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Determination of Some Heavy Metals in Tissues of Binni *Mesopotamichthys sharpeyi* and Water in Al-Dalmaj Marsh/Iraq

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Abstract: The study was conducted in Al-Dalmaj marsh, considered one of the most important wetlands at the national and regional level and represents the most critical environment to form a good stock of Binni *Mesopotamichthys sharpeyi* in Iraq. The study assessed heavy metals in water and *M. sharpeyi* by detecting accumulation of (Nickel, Cadmium and Lead) in the tissues of gills, liver, and small intestines during the summer and winter seasons 2022-2023.

The study results showed a high concentration of heavy metals in the water during summer compared to winter. Nickel levels ranged (0.19 ±0.627, 0.20 ±0.531) in water for both stations. The highest concentration was (1.339 mg/L) in suspended phase during summer, and ND in dissolved phase in winter, while Cadmium rates were (0.25±0.948, 0.17±0.478) in both stations respectively, the highest concentration was (1.827 mg/L) in suspended phase of station 1 during summer. Both stations ' lead rates were (0.39±1.455, 0.09±1.117). (3.176 mg/L) was the highest concentration in the suspended phase of station 1 during summer, while (0.121 mg/L) was the lowest in the suspended phase in winter.

The results showed a sequence of concentrations of heavy metals in *M. sharpeyi* organs: Gills > Liver ≥ Small Intestines. The highest concentration rate of Nickel (4.109 & 3.692 mg/g) was recorded in small intestines and liver, respectively, during winter, the lowest rate (3.057 mg/g) was recorded in the gills during summer, the total of sedimentation rate of Ni in the liver and intestines was (3.726 mg/g), whereas (3.114 mg/g) in gills. Cadmium recorded an equal value of (0.957 mg/g) representing the highest percentage in the small intestines for both seasons. The highest concentrations (0.906 mg/g) in liver during summer. The total sedimentation rate of Cd in liver and small intestines was (0.852 mg/g), while (0.738 mg/g) was in gills. Lead recorded a high significant rate reaching to (8.501 mg/g) in gills during summer, followed by (6.115 mg/g) and (5.891 mg/g) in the liver and small intestines, respectively. Generally, lead reached the highest value for all elements assessed in fish at (8.501 mg/g) in the gills during summer, while (5.027 mg/g) was the highest rate in the liver during winter, and (3.709 mg/g) was the lowest rate in small intestines during winter. The total sedimentation rate of Pb in liver and small intestines was (5.185 mg/g), and (6.41 mg/g) was in the gills. Cadmium was recorded above the permissible (0.05 mg/g) limit by FAO [25] in the small intestine and liver, whereas lead exceeded the allowable limits (5 mg/g) by FAO/WHO [26]. Accordingly, the intake of these organs is unsafe for humans, and the registration of these high values poses a risk to the survival of this species as it can cause the death of fish in their environment under certain conditions.

Keywords**:** *Binni, Heavy Metals, Water, Nickel, Cadmium, Lead, Al-Dalmaj Marsh, Iraq*

1. Introduction

The Iraqi marshes represent one of the most important wetland ecosystems in the Middle East, and have environmental, social and cultural importance as they support a huge natural diversity, and a social ecosystem for the locals, as they depend on the natural resources through bird hunting, fishing, reed cutting, and buffalo breeding [31]. Being known for its high productivity, as it provides habitats for birds, fish, and other fauna, it is the most important natural source for fishing, bird monitoring and wildlife in Iraq [3]. Al-Dalmaj wetlands are considered important at the national and regional levels [24; 57],. The environment of Al-Dalmaj includes pure water and submerged plants that provide excellent protection for fish, provide a high percentage of oxygen, and represent the most important wetlands in Iraq for *M. sharpeyi* appears to be the last healthy stock in the Al-Dalmaj marsh found in southern Iraq and may be an important source for the rehabilitation of this species in the marshes of southern Iraq [46]. Fishing in the marshes is one of the significant sources of fish in the Iraqi market, since it is an essential part of the Iraqi family diet [46].A variety of pollutants affect the Tigris and Euphrates River basins, the most important of which are related to water quality, such as sewage, salinity and nutrient pollution from agricultural runoff, irrigated agricultural fields return water to estuaries and wastewater carries fertilizers, pesticides, and salts that have been washed away by the soil [12]. Some pollutants may be from agricultural residues, such as mercury in grain fogging, human activities, wastewater discharged into water, other activities involving the release of heavy metals [42]. Therefore, the aquatic environment can be exposed to many substances or elements that are introduced directly or indirectly, and lead to harmful effects on aquatic organisms and human health [32]. Fish are widely used to assess the health of aquatic ecosystems due to the accumulation of pollutants in the food chain where they are exposed to adverse effects and death in aquatic systems [28]. In addition to their use as bioindicator for detecting heavy metals [35], fish is also one of the most important biological groups found in aquatic systems because it constitutes a food source for living organisms and contains many protein substances [33].

M. sharpeyi are found in southern part of the Tigris and Euphrates rivers in Syria, Iraq, and Iran, but are now absent from most of their distribution areas [50]. It was discovered

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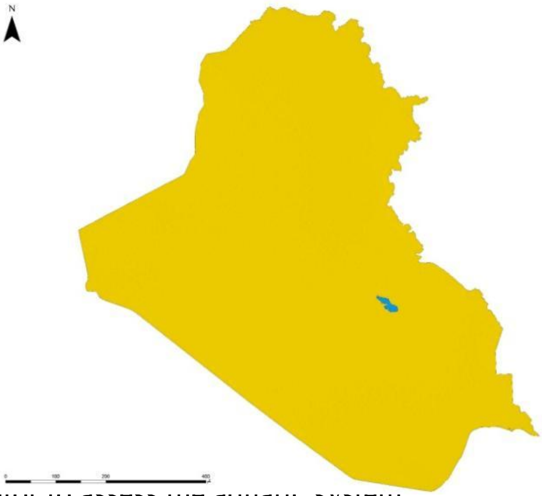


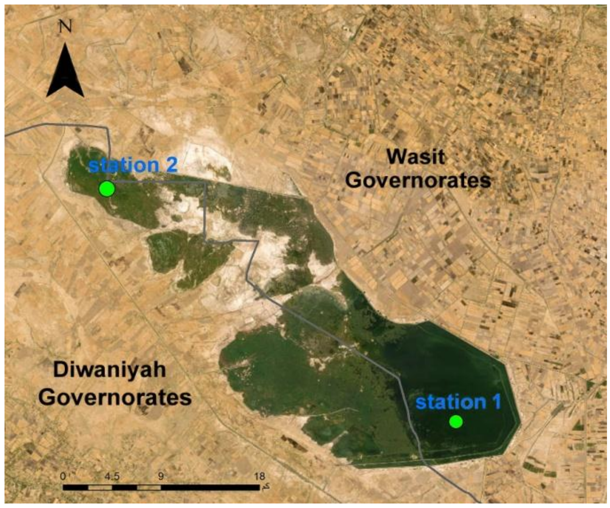


Figure 1. Showing the study area; green symbol represents the study stations of water samples**[46]**

Description of the Study Area
Al-Dalmaj Marsh

Al- Dalmaj marsh or Hor Al-Dalmaj Marsh (Figure. 1) is a largely isolated marsh located 65 km northeast of Diwaniyah {ity and 35 km southeast of Kut City with 50 km long and 10 km wide [17]. Its divided into three sections, of which the central section is part of the functional hydrological system in conjunction with the Al-Dalmaj Wetlands, considered one of Iraq's main lakes [45]. The total storage capacity of the marsh is 429 million m^3 of water [52]. It is important aquatic environments in the central parts of Iraq located within the latitudes (N 32° 05′ to 32° 23′) and longitudes (E 45° 10′ to 45° 38′) [27]. Al-Dalmaj wetlands include diverse habitats represented by terrestrial ranging from arid regions to real desert, a large part of the water that divides into an open water lake reaching depths exceeding 2m and marsh with dense reeds and shallow water (less than 1 m) [13& 46]. The southern part of the marsh includes mainly clay surfaces, with Phragmites and Typha as well as submerged plants with large dry land and scattered ground shrubs [46].

2. Methodology
Sample Collection:

The samples were collected during August 2022, to February, 2023, eight samples of fish were collected (males and females) from the Al-Dalmaj marsh, the samples were obtained from hunters in the area, they were fresh. fish identified directly based on [19& 20**]**. The samples were placed in containers containing crushed ice until they reached the laboratory, then dissected by making a longitudinal incision in the body for taking the organs (Gills, Liver and Small intestines) for study then concentration of heavy metals was measured. Two stations have been identified for water sampling from the Al-Dalmaj marsh, GPS coordinates (N32° 8'38.86"; E45°35'53.16") and (N32°20'34.34"; E45°15'1.93") were measured using GPS (Fig. 1). Water samples were collected from under the surface water with a depth of (30 cm) to detect heavy metals at a rate of three repeaters for each sample, using 5-liter polyethylene containers that were washed with dilute hydrochloric acid (10%) and then rinsed with distilled water, then kept in refrigerator.

Extraction of Heavy Metals

Dissolved Heavy Metals: water samples were filtered for a volume of 2 L for each sample, by three repeaters of the stations using Filter paper 0.45 µm, after washing it with diluted nitric acid (0.5 N) and deionized water, then dried at 60 ^{o}C for 12 h and weighed, the filtered water samples were concentrated by passing them through the Ion exchange column (2X50) cm and containing a resin type (Chelex-100) size (50-100) at a speed of 5 ml / min, then heavy metal ions were removed using 80 ml of concentrated HNO3 Nitric acid, 10 ml of deionized water, and left the solution to complete the dissolution, then completed the final volume to 25 ml with deionized water, and stored in polyethylene bottles [11].

Suspended Heavy Metals: the filter papers used in the filtration of water samples were dried at temperature of 80C°, for 24 h, then weighed for the purpose of extracting the amount of stuck, followed by the extraction of ions of heavy element particles with a weight of (0.5) g of the dry sample and placed in special containers then added 6 ml of a mixture of concentrated Hydrochloric Acid HCL and concentrated nitric acid HNO3 in a ratio of (1:1) and heated at 80^{o}C and evaporated to near drying, then added 4 ml of a mixture Perchloric Acid HCIO4 and Hydrofluoric HF concentrates (1:1), the solution was evaporated to near drying and dissolved the precipitate by adding 20 ml of diluted nitric acid (0.5 N) and left for 10 minutes, sample was separated by a centrifuge for 20 minutes at a speed of 3000 cycles/ minute, the solution was taken and placed in a volumetric vial of 25 ml, either the precipitate was washed with deionized water, and washing water was added to the volumetric vial after separating the precipitate and completing the volume to 25 ml [60], samples then were preserved in polyethylene bottles.

Fish tissues: after collected and preserved samples, they were prepared to extract 1 g dry weight from the tissues (Gills, Liver and Small intestines), and dried using a convection oven at a degree of 80^{o}C for 24 hours, then grinded and sieved with a sieve holes size of (0.5) and placed in a flask of 250 ml, then added to 6 ml of a mixture of acid HCL (4.5) ml and HNO3 (1.5) ml centers, then heat on a thermal plate with a degree of 80°C, and added 4 ml of mixture of concentrated perchloric acid and hydrofluoric acid (1:1) and evaporate to near dryness, then took the filtrated and completed the volume with deionized water to 25 ml, adopting the method of [**51**] which is used to digest samples for the purpose of measuring heavy elements.

Calculation of the concentration of heavy metals in tissues

$$E_{con} = \frac{A \times B \times df}{D}$$

Whereas: E_{con}: Element concentration in sample (mg/g dry weight); **A**: concentration of the element extracted from the titration curve (mg/L); **B**: Final sample volume (ml); **D**: Dry weight of sample (g); **df**: Dilution Factor, used it as follows:

$$df = \frac{\text{volume of dilution sample solution in mil}}{\text{volume of a liquid taken for dilution in mil}}$$

Measurement of heavy metals in tissues

Heavy element ions in tissues were measured using the Flame Atomic Absorption Spectrophotometer, AA-7000 Shimadzu model, after the standard solution of the examined elements were prepared according to the methods mentioned in [11].

The Statistical Analysis

The results of the study were analyzed statistically using the Statistical Analysis System - [56] to study the effect of different factors on the studied traits according to the design of complete random sectors (RCBD), and significant differences between the averages were compared with the test of the least significant difference (LSD), and the Pearson correlation coefficient was extracted between the different variables. Significant differences were determined at a probability level of $P<0.05$.

Results and Discussion

Heavy metals have received great attention in deferent countries of the world because they tend to accumulate especially in soft and hard tissues such as bones and liver [34]. It is highly toxic and cumulative susceptibility to being non-biodegradable as it does not integrate into the natural cycle of the ecosystem, which represents the main source of pathways of biological interactions, causing accumulation in the organs of living organisms and thus affecting their work [53]. The movement of heavy metals through food chain is the basis for their transformation and transition from the water-soluble form to phytoplankton and their adhesion to suspended molecules, then move to zooplankton to primary and secondary consumers, this transition takes place at different nutritional levels of organisms, then can transfer these elements to humans, who are located at top of the food pyramid [43]. Fish tend to accumulate heavy metals from the water, therefore is considered an entry point for elements contamination in aquatic environment, from which their biological effects resulting from high concentrations of elements are inferred [21]. Like other living organisms, they are affected by the accumulation of heavy metals inside their bodies [63 & 54], and because of their ability to accumulate these elements within their tissues to levels beyond those found in their surroundings through absorption processes along the surfaces of the gastrointestinal tract, liver, and kidneys [10]. They are highly sensitive to toxic substances when compared with invertebrates [2; 64]. Heavy metals most present in fish include Cadmium, Lead, Mercury, Zinc, Copper, Nickel, Cobalt, Molybdenum, Chromium, and Tin, among which the most researched, in relation to fish abnormalities include Cadmium, Copper, Lead, Zinc, Mercury, Chromium. These elements accumulate in aquatic animal tissues and turn toxic, when levels reach certain toxicity limits, the elements are consumed mainly through the gills and digestive tract, and to a smaller extent through the skin [40].

The results of the study showed that the sequence of concentrations of heavy metals in *M. sharpeyi* fish organs as follows: Gills > Liver ≥ Small intestines. The above ranking shows that the gill recorded the highest percentage of accumulation compared with other organs, followed by liver, by virtue of its location and function, exposed directly to water and that the concentration of heavy metals increases with increasing concentrations in water. Both; [30& 44] indicated that gills contained more accumulated heavy metals in fish, followed by the liver, because the gills are in direct contact with the water and the concentration of heavy elements in them increases with the concentrations in water. The gills play an important role in the process of oxygen exchange and are the main site for the absorption of pollutants and chemicals. The presence of heavy metals in gills in high concentrations indicates that the dissolved and suspended phase in the water is a major reason for their entry into the body of fish and then followed by the type of food eaten by fish [4]. The presence of heavy metals in gills indicates the presence of elements in the water surrounding fish, while the presence of heavy elements in liver indicates the long-term accumulation [48]. The results showed higher concentrations of heavy metals in *M. sharpeyi* organs during the summer compared to the winter, this can be due to an increase in concentrations of heavy metals in the water during summer, which led to an increase the concentration of salts of the elements and caused an increase in their accumulation in fish [4].

Heavy Metals in water

Pollutants represented by heavy metals are dangerous to the aquatic environment and these elements enter either naturally or through pollutants resulting from human activities and greatly affect various forms of life in these environments. In addition to that, pollution with heavy metals is not visible compared to other types, for this, it causes many dangers, most notably toxicity to all forms of life in the aquatic environment due to accumulation. As a result, these toxins reach humans as the ultimate consumers of biology [9]. The results of the current study showed a high concentration level of heavy metals in the water of Al-Dalmaj marsh during summer compared to the winter season, in which it decreased. The reason is likely to go back to the rising temperatures in summer, causing release of elements in the water column, as well as increased evaporation rates lead to high concentrations or may be due to the decomposition of organic matter carried out by microorganisms in summer [22]. The concentration of heavy metals in water during winter experienced a significant decrease, it can return to the transformation of the elements continuously, as they do not remain in the water for a long time due to the role of phytoplankton, animals, fish, and aquatic plants, or it can be due to the cessation of some industrial processes or the lack of industrial waste that contains high concentrations of heavy elements. Physicochemical factors play important role in reducing the concentration of elements in water through the process of dissolution inside the bodies and the formation of complexes in association with organic compounds, pH, salinity and other factors have an impact on the readiness and transfer of heavy elements to the aquatic environment, this is confirmed by [7& 55]. The concentrations of nickel, cadmium and lead in the aquatic environment can be attributed to the most important sources. Al-Dalmaj marsh depends on its water coming mainly from the Main Outfall Drain Canal (MOD), which in turn is fed by a network of trocars that bring water from agricultural land extending north towards Baghdad, carrying with it; salts, fertilizers, pesticides, poisons, and other pollutants released from agricultural lands, and water sewage that are not treated properly and discharged in the main rivers arrives with the irrigation water used to irrigate agricultural lands, which eventually slips into the network of sub-puncture channels to reach the Al-Dalmaj marsh through the MOD. Other pollutants may join the water with the extension of the channel south towards the marsh, in addition, the water of agricultural lands surrounding the water body and the lands extending with the canal to reach the water loaded with various elements and pollutants to the Al-Dalmaj, thus these elements enter the living organisms, then food web and move through their levels and gradually accumulate in the neighborhoods that live within this environment or that depend on the aquatic environment for their livelihood, causing serious effects on their bodies. When comparing the seasonal changes of the Ni concentration in the water during summer and winter seasons, the results showed a significant difference in concentration between both stations for dissolved and suspended phases during summer and winter seasons at a significant level $P \leq 0.05$. Ni water rates were recorded at both stations between (0.19±0.627, 0.20 ±0.531). The highest concentration was (1.339 mg/L) in suspended phase of Station 1 during summer compared with winter season. ND of dissolved phase in winter, the results indicate that no significant value between the rates of stations in both seasons (Figure. 2). [6] recorded in the analysis results of the highest value of Ni (2.984) in suspended phase during summer, when studying heavy metals in the water of the Al-Dalmaj marsh. Nickel is one of the necessary elements for living organisms. It plays an important role in the functioning of enzymatic systems as many vital activities cannot occur without it, but it becomes toxic when high concentrations [5]. Studies refer that a large proportion of Al-Dalmaj marsh watershed comes from agricultural lands, indicating that source of heavy metals comes from agricultural fertilizers, pesticides and residues that are randomly disposed of by runoff during rainy seasons [27].

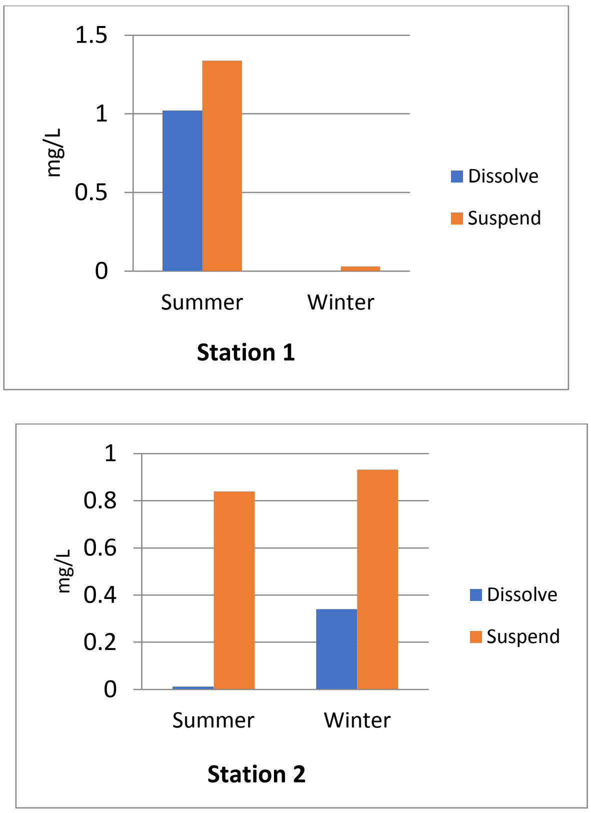


Figure. 2 : Comparing Ni concentrations in dissolved and suspend phases for stations studied during both seasons.

Cadmium, results showed a significant difference in concentration of Cd when comparing the first and second stations in examining the rates of element in both phases, dissolved and suspend during summer at the level of P≤0.05, while no clear differences appeared in the winter, and the rates were (0.25 ±0.948, 0.17±0.478) respectively for both stations. The highest concentration were (1.152, 1.827 mg/L) in suspended phase in the stations 1&2 respectively during the summer, compared to the values in winter season. The results of statistical analysis indicate a significant value was recorded between the rates of both stations and for both seasons (Figure. 3). This is consistent with the results of [8], the lowest concentration of cadmium was (0.1 mg/L) in winter and highest value recorded (2.94 mg/L) in summer. There were significant differences in the level of Cd between the seasons in Al-Dalmaj marsh. All water sites in the marsh are polluted in deferent degrees, which affects aquatic life, Fertilizers, pesticides used in the agricultural fields, household and industrial waste in the marsh catchments are among the main factors for water pollution with heavy metals, these elements can be transmitted from environment and cause a rise in the concentrations of heavy metals in waters of Al-Dalmaj marsh. It also varies according to spatial distribution of minerals, and also water depths [27].

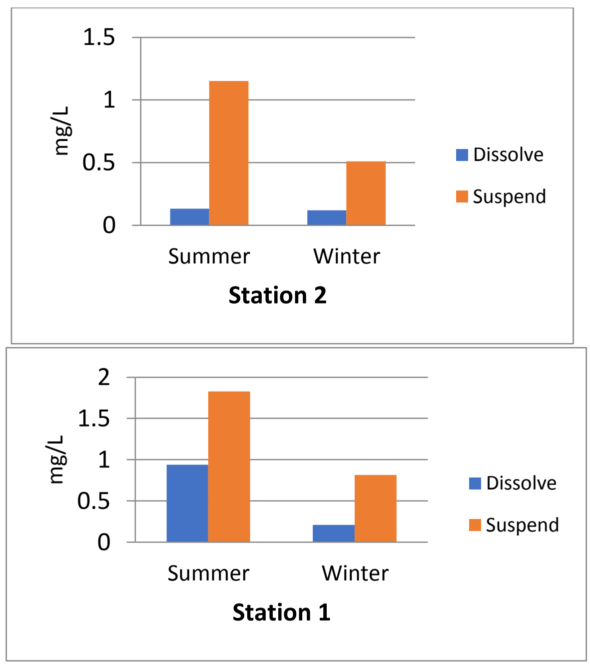
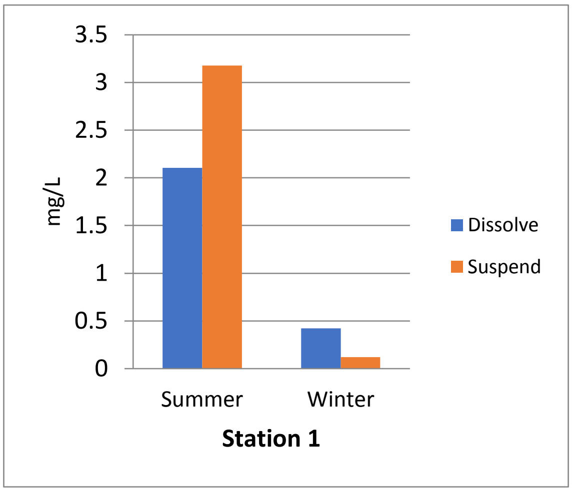


Figure. 3: Comparing Cd concentrations in dissolved and suspend phases for stations studied during both seasons.

Lead result showed a significant difference in concentration between the two stations in dissolved and suspended phases during summer and winter seasons at a significant level P≤0.05. Pb rates were recorded in both stations (0.39 ±1.455, 0.09 ±1.117) respectively. (3.176 mg/L) was the highest concentration in the suspended phase in station 1 during summer compared with winter. At the same time (0.121 mg/L) has a lower value in the suspended step during winter, followed by the dissolved phase in summer, the results of the statistical analysis indicate a significant value between the stations and for both seasons (Figure. 4). [8] refer to Pb rate the lowest value (0.5 ppm) in the winter and the highest value (3.38 ppm) in the summer, the results showed significant differences P<0.05 between the seasons. The concentrations of heavy metals in the Al-Dalmaj marsh show seasonal variation according to the studied sites [6], and [1] mentioned that levels of Pb in Al-Dalmaj marsh water were higher than permissible limit levels, Pb is one of the most important heavy metals because it is the most toxic element [49].



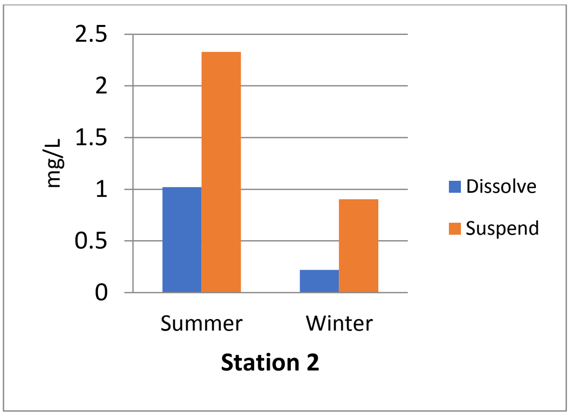


Figure. 4: Comparing of Pb concentrations in dissolved and suspend phases for stations studied during both seasons.

Seasonal changes rate of Nickel (Ni) concentration in fish between summer and winter

The results showed no clear significant differences when comparing the rates of Ni concentrations between tissues of gills, liver and small intestine during the summer and winter at a level of P≤0.05. While the highest concentration of Ni (4.109 mg/g) and (3.692 mg/g) were recorded in small intestine and liver, respectively during winter, the lowest rate (3.057 mg/g) was recorded in the gills in summer (Figure. 5). The total of sedimentation rate of Ni in the liver and intestines was (3.726 mg/g), whereas (3.114 mg/g) in gills. The high percentage of Ni in intestines can be related to the availability of the concentration of the element in the food. Since the percentage recorded an increase in the small intestine, this indicates the entry of Ni through the diet available in surrounding environment, where it accumulates after metabolism. It also indicates that the food available for fish contains a high concentration of Ni, and water has an important role in increasing the concentration of elements and their accumulation in the tissues of living organisms. The accumulation of heavy metals depends on the method of absorption, storage, and excretion [18]. The high percentage of Ni in the liver is due to the long-term accumulation of this element, and the current results are consistent with the mentioned [41 & 38]. The liver of fish is the organ in which high amounts of Ni have accumulated, followed by kidneys, gills and muscles. Age and size are other factors that affect the amount of nickel accumulation in tissues, many scientists have pointed out. [27] found a high concentration of Ni in the tissues of Al-Dalmaj marsh fish, and the concentrations of all heavy metals increase with the increase in fish weights, generating risks to fish, which may harm consumers. Despite the high nutritional levels of heavy metals in the marsh waters, factors such as age, weight, and low-fat content in fish affect the bioaccumulation factor and the effect of spatial variation of heavy metal concentrations in marsh waters.

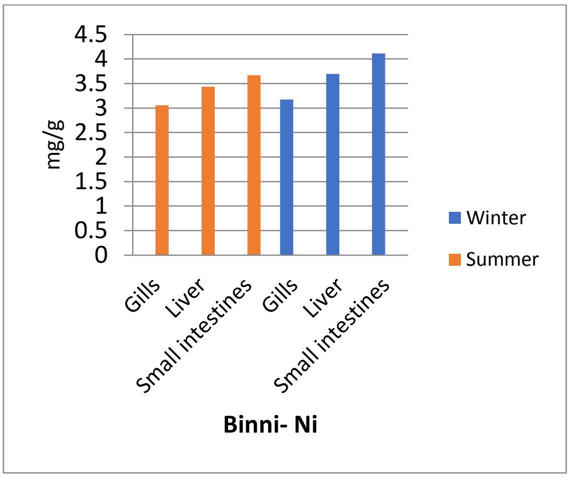


Figure. 5: Comparison Ni concentrations between gills, liver and intestine tissues in both seasons.

Seasonal changes rate of Cadmium (Cd) concentration in fish between summer and winter

The results showed significant differences comparing the concentration rates of Cd between liver tissues. At the same time, there are no clear significant differences between gills and small intestines rates during summer and winter seasons at level of $P \leq 0.05$. The highest rate of Cd concentration in both seasons was recorded at an equal value in small intestines (0.957 mg/g), and the lowest rate of concentration (0.591 mg/g) in the liver during winter, while (0.786 mg/g) was the lowest rate in small intestines during the summer (Figure. 6). (0.852 mg/g) the total sedimentation rate of Cd in liver and small intestines, and (0.738 mg/g) was in the gills. The results are consistent with [59], which indicated in studying the accumulation of heavy elements, the concentration Cd rate came third among the recorded elements, where digestion, absorption and excretion occur in the intestine.

The current study also indicates that Cd accumulated in tissues is lower than Ni and Pb. [29 ; 15] mentioned that cadmium can accumulate in food chain in a lower concentration of mercury or lead. It is a non-essential element that can cause damage tissue and behavioural changes, Cd is considered toxic even at low levels [15; 39 & 29]. The Environmental Health Standards for Cadmium [62] reported that this element is stored in various body tissues. Still, the main site of accumulation in aquatic organisms is the kidneys and liver, along with other tissues, particularly the gills and exoskeleton [23].

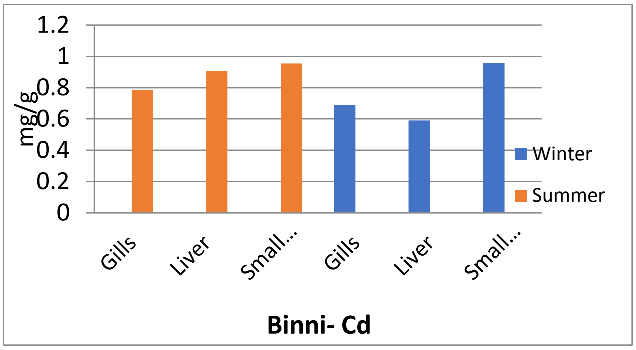


Figure. 6: Comparison of Cd concentrations between gills, liver and intestine tissues in both seasons.

Seasonal changes rate of Lead (Pb) concentration in fish between summer and winter

The study results recorded significant differences comparing the concentrations of Pb element between the gills, liver and small intestine tissues at the level of P≤0.05. (8.501 mg/g) was the highest rate of Pb during summer in the gills, followed by (6.115 mg/g) and (5.891 mg/g) in the liver and small intestines, respectively. In general, Pb reached the highest recorded value for all tested elements at a rate of (8.501 mg/g) in the gills during summer. In comparison (5.027 mg/g) was recorded as the highest rate in the liver during winter season, and (3.709 mg/g) recorded as the lowest rate in the intestines during winter (Figure. 7). The total sedimentation rate of Pb was (5.185 mg/g) in liver and small intestines, and (6.41 mg/g) in the gills.

Our results are consistent with [8], where the highest rate of lead accumulation was recorded at (8.3 ppm) in Common Carp *Cyprinus carpio* during summer. In comparison, the highest rate (5.6 ppm) of lead accumulation was recorded in carp fish during winter in his study of Al-Dalmaj marsh fish. The high levels of lead recorded in the gills are attributed to being the first entrance to water exposure that carries heavy metals, which was pointed out by [58]. The gill surfaces are the first target of waterborne minerals, and the microenvironment of gill surface consists of an epithelial membrane that contains mainly phospholipids covered with a mucous layer [14& 61]. We can point out that the high value of lead accumulated in the gills indicates the absorption of Pb element occurs through water after entering the gills then elements are transferred after several operations to the rest of the body. This is consistent with the results of [27], which found that Pb is one of the most dangerous accumulated minerals in many samples of Al-Dalmaj marsh fish, and is directly proportional to the size of the fish, and warned that there are risks in most fish samples. The additional effect of all minerals measured in the risk index showed that eight of fish samples indicate that they are unfit for consumption. Pb is toxic even at low levels [39]. The levels of heavy metals, including lead, in waters, sediments and fish of the Al-Dalmaj marsh were higher than the permissible limit levels [1], and these heavy elements accumulated in the fish can be transmitted to humans who feed on them [16].

The high lead content in the gills, due to the possibility of adsorption of particles or organic lead to fish gills, and low pH on the surface of the gills (due to the respiration of carbon dioxide) may dissolve lead in soluble form, which can diffuse into the gill tissues [47].

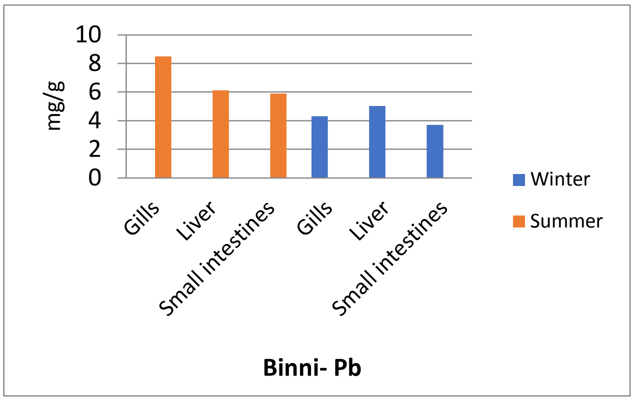


Figure. 7: Comparison of Pb concentrations between gills, liver and intestine tissues in both seasons.

Conclusions

The study indicatess that the sequence of heavy metal concentrations in M. sharpeyi organs is as follows: Gills > Liver ≥ Small intestines. The concentration of heavy metals increases with increasing concentrations in water. Furthermore, higher concentrations of heavy metals in *M. sharpeyi* organs during summer, this can be due to an increase in concentrations of heavy metals in the water during summer, due to the high temperature and water shortage, which led to an increase the concentration of the elements and causes an increase in their accumulation in fish. The results indicate a high concentration of heavy metals in the gills, liver and small intestine during both seasons, the accumulation rates of elements in the summer recorded higher value due to several factors, the most important of which is an increase in concentrations of these metals in dietary and water in the summer.

The most prominent pollutants found in the waters of Al- Dalmaj marsh comes from water of agricultural lands, carrying fertilizers, toxins, pesticides and others, which affects the diet of *M. sharpeyi* and thus causes the accumulation of elements after reaching them. The concentrations of elements in the intestine were mainly caused by diet, and in the liver caused by the long period in which fish were exposed to these elements from the environment. Such a high percentage can significantly affect and threaten living organisms, especially since lead and cadmium are toxic even at low levels.

The high concentrations of elements in the gills directly caused by water, either in the liver was caused by the long period in which the fish were exposed to these elements, or in small intestines resulting mainly from the diet its get from the environment which they live, this high percentage can significantly affect living organisms and threaten them, especially since lead and cadmium are toxic even at low levels.

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