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AN ECOLOGICAL STUDY ON ALGAE IN ALTUN KUPRI DISTRICT – KIRKUK CITY/ IRAQ

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Abstract
The current study was conducted to identify the algae present in the Lower Zab River within the Altun kupri district of Kirkuk Governorate, diagnose it, and determine the extent to which it is affected by the surrounding environmental factors. The two branches of the river and the rest of the stations are located between them. The study started from the month of November of the year (2021) and ended in the month of April of the year (2022).

The results showed that the air temperature ranged between (11.1-18.3) degrees Celsius, where the highest value was recorded in the first station in April and the lowest value in the fourth station in February, and the water temperature recorded values ranging between (8.0-17.6) degrees Celsius Where the highest value was recorded in the first station in April and the lowest in the first station in February, and the total base values ranged between (99.2-193) mg/L, where the highest value was in the third station in January and the lowest value in the fifth station in February. As for the hardness, the water was hard, as the total hardness values ranged between (141.2-397.3) mg / liter. The values of chloride were within the permissible limits, as their values ranged between (10.04-147.45) mg/L, where the highest value was recorded in the second station in November and the lowest in the fourth station in January. While the values of phosphate ranged between (0.127-2.43).) mg/L, and the highest value was in the second station in February and the lowest in the second station in January. As for the qualitative study, it included the diagnosis of algae in the studied stations. The diatoms made up the majority of the types of phytoplankton present in the study stations, and the green algae came in the second place, then the blue-green algae, followed by the euglena algae.

The results of the statistical analysis using Duncan's test (at the level of significance 0.05) showed that there were no significant differences between the study stations in relation to the locational differences, while significant differences were recorded between the months.

Keywords: Aquatic environment, Lower Zab River, Classification of algae.

1-1 Introduction

The ecosystem represents an organizational or spatial unit that includes living organisms that include producers, consumers, decomposers and non-living factors that interact with each other and lead to the exchange of materials between living and non-living components (Al-Saadi, 2006). It is a basic reservoir and shares a huge proportion in the productive capacity of the land, and both water resources and biodiversity are linked to each other and are a value necessary for the sustainability of vital communities (Sufia and Aishah, 2019).

The internal water area of Iraq is about 24,000 km, or approximately 5% of the country's area. The internal water is in the form of streams, rivers or lakes. Iraq is characterized by the abundance of its fresh surface water, which is represented by the Tigris and Euphrates rivers and their tributaries (Al-Saadi, 2005). The Tigris is the largest river in Iraq and the main source of water Potable for most of its cities (Al-Sabah, 2007).

To study any type of water, ecologists use certain types of measurements such as biological, chemical and physical indicators in general to measure changes in the quality of river water, and these measurements give information about the level of pollution (Omar, 2010).

The area of water use is increasing beyond simple human and agricultural purposes to extensive industrial and civil uses, which makes water more vulnerable to direct and indirect pollution (Al-Dulaimi, 2021). In addition to the climatic effects on running water, such as the effect of heat, cold, heavy rain and floods (Al-Sudani, 2016).

Algae has many benefits, as it is considered a primary producer in the marine environment, as it is the only one that attracts light through the presence of various pigments and converts light energy into chemical energy to stabilize carbon dioxide in the form of a sugary substance (carbohydrate) (Al-Saadi, 2006).

Algae is an important source of food production and renewable energy, especially microalgae, which can grow in water in media that are limited in growth for the rest of plants, such as water, saline soils, desert, rocky and wet lands, cold and hot ecosystems and other media (Al-Ugaili, 2016). Algae are considered one of the most important biological elements in the ecosystem and the planet. They are often the most important autotrophic microorganisms responsible for cooling the Earth's atmosphere. Algae have been used in assessing water quality and detecting the presence or absence of pollution in many countries of the world, where their aggregates and diversity were adopted to determine the quality of water systems as they are quick to respond to changes in the physical and chemical characteristics of water sources and that their density and appearance depends on the living and non-living factors of water (Komala et al, 2013). It provides us with quantitative and qualitative information about the changes that occur in the environment, as evidence can be designed to monitor aquatic ecosystems based on some types of these algae. Therefore, evidence was used to tolerate pollution based on the percentage of dominance of sensitive species, as the low value of biodiversity reflects the state of pollution of the water surface. In contrast, the high values of biodiversity and the decrease in biomass indicate the cleanliness of the water body (Al-Tamimi, 2006).

Materials and Methods

General Description of the area study

The Lower Zab is a river whose sources are located in northwestern Iran and extends for 402 km inside Iraq. It is the third tributary of the Tigris River and flows into the Tigris River north of the city of Baiji after passing through the Altun Kobri area. It is the most important water resource in Kirkuk Governorate, where its water is the main source of drinking water and is characterized by its slope between valleys. (Jassim, 2006). Picture (3-1) is a map to show the entry of the Lower Zab River into the Altun Bridge area, with the studied stations on it.

2-3 Description of the study stations:

1- first station

The new Altun Bridge is located outside the district, and this area is considered the entry point of the Lower Zab River within the borders of Kirkuk Governorate.

2- The second station

Orta area, which represents the area between the new Altun Bridge and the old iron bridge after the river entered the district.

3- The third station

Near the old iron bridge within the district of Alton Kobri, and it is considered a residential area.

4- The fourth station

After the old iron bridge, it is also considered a densely populated residential area.

5- Fifth Station

The end of the Altun Bridge district, before the meeting point of the two branches of the river, and it is considered an agricultural area.

3-3 Samples collection method

Water samples were collected monthly from the stations under study at the rate of one sample per month starting from November of 2021 until the end of April of 2022. Samples of physical and chemical factors were collected in narrow-necked plastic bottles after being washed twice with the sample water, as they were filled to the full capacity of two liters. As for the samples for examining the dissolved oxygen and the samples for examining the biological requirement for oxygen, they were collected in opaque bottles and filled to their full capacity and without any air bubble so that the transport process and water movement would not affect a number of properties. The plastic bottles were closed well and the necessary information was recorded on each bottle. Samples were also collected. Especially for the examination of algae, and the analyzes mentioned were carried out in the laboratory of the Environmental Department and the Laboratory of the Department of Agriculture.

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3-4 air and water temperature

The air and water temperature in the field were measured using a mercury thermometer with a range of 0-100°C and a gradient of 0.1°C. The air temperature was measured in the shade and at a height of one meter from the surface of the ground. As for the water temperature, it was measured by dipping the thermometer directly into the sample. The temperature was recorded after it was fixed and the process was repeated several times to ensure the temperature.

3-5 total alkalinity

The method described by (ASTM, 1989) was followed in estimating the total baseline by taking 50 ml of sample water and adding 3 drops of orange methyl index to it, then smeared with sulfuric acid to a concentration of 0.02 standard, until the color changes at the rate of two readings. The total baseline is calculated according to the following equation :

Total alkalinity

$$(mg/L) = (\frac{\text{caco3 l Equivalent weight x 1000 x acid standard x acid scavenging volume)}}{sample\ volume\ (ml)}$$

3-6 total hardness

The method approved by (ASTM, 1984) was followed, where 50 ml of sample water was taken and 0.5 ml of buffer ammonia solution was added to it, and then drops of Erichrom black T guide were added, the color became purple, and it was smeared with a solution of Na2EDTA at a concentration of 0.05 N until it was transformed. The color is blue, and the total amount of hardship is calculated according to the following law:

$$\text{total hardness mg/L} = \frac{\text{(CaCo3 l Equivalent weight x 1000 x EDTA standard x EDTA volume)/}}{\text{(sample volume x 2)}}$$

3-7 chlorides

The value of the chlorides was estimated using Mohr's Determination of chloride by mohr method. 10 ml of the sample was taken and placed in a 250 ml conical flask. Two drops of potassium chromate were added. The color became yellow, then it was titrated by silver nitrate until the red color began to appear, and the process was repeated using water. Distilled in place of the sample and measure the volume of silver nitrate used. (APHA 1998)

Volume of silver nitrate used to titrate the sample Volume of silver nitrate used to titrate distilled water = volume of silver nitrate used to precipitate the chloride, the silver nitrate standard is calculated using a standard 0.01 sodium chloride solution.

3-8 phosphate

The value of phosphate was recorded using a spectrophotometer according to the (stannous chloride) method, at a wavelength of 885 nm, and the results were expressed in milligrams / liter (Abbawi and Hassan, 1990).

3-9 Biological tests

3-9-1 Field work

Samples were collected and placed in plastic bottles and preserved by adding Lugols solution (Vollenweider, 1974).

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3-9-2 Algae diagnosis

Samples were collected and placed in plastic bottles and preserved by adding Lugols solution (Vollenweider, 1974). Lugols solution was prepared by dissolving (15) g of iodine in (200) ml distilled water and adding (20) ml of potassium iodide KI and (20) ml of glacial acetic acid, and the solution was added at the rate of (1%), that is, (1 ml) for each (100 ml) of the sample. (Prescott, 1979).

3-9-3 Identification of non-Diatoms algae

The algae samples were examined using a microscope under 10X small powers and 40X strong powers, and all samples were photographed using a mobile phone type Iphone X8. Guiry&Guiry,2022; Akbult&Yldiz,2002; Celekli et al, 2007; Jordan et al, 2009; Prescott, 1975;

3-9-4 Identification of Diatoms

A drop of the model was placed on a glass slide and dried at a temperature of 70 degrees Celsius and a drop of concentrated nitric acid was added to it to clarify the structures of the diatoms and left to dry. Taylor et al, 2007; Lavoie et al, 2008; Guiry&Guiry,2022; Prescott, 1975; Jordan et al, 2009; ; Akbult&Yldiz,2002.

3 – 10 Statistical analysis

It was done using the ready-made statistical program (SPSS) Special Program for Statistical system (SPSS version 23).

3- 10 – 1 (ANOVA)Analysis of Variance test

This analysis shows the presence or absence of significant differences in the studied variables according to the variables (spatial differences between stations locations and temporal differences between months and seasons).

3-10-2 Duncan test

Complementary test for analysis of variance test

Results and Discussion

4-1 Physical and chemical factors

4-1-1 Air Temperature

The results of the study in Table (4-1) showed that the highest value of air temperature was in the first station in April, when it reached 18.3 degrees Celsius, and the lowest value was in February in the fourth station, where it reached 11.1 degrees Celsius. The highest average of temporal values was during the month of April At a rate of 17.76, the highest rate of spatial values was in the first station at a rate of 15.91. The reason for the difference in temperature between the studied stations is due to the difference in temperatures between seasons (Hussain, 1996) and what is characterized by the climate of the region, as well as because of the continental climate that characterizes Iraq, which It is hot in summer and cold in winter (Al-Obaidi and Abdul-Jabbar, 2016). Table (4-1) values of monthly and local changes in air temperature (°C) in the studied stations.

stations / months		Station 1	station 2	Station 3	Station 4	Station 5	Average
2021	November	17.6	16.3	16.1	15.5	15.2	16.14
	December	15.3	14.7	15.4	14.1	14.3	14.76
2022	January	16	15.3	16.3	15.7	16.6	15.98
	February	12.6	12.2	11.6	11.1	11.4	11.78
	March	15.7	16.6	15.7	15.1	15	15.62
	April	18.3	17.5	17.1	18.1	17.1	17.76
average		15.91	15.43	15.36	14.93	15.05	

4-1-2 Water temperature

The results of the study in Table (4-2) showed that the highest value of the water temperature was in the first station in the month of April, reaching 17.6 degrees Celsius, and the lowest value was in the first station also in February, reaching 8 degrees Celsius. The highest value of the water temperature was in The fifth station was in March with a value of 15.8 degrees Celsius, and the lowest value for the fifth station was also in February, with a value of 8.9 degrees Celsius. As the water temperature follows changes in air temperature and this is a natural phenomenon in an area located within a climate characterized by high temperature in summer and low Heat in Winter (Al-Shawani and Abdul-Jabbar, 2010).

Temperature is an important factor for water quality as it affects the amount of oxygen in the water and the photosynthesis process carried out by aquatic plants and plankton, as well as the metabolic processes of aquatic organisms (Harrington 2001). The results of the current study came close to the study of Al-Shawani (2001), where it recorded values ranging between (6.5-28.7) degrees Celsius and close to what was obtained by Hassan (2017), where it recorded values ranging between (8-22) degrees Celsius. 2019), as it recorded values ranging between (10-25) degrees Celsius.

Table (4-2) values of monthly and local changes in water temperature (°C) in the studied stations.

stations / months		Station 1	station 2	Station 3	Station 4	Station 5	Average
2021	November	14.8	14.3	14.6	14.8	14.1	14.52
	December	11	10.7	11.2	11.7	11.1	11.14
2022	January	9.9	10.3	10.1	10	9.5	9.96
	February	8	8.4	8.1	9	8.9	8.48
	March	16.1	15.8	15.2	16.7	15.8	15.92
	April	17.6	16.9	16.9	16.3	16	16.74
average		12.9	12.73	12.68	13.08	12.56	

4-1-3 Total Alkalinity

The total alkalinity is a function of the water content of carbonates, bicarbonates and hydroxides to know the quality of water and its suitability for different uses, which represents the main reason for water alkalinity (Zaroulia, 2019). The results of the current study showed in Table (4-3) that the highest value of total alkalinity in water was in the third station in In January, it reached 193 mg/L, and the lowest value was recorded in the fifth station in February, which amounted to 99.2 mg/L. The highest rate of spatial values was recorded in the third station at a rate of 126.6 and the lowest rate in the first station at a rate of 121.1, while the highest rate of temporal values was recorded during the month of January with a rate of 121.1 175.0, and the lowest rate was during the month of November, at a rate of 105.5 The reason for the decrease in the basic values may be due to a decrease in the water temperature, which leads to the precipitation of carbonates in it and thus a decrease in the basicity of the water. Also, when the pH value is less than 8.3, the bicarbonate ion is responsible for the basicity of the water, because this pH value is considered a point All carbons CO_3 are converted to HCO_3 carbons (Al-Radayda, 2002). Also as a result of the consumption of Co_2 gas used by algae and aquatic plants as a source of carbon in photosynthesis processes (Al-Saffawi & Al-Sardar, 2018). As for the reason for the high base values, due to rising water levels and precipitation, which leads to the washing of neighboring lands (Whitton, 1992). Al-Safawi (2007) on the Tigris River, where it recorded values ranging between (14-105) mg / liter. It was similar to the study of Al-Dulaimi (2021) where it recorded values ranging between (62.8-200) mg / liter.

Table (4-3) values of the monthly and local changes in the total basal mg/litre in the studied stations.

stations / months		Station 1	station 2	Station 3	Station 4	Station 5	Average
2021	November	104.3	103.5	103.8	109.1	107.2	105.5
	December	106.8	107.5	121.8	99.5	101.7	107.4
2022	January	168	172	193	169	173	175
	February	126.6	124.6	105.8	112.8	99.2	113.8
	March	117.8	112.8	114.6	123	121.5	117.9
	April	103.6	124.4	120.8	116.2	127.03	118.4
average		121.2	124.1	126.6	121.6	121.6	

4-1-4 Total Hardness

Hardness represents the quantitative concentration of the number of positive ions. It is not formed by the influence of a single ion, but by several polyvalent ions. Calcium and magnesium ions are dominant, as well as other positive ions (Abdul-Malik and others, 2018). Hardness is one of the most important chemical properties to determine the suitability of water for domestic use and industrial purposes. The reason for the presence of hardness in water is largely due to the content of carbonates, calcium, magnesium and sulfur dissolved in the water, but sometimes and to a lesser extent due to the presence of chlorides and nitrates, as well as iron and aluminum (Cheepi, 2012)).

The results of the current study in Table (4-4) showed the lowest value in February in the fourth station and it was (141.2 mg/L) and the highest value in November in the fifth station, which amounted to (397.3 mg/L) as the total hardness values in the study were It is higher compared to what it is in the total basic, and this indicates the presence of ions other than calcium and magnesium such as sulfates and chlorides, which contribute to the formation of non-carbonate hardness, so the river water was considered very hard (Lind, 1979). The hardness varies according to the water source where the surface water is hard Less than the hardness of groundwater due to the geological characteristics of the lands through which the water flows (Gabriel, 2006), as well as because of the industrial, human and agricultural waste added to the river (Saadallah et al., 2000). As for the reason for the decrease in values, it is attributed to the union of the hardening ions, especially the calcium ion, with other water elements such as phosphorous, for example, forming stable compounds (Al-Tai, 2000). The results of the current study came close to the study of Al-Shawani (2001), which recorded (140-216 mg / liter) and an approach to the study of Al-Dulaimi (2021), which recorded values ranging between (110-218.2 mg / liter). The current study did not agree with the study of Abdul-Jabbar (2008). It recorded values that ranged between (260-600 mg/L). They did not agree with the study of Salman and Manati (2015), as they recorded values that ranged between (388-504 mg/L).

Table (4-4) values of monthly and local changes for the total hardness of mg/l for the studied stations

stations / months		Station 1	station 2	Station 3	Station 4	Station 5	Average
2021	November	391.5	379.5	366.5	356.5	397.3	378.2
	December	221	161.5	242	216	273.0	222.7
2022	January	200.5	206.5	166.5	153	149.3	175.1
	February	206	197.5	148.5	141.2	150	168.6
	March	208	189	208.5	260	207	214.5
	April	191	198	213	193	197	198.4
average		236.3	222	224.2	219.9	228.9	

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4-1-5 Chloride

Chloride is one of the negative ions of importance in natural water because it gives the water a salty taste by bonding with the sodium ion to form sodium chloride salt (table salt), and this taste varies according to the concentration (Abawi and Hassan, 1990). Its presence in water bodies on other salts (Harrington et al, 2001).

The results in Table (4-5) showed the highest value in the second station in November, reaching 147.5 mg/L, and the lowest value was recorded in the fourth station in January with a value of 10.0 mg/L. While the highest value in the third station was in November. With a value of 145.0 mg/L and the lowest value for the same station in January was 10.0 mg/L, while the average spatial values for the third station were 37.2. The reason is due to the high water levels and the erosion of the salt-laden soil that surrounds the two edges of the river. The lowest value was recorded, as it recorded 13.5 mg / liter. The current study recorded a higher value than what was recorded by Al-Shawani in 2009 and Al-Dawri 2000, where they recorded the highest value of 75 mg / liter and 67 mg / liter, respectively.

Table (4-5) values of monthly and local changes in chlorides mg/L at the studied stations

stations / months		Station 1	station 2	Station 3	Station 4	Station 5	Average
2021	November	145.1	147.5	145.0	142.1	142.2	144.3
	December	25.7	15.2	20.1	19.7	18.5	19.9
2022	January	15.6	14.9	10.0	13.8	12.2	13.3
	February	12.4	16.8	14.3	11.5	14.6	13.9
	March	15.1	19.5	16.6	12.6	14.1	15.6
	April	13.4	14.5	17.4	14.3	15.9	15.1
average		37.9	38.1	37.3	35.7	36.3	

4-1-6 Phosphate

The current study in Table (4-6) recorded the lowest value in the second station in January with a value of 0.09 mg/L, and the highest value was in the second station also in February with a value of 2.429 mg/L, and the highest temporal average was recorded during February with a rate of 1.89 and the highest spatial rate in The second station has a rate of 0.73. Phosphate is one of the most important nutrients that affect the growth and increase the cellular activity of phytoplankton, but its concentration in the aquatic environment is low (Turner et al, 2005).

Phosphate is found in most fresh water in an inorganic form, however it constitutes an important aspect of a biological system and is also found in an organic form. The main sources of phosphate are wastewater, detergents, agricultural effluents that contain fertilizers, industrial wastewater, and the high concentration of phosphate indicates pollution (Deeb and Bkdash, 2021).

The results indicate that the value of phosphate changes according to the different nature of the climate and temperature, as well as the percentage of rain for each season with the water level, as well as some plankton and plants that work to accumulate a quantity of phosphate inside, and this leads to a decrease in phosphate concentration as well as the ability of phosphate to accumulate in sediments (Weinner, 2000) and its rise is due to the frequent consumption of detergents and washing materials that contain phosphate, which are thrown into the water through sewage and house waste and phosphate fertilizers (Al-Aaragy, 1996). 2000), where the two studies recorded (7.13,6.93 mg/L), respectively. The results of the current study are in agreement with the study of Al-Safawi and Al-Manjri (2018). Where they recorded values ranged between (0.110-5.483) mg/L. The current study was similar to Al-Dulaimi (2021) study, where it recorded values ranging between (0.02-3.6) mg/L.

Table (4-6) values of monthly and local changes of phosphate mg/L in the studied stations

stations / months		Station 1	station 2	Station 3	Station 4	Station 5	Average
2021	November	0.33	0.29	0.39	0.38	0.29	0.33
	December	0.79	1.12	0.34	0.34	0.23	0.57
2022	January	0.13	0.09	0.33	0.18	0.28	0.20
	February	2.27	2.43	1.76	1.48	1.52	1.89
	March	0.38	0.24	0.34	0.22	0.38	0.31
	April	0.31	0.19	0.19	0.29	0.33	0.27
average		0.70	0.72	0.56	0.48	0.50	

4.2 Qualitative study of algae

Twenty-six species of algae were identified in the different stations included in this study, and it was found that they belong to the two main kingdoms of algae, distributed over 4 phyla, distributed in 6 ranks, 15 orders, and 16 families comprising 19 genera. The studied classes amounted to 12 types.

The study showed the dominance of diatoms in all months of the study and the reason is due to their ability to reproduce and grow in a wide range of environmental conditions (Kasim and Mukai, 2006), as well as the variation in environmental conditions such as nutrients, temperature and light transmittance, which makes a few species adapt to those conditions (Hassan et al, 2012) and the emergence of some genera in some locations helped the growth of other species due to their ability to withstand high temperatures and changes in environmental conditions (Orlando, 2016).

The diatoms are also distinguished from other algae by the regularity of their cell wall and composition of silicon materials (Lutz, 2001), while the blue-green algae are small in size with a limited number of regular and irregular cells or single straight, twisted or spiral filaments. It is due to its suitability to low light when compared to the rest of the species (Muylaert et al, 2004) as well as its ability to grow in different aquatic environments (Leelahakrie and Peerapornpisal, 2011).

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Table (4-8) shows that Bacillus algae is the high percentage among algae species, as it constituted 46.2% of the total diagnosed algae, as the number of Bacillus algae diagnosed in this study was 8 genera. The reason is due to many factors, including the intensity of lighting, its length, nutrients, temperature, and flow rate (Lili and Lusan, 2010), as well as the short life cycle, and there are many variables that affect the distribution and diversity of diatoms communities, such as sediments and salinity in the water column (Nahar, 2010). The green algae came in second place after the Bacillus algae, as they constituted 38.5% of the total diagnosed algae, as the number of green algae diagnosed in this study reached 7 genera. The blue-green algae came in the third place with 11.5% of the total diagnosed algae, where 3 genera were diagnosed. Euglena algae with a percentage of 3.8%, where one genus of Euglena was diagnosed. The ability of these sections of algae, namely diatomaceous earth, greens and blue-greens to adapt widely to various environmental factors, as well as their ability to live in algae and salinity concentrations leads to their multiplication in the waters of the Tigris River. And the density of aquatic plants that provide a suitable environment for these algae, as well as dissolved oxygen (Darweesh, 2017).

Table (4-7) the distribution of algae diagnosed in the five stations during the study period

Diagnosed algae	st.1	st.2	st.3	st.4	st.5
Kingdom: Protista **Phylum: Bacillariophyta** **Class: Bacillariophyceae** **Order: Centrals** **Family: Melosiraceae**					
Genus: Melosira varians	*	*	*	*	*
Order: Surirellales **Family: Surirellaceae**					
Genus: Surirella SP.	*	*	*	*	*
Order:Bacillariales **Family: Bacillariaceae**					
Genus: Nitzschia SP.		*	*	*	*
Genus: Nitzschia Palea	*	*	*	*	*
Order:Cocconeidales **Family: Cocconeidaceae**					
Genus: Cocconeis SP.	*		*	*	
Order: Pennales **Family: Naviculaceae**					
Genus: Navicula SP.		*	*	*	*
Genus: Navicula veneta		*	*	*	
Genus: Gyrosigma acuminatum	*	*	*	*	*
Order: Thalassiophysales					

Family: Catenulaceae					
Genus: Amphora copulata			*		
Genus: Amphora ovalis	*	*	*		
Order: Cymbellales **Family:Cymbellaceae**					
Genus:Cymbella SP.	*	*	*	*	*
Genus: Cymbella tumida	*	*	*	*	*
Phylum: Euglenophyta **Class: Euglenophyceae** **Sub class: Euglenophycidae** **Order: Eugleniales** **Family: Eugleniaceae**					
Genus: Euglena SP.	*	*	*		
Phylum: Chlorophyta **Class: Trebouxiophyceae** **Order: Chlorellales**					
Family: Scenedesmaceae					
Genus: Scenedesmus sp.		*		*	
Genus: Scenedesmus quadricauda	*	*	*	*	*
Family: Hydrodictyaceae					
Genus: Pediastrum duplex	*	*	*	*	
Genus: Pediastrum simplex			*		
Class:Zygnematophyaceae **Order: Zygnematales** **Family: Zygnemataceae**					
Genus: Zygnema SP.	*		*		
Class:Chlorophyceae **Order: Chlamydomonadales** **Family: Chlamydomonadaceae**					
Genus: Chlamydomonas SP.	*	*		*	*
Order: Volvocales **Family: Volvocaceae**					
Genus: Eudorina sp.		*	*	*	
Genus: Pandorina morum	*	*	*		
Order: Ulotrichales **Family: Ulothricaceae**					
Genus: Ulothrix SP.	*	*		*	
Genus: Ulothrix zonata	*	*	*		*
Kingdom: Monera **Phylum: Cyanophyta** **Class: cyanophyceae**					

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Order:Chroococales **Family: Chroococaceae**					
Genus: Rhabdonema adriaticum	*				*
Order: Oscillatorioles **Family: Oscillatoriaceae**					
Genus: Oscillatoria formosa	*	*	*	*	*
Genus: Spirulina laxa	*		*	*	*

Table (4-8) diagnosed algae divisions, number of species, ranks, families, genera and species and their percentages during the study

Types of algae	Class	Percentage%	Order	Percentage%	Family	Percentage%	genus	Percentage%	Species	Percentage%
Bacillariophyta	1	16.6	7	46.6	7	43.7	8	42.1	12	46.2
Euglenophyta	1	16.6	1	6.7	1	6.3	1	5.3	1	3.8
Chlorophyta	3	50	5	33.3	6	37.5	7	36.8	10	38.5
Cyanophyta	1	16.6	2	13.3	2	12.5	3	15.7	3	11.5
Total	6		15		16		19		26	

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