Environmental Effect of Al- Kut Dam on Tigris River Properties Which passed throw Wassit Province-Iraq.

Mahran M. Rhadi

College of Education for pure Science (Ibn AL-Haitham)- Baghdad University.

Muhanned R. Nashaat

Animal and Fish Resources Center/ Agriculture and Biological Research Directorate/ Ministry of Science and Technology/ P.O. Box 765, Baghdad. Iraq.

Hussain A.M. Dauod

College of Education for pure Science (Ibn AL-Haitham)- Baghdad University.

التأثيرات البيئية لسدة الكوت على خواص نهر دجلة المار عند محافظة واسط/العراق

مهران محسن راضي [1]مهند رمزي نشأت [2]حسين عبد المنعم داود

كلية التربية للعلوم الصرفة (أبن الهيثم) – جامعة بغداد

[1]مركز الثروة الحيوانية والسمكية, دائرة البحوث الزراعية والبايولوجية– وزارة العلوم والتكنولوجيا ص. ب 765 بغداد.

[2] كلية التربية للعلوم الصرفة (أبن الهيثم) – جامعة بغداد

المستخلص:

درست المعايير الفيزيائية والكيميائية لمياه نهر دجلة ضمن مدينة الكوت وتم لغرض ذلك أختيار خمس محطات. أجريت النمذجة لمحطات الدراسة شهرياً خلال الفترة من شهر كانون الثاني ولغاية كانون الاول2015 . أظهرت قيم العكورة أرتفاعاً في الصيف أذ تراوح معدلها 68 وحدة الكدرة نقثالين, أما انخفاض العكورة لمياه نهر دجلة عند السدة كان احد النتائج الايجابية لتأثير السدة في نهر دجلة والمواد العالقة الكلية. أن مياه النهر عذبة وذات تهوية جيدة أذ وصل أرتفاع الأوكسجين المذاب الى 20.5 ملغم/لتر ولوحظت حالة أشباع وصلت الى 246.75 ملغم/لتر, كانت قيم المتطلب الحيوي للاوكسجين متذبذبة, نتائج الاس الهيدروجيني كانت تميل الى القاعدية الخفيفة. وأظهرت نتائج العسرة الكلية ارتفاعاً لتصل الى 636 ملغم/لتر وكان عنصري الكالسيوم والمغنيسيوم هما المسببان للعسرة وكانت القاعدية أغلبها تعود لوجود أيونات الكاربونات والبيكاربونات, وأرتفعت الكبريتات الى 280 ملغم/لتر , ووصلت الفوسفات الى 0.04 ملغم/لتر, أما النترات فتراوحت تراكيزها بين 0.12- 1.65 ملغم/لتر.

كلمات مفتاحية : نهر دجلة , سدة الكوت, المعايير الفيزيائية والكيميائية.

Abstract

The physical and chemical parameters of Tigris River water at AL- Kut City have been investigated. Five stations at the river were chosen to perform the study. Monthly samples from all stations were collected during the period from January - December 2015.

The result of turbidity values showed height in summer reached to 68 NTU, The decrease of turbidity and the total suspended solids was one of the positive results to the effect of AL-Kut Dam on the Tigris River after the dam. The river water was fresh with a good aerated water with height of the dissolved oxygen value has been reached to 20. 5mg/L. Over saturated Oxygen condition was noticed 246.75 mg/L but the biological demand of oxygen with variation in some values. The result of hydrogen ion concentration values on the weak alkaline side. The Higher values of total hardness were recorded 636mg/L, also the Calcium and magnesium were the main cause of hardness. The most alkaline was caused by carbonate and bicarbonate ions the sulphates were increased to 280 mg/L. The phosphate of the surface water in concentration from 0.12- 1.65 mg/L.

Keywords: Tigris River, Al- Kut Dam, Physical and Chemical.

Introduction

Water resources play an essential role for the life of living organisms including human, and are represented one of the most important abiotic factor of the environment. Water is essential element for industry, and agriculture activities of the human (1). Reviewed of the previous studies delt with the physic- chemical parameters of the Tigris river and their tributaries and streams at AL-Kut city including Abboud study(2), which gave an idea about the size of pollutions in the river , Al-kuraishi(3)who give some information's about the physical and chemical characteristics of Tigris river water AL-Kut Dam, Darweesh(4) on Al-Mazak river south west of AL-Kut city, Al-Dabi(5) on Al-Battar river North of Al-Kut city, and Muhamed(6) study on the physical and chemical characteristics of Tigris river water AL-Kut Dam, All the above studies delt with the physical and chemical parameters of Tigris river water, and did not give any idea about the effect of AL-Kut Dam on the environment characteristics of Tigris river water with the exception of the study done by Al-kuraishi(3).

One of the major drawback for the present investigation is the almost lack information's about the effect of AL-Kut Dam on the water quality and the environmental characteristics of Tigris river within Wassit Province

Material and Methods

AL-Kut Dam situated at AL-Kut city within Wassit Province, the Dam established in the year 1939 for storage of water and increase the water level of Tigris river and to supply AL-Garraf, AL-Dijelah, AL-Dalmaj and AL- Mazak canals for the irrigation purpose north of AL-Kut city(7).

The present study conducted at Tigris river within AL-Kut city Mid of Iraq.During the period from January – December 2015. Five stations were selected at Tigris river to perform the present study (figure 1).

Station (1) located before AL-Kut Dam about 4Km at the point of Tigris river entrance to Al-Kut city, the river at this region is 150 m width and 2.5m depth. The water at this at this station is fast. The station (2) located near the Dam about 100m and the river width is 500m with 5m depth, and river characterized by slow

with the previous study in different Iraqi inland water bodies (3,15,16).

Water temperature in station (1) above the location of the Dam was 8.5°C as a lowest value during January 2015 while the highest value recorded was 29°C during September 2015. In station (2) at the Dam Lake the temperature was 9°C during January and February 2015, as a lowest value while the highest value 29.8°C recorded during July 2015. On the other hand stations at the lower reaches (stations 3,4,5) the lowest value was 10°C during January 2015 and the highest was 31.5°C during July 2015(station 5).Results of statistical analysis showed no differences in different station ($p \leq 0.05$). The changes in water temperature between stations above the Dam (station 1&2) and the stations of lower reaches (stations 3,4,5), is related to the thermal stratification , or due to the time of sampling (17).

Electric conductivity values also showed some differences in different station they were 1330 µS/cm with 0.85‰ salinity value during July 2015 as a highest value and 750µS/cm with 0.48‰ salinity value during January 2015 at station (1), while the highest value for electric conductivity was 1160 µS/cm with 0.74‰ salinity value during February 2015 at station (2). While the values at stations (3,4,5) was 1380 µS/cm with 0.88‰ salinity value during August 2015 at station(4),and the lowest value was 770 µS/cm with salinity value of 0.49‰ during March 2015 at station (5).

The values of total dissolved solid material (TDS) of Tigris river in different stations and months at upper of lower reaches of AL-Kut Dam was 0.66 current. Station (3) located at lower reaches of the Dam in about 1.5 Km, the width of the river of this station is 540m with 1.80m depth and the river characterized by the presences of green algae, station (4) in located about 3.5m depth faraway from station (3) the river width at this station is 474m with 1.30m depth, and the river characterized by the present ***Phragmites australis*** and ***Typha domengnsis***. Station (5) is located about 5Km faraway from station (4), the river at this station is 358m width with 2.30m depth and characterized by the stony edge, high level of water and presence of algae.

Samples were collected at both sides of the river and from the surface of water (about 30 Cm deep) several measurement were recorded the field and in the laboratory which included air and water temperature, PH, electric conductivity, Total hardness, dissolved materials, salinity, dissolved O_2, BOD_5, AL-Kalinity, Calcium, Magnesium, phosphate, sulphat, Total Solid Suspended (TSS), bicarbonate, data were analysced(8,9,10,11,12,13).using statistical analysis system (SAS)(14).

Result and discussion

Table (1) revealed the means, ranges and standard deviation of the values of physical and chemical parameters of Tigris river at the five stations at Tigris river.

Results of the study revealed that there are clear differences in air temperature during the period of study (Table 1& figure 2). The results of statistical analysis showed some differences between the different stations ($p \leq 0.05$) which related to the time of temperature measurement, the results agree

station. On the other hand the lower Dam stations the highest value of (DO) 20.5 mg/L during December and the highest percentage of saturation 246.75% during September 2015. The statistical analysis showed no signification differences between the different stations ($p \leq 0.05$).

The changes in (DO) value in the different stations are probably due to the effect of the dead algae and the amount of organic materials in the bottom which consume the (DO) in addition to the high concentration of ions in water (20).

The present study recorded highest value for (BOD_5) for the upper Dam stations which was 5 mg/L during June and August and the lowest value was 0.7 mg/L during January at station (1), while the highest value was 6 mg/L during August at station (2) and the lowest value was 0.8 mg/L during February 2015 at station (2). The stations at the lower Dam (stations 3,4,5) recorded 7.5 mg/L during July at station (3) as a highest value and the lowest value was 0.4mg/L which was recorded during September 2015 at station (4). The statistical analysis showed no signification differences ($p \leq 0.05$) between the different stations.

The results revealed some changes related with the sites. The highest value of (BOD_5) recorded during July 2015 at station (3) after the Dam, which probably due to discharge deep water from the Dam reservoir which is rich with organic materials that consume the (DO) leading to increase (BOD_5), while the value was low at the other stations which are mostly far away from the pollution sources caused by output of the sewage and the increasing in water level which in g/L as a highest value during July and the lowest value 0.25 g/L during December at station (1), while the value of (TDS) at station (2) were 0.73 g/L during June as a highest value and 0.53 g/L during January as a lowest value. The station (3,4,5) recorded the highest value of 0.69 g/L during Augusts at station (4) and the lowest value was 0.26 g/L during December at station (5). The results of the present study showed no signification differences ($p \leq 0.05$) in different stations for electric conductivity, salinity and (TDS).

On the other hand results of the present study for electric conductivity, salinity and (TDS) revealed some changes related with the station (2) the values were 1.03‰, 1610 µS/cm and 0.73 g/L respectively. The increasing of the values is probably related with the decreasing in water level at summer months (16, 18).

Results of the present study showed that there are no differences in the values of pH ($p \leq 0.05$). This is probably due to the quality of water of Tigris river which is rich with carbonate and bicarbonate ions (19).

The present study recorded the highest value of dissolved oxygen and percentage of saturation oxygen for the tow station above the Dam were 15.1 mg/L with percentage of saturation of 159.61% during October 2015 and the lowest were 6.2 mg/L with percentage of saturation of 79.08 % during July 2015 at station (1). While in station (2) the values 17.4 mg/L and 183.61% during September 2015 as a highest(DO) and percentage of saturation respectively and 6 mg/L and 77.92 % as a lowest values of (DO) and percentage of saturation during Augusts 2015 at the same

The values of total Alkalinity at the station above of the Dam range between 172 mg/L during August at station (1), and 120 mg/L during April at the same station, while the values at station (2) range between 143 mg/L during February as a lowest value and 230 mg/L during July as a highest value. The station (station 3,4,5) at the lower reaches of the Dam reach to 185 mg/L during August at station (3) and 115 mg/L during December at station (4). The statistical analysis revealed no signification differences between the different stations ($p \leq 0.05$).

The bicarbonate value recorded during the present study at the station upper the Dam between 197 mg/L as a highest value during June and 110 mg/L during February at station (1), while the values at station (2) range between 150 mg/L as a lowest value during February and 220 mg/L as a highest value. The other station (3,4,5) at the lower reach of the Dam recorded 197 mg/L as a highest value during August at station (3) and 140 mg/L as a lowest value during December at station (5). The statistical analysis showed no signification differences ($p \leq 0.05$) of bicarbonate value between the different stations.

The increase and decrease of total Alkalinity values during certain months related with the change in turbidity and water level as the output of water reached to the lowest value (116.02 m^3/s). The seasonal changes of total al-kalinity and bicarbonate at station (2) recorded a highest value comparison with the other stations as a result of Dam effect to increase the total Alkalinity as a result of water storage process which use as trap for salts in addition to the effect of carbon dioxide in total al-kalinity increase due to responsible for decreasing the organic contents of the water(21)

The values of turbidity for Tigris river samples from upper Dam stations (stations 1and2) were 43.22 NTU during August 2015 as a highest value and 13.48 NTU during January 2015 at station (1), while the value reach to 31 NTU during August at station (2) as a highest value and 10.43 NTU during February 2015 at the same station. The stations at lower reaches of the Dam (station 3,4,5) represented by 68 NTU during July at station (5) as a highest value and 11.81 NTU during December at station (4) as a lowest value. The statistical analysis of the data revealed that there are no signification differences ($p \leq 0.05$) in different stations. The decreasing in the level of turbidity is probably due to the fact that there is no fast current in the water. This result agrees with previous study (22).

The values of total solid Suspended (TSS) in the two stations before the Dam were 65 mg/L during August at station (1) as a highest value and 2 mg/L during December and January at the same station as a lowest value. The highest value in station (2) 29 mg/L during July and the lowest value was 1 mg/L during January. On the other hand the highest value recorded in the station after the Dam (station 3,4,5) was 88 mg/L during August at station (4) and the lowest value was 2 mg/L during December, January and February at station (4 and 5). Statistical analysis of the data revealed some differences between the stations, the differences probably related with the slow current of water, which lead to increase the turbidity and increase in the biomass of phytoplankton (23).

(3,4,5) were ranged between 4.2 mg/L during August at station(3) and 51.13 mg/L during December. Statistical analysis showed no signification between the different stations ($p \leq 0.05$) .

Comparison the results of high total hardness revealed that the river water is highly intractable which agree with several previous study in in Iraq. Water bodies due to the presence of calcium and Magnesium ions (25).

The present study recorded the highest value of sulphate which reach to 280 mg/L during February and the lowest value was 83 mg/L during July at station (1), while the values at station (2) were ranged between 150 mg/L during November and January a highest value and 65mg/L during June as a lowest value. The stations (3,4,5) recorded 202 mg/L as a highest value, at station(3) during December and the was 70 mg/L at station (4 and 5) during July and August respectively. The statistical analysis revealed no differences between the different stations ($p \leq 0.05$). The high value of sulphate at the at the Dam agree with similar studies as a results water immure in Dam lake (26, 27).

Results of the present study recorded highest value for nitrate at station (1) and (2) which reach to 2.12 mg/L at station (1) during December and the lowest value was 0.24 mg/L during June, while the lowest value in station (2) was 0.57 mg/L during July and the highest was 3.16 mg/L during March. In station (1),(2) and (3) the highest value was 1.65 mg/L during March at station (3) and the lowest was during June at station (4).

The highest level of nitrate recorded during winter and spring months the respiration and low biomass of plants that consume carbon dioxide and increase the value of al-kalinity and bicarbonate (24).

The value of total hardness in the station upper the lake (station 1 and 2) range between 308 mg/L during August at station (1) and 550 mg/L during January at the same station, while in station (2) the value range between 308 mg/L during July and 636 mg/L during February. In the other three stations (3,4,5) the values range between 316 mg/L during August at station (4) and 580 mg/L during February at station (5). Statistical analysis revealed no differences ($p \leq 0.05$) between the different stations. The differences in the values probably related to the rainfall and evaporation (7).

Results of the present study declare Clare differences in calcium values in Tigris river water for the station upper and lower of the Dam. In the upper Dam stations the values of calcium ions ranged between 80.19 mg/L during October at station (1) and 178.34 mg/L during May at the same station, while the values at station (2) ranged between 116.23 mg/L during October 192.38 mg/L during January. On the other hand the values at the other three stations (3,4,5) were ranged between 92.18 mg/L during October at station(3) and 185 mg/L during May at the same station.

The values of Magnesium ions revealed clear differences is station 1 and 2 and they were ranged between 3.02 mg/L during August of station (2) and 36.95 mg/L during February at the same station while at station (2) the values ranged between 3.68 mg/L during June and 69.58 mg/L during February. The values of Magnesium ions in the other three stations

0.02mg/L during March at station (4) and the highest was 0.09 mg/L during July at the same station. Statistical analysis revealed no signification between the different stations ($p \leq 0.05$) .The differences of stations location is responsible for the change in the value of phosphate due to the effects of several factors such as decrease the penetration of light and decrease the temperature in addition to increase the storage period which lead to precipitate the phosphate in the base of lack(31). At station (3) high value of phosphate was recorded due to the using of phosphate fertilizer in agricultural area near the location of station (3), this result agree with the data recorded by (32) which is due to the suitable water temperature and availability of the oxygen and low level of water during three months and at these condition bacteria in water change the nitrate to nitrite (28). The results of the present study agree with the study of (29, 30).

The value phosphate recorded during the present study was 0.02 mg/L during March at station (1) as a lowest value while the highest value recorded was 0.08 mg/L during August at the same station. In station (2) the lowest value was 0.01 mg/L and the lowest value 0.05 mg/L during August. The other three stations (3),(4) and (5) recorded lowest value of

Table (1): Mean, range and standard deviation of the value of physical and chemical parameters of water in Tigris river before and after AL-Kut Dam during the period from January to December 2015.

Parameters	Stations				
	Station 1	Station 2	Station 3	Station 4	Station5
Air Temp. ^{o}C	10-33 22.25± 8.08 A	10-34.5 23.32.32± 8.54 A	12.2-38 24.95± 8.35 A	12-31 23.39± 6.80 A	12-40 27± 8.78 A
Water Temp. ^{o}C	8.5-29 20.53± 7.88 A	9-29.8 20.79± 7.84 A	11-30.6 21.93± 6.87 A	10- 29 21.59± 6.57 A	10.5-31.5 22.30± 7.21 A
EC µS/cm	750-1330 1067.5±204.67 A	1160-1610 1252.5± 125.34 B	772-1330 1113.91± 194.25 A	780-1380 1100 ± 204.36 A	770-1370 1129± 215.65 A
Salinity (‰)	0.48-0.85 0.65± 0.12 A	0.74-1.03 0.80± 0.07 B	0.49-0.85 0.71± 0.12 A	0.49-0.88 0.70± 0.12 A	0.49-0.87 0.72± 0.13 A
TDS(g/L)	0.25-0.66 0.52± 0.12 A	0.53-0.73 0.60± 0. 05 B	0.38-0.69 0.54± 0.10 A	0.32-0.67 0.51± 0.11 A	0.26-0.68 0.51± 0.14 A
pH	7.4-7.7 7.51± 0.09 A	7.2-7.8 7.55± 0.16 A	7.4-7.8 7.56± 0.12 A	7.2-7.7 7.42± 0.14 A	7.3-7.9 7.58± 0.18 A
DO (mg/L)	6.2-15.1 9.53±2.69 A	6-17.4 11.68± 3.53 A	7.5-20.5 11.94± 4.09 A	6-17.3 9.05± 3.45 A	7.2-17.2 10± 2.83 A
Saturated Oxygen (%)	79.08-159.61 103.33± 24.26 A	77.92-183.61 128.58± 37.66 A	99.07-246.75 135.25± 47.21 A	66.07-186.62 100.34± 31.92 A	88.65-185.54 113.149± 28.56 A

BOD_5 (mg/L)	0.7-5 3.30± 1.26 A	0.8-6 3.90± 1.50 A	0.9-7.5 3. 6± 2.11 A	0.4-5.8 3.60± 1.71 A	2.5-6.7 4.7± 1.59 A
Turbidity NTU	13.48-43.22 30.36 ± 10.46 A	10.43-31.32 22.53 ±5.91 B	18.69-60 35.47± 15.08 A	11.81-65 30.33 ± 17.41 A	17.19-68 32.44 ± 14.05 A
TSS(mg/L)	2-65 22.19± 20.66 A	1-29 8.96±8.16 A	3-36 13.83±10.70 A	2-88 24.42± 16.08 A	2-51 14.12±11.41 A
T. Alkalinity (mg/L)	120-172 145.5± 18.69 A	143-230 171.58± 23.25 A	138-185 166.5± 15.23 A	115-183 153 ± 20.66 A	140-180 162.83± 11.88 A
Bicarbonate (mg/L)	110-197 154.5± 29.32 A	150-220 181.66± 20.95 A	145-197 175.16± 17.38 A	144-193 169.83± 17.17 A	140-190 171.75± 16.05 A
Total Hardness as ($mgCaCo_3$/L)	308-550 468.91± 80.82 A	380-636 488.83± 86.50 A	340- 568 475± 80.94 A	316-576 474.66± 92.50 A	332-580 470.33± 86.60 A
Ca^{+2} (mg/L)	80.19- 178.34 148.34±27.60 A	116.23-192.38 154.61± 24.44 A	92.18-185 146.65± 25.58 A	100.2-180.36 147.61± 23.90 A	96.02-184.36 151.98± 25.50 A
Mg^{+2} (mg/L)	3.02-36.95 23.55± 12.12 A	3.68-69.58 24.94± 18.91 A	4.2-45.66 27.92± 14 74 A	4.87-51.13 26.81± 14.30 A	4.68-45.66 22.03 ± 14.86 A
Sulfate SO_4^{+4} (mg/L)	83-280 139.33± 63.63 A	65-150 108.16± 33.42 A	84-202 129.91±38.58 A	70-190 111± 36.22 A	70-180 124.58± 35.51 A
Nitrate-Nitrogen ($mgNO_3$-N/L)	0.24-2.12 1.07± 0.51 A	0.57-3.16 1.50± 0.74 A	0.55-1.65 1.12±0.33 A	0.12-1.56 0.90± 0.42 A	0.17-1.63 0.98± 0.48 A
Phosphate PO_4^{-2} (mg/L)	0.02-0.08 0.04± 0.01 A	0.01-0.05 0.03± 0.009 A	0.03-0.07 0.04± 0.01 A	0.02-0.09 0.04± 0.01 A	0.02-0.09 0.04- 0.01 A
O.M. Sediment organic Matter	0.6-2.3 1.27±0.76 AB	1.5-3.1 2.15± 0.68 A	1.2-2 1.5± 0.35 B	1.1- 1.9 1.4± 0.35 B	0.7-2.2 1.3± 0.66 AB

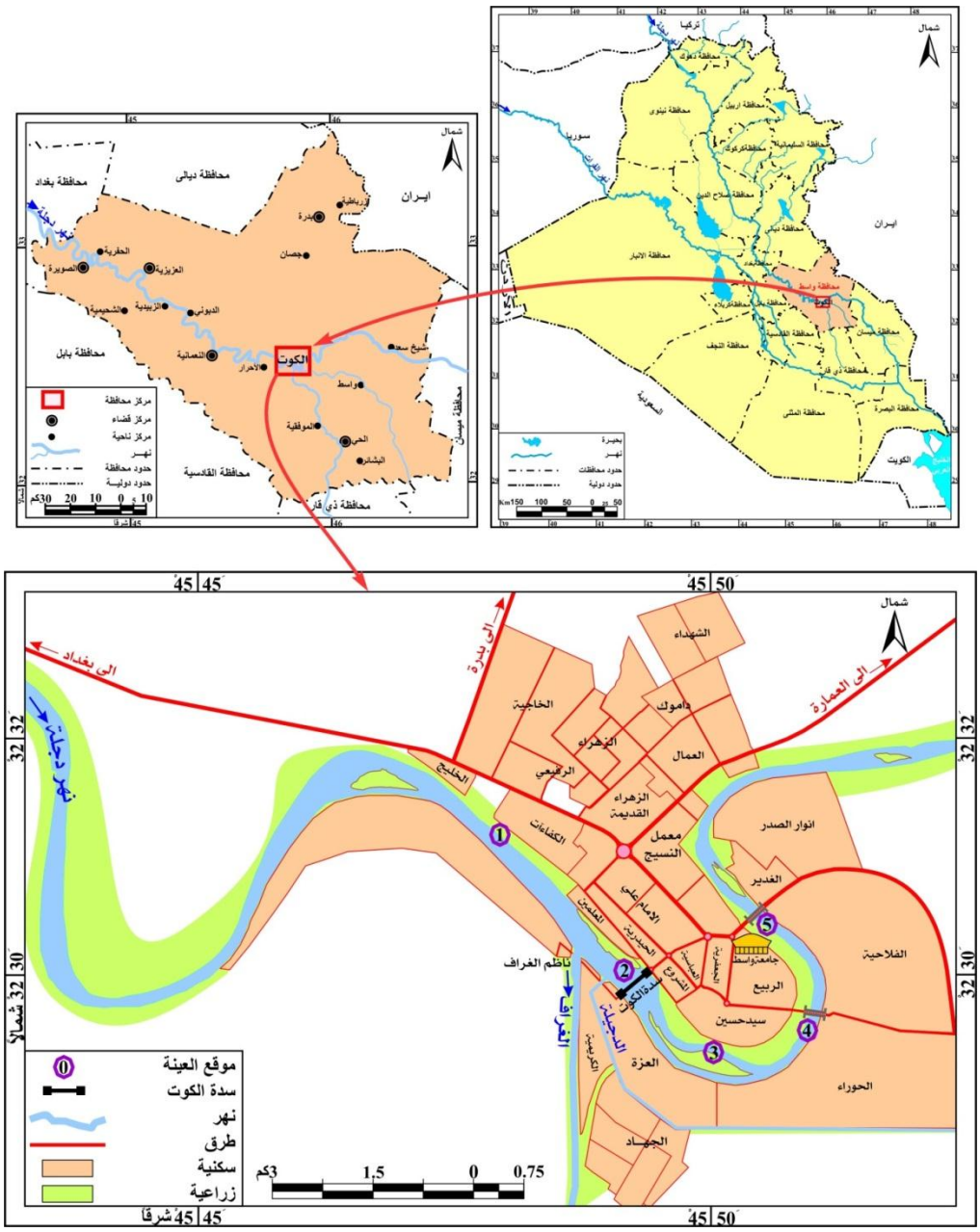
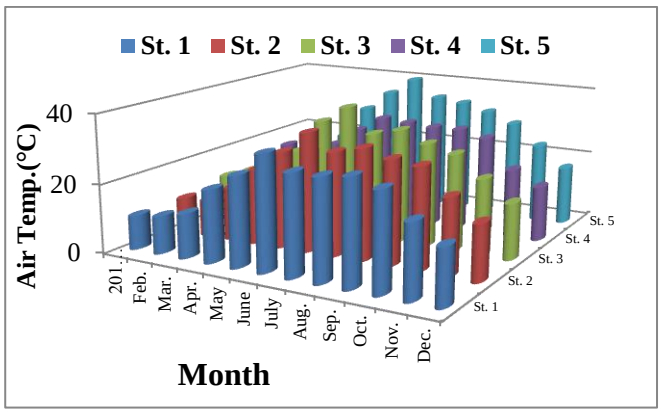
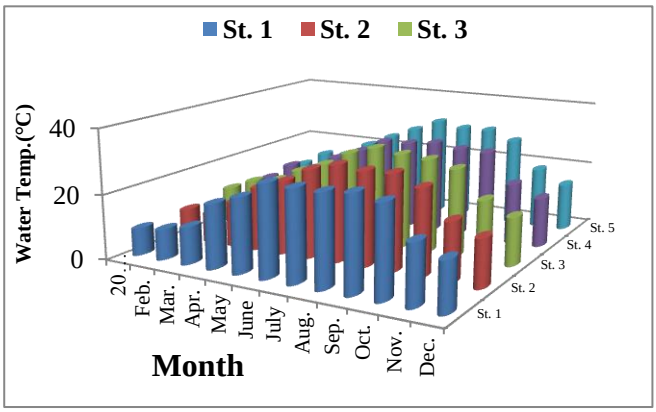
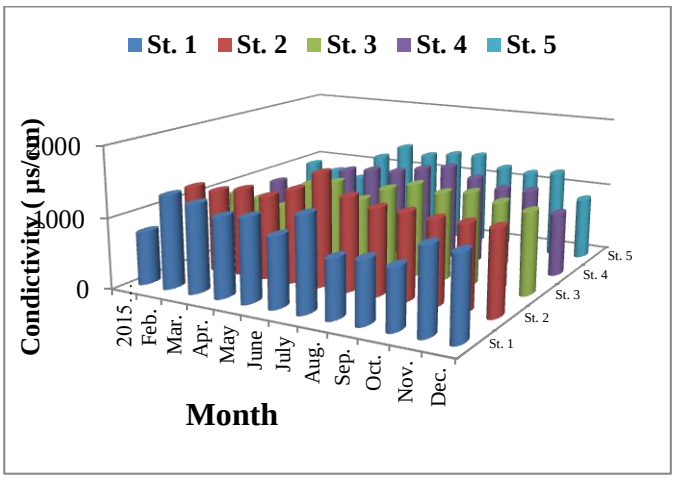
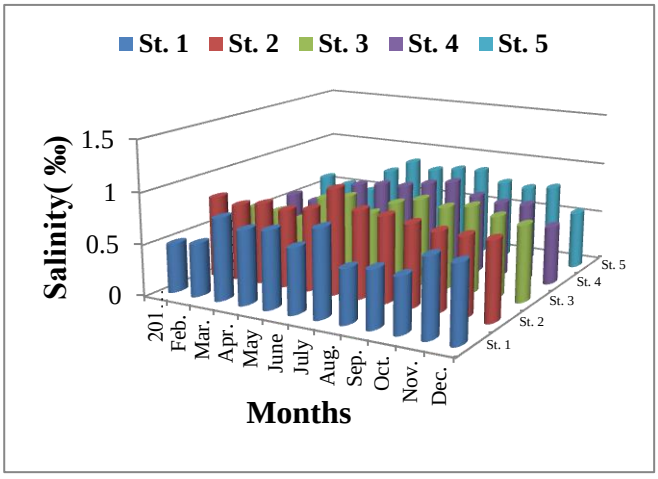


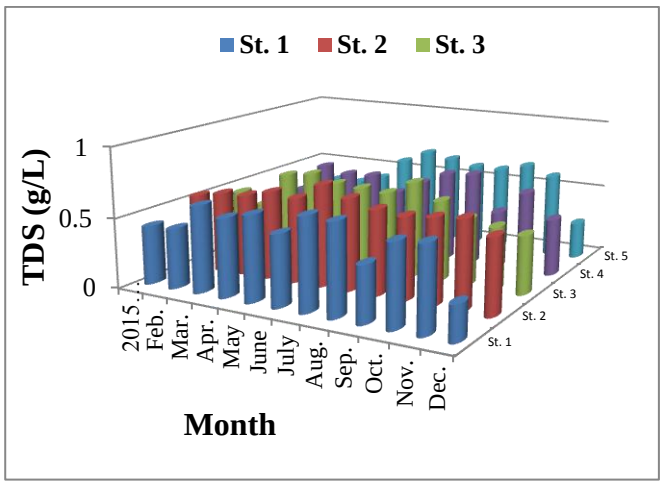
Figure (1): Sites of study (S_1-S_2) within Al-kut sity

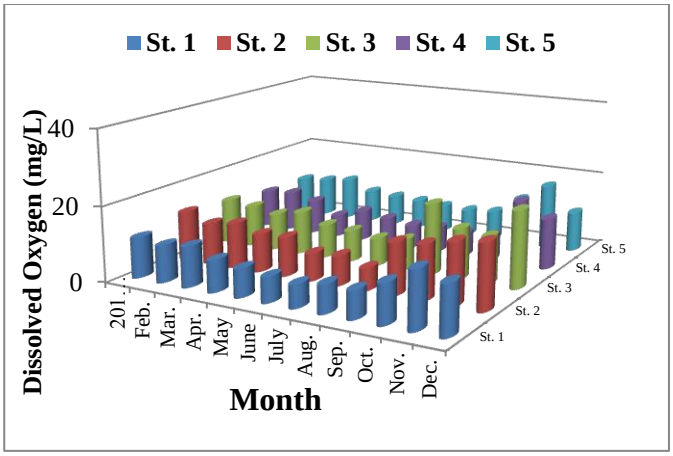

St. 1
St. 2
St. 3
St. 4
St. 5
Air Temp.(°C)
40
20
0
201..
Feb.
Mar.
Apr.
May
June
July
Aug.
Sep.
Oct.
Nov.
Dec.
St. 5
St. 4
St. 3
St. 2
St. 1
Month

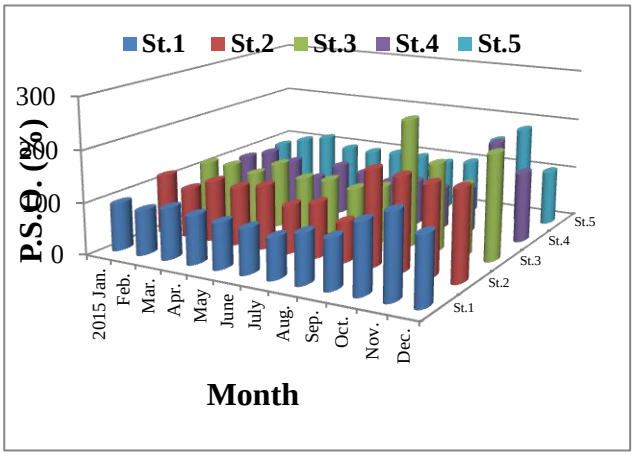

St. 1
St. 2
St. 3
Water Temp.(°C)
40
20
0
20..
Feb.
Mar.
Apr.
May
June
July
Aug.
Sep.
Oct.
Nov.
Dec.
St. 5
St. 4
St. 3
St. 2
St. 1
Month

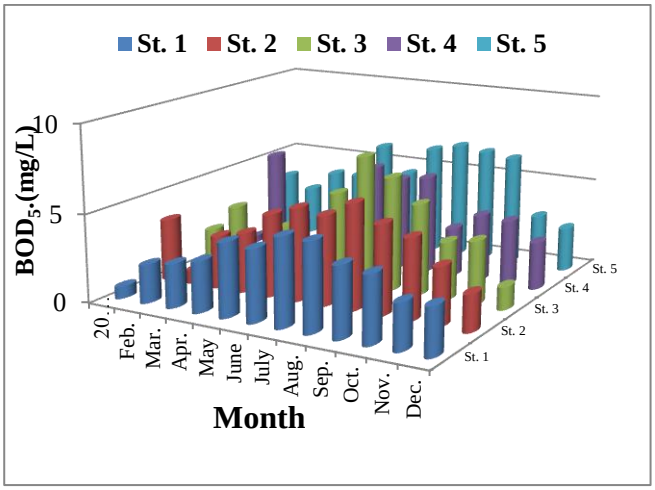

St. 1
St. 2
St. 3
St. 4
St. 5
Condictivity (µs/cm)
000
000
0
2015..
Feb.
Mar.
Apr.
May
June
July
Aug.
Sep.
Oct.
Nov.
Dec.
St. 5
St. 4
St. 3
St. 2
St. 1
Month

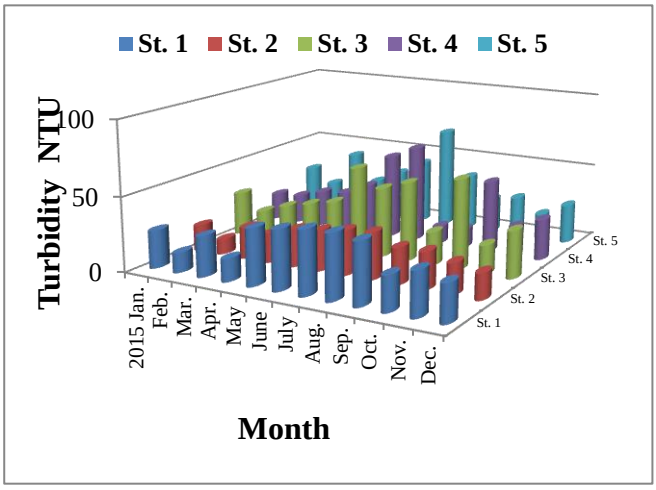

St. 1
St. 2
St. 3
St. 4
St. 5
Salinity(‰)
1.5
1
0.5
0
201..
Feb.
Mar.
Apr.
May
June
July
Aug.
Sep.
Oct.
Nov.
Dec.
St. 5
St. 4
St. 3
St. 2
St. 1
Months

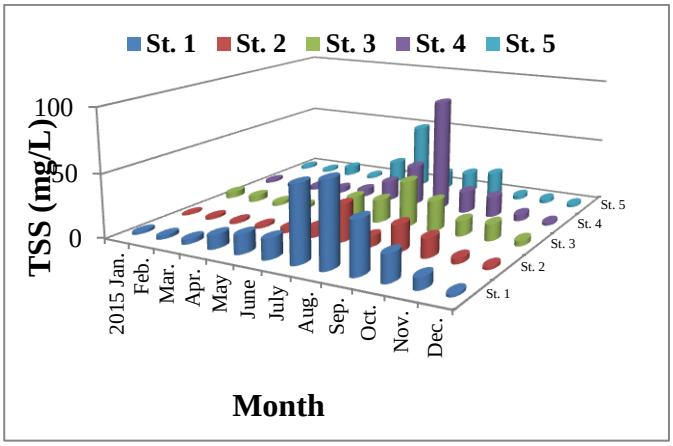

St. 1
St. 2
St. 3
TDS (g/L)
1
0.5
0
2015 ...
Feb.
Mar.
Apr.
May
June
July
Aug.
Sep.
Oct.
Nov.
Dec.
St. 5
St. 4
St. 3
St. 2
St. 1
Month

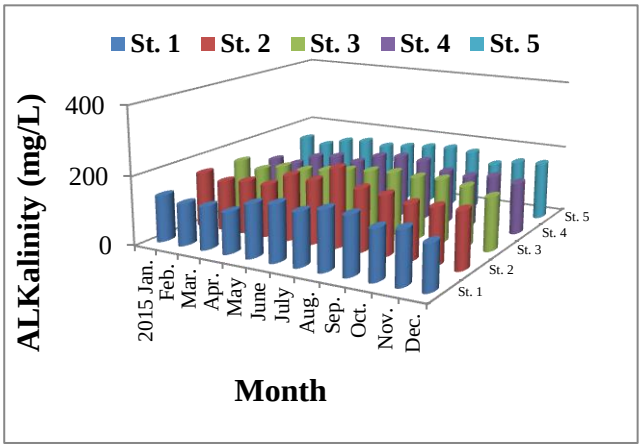

St. 1
St. 2
St. 3
St. 4
St. 5
Dissolved Oxygen (mg/L)
40
20
0
201...
Feb.
Mar.
Apr.
May
June
July
Aug.
Sep.
Oct.
Nov.
Dec.
St. 5
St. 4
St. 3
St. 2
St. 1
Month

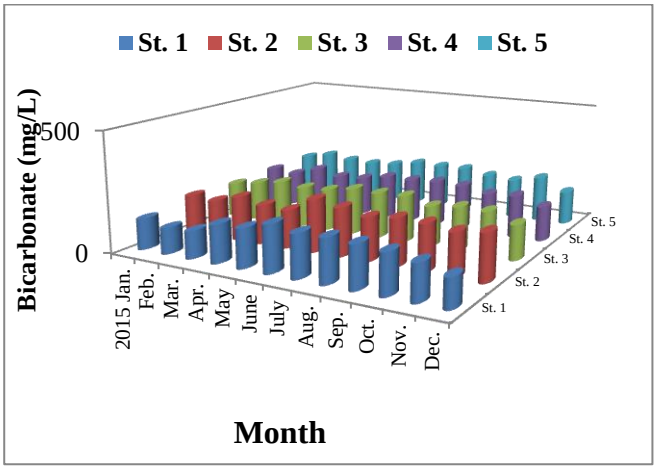

St.1
St.2
St.3
St.4
St.5
300
0
2015 Jan.
Feb.
Mar.
Apr.
May
June
July
Aug.
Sep.
Oct.
Nov.
Dec.
St.5
St.4
St.3
St.2
St.1
Month

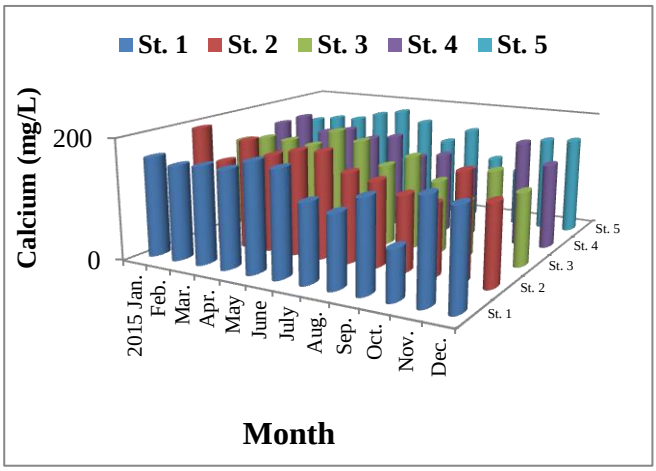

St. 1
St. 2
St. 3
St. 4
St. 5
BOD5.(mg/L)
10
5
0
20..
Feb.
Mar.
Apr.
May
June
July
Aug.
Sep.
Oct.
Nov.
Dec.
Month

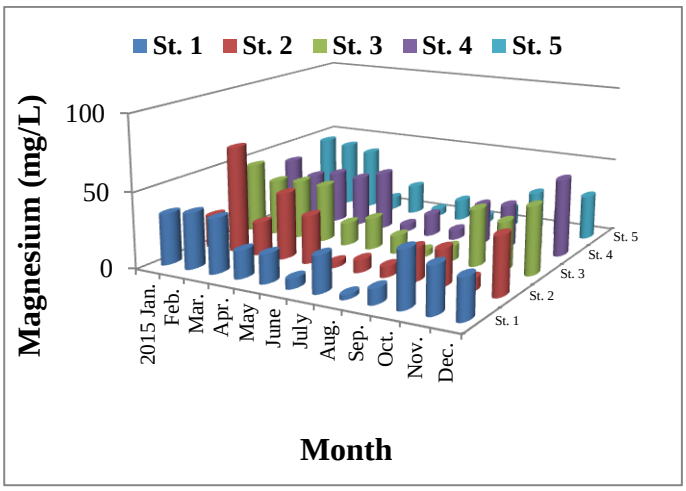

St. 1
St. 2
St. 3
St. 4
St. 5
Turbidity NTU
100
50
0
2015 Jan.
Feb.
Mar.
Apr.
May
June
July
Aug.
Sep.
Oct.
Nov.
Dec.
Month

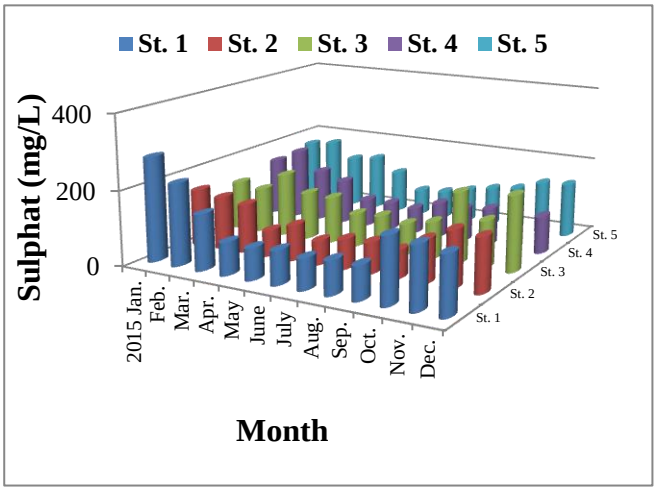

St. 1
St. 2
St. 3
St. 4
St. 5
100
50
0
TSS (mg/L)
2015 Jan.
Feb.
Mar.
Apr.
May
June
July
Aug.
Sep.
Oct.
Nov.
Dec.
Month

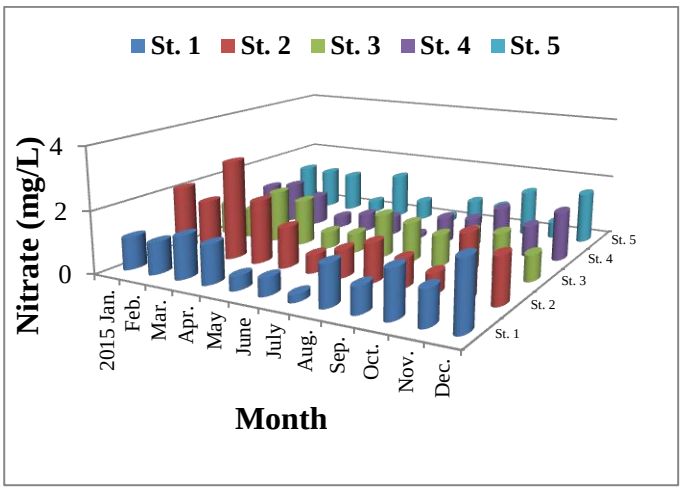

St. 1
St. 2
St. 3
St. 4
St. 5
400
200
0
ALKalinity (mg/L)
Month

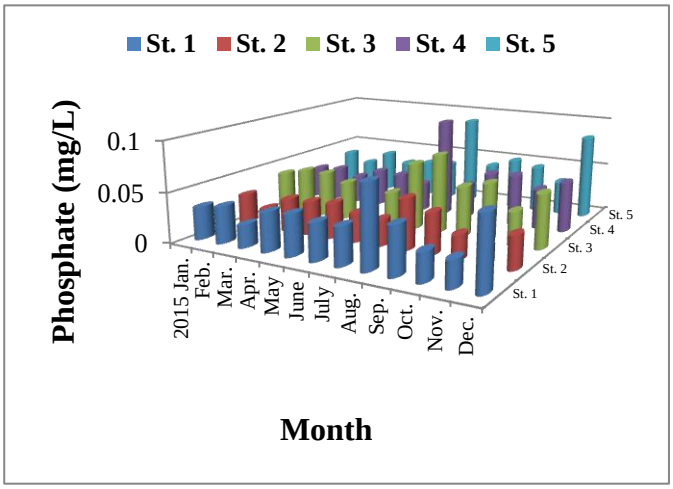

St. 1
St. 2
St. 3
St. 4
St. 5
500
0
Bicarbonate (mg/L)
Month


St. 1
St. 2
St. 3
St. 4
St. 5
200
0
Calcium (mg/L)
Month


St. 1
St. 2
St. 3
St. 4
St. 5
Magnesium (mg/L)
100
50
0
2015 Jan.
Feb.
Mar.
Apr.
May
June
July
Aug.
Sep.
Oct.
Nov.
Dec.
St. 1
St. 2
St. 3
St. 4
St. 5
Month


St. 1
St. 2
St. 3
St. 4
St. 5
Sulphat (mg/L)
400
200
0
2015 Jan.
Feb.
Mar.
Apr.
May
June
July
Aug.
Sep.
Oct.
Nov.
Dec.
St. 1
St. 2
St. 3
St. 4
St. 5
Month





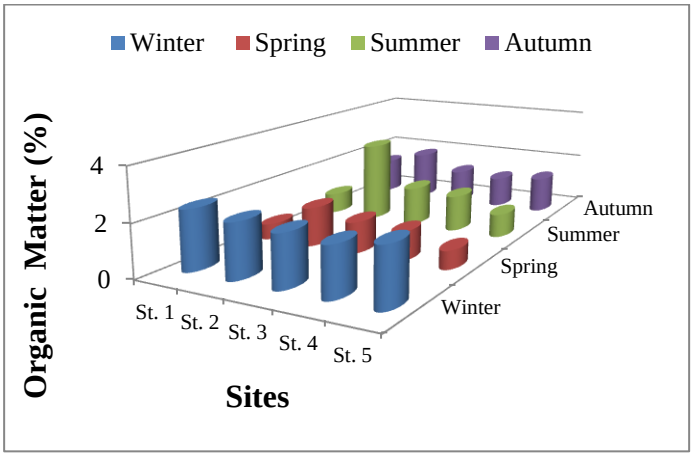


Figure (2): Seasonal changes of some physical and chemical parameters of study stations during the period January- December 2015.

References

proposed treatments. Journal of Misan Research, 2(1): 45-71.(In Arabic)

2- Abboud, S.S.(2014). Ecological study of some dominant species Chironominae (Diptera : Chironomidae) as Bio-

1- Abdullah, H. J.(2005). Dams and their negative impacts on the current water resource environment and

10-Mackareth, F.J.H. ; Herson, J. &Talling, J.T. (1978). Water analysis some revised method liminology. Sci. Publ. Fresh water. Bio. Ass . England., 36:1-120.

11- Lind, O.T. (1979). Hand book of Common Methods in Limnology. 2nd ed. London 199pp.

12- Brands, H.J. & Tripke, E. (1982). Water manual. Vulkan-Verlag, Essem: 320pp.

13- Degremont, Company(1979). Water treatment hand book. 5ed, Division of John Wiley &Sons, New York: 1186 pp.

14- SAS, Statistical Analysis System . (2012). Statistical Analysis System, User's Guide. Statistical.Version 9.1th ed. SAS.Inst. Inc. Cary. N.C. USA .

15- AL-Lami, A,A ;Kassim, T. I. & AL-Dulymi ,A . A. ,(1999). A limnological study on Tigris river ,Iraq .The Sci. J. of Iraqi Atomic Energy Commission ,1:83-98.

16- - Sabri , A. W.; Maulood , B. K. & Sulaiman ,N .E. (1989). Limnological studies on river Tigris: Some physical and chemical characters. J. Biol. Sci. Res., 20(3):565-579.

17- Ismail, A.M.(2001). The specific composition of phytoplankton in three districts in Diyala province - Iraq. Al-Fatih Journal, (8): 184-191. .(In Arabic).

18-AL-Lami, A. A.; AL-Saadi, H.A.; Kassim,T. I., AL-Dulymi & AL-Aubaidi, K.H.(1997). Seasonal Variation of Limnological Characters in Qadisia lake, Iraq. Mutah Journal for Research and studies, 12(1) pp: 383-414.

19-AL-Saadi ,H .A. & Maulood ,B.K.(1991). The contribution of aquatic ecology for Iraq development .J.Col.Edue.for Women ,Univ.Baghdad,2:8-11.

20- Tyar, T.A.T. (1988). The effect of Saddam's dam on water quality and its indicator for water pollution of Tigris River in Al-Kut City / Southern Iraq. M.Sc. Thesis, College of Science,Uni. Of Wasit, 60 pp.(In Arabic)

3- Al-kuraishi, R.A.J.(2011). A study of the Effects of some Ecological Factors of Kut Dam on the Benthic Invertebrates of River Tigris. M.Sc. Thesis, College of Science for Women ,Uni of Baghdad, 204 pp. .(In Arabic)

4- Darweesh ,N.M. (2012). Ecological and Identification of some genus of Chironominae (Diptera : Chironomidae) in Al- Mazak river branch in Al - Kut City Southern of Iraq. M.Sc. Thesis, College of Science,Uni. Of Wasit, 54 pp.

5- Al-Dabi,F.K.Sh.(2014). Effect of some ecological factors and *Albizzia lebbeck* (L.) seeds extract on the Chironomidae larvae in Al-Battar river North of Al-Kut city/ Iraq. M.Sc. Thesis, College of Science,Uni. Of Wasit, 81 pp.

6- Muhamed, N.J.(2016). Ecological Study on Zooplankton Community and the Impact of Kut Dam on its Biodiversity in Tigris River,Iraq. M.Sc. Thesis, College of Science,Uni. Of Wasit, 157 pp. .(In Arabic).

7- General Authority for Dams and Reservoirs Projects (1999). Directory of Operation and Maintenance of Al Kut, Part 1 and Part 2.

8- APHA (American Public Health Association). (1998). Standard Methods for theExamination of Water and Waste water, 20th Ed. American Public Health Association, Washington. DC.

9- APHA(2003). Standard Methods for the Examination of Water and Waste water. 14th Ed.

City. Rafidain Journal of Science, 4(1) pp:30-40. (In Arabic).

27-Mustafa, M.H.B.,(2000) . Tigris River Water Quality within Mosul Area, Rafidain Journal of Science, 11 (4):26-39.

28-Lunsford, A. (2003). Compartion of the fate of dissolved organic matter in two coastal systems; Hog island Bay,VA(USA) and plum, island sound, MA(USA). M.Sc. Thesis, College of William and Mary, Virgnia, USA.

29-Rabee, A.M.(2010). The Effect of AL-Tharthar-Euphrates canal on the quantitative and qualItative composition of Zooplankton in Euphrates River.Journal of Al-Nahrain University.,13 (3):120-128.

30- Al-Nimrawee,A.M.R.(2005). The biodiversity of zooplankton and benthos invertebrates in Tigris and Euphrates rivers, central Iraq. Ph.D. Thesis, College of of Science-University of Baghdad 162 pp**.** (In Arabic).

31-Walz, N. & Welker, M. (1998). Plankton development in a rapidly flushed lake in the River Spree System (Neuendorfer See, Northeast Germany). Journal of Plankton Research, 20: 2071-2087.

32- Al-Sarraj, E.S., Jankeer, M.H. and Al-Rawi, S.M. (2014). Some Indicators of Water Quality of the Tigris in Mosul City an Inferential Study. Rafidain Journal of Science, 25(1) pp:1-22. (In Arabic).

impact on the efficiency of the water purification plants in the city of Mosul. M.Sc. Thesis, College of Engender Uni. Of Mousl 120 pp**.** (In Arabic).

21- Sabri , A. W.; Younis, Sultan, M.H and H.H. (2001). Bacterial pollution in the Euphrates River . Journal of Environmental Research and Sustainable Development, 18(1) pp:111-124. (In Arabic).

22- Al-Obaidy,M.B. and Al-Ni'ma, B.A.(2013). Turbidity and Removal Efficiency in the Main Water Purification Plants of Nineveh Province. Rafidain Journal of Science, 24(3) pp:39-53. (In Arabic).

23−AL-Lami,A .A.; AL-Saadi,H.A.; Kassim, T.I.; AL-Dulymi, A.A . & AL-Aubaidi, K.H.(1997). Seasonal variation of the limnological characters in Qadisia Lake , Iraq ,Mu'tah ,J.,Res., Studies, 12 (1):383-414.

24-Goldman ,C.R. & Horne, A. J. (1983).Limnology. McGraw Hill,Inc.

25-Michaud,J.P.(1991). Guide to understanding and monitoring Lake and Streams. Publ. 94-149 .Washington State Dept.ofEcology ,Publications Office , Olympia ,WA,USA,(360) : 407-7472.

26- Mustafa, M.H. and Jankeer, M.H. (2007). Quality Difference Between Two Location on Tigris River Within Mosul