Eight Stations from El-Sallum to Sidi-Kreer along Egyptian Mediterranean Coast were determined to evaluate the levels and distribution of manganese and the results showed that the Manganese levels were 57.953 µg/g dry weight [33].

In the same way, the levels of manganese were investigated in sediment in different sites of Lake Manzalah, Egypt and the metal concentration in the samples were 1.07, 1.18, 1.25, 1.33, 0.99, 0.96,0.74, 0.63 and 1.27 mg/g in 9 sites respectively [30].

Metal contents in tissues of fish:

The given results illustrated that lead levels were detected in the fish samples (Oreochromis niloticus and Claries lazera fish) which are collected from Wadi El-Rayan Lakes in El-Fayoum Goverenrate during winter and summer seasons were in average of (0.003±0.0003 and 0.005±0.0003) ppm in Tilapia Nilotica and (0.006±0.0003 and 0.005±0.0006) ppm in catfish during winter and summer seasons respectively.

As seen in table 1. the lead concentrations in tissues of Tilapia and catfish samples showed a highly significant difference at $P<0.01$ from the permissible limit set by Egyptian Organization for Standardization (EOS), (1993) (2 µg/g) during winter season but during the summer season the lead concentrations in Tilapia fish muscles showed a highly significant difference at $P<0.01$ from the permissible limit set by Egyptian Organization for Standardization (EOS), (1993) (2 µg/g) but in case of catfish muscles samples showed significant difference at $P<0.05$ from the permissible limit set by Egyptian Organization for Standardization (EOS), (1993) (2 µg/g) [14]. Catfish species showed a more accumulation of lead than Tilapia species during winter season but in case of summer season the concentrations were the same in Tilapia and catfish samples these observations are mainly due to the different fish habitat and the influence of the surrounding ecosystem status. These results are coincidence with that reported by Abdel-Baky et al., 1998 [34] for Tilapia zilli and Claries lazera fish of lake Manzalah.the results were supported by Abdou, 2005 [17] who investigated that the concentrations of lead in 50 fish tissue samples of tilapia nilotica collected from Wadi El-Rayan Protcted area (WRPA) lakes –Egypt were (0.157±0.053 ppm).

In the same way, the analysis of lead concentrations in Tilapia nilotica fish samples collected from some fish farms in El-Fayoum Governorate, Egypt ((El-shoura, Gouda 1, Gouda 2, Shalakani were (6.5, 5.5, 4.8 and 5.4, µg/g dry wt.) [21]**.** Ali and Fishar (2005) [22] recorded that the average lead concentration in Tilapia fish samples collected from Lake Qarun during summer season at 7 stations in El-Fayoum Provience, Egypt were ranged from the highest values to the lowest one as the following (7.86, 6.47, and 5.82 µg/g in the east, middle and west sites of the lake) respectively.

In the same way, the analysis of lead concentrations in Tilapia nilotica fish samples collected Egyptian fish farms revealed that the average concentration of lead were (1.52±0.02 ppm) [3]**.** Also the results were supported by Labib et al., 2007 [35] who investigated that the mean concentration of lead (ppm) in Tilapia nilotica and Claries Lazera fish samples caught from different districts of Qena Provience (N.Hamady, Qena, Kous, Luxor and Esna) were (0.53,0.69, 1.12, 0.60 and 0.47) and (0.26, 0.31, 0.28, 0.37 and 0.27) respectively.

Also, the results were agree with Khadiga, 2010 [25] who recorded that the concentration of lead (ppm) in Claries lazera fish samples caught from nine districts in Beni Suef Governorate were in average of 2.36, 1.48, 2.33, 2.26, 2.698, 3.43, 2.808, 2.553 and 1.92 in Beni Suef city, El-fashn district, Beba district, Somosta district, Ehnasia district, El-wasta district, Naser district, Bayed El-arab district and Sanor district respectively.

The concentrations of cadmium determined in the fish samples (Oreochromis niloticus and Claries lazera fish) which are collected from Wadi El-Rayan Lakes in El-Fayoum Goverenrate during winter and summer seasons were shown in Table 1 and figure 2.

The given results illustrated that Cd levels were detected in the fish samples (Oreochromis niloticus and Claries lazera fish) which are collected from Wadi El-Rayan Lakes in El-Fayoum Goverenrate during winter and summer seasons were in average of (0.003±0.0007 and 0.004±0.0002) ppm in Tilapia nilotica and (0.002±0.0002 and 0.006±0.0009) ppm in catfish during winter and summer seasons respectively. These recorded limits of Cd were above the limit recorded by Egyptian Organization for Standardization (EOS), (1993) (0.5 µg/g) [14].

As seen in table 1, the cadmium concentrations in tissues of Tilapia and catfish samples showed a highly significant difference at $P<0.01$ from the permissible limit set by Egyptian Organization for Standardization, (EOS) (1993) [14] (0.5 µg/g) during winter season and summer season. The obtained results revealed that the cadmium levels in Tilapia and catfish tissues were much higher in summer season than in winter season. Catfish species showed a more accumulation of cadmium than Tilapia species during summer season but in case of winter season the concentrations were much higher in Tilapia than in catfish samples these observations are mainly due to the different fish habitat and the influence of the surrounding ecosystem status.

These results are coincidence with that reported by Abdel-Baky et al., (1998) [34] for Tilapia zilli and Claries lazera fish of lake Manzalah. the results were supported by Abdou, (2005) [17] who found that the concentration of cadmium in 50 fish tissue samples of Tilapia nilotica collected from Wadi El-Rayan Protcted area lakes– Egypt was (0.11±0.035 ppm).

In the same way, the analysis of cadmium concentrations in Tilapia nilotica fish collected from some fish farms in El-Fayoum Governorate, Egypt ((El-shoura, Gouda 1, Gouda 2, Shalakani were 2.2, 2.7, 1.9 and 2.0 µg/g dry wt. [21]. In the same way, the analysis of cadmium concentrations in Tilapia nilotica fish samples collected Egyptian fish farms revealed that the average concentration of cadmium were (21±0.05 ppm) [3]**.**

Concentration of cadmium were determined in muscles samples of three fish species (Oreochromis niloticus, Tilapia zilli and Claries gariepinus) in different sites of Lake Manzalah ,Egypt and the results revealed that the samples contain cadmium in a level of (1.17, 1.33 and 0.94), (1.19, 1.12 and 1.17), (1.49, 2.05 and 1.89), (1.37, 1.41 and 1.14) and (1.44, 1.68,1.05 and 76.13 µg/g) in five sites in the three fish species respectively [30].

Concentrations of metals Cd, Pb, Fe, and Zn in tissues of Tilapia nilotica and Claries lazera fish of The concentrations of zinc metal determined in the fish samples (Oreochromis niloticus and Claries lazera fish) which are collected from Wadi El-Rayan Lakes in El-Fayoum Goverenrate during winter and summer seasons were shown in Table 1. and figure 2. The given results illustrated that zinc levels were detected in the fish samples (Oreochromis niloticus and Claries lazera fish) which are collected from Wadi El-Rayan Lakes in El-Fayoum Goverenrate during winter and summer seasons were in average of (0.458±0.079 and 0.199±0.026) in Tilapia nilotica and (0.795±0.123 and 0.401±0.265) in catfish during winter and summer seasons respectively. These recorded limits of zinc were above the limit recorded by Egyptian Organization for Standardization (EOS), (1993) (40 µg/g) [14].

As seen in table 1. the zinc concentrations in tissues of Tilapia fish samples showed a highly significant difference at $P<0.01$ from the permissible limit set by Egyptian Organization for Standardization (EOS), (1993) (40 µg/g) during winter season and summer season but in case of and catfish species showed a highly significant difference at $P<0.01$ from the permissible limit set by Egyptian Organization for Standardization (EOS), (1993) (40 µg/g) during winter season only but no significant difference in the summer season from Egyptian Organization for Standardization (EOS), (1993) [14].

The obtained results revealed that zinc concentrations in Tilapia and catfish were much higher in winter season than in summer season. Catfish species showed a more accumulation of zinc than Tilapia species during winter season and summer seasons. The results agree with Authman and Abbas, (2007) Who found that the average Zn concentration in water (mg/l) and Tilapia fish muscle (mg/kg) samples collected from Qarun Lake in El-Fayoum Provience, Egypt were 0.18, 0.096, 13.56 and 3.00 in spring, summer, autumn and winter seasons respectively [36].

The analysis of zinc concentration in Tilapia fish samples collected from Lake Qarun during summer season at 7 stations in El-Fayoum Provience, Egypt were ranged from the highest values to the lowest one as the following (26.29, 25.92 and 22.83 µg/g in the east, middle and west sites of the Lake) respectively [22]**.**

Also, Tilapia nilotica and Claries lazera fish samples caught from different districts of Qena Provience (N. Hamady, Qena, Kous, Luxor and Esna) were determined to evaluate the level and distribution of zinc and the analysis showed that the zinc levels were ranged as 6.47, 9.38, 10.05, 9.26 and 8.60) and (3.90, 3.58, 2.90 and 2.69) respectively [35]**.** While the distribution of zinc were investigated in Oreochromis niloticus fish muscles collected from the Northern Delta Lakes (Edku, Borollus, Manzalah) and the metal concentrations in the samples ranged from (0.050, 9.88 and 217.334 respectively [4]**.**

The analysis of muscles of catfish which are collected from seven districts of El Ebrahimia canal (Beni-Sueif, El-fashn, Beba, Somosta, Ehnasia, El-wasta and Naser) and two districts of the Nile River east (Bayed El-arab and Sanor) revealed that the Zn levels are 4.146, 6.325, 10.441, 7.419, 6.08, 3.293, 9.475, 6.083 and 3.615 ppm (mg/l) respectively [25]**.** Also the results were supported by Fatma, (2008) [37] who found that the zinc concentration in muscle of two fish species (Oreochromis niloticus and Lates Niloticus) samples collected from different Khors of Lake Nasser, Egypt (El-Ramla, Kalabsha, Korosko and Tushka) were (13.80 and 11.63), (9.11 and 8.63), (10.33 and 8.80) and (15.25 and 12.12 mg/kg) respectively.

The mean Zinc concentration (ppm) in the Tilapia fish samples collected from the River Niger with in the vicinity of the Ajaokuta Iron and Steel industry in Kogi State of Nigeria were 9.3, 10.2 and 10.3 in (site A Geregu, site B Complex site and site C Itobe bridge) respectively and in catfish samples the Zn concentration were 12.2, 10.3 and 11.8 respectively [38]**.**

The concentrations of iron metal determined in the fish samples (Oreochromis niloticus and Claries lazera fish) which are collected from Wadi El-Rayan Lakes in El-Fayoum Governorate during winter and summer seasons were shown in Table 1. and figure 2. The given results illustrated that iron levels were detected in the fish samples (Oreochromis niloticus and Claries lazera fish) which are collected from Wadi El-Rayan Lakes in El-Fayoum Goverenrate during winter and summer seasons were in average of (1.530±0.169 and 0.629±0.171) ppm in Tilapia nilotica and (0.319±0.067 and 0.295±0.097) ppm in catfish during winter and summer seasons respectively.

As seen in table 1, iron concentrations in tissues of Tilapia fish samples showed a highly significant difference at $P<0.01$ from the permissible limit set by Egyptian Organization for Standardization (EOS), (1993) (30 µg/g) during winter and summer season, but in case of Claries lazera fish species showed a highly significant difference at $P<0.01$ from the permissible limit set by Egyptian Organization for Standardization (EOS), (1993) (30 µg/g) in winter season and no significant difference from the permissible limit set by Egyptian Organization for Standardization (EOS), (1993) (30 µg/g) in summer season [14].

Tilapia species showed a more accumulation of iron than catfish species during winter season and summer season., the concentrations of iron in Tilapia and catfish samples were much higher in winter season than in summer season. In the same manner, Ali and Fishar, (2005) [22] found that the mean iron concentration in Tilapia fish samples collected from Lake Qarun during summer season at 7 stations in El-Fayoum Provience, Egypt were ranged from the highest values to the lowest one as the following 42.39, 22.26 and 19.61 µ g/g in the east, middle and west sites of the Lake) respectively.

Also, the obtained results were agree with Amaal and Geneid, (2009) [30] who found that the concentrations of iron in muscles samples of three fish species (Oreochromis niloticus, Tilapia zilli and Claries gariepinus) in different sites of Lake Manzalah, Egypt were (70.26, 61.99 and 70.32), (76.35, 68.19 and 81.56), (83.82, 78.70 and 67.23), (62.61, 57.39 and 67.38), (84.96, 72.57 and 76.13 µg/g), in five sites in the three fish species respectively. While Fatma, (2008) [37] revealed that iron concentration in muscles of two fish species (Oreochromis niloticus and Lates Niloticus) samples collected from different Khors of Lake Nasser, Egypt (El-Ramla, Kalabsha, Korosko and Tushka) were (53.22 and 52.75), (67.01 and 63.38), (55.39 and 48.22) and (78.00 and 68.81 mg/kg) respectively.

Also, iron levels were determined in Oreochromis niloticus fish muscles samples collected from the Northern Delta Lakes (Edku, Borollus, Manzalah) and the analysis revealed that the iron concentration in the samples ranged as (75.19, 21.44 and 256.66) respectively [4]**.** Also, the results were supported by Bolawa and Gbenle, (2010) [39] who found that iron levels in Tilapia nilotica fish samples collected from Makoko and Carter Bridge Rivers in Lagos, Nigeria were 18.96 and 1.74 mg/g respectively**.**

The concentrations of copper metal determined in the fish samples (Oreochromis niloticus and Claries lazera fish) which are collected from Wadi El-Rayan Lakes in El-Fayoum Goverenrate during wnter and summer seasons were shown in Table 1. and figure 2. The given results illustrated that copper levels were detected in the fish samples (Oreochromis niloticus and Claries lazera fish) which are collected from Wadi El-Rayan Lakes in El-Fayoum Goverenrate during winter and summer seasons were in average of (0.014±0.002 and 0.0198±0.0014) ppm in Tilapia nilotica and **(**0.011±0.0006 and 0.0099±0.001) ppm in Catfish during winter and summer seasons respectively.

As seen in table 1. the copper concentrations in tissues of Tilapia samples showed a highly significant difference at P<0.01 from the permissible limit set by Egyptian Organization for Standardization (EOS), (1993) (20 µg/g) during winter season only but during the summer season the copper concentrations in Tilapia fish muscles have no significant difference from the permissible limit set by Egyptian Organization for Standardization (EOS), (1993) (20 µg/g) but in case of catfish muscles samples showed a highly significant difference at P<0.01from the permissible limit set by Egyptian Organization for Standardization (EOS), (1993) (20 µg/g) during winter and summer season [14].

The obtained results revealed that the copper levels in Tilapia and catfish tissues were much higher in summer season than in winter season. Tilapia nilotica fish species showed a more accumulation of copper than catfish species during winter and summer seasons and that results were supported by Authman and Abbas, (2007) [36] who status that copper levels were (17.85 mg/kg) and (5.93) in samples of Tilapia fish species which are collected from Lake Qarun in El-Fayoum provience, Egypt during summer and winter seasons respectively. Also, the given results were agree with Abdou, (2005) **[17]** who recorded that the examination of 50 Tilapia fish species samples collected from(Wadi El-Rayan Protected Area lakes, in El-Fayoum Provience, Egypt revealed that the average concentrations of copper 0.697 ppm respectively**.**

Copper level in Tilapia fish species samples collected from Bolti Lake was 1.65 µg/g [19]**.** Also, the results were supported by Ali and Amaal, (2005) [21] who status that copper levels were determined in Tilapia fish species (µg/g) samples collected from some fish farms in El-Fayoum provience, Egypt (El-shoura, Gouda 1, Gouda 2, Shalakani) and the results revealed that the mean copper concentrations were (10.3, 11.6, 8.2 and 9.3) respectively.

In the same way**,** one hundred and sixty five fresh water fish Tilapia nilotica (115) and Claries lazera (35) were collected from five districts of Qena Governorate, Upper Egypt (N.Hamady, Qena, Kous, Luxor and Esna were analyzed quantitatively for the presence of copper and the results revealed that The mean concentration of copper (ppm) were(1.53, 1.44, 1.11, 1.03 and 0.95) and(0.47, 0.49, 0.40, 0.35 and 0.39) respectively [35].

Also**,** Shakweer and Abbas, (2005) [40] found that the mean concentration of Cu in Tilapia fish samples collected from Edku Lake were 4.47 to 19.33 (mg/kg) in the same manner**.** The copper levels in muscle of two fish species (Oreochromis niloticus and Lates Niloticus) samples collected from different Khors of Lake Nasser, Egypt (El-Ramla, Kalabsha, Korosko and Tushka) were (2.82 and 2.63), (1.95 and 1.32), (3.11 and 2.90) and (3.50 and 3.00 mg/kg) respectively [37].

Also, the given results were agree with Authman and Abbas, (2007) [36] who found that the average copper concentration in Tilapia fish muscle(mg/kg) samples collected from (Qarun Lake in El-Fayoum Provience, Egypt were 12.75, 17.85, 9.94 and 5.93 in spring, summer, autumn and winter seasons respectively [36]**.**

The concentrations of manganese metal determined in the fish samples (Oreochromis niloticus and Claries lazera fish) which are collected from Wadi El-Rayan Lakes in El-Fayoum Goverenrate during winter and summer seasons were shown in table 6. and figure 12. The given results illustrated that manganese levels were detected in the fish samples (Oreochromis niloticus and Claries lazera fish) which are collected from Wadi El-Rayan Lakes in El-Fayoum Goverenrate during winter and summer seasons were in average of (0.038±0.013 and 0.015±0.008) ppm in Tilapia nilotica and (0.009±0.001 and 0.009±0.002) ppm in Catfish during winter and summer seasons respectively.

These recorded limits of manganese were above the limit recorded by Food and Agricultural Organization/World Health Organization (FAO/WHO), (1999) (2-9 µg/g) in case of Tilapia nilotica but in Claries lazera the recorded limits of manganese were within the limit recorded by Food and Agricultural Organization/World Health Organization (FAO/WHO), (1999) (2-9µg/g).

As seen in table 1. the manganese concentrations in tissues of Tilapia samples showed no significant difference from the permissible limit set by Food and Agricultural Organization/World Health Organization (FAO/WHO), (1999) (2-9µg/g during winter season and summer season but in case of catfish the manganese concentrations in muscles showed a highly significant difference at $P<0.01$ from the permissible limit set by Food and Agricultural Organization/World Health Organization (FAO/WHO), (1999) (2-9µg/g) in winter season and showed significant difference at $P<0.05$ from the permissible limit set by Food and Agricultural Organization/World Health Organization (FAO/WHO), (1999) (2-9 µg/g) in summer season Tilapia fish species showed a more accumulation of manganese than catfish species during winter and summer season. The obtained results revealed that the manganese levels in Tilapia fish were much higher in winter season than in summer season but in case of catfish the manganese levels is the same in winter and summer seasons [41].

In the same way, the analysis of manganese concentrations in Tilapia nilotica fish samples collected from some fish farms in El-Fayoum Governorate, Egypt (El-shoura, Gouda 1, Gouda 2, Shalakani were (33.0 , 22.1 , 24.1 and 21.3) respectively [21]**.** Also, Ali and Fishar, (2005) [22] revealed that the average manganese concentration in Tilapia fish samples collected from Lake Qarun during summer season at 7 stations in El-Fayoum Provience, Egypt were ranged from the highest values to the lowest one as the following (5.87, 8.82, 5.47 µg/g in the east, middle and west sites of the Lake) respectively.

Also, the results were agree with Khadiga (2010) [25] who recorded that the concentration of manganese (ppm) in Claries lazera fish samples caught from nine districts in Beni Suef Governorate were in average of 0.728, 1.205, 1.67, 1.116, 0.883, 0.83, 0.173, 1.41 and 0.968 in Beni Suef city, El-fashn district, Beba district, Somosta district, Ehnasia district, El-wasta district, Naser district, Bayed El-arab district and Sanor district) respectively.

In the same way, the levels of manganese were investigated in muscles samples of three fish species (Oreochromis niloticus, Tilapia zilli and Claries gariepinus) in different sites of Lake Manzalah, Egypt and the metal concentration in the samples were ranged from (5.47, 4.48 and 4.57), (4.62, 4.11 and 4.57), (5.63, 5.43 and 4.58), (4.31, 4.11 and 4.20), (5.49, 5.10 and 5.17 µg/g) in five sites in the three fish species respectively [30].

Also, the results were supported by Saeed and Shaker (2008) [4] who found that manganese concentration in Oreochromis niloticus fish muscles samples collected from the Northern Delta Lakes (Edku, Borollus, Manzalah) were (1.98 ,0.23 and 22.98 µg/g) while the mean concentration of manganese (µg/g) in Tilapia fish species samples collected from Bolti Lake were 3.67 [19]**.**

In the same way, the values of manganese accumulation in Tilapia fish species muscle samples collected from Nasser Lake, Egypt were 0.026(µ/g)**.**

The obtained results were agree with Bolawa and Gbenle, (2010) [39] who revealed that the manganese concentrations in Tilapia nilotica fish samples collected from Makoko and Carter Bridge Rivers in Lagos, Nigeria were 0.45 mg/g and 0.87 respectively.

Conclusion

The high concentrations of the metals reported in this study are evident in the water, aquatic plant, sediment and fish samples taken from Wadi El-Rayan, which contains high levels of trace metals.

An increased concentration of some metals in water above the national and international limits may have health risk to several rural communities that rely on the canal as source of domestic water.

Accumulation of high concentrations of metals in the fish tissues lead to a high mortality rate, and cause many biochemical and histological alterations in surviving fish, which rendering surviving fish unfit for human consumption.

High concentrations of these trace metals may results from agricultural sources, and other anthropogenic activities that produce industrial, transport and domestic waste, as well as accidental pollution incidents.

More research should be done to discover the possible sources and the quantitative distribution of the different heavy metals in surface waters.

A system to monitor heavy metals in water, plant and fish tissues is necessary as they are an environmental risk for human and fish health.

We can concluded that there is an environmental exposure to Cd, Pb, Fe, Mn, Zn and Cu in water, aquatic plant and sediment as macroenvironment and in the microenvironment of the Tilapia nilotica and catfish due to the domestic, agricultural and industrial wastes, either partially or without treatment are being discharged into surface water.

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