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THE EFFECT OF DIYALA RIVER DRAIN ON THE ENVIRONMENT AND THE TWO TYPES OF IRAQI FISH IN THE TIGRIS RIVER

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Abstract

The present study was conducted to determine the effect of the Diyalariverestuary on the environment and life of two local economic fish, the *Barbus xanthopterus* and the *Barbus grypus* in the Tigris River south of Baghdad for the period 2017 until January 2018. Two study sites were selected as shown in Fig. 1, and water and fish samples were collected monthly for the duration of the study. On-site and monthly differences of some physical and chemical properties of water were observed in the current study. The highest temperature of water was 31.3°C in July 2017 at the second location and the lowest temperature of 8.6 °C in January 2018 at the first location, and the ranges of dissolved oxygen concentration between the lowest value of 2.3 mg /l in July 2017 for the second location and the highest value 10.2 Mg / l in January 2018 for the first site, PH values were recorded in ranges between 6.9 to 7.6 for the first position and from 5.5 to 6.7 at the second site. Salinity of the water ranged from 0.3 to 0.5 g / L at the first location and 0.5 to 1 g / L for the second site. 18.9 to 36.5 units of naphthalene cyst in the first location and 26.6 to 57.3 units of naphthalene as the second site, and the oxygen requirement for water was recorded between 0.6 to 2.5 mg / L at the first location and 4.8 to 15.2 mg / L at the second site. Some blood serum enzymes were measured by blood enzymes and their concentrations in the *Barbus xanthopterus* fish ranged in enzyme Glutamic oxaloacetic transaminase (GOT) from 38.0 to 875.9 U / L and enzyme Glutamic pyruvic transaminase (GPT) between 1.6 to 26.4 U / L and enzyme Alkaline phosphatase (ALP) 9.4 to 83.7 U / L and enzyme Lactate dehydrogenase (LDH) from 104.3 to 1051.8 U / L, while the *Barbus grypus* fish concentrations with enzyme (GOT) ranges between 63.6 to 617.8 U / L and enzyme (GPT) from 5.5 to 27.9 U / L and enzyme (ALP) between 3 and 95.2 U / L and enzyme (LDH) enzyme between 175.7 to 936.7 U / L. The current results showed that the concentrations of blood enzymes of the Barbus xanthopterus fish and the *Barbus grypus* fish in the second station increased in hot months and decreased in the cold months.

Current results indicate that there are clear effects of the Diyala water drain at the Tigris River in the second location and therefore there have been significant impacts on the environment and some biological and physiological characteristics of the two fish of the current study.

Key words : *Barbus xanthopterus* fish and the *Barbus grypus* fish, Tigris River, enzymes (GOT, GPT, ALP, LDH), Pollution.

Introduction

It is known that the global demand for aquatic food is increasing. This is due to population growth and preference for healthy foods. Fish is a good food rich in high quality protein and is important for human health (Abimorad and Carneiro, 2007). Fish is one of the most commercially traded foods in the world Where its trade expanded over time (FAO, 2014). Fish are known globally as important food because it improves human health and is one of the most important economic goods in circulation in developed countries (Nwosu and Onyeneke, 2013). The history and importance of the fishery in Iraq extends to nearly 4000 years through history (Al-Nasiri and Hoda, 1975). In the internal Iraqi water environment 69 species of fish are economically important: *Barbus xanthopterus, Barbus grypus, Barbus esocinus, Barbus barbulus, Aspius vorax,* and *Barbus luteus*. Cyprinidae fish are important and predominant in the number of fish species in fresh water (Al-Dham, 1977; AL-Tamimi, 2004). *Barbus xanthopterus* and *Barbus grypus* represent about 30% and 20% of total catches respectively (Haddedand Ali, 1991). In view of the commercial

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importance of fishes *Barbus xanthopterus* and *Barbus grypus,* many local studies have been carried out in many Iraqi water environments, including rivers, lakes, reservoirs, Tigris and Euphrates rivers (AL- AL-Tamimi, 2004; Al-Rudainy, 2009; Khalaf, 1961). Some of them studied Qattan fish and cared for their spread and growth (Al-Rudainyet *et al.,* 1999; Abu al-Hani and Al-Rudainy, 2000). Some of them studied their environment, their life and their stock (Al-Rudainy *et al.*, 2004). Local studies also dealt with carp, and others focused on their environment and stocks (Al-Tamimi, 2004; Al-Rudainy, 2009), and others who took up their lives and fed them (Al-Rudainy, 1989). Water pollution is one of the most important factors and obstacles in reducing the production of many fish species because it hinders the internal environment of the fish and the vital activities, including nutrition and reproduction of all living organisms, which in turn affects the life of living organisms (Al-Saad *et al.,* 2006). Water pollution is defined as the addition of polluting substances, residues or energy by humans to the aquatic environment that is sufficient to cause physical, chemical or biological adverse changes that result in damage to human health, living resources or ecosystems (Gesamp, 1993; Al-Saad and others, *et al.*, 2003; Al-Tamimi, 2004). Many studies have focused on the use of aquatic organisms in general and fish in particular for detection or as a guide and a basic indicator for the presence of pollution to assess the health of the aquatic environment. Therefore, the transport of various contaminants, including heavy elements, through the food chain by eating food by fish and accumulating inside their bodies Eventually humans reach by eating fish as food (Farkas *et al.,* 2002; Rasheed, 2012). Given the scarcity or lack of local and modern studies on the effects of pollutants, including heavy elements on the environment and life of local economic and commercial fish, such as fishes and fishes in the Tigris River Ntathar downstream of Diyala south of Baghdad. The present study aimed to focus on the assessment of physical and chemical properties and the measurement of the activity of blood enzymes in the fish and the catch of the Tigris and the Tigris on a monthly basis and know the extent of pollution and observation of changes in the site and the division in the fish studied and comparing the results of the current study with the results of other studies.

Materials and Methods

The present study was conducted in two locations at the Tigris River south of Baghdad/Iraq for the period from July 2017 to January 2018. The first site extends 4 km and is located to the north of the junction of the Tigris River at the mouth of the Diyala River, the second site extends 4 km south of The junction of the Tigris River at the mouth of the Diyala River (Fig. 1). Fish samples were collected using two types of gill nets (100 × 3) m, length of mesh eye (2, 2.5, 3 and 3.5 cm) and cast net or net length (1.5 and 2.5 cm). 42 samples were recorded for each of the *Barbus xanthopterus* fishes, ranging from 22.63 to 40.46 cm with a total weight of 117.8 to 1070.3 g and their ages from 1 to 7 years and *Barbus grypus* fish in total lengths ranging from 29.9 cm to 41.7 cm and total weights between 318 and 770 g and their age Between 3 and 6 years.

Physical and Chemical Test

1. Air and Water Temperature Air and Water Temperature (°C)

Both the air and water temperature were measured by using the mercury meter from 0-55 °C at all study stations. The readings were taken in the shade and waiting for 5 minutes for regular readings. The water temperature was measured by immersing the device 5 cm from the water surface And wait for the same period and then read the result in unit centigrade (m o).

2. Hydrogen Ion Concentration

The pH-meter, which is a HANNA type, is used to measure the pH of the river water after it has been treated and calibrated with standard buffer solution with known pH 4, 7 and pH 9.

3. Salinity and Total Dissolved Solids (TDS)

Measured using an electrical conductivity meter (MARTINI Instruments) made in Europe, soluble solids in the field were measured directly in g/L unit. The equation given in APHA (1998) was used to calculate salinity values in terms of the values of electrical conductivity

Salinity ()) = EC (μ semins) / (cm) × 0.00064

4. TurbidityTurbidity

(HANNA/H1) turbidity meter and the results were expressed in the Nephlometric Turbidity Unit (NTU).

5. Dissolved oxygen and bio-oxygen Demand (BOD5)

The dissolved oxygen was measured using the Modification Azid method, which is indicated by APHA (2003) after the sample was installed and corrected with the standard 0.025N sodium thiosulfate. The results were reported in mg/L. For the purpose of determining the oxygen requirement, the samples were incubated at 20°C Five days, and then the biological requirement was measured in the same way as described above. The values of BOD5 were calculated by the following equation:

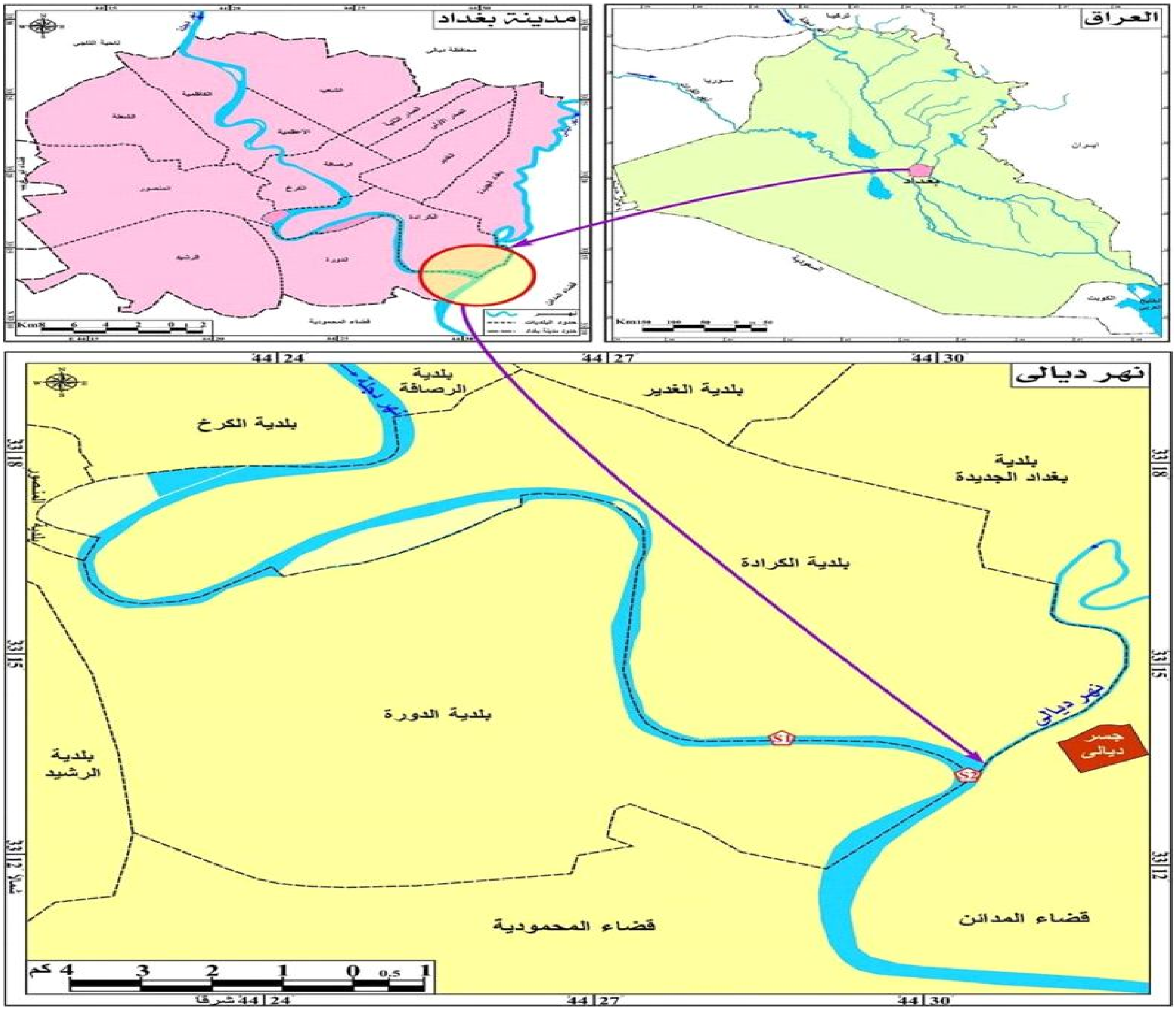

Fig. 1 : A map showing the location of the study in the Tigris River

BOD5 mg / L = dissolved oxygen primary

- dissolved oxygen final

Determination of the biological properties of the activity of certain enzymes

After the separation of the centrifugal blood, the serum is taken by a pipette and kept at -20°C until the biochemical examination of the blood enzymes. GOT, GPT, ALP, and LDH were used as a special detector from Italian Assel for each of the required tests. Enzymes were measured according to the method of Retiman and Frankel (1957), and measured ALP according to the method of Belfied and Goldberg (1971). Vegasys Chemical Analyzer was used to analyze the enzymes of the Italian AMS company. Samples are placed inside the device and the analysis process is read through a special computer screen of the device. The mechanism of action of the device depends on the analysis of the enzymes on the absorptive light Absorption photometry as each enzyme to measure its own wavelength, and a dedicated detector is used for each enzyme (Roche, 2009).

Statistical analysis

Statistical Analysis System (SAS) was used in the analysis of data 22 and the program was used for the analysis of data according to RCBD. The differences between the averages were compared with the Duncan Multiple Range test to find significant differences between the various transactions at the level Morality 0.05.

Results and Discussion

Physical and chemical properties of water

Air and water temperature

Temperature is one of the most important environmental factors affecting the metabolic processes of the organism. It is one of the specific and most important environmental factors associated with the presence, density, distribution and growth of aquatic organisms, as well as its effect on many physical and chemical properties of water (Power *et al.*, 2000). Table 1 and 2 indicate air temperature fluctuation during the study period, ranging between 33.4°C in July 2017 and 11.8°C in January 2018. Water temperature variation during the study period. Recording the highest temperature of 31.3°C was observed during July 2017 for the second site and the lowest temperature of 8.6°C during January 2018 at the first location. The above results indicate fluctuating water temperatures and high temperatures during the hot months and their decline during the cold months, which is certainly due to the nature of the climate of the Iraqi environment as hot dry summer and cold in winter. The current study agreed with the study of Al-Sarraj *et al.*, (2014), which attributed this to several factors, including the length of daylight hours with sunlight, light permeability, the quality of the suspended materials, their quantity in the water environment, and water movement and levels. The Khalifa study (2017) showed that most of the environmental studies of Iraqi water in general and the Tigris River in particular are characterized by high temperatures most of the months of the year and decrease during the winter months.

Dissolved oxygen concentration

Dissolved oxygen plays an important biological role in the metabolic processes of all living organisms. Its main source in the water bodies is the atmosphere, as well as the phytoplankton and aquatic plants that supply the water surface through the process of photosynthesis (Wetzel, 2001).

Table 1 and 2 show changes in dissolved oxygen values between sites and months of the current study. Recording the highest value of 10.2 mg/l during the month of January 2018 at the first location, while the lowest value of 2.3 mg/l during the month of July 2017 for the second site. Current results indicate that the concentration of dissolved oxygen at the first site is higher than that recorded in the second location throughout the study period. The high values recorded for the concentration of oxygen in the first site may be due to good ventilation and continuous mixing, as well as the large role of aquatic plants in addition to being large open areas facilitate the exchange of gas, compared to those low in the Tigris River at the second site, which is certainly affected by water The contaminated Diyala River, which carries many of the remnants of the Rustmiya plant to treat sewage and organic matter carried by waste and household waste into the riverbed and analyzed by microorganisms, increasing the demand for oxygen and thus decreasing concentrations (Al-Tamimi 2004; Khalifa 2017). The current results were consistent with previous local studies that recorded high values of dissolved water oxygen ranging from 7.1 to 11.7 mg / L at different locations of the Tigris due to good ventilation (Hamadi, 2005; Khalifa, 2017) and low values and attributed to the impact of the Tigris River with factory waste And human activities (Al-Tamimi, 2004). The high concentration of oxygen during the cold months and decrease during the hot months is certainly due to the effect of temperature, as the high temperatures certainly lead to increased evaporation of gases, including dissolved oxygen, and increase the metabolic properties of water and increase the consumption of dissolved oxygen, as well as the speed of the process of decomposition organic matter And the decomposition of dead water, all of which will reduce the concentration of oxygen dissolved water during the hot summer months and vice versa during the cold winter months (Nassar and Shams El-Din, 2006).

PH

Tables 1 and 2 show slight fluctuations in pH values during the study months. Ranging between 6.9 to 7.6 at a rate of 7.2 ± 1.0 in the Tigris River at the first position and between 5.5 to 6.7 at a rate of 6 ± 0.1 at the second site. The results of the pH showed that the water of the first site was closer to the moderate compared to the decrease in the second site throughout the study period. The Iraqi waters in general and the Tigris River in particular are close and close to the moderate and tend to al-Qaeda sometimes (AL- Lami *et al.,* 1996). The current study agreed with some previous local studies in different locations of the Tigris River, where pH values ranged from 6.6 to 8.6 and light basal alkalinity to abundance of bicarbonate and carbonate in Iraqi waters (Al-Jizani, 2005; Hussein, 2009). The automatic regulatory capacity of water bodies such as rivers and lakes depends on the relationship between the concentration of carbon-free hydrogen ion produced by the decomposition of bicarbonates. Generally, the pH values of any water surface are affected by the length of daytime, night time and season of the year and its biological diversity (Richardson and Hussain, 2006).

Salinity

Salinity is defined as the concentration of total soluble salts in water, including both positive and negative ions. In the aquatic environment, the concentration of salinity is necessary for aquatic organisms and plants that live at specific levels. Salinity plays an important role in determining the biological community and the nature of its composition (Power *et al.*, 2000).

Tables 1, 2 show differences in salinity values during the months and months of the study. With the maximum value of 1 g / l during the month of July 2017 and recorded in the second location and less value of 0.3 g / l during the month of January 2018 and recorded in the first location. Current results indicate that the waters of the Tigris River are located in fresh water to low salinity and according to the Reid (1961) classification of water. Al-Tamimi (2004) recorded in his study the value of the water of the Tigris River between 0.4 to 0.9 g/d on the Tigris River south of Baghdad, which is an approach to the current results. The current water salinity values were high during the summer months and low during the winter months, as well as in the water of the second site was higher than in the first location. High temperatures during the summer months and increased evaporation rates, as well as low water levels in the Tigris River as well as continuous washing of soil salts as a result of agricultural activity may result in higher salinity concentration (Abbas *et al.,* 2015). The high values of water salinity in the Tigris River at the second site are due to the organic waste of the water of the Diyala River from its confluence with the Tigris River as well as the shallow water and low rotation. This is indicated by some previous local studies of the waters of the Tigris River (Khalifa, 2017; Al-Tamimi, 2004).

The turbidity

The turbidity is a measure of the total substances suspended in water, which are inversely related to transparency. Precise materials suspended in water from clay, greens, bacteria, animals and plants inhibit the passage of light through the water column, leading to refraction and dispersion (Stirling, 1985). Table 1, 2 show changes in the turbidity values of Tigris water for the current study sites and during the different months. The highest value of 57.3 Naphthalene units in July 2017 was in the second position, compared to the lowest value of 18.9 units of Naphthalene Catheter and recorded in January 2018 at the first location. The current results indicate increased turbidity in the water of the Tigris River in the second location compared to the first site during the study period due to its meeting with the highly polluted Diyala River and the presence of waste from the Rustmiya plant to treat sewage water, pollutants and organic materials carried by waste and household waste downstream Microstructure and increased movement and mixing (Al-Khafaji, 2000; Nghimsh and Ali, 2005). The rise in water turbidity in the second place during the hot months may be due to increased water currents, tidal waves and increased activity of organisms and aquatic organisms (Sabri *et al.*, 1989, Al-Tamimi, 2004), leading to the mixing of bottom materials at the bottom of the water, Light transmittance (Chomera *et al.,* 2007). The study of Al-Tamimi (2004) confirmed that the decrease in the values of turbidity during the cold months and their rise during the hot months was associated with temperature variations throughout the study period, which may be consistent with the current study.

Biochemical requirement for oxygen

BOD5 refers to the amount of oxygen consumed by microorganisms in the atmospheric oxidation processes of the organic substances present in the sample at 20°C (GEMS, 1997). This is a guide to quantifying the amount of organic oxidants present and decomposed by microorganisms Akbar *et al.*, (2005). The importance of bio-oxygen requirement is to assess the degree of pollution of wastewater and industrial water, and the ability and viability of water bodies to absorb amounts of polluting substances under aerobic conditions and to evaluate the self-purification of rivers (WHO, 2004).

Table 1, 2 show differences in the values of bio-oxygen requirements at the signatories in the Tigris River and during the different months. Recording the highest value of 15.2 mg/L during the month of August at the second site and the lowest value was 0.6 mg/l during the month of January 2018 in the first location. The rise of this indicator in the water of the Tigris River at the second site may be due to the meeting with the Diyala River and the waste of organic waste, sewage and household waste into the riverbed and analyzed by microorganisms, increasing the demand for oxygen in addition to the presence of plants that consume oxygen. The high values of the oxygen requirement during hot months may be due to higher temperatures and increased activity of microscopic organisms that play a key role in the process of decomposition of organic matter and the withdrawal of oxygen from the water column (Kinesh, 1986). Al-Imarah *et al.*, (2006) indicate that this indicator increased during the months of heat and pollution. Akbar *et al.,* (2005) in Hawr al-Jabbayish and donkey showed high values of BOD5 during the hot months, attributed to the stagnation of water and the abundance of plants in it And near the study stations from the residential areas, which is close to what found in the current study.

Activity of some enzymes in the blood

The liver produces highly specialized organic substances that are used as agents to regulate all vital processes within the body called enzymes. They are essential for the metabolic process, metabolism and control of the free radicals resulting from the metabolism

Table 1 : Values of some physical and chemical properties of the water of the first site in the Tigris River south of Baghdad.

Months	Air temperature	Temperature Water	Dissolved oxygen concentration Mg/l	PH	Salinity G / l	The turbidity Nectaline Catheterization Unit	Biochemical requirement for oxygen Mg / l
July 2017	31.6	29.2	7.1	7.6	0.5	29.2	2.5
August	31.0	28.3	7.5	7.1	0.5	36.5	2.3
September	29.8	27.8	9.0	7.2	0.5	25.3	2.1
October	28.6	24.5	9.1	7.1	0.5	24.7	2.0
November	22.2	18.5	9.2	6.9	0.4	23.6	1.6
December	16.1	12.2	9.5	6.9	0.4	20.6	1.6
January 2018	11.8	8.6	10.2	7.1	0.3	18.9	0.6
Range	31.5 – 11.8	29.2 -8.6	10.2 7.1	7.6-6.9	0.5-3.5	36.5- 18.9	2.5-0.6
±average standard error	24.5±1.6	21.3±1.7	8.8±0.2	7.2±0.1	0.4±0.02	25.5±1.22	1.8±0.1

Table 2 : Values of some physical and chemical properties of the second site water in the Tigris River south of Baghdad.

Months	Air temperature	Temperature Water	Dissolved oxygen concentration Mg/l	PH	Salinity G / l	The turbidity Nectaline Catheterization Unit	Biochemical requirement for oxygen Mg / l
July2017	33.4	31.3	2.3	6.7	1.0	57.3	14.0
August	32.8	29.9	2.5	6.3	0.9	54.0	15.2
September	31.6	29.8	2.7	6.3	0.9	43.7	10.2
October	29.8	26.8	3.2	5.8	0.8	36.3	7.5
November	23.6	20.7	4.2	5.5	0.8	33.2	5.4
December	17.5	15.2	5.4	5.6	0.7	32.1	5.2
January 2018	12.8	10.7	6.5	5.6	0.5	26.6	4.8
Range	33.12.8	31.-9.1	6.5- 2.3	6.5-5.5	1.0 -0.5	57.3- 26.6	15.2- 4.8
±average Standard error	25.9±1.7	22.3±1.7	3.1±0.4	6.0±0.1	0.8±0.03	40.5±2.4	8.9±0.9

which is harmful and dangerous to the body of the organism and the pathological changes resulting in the liver for several reasons Environmental pollution and concentration of toxic metals, which are reflected in changes in the activity of enzymes produced by the liver (Agrahari *et al.*, 2007).

Table 3 shows significant differences (Pd≤0.05) in the values of the *Barbus xanthopterus* fish blood enzymes collected from the Tigris at the current sites and months of the study. Recording the highest concentration of GOT, GPT, ALP and LDH was recorded in values of 875.9, 26.4, 83.7 and 1051.8 respectively during July 2017 at the second position, while the lowest values of the same enzymes were 38.0, 1.6, 9.4 and 104.3 Respectively during the month of January 2018 in the first location. The results of the same table indicate a significant increase in GOT, GPT, ALP and LDH enzymes in the blood of the *Barbus xanthopterus* fish, which coincided with high temperatures during the summer months at the second site and vice versa for the first location during the winter months. The concentrations of the four enzymes in the blood of the fish themselves at the second site were higher than at the first site. The increase in the four enzymes measured in fishes at the second location in the waters of the Tigris River may be due to the impact of the Tigris River by the polluted water of the Diyala River and the organic and inorganic wastes it carries, which causes the fish to strain and infect them with cancer. Some previous local studies indicate that the Diyala River is heavily polluted by heavy metals as a result of the output of laboratories, hospitals, generators and civil activities on the Diyala River (Al-Jubouri, 1990; Al-Shakraji, 1999; Al-Maliki, 2005). Coppo *et al.,* (2001) noted that GOT, GPT, ALP and LDH enzymes are released from the liver and increased concentrations in the blood when exposed to sudden stress or over time

Table 3 : Values of some of the blood enzymes of *Barbus xanthopterus* fishes the Tigris River south of Baghdad.

	Aspartate Amino Transaminase (AST/ GOT) U/L		**AL anine Transaminase (ALT/GPT) U/L**		**Alkaline Phosphatase (ALP) U/L**		**Lactate Dehydrogenase (LDH) U/L**	
Months	**First Site**	**Second Site**	**First Site**	**Second Site**	**First Site**	**Second Site**	**First Site**	**Second Site**
July2017	376.9Ba	875.9A a	25.3A a	26.4A a	40.6B a	83.7A a	375.7B a	1051.8Aa
August	205.3Bb	525.1A b	21.8B b	23.3A b	35.6B b	80.4A a	312.7B b	833.0A a
September	199.6Bb	315.5A c	20.2A c	20.8A c	39.8B a	59.9A b	290.8B b	855.7A a
October	137.9Bb	311.3A c	19.8A c	19.7A c	34.6B b	52.8A b	300.0B b	572.0A b
November	125.3Bb	200.7A d	12.7B d	18.7A c	34.2B b	50.1A b	281.1B b	575.9A b
December	75.7Bc	195.5A d	9.5B e	6.8A d	11.3B c	9.6A d	294.6B b	568.6A b
January 2018	38.0Bd	149.5A d	1.6B f	4.9A e	9.4B d	24.7A c	104.3B c	12..9A c
Range	38.0- 376.9	149.5- 875.9	1.6- 25.3	4.9- .6.4	9.4- 40.6	9.6- 83.7	104.3- 375.7	128.9- 1051.8
±average Standard error	165.5±23.0	367.6±53.1	16.0±1.8	17.1±1.7	29.3±2.7	51.6±5.6	283.4±15.5	651.6±62.9

The various capital letters indicate significant differences within one row at the probability level ($P \leq 0.05$). Different small letters indicate significant differences within the column per month at the probability level ($P \leq 0.05$).

such as high water temperature, environmental pollution and exposure to toxic heavy elements, causing acute liver disorders. Several previous studies have indicated that heavy metals and pesticides in the water cause an increase or decrease in serum protein levels and concentrations depending on the type of pollutant, toxic substance, type of fish exposed to polluted water quality and the duration of exposure (Monteiro *et al.*, 2005; Jee *et al.*, 2005). Valarmathi and Azariah (2003) reported that toxic substances lead to numerous changes in the physiological state of the animal because they eventually cause internal deformities in the cell's organisms that can result in increased or inhibited activity of the various enzymes. In general, the high or low level of ALT, ALP, AST and LDH enzymes in the blood is used as a guide and indicator to assess the health status of the liver and the effects that surround the fish (Dorcas and Solomon, 2014). These enzymes control the metabolism of the organism, so any slight variation in their activities can affect organisms by affecting metabolism (Balasubramanian and Kumar, 2013). These enzymes are important protein catalysts for the vital life-life of fish and a good indicator of liver activity and effectiveness. They are a major means of detecting levels of pollution

Table 4 : Values of some of the blood enzymes of *Barbus xanthopterus* fishes the Tigris River south of Baghdad.

	Aspartate Amino Transaminase (AST/ GOT) U/L		**AL anine Transaminase (ALT/GPT) U/L**		**Alkaline Phosphatase (ALP) U/L**		**Lactate Dehydrogenase (LDH)**	
Months	**First Site**	**Second Site**	**First Site**	**Second Site**	**First Site**	**Second Site**	**First Site**	**Second Site**
July2017	160.9B b	302.8Ac	19.7B b	24.8A b	60.7B b	86.6A a	390.7B a	758.7Ab
August	175.B a	617.8 a	29.0A a	27.9A a	84.1A a	95.2A a	483.7B a	936.7Aa
September	138.9B c	505.7A b	16.1B c	27.6A a	65.7A b	71.7A b	380.6B a	657.6Ab
October	133.5B c	224.7A d	15.1B c	24.1A b	39.1B c	63.6A b	352.6B a	567.6Ab
November	81.0B d	254.7A d	14.0B c	26.9A a	14.7B d	43.4A c	293.5B b	417.7Ac
December	88.9B d	201.7A d	7.8B d	22.0A c	6.7B e	29.7A d	224.0B b	321.3Ad
January 2018	63.6B e	183.8A d	5.5B e	20.9A c	3.0B f	29.3A d	175.7B c	275.1Ad
Range	63.6-175.8	183.8- 617.8	5.5- 29.0	20.9- 27.6	3.0- 84.1	29.3 - 59.2	175.7- 483.7	275.1- 758.7
±average standard error	120.4±9.1	327.3±34.7	15.3±1.6	24.9±0.6	39.1±6.8	60.1±5.5	328.7±21.8	562.1±50.1

The various capital letters indicate significant differences within one row at the probability level ($P \leq 0.05$).
Different small letters indicate significant differences within the column per month at the probability level ($P \leq 0.05$).

and environmental and pathological changes in fish (Johnstoen *et al.*, 1994; Martinez *et al.*, 2004).

Table 4 shows significant differences (Pd≤0.05) in the values of *Barbus grypus* blood enzymes in the Tigris River at the sites and months of the current study. Recording the highest increase in GOT, GPT, ALP and LDH enzymes was recorded at 617.8, 27.9, 95.2 and 936.7 respectively during August 2017, while the lowest values of the same enzymes were 63.6, 5.5, 3.0 and 175.7 Respectively in January 2018 in the first position. It was noted that the forced increase in the concentration of blood enzymes in the *Barbus grypus* fish with higher temperatures in the second site and decreased with lower temperatures at the first site. Also, the values recorded for the blood enzymes of carp in the second location were higher than in the first location.

The increase in the level of the four enzymes at the second site in the waters of the Tigris River affected by the water of the Diyala River is highly polluted by the waste and household waste into the riverbed and analyzed by microorganisms. The study of Adham (2002) suggests that the reason for increased enzyme production in liver cells is to neutralize the toxic effect of mineral contamination, and therefore the high level of concentration of these enzymes may be due to liver injury to some fungal diseases causing damage to liver cells. Durborowet *et al.*, (2003) have shown that liver cell necrosis leads to increased permeability of membranes to these cells, causing the release of large enzymes and increasing their concentrations within the body's specific organs. The pollution of the heavy metals accumulated varies with the different organs of the animal body. In the same way, the effect may be different on the various metabolic activities of the organisms, including the effectiveness of the enzymes, whether the response is to synthesize or increase the concentration of the enzyme concentration, and the increase in water temperature leads to an increase Enzymatic activity due to increased activity of nutrition, growth and movement, and thus lead to a higher level of concentrations of these enzymes in general (Svoboda, 2001; James *et al.*, 1991).

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