WATER QUALITY MONITORING OF AL-HAWIZEH MARSH

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Abstract

The Mesopotamian marshlands faced a massive destruction from the year 1990 till 2003. This destruction leads to displace the marsh dwellers and decrease the numbers of flora and fauna in the region. After the war in 2003 in Iraq the rehabitation and restoration of the devastated marshland ecosystem started. In this study a survey was made on the physical and chemical characteristics of Al-Hawizeh marsh for an interval and creates comparison among these characteristics during the four season's then format a relationships between water salinity and electrical conductivity and another relationship between turbidity and total suspended solid. It was found that the water quality of Al-Hawizeh marsh for most of the properties was good in summer time because of the flood water from Tigris and the other feeders of the marsh. Some properties of Al-Hawizeh marsh was coincide with the maximum allowable values of the Iraqi drinking standards (1986). The equation between the salinity and electric conductivity was exponential equation while between the turbidity and the total suspended solid was power equation.

Key Word: marsh, Mesopotamian, Hawizeh marshland, Turbidity, TSS.

مراقبة نوعية مياه هور الحويزة

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الخلاصة

ان الاهوار في بلاد مابين النهرين قد تعرضت الى تدمير كبير من عام ١٩٩٠ الى ٢٠٠٣. هذا التدمير ادى الى هجرة ساكني الاهوار والى نقصان نباتات وحيوانات المنطقة. بعد حرب ٢٠٠٣ بدأت عملية اعادة تأهيل وأحياء الاهوار المدمرة . تم في هذه الدراسة اجراء مسح على الخواص الفيزياوية والكيمياوية لهور الحويزة خلال فترة معينة ومقارنة هذه الخواص خلال فصول السنة الاربعة ومن ثم تكوين علاقة رياضيه تربط بين ملوحة الماء والتوصيل الكهربائي و علاقة اخرى بين العكورة وتركيز المواد الصلبة الكلية. وقد تم التوصل في هذه الدراسة الى التالي :-- نوعية مياه هور الحويزة ،بالنسبة لأغلب الخواص، كانت جيدة خلال فصل الصيف بسبب كمية المياه الكبيرة القادمة الى الهور من نهر دجلة وبقية مغذيات الهور.بعض خواص مياه الهور كانت متطابقة مع القيم العليا

المسموحة لمياه الشرب حسب المواصفة العراقية لعام ١٩٨٦. توجدعلاقة تربط الملوحة بالتوصيل الكهربائي وهي علاقة اسية اسية exponential equation وعلاقة بين العكورة وتركيز المواد الصلبة وهي علاقة اسية power equation.

Introduction

Wetlands mean simply the land that is wet, the land that is saturated with water(Water and Land Resources,1998).Marshes are frequently or continually flooded wetlands characterized by emergent herbaceous vegetation adapted to saturated soil condition, changing water flows, and mineral soil. Marshes are the most common wetlands types in North America and South of Iraq (USEPA, 2008). Marshes recharge groundwater supplies and moderate stream flow by providing water to streams. This is especially important function during periods of drought. The presence of marshes in watershed helps to reduce damage caused by floods by slowing and strong flood water. Historically , people lived and around the wetlands and in the interior of the marshes, and derived both subsistence and market economies from extractive uses such as harvesting reeds, water buffalo dairy products, fish, water, foul and agriculture. All Iraqi marshlands are located in south of Iraq in the longitude between (E 48º 00') from east to (E 46º) from the west and the latitude between (N 31º 50') from the north to (N 30º 30') from the south (Kadhem, 2005).

Marshlands are part of three governorates in south; Basrah, Amarah, and Thi-qar. The areas of all marshlands before drying are 20000 km², while the areas of the three governorates are 33577 km².Marsh in Iraq is typically divided into the three major areas: Al-Hammar, south of the Euphrates; the Central marshes between the twin rivers; and Al Hawizeh marshes east of the Tigris river (Abbas,2006), as shown in **Figure(1).**

Following the end of the Gulf War in 1991, the marsh dwellers were important elements in the uprising against the previous regime. To end the rebellion, the regime implemented an intensive system of drainage and water diversion structures that desiccated over 90% of the marshes(Partow, 2001). The reed beds were also burned and poison introduced to the waters (Nicholson, 2002).

Al- Hawizeh marsh locates to the east of the Tigris river in Misan governorate and extended to the Iranian territory (known there as Al-Azim marsh), as shown in **Figure (1)** (Evans , 1995) Al-Hawizeh marsh covered at least 3,000 square kilometer of area in the flood time and less of hundreds square meters in summer time (UNEP,2001, Hamadani, 1984).The major portion is located in Iraq covering an average area of 3500 km² during the flooding season. This marsh is reduced to 650 km² during the drying (Abbas, 2006).

The Data

The chemical and the physical tests include ; air and water temperature, pH, Salinity, Turbidity, Total Suspended Solids (TSS), Total Dissolved Solids (TDS) , Electrical conductivity (EC), Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD) , Total Hardness (T.H.) ,Calcium , Magnesium , Bicarbonate, Chloride and Sulfate, the data are from the Iraqi Foundation , the data in **Table (1)** represent the average of four values for each items , these four values collected from four stations in the marsh , the locations of these stations is (Station(1) N 31º 34'7.56" E 47º 30'31.38"; Station(2) N 31º33'44.51" E 47º 30'36.53"; Station(3) N 31º 37'11.37" E 47º 35'20.51"; Station (4) N 31º35'36.89" E 47º 38'45.11") .The instruments used for measuring the water parameters are: thermometer for temperature, Hanna(HI93703) for turbidity, the (WTW) 340i for measuring pH, conductivity, salinity, TDS, and DO , the BOD_5 can be calculated by subtracting dissolved oxygen after five days from the time of sampling, the T.H. and Ca^{+2} were calculated by titration with EDTA standard solution, The estimation of Mg^{+2} was :

(T.H.-CaH)*0.243=Mg

Where:

CaH is the Calcium hardness and T.H. is the total hardness.

The estimation of HCO_3^- values was by the titration with standard sulfuric acid solution, Cl^- values were estimated by titration with silver nitrate standard solution, and SO_4^{-2} was estimated by using spectrophotometer.

Result and Discussion

From **Figures (2)** and **(3)** which show the air and water temperatures for Al-Hawizeh marsh during the year, the minimum temperature of air and water in Al-Hawizeh marsh was in February and January respectively; and the maximum temperatures of air and water were in July and August respectively.

Figure (4) shows the turbidity values for Al-Hawizeh marsh, **Figure (5)** explain a decreasing in salinity in summer season because of the dual action of the high extension of vegetation in these months.

Figure (6)shows that the minimum concentration of BOD were in summer time because of the dual action of the high extension of vegetation in these months, the high concentrations of the BOD_5 in the fall and winter are because of the decomposition of the aquatic plants. **Figure (7)** show that the maximum values of EC occur in spring (just like the TDS values as shown in **Figure(8)** the low EC values in summer time is because of the dilution by the relatively higher water level and the high vegetation extension.

Figure (9) show the variation in the concentration of the total solid in all seasons. One can see the relative similarity in turbidity and TSS graphs and this is because the TSS is causing the turbidity in the water samples.

Figure (10) explain the values of pH for Al-Hawizeh marsh; which was almost lower in the fall season than the other seasons and that may be caused by the production a weak acid, called "carbonic" acid resulted from the combining of water with the carbon dioxide (CO_2) from organic substances decomposition and the pH values were within the range of Iraqi drinking standards(1986) (6.5-8.5). **Figure(11)** explain that the decreasing in concentration of T.H. in summer time because of the dilution caused by relatively higher water levels(UNEP, 2003) and the action of the extended vegetation (IMET, 2006) . On the other hand the high concentrations in fall and winter seasons are caused by the low water levels.

Figure (12) show that high DO concentrations in winter time are because of the lower temperatures which lead to increase the ability of water to contain Oxygen. **Figures (13)** and **(14)** show that the calcium and magnesium concentrations decreasing in summer time because of the dilution caused by relatively higher water levels. On the other hand the high concentrations in fall and winter seasons are caused by the low water levels. The concentration of calcium was within the limit of Iraqi drinking standards (1986) (less than 200 ppm) and the concentration of magnesium was within the limit of Iraqi drinking standards (1986) (less than 150 ppm).

Figure (15) show the concentration of bicarbonate for Al-Hawizeh marsh. The high pH value in spring is due to the flood water which led to raise the alkalinity in the water because of the type of soil in the area .

Figure (16), and **(17)** explain that there is a decreasing in concentration of chloride and sulfate in summer is because of the dilution caused by relatively higher water levels and the action of the extended vegetation (IMET, 2006, Al-Khazrajy, 2006). On the other hand the high concentrations in fall and winter seasons are caused by the low water levels. The concentration of chloride was within the limit of Iraqi drinking standards (1986) (less than 600 ppm).

The change in salinity and electrical conductivity values for Al-Hawizeh marsh during the year was shown in **Table (1)**, The best equation between salinity and electrical conductivity for Al-Hawizeh marsh is exponential equation ($y=814.77e^{0.8664x}$) where x is the salinity and y is the electrical conductivity. For this equation the correlation coefficient is 70.1%; as shown in **Figure (18)** and **Table (2).** While the best equation between turbidity and TSS for Al-Hawizeh marsh is power equation ($y=1.0307x^{0.9762}$) where x is the turbidity and y is the TSS. For this equation the correlation coefficient is 43.9%; as shown in **Figure (19)** and **Table (3)**.

Conclusions and Recommendations

The following conclusions may be derived from the following research:

1- From the comparison between the physical and chemical properties of water, it has been found that the best properties were in summer.
2- There was an exponential relationship between the salinity of water and electrical conductivity.
3- There was a power relationship between the turbidity of water and the total suspended solid concentration.

The following recommendation may be derived from the following research:

1- It is recommended to do researches about soil characteristics before reflooding new areas; since the soil may have toxic materials that can be transferred as dissolved phase to all over the marsh.

2- It is recommended to monitor the changes in water, vegetation and soil surface area and characteristics frequently, by using high resolution images and accurate instruments and laboratories.

References

Abbas, S.F., (2006), "**Application of Hydrodynamic Model in Abu Zirig Marshland**", M.Sc.Thesis, University of Al-Mustansiriya.

Al-Khazrajy, K.A., (2006),"**A Tectonic Study of the Marshes South of Iraq Using Geophysical and Sedimentological Data".** Ph.D. Thesis, University of Baghdad.

Evans, M., I., (1995) ."**Important birds areas in the Middle East** ".bird life international, p184.

Hamadani, S. M., (1984), **"Gleams of Irrigation Development in Iraq Before and Recently".** Sadoon Press.(Arabic).

IMET. ,(2006), **" Overview of Present Conditions and Current Use of the Water in the Marshlands Area" .**BOOK 4.Iraq Foundation.

Kadhem, A. J., (2005), **"Water Quality Monitoring of Abu Zirig Marsh in Southern Iraq After Drying",** M. Sc. Thesis, University of Al-Mustansiriya.

Nicholson, E. and P. Clark (Eds). ,(2002), **"The Iraqi Marshlands: A Human and Environmental Study".** The AMAR Appeal International Charitable Foundation.

Partow, H., (2001), **"The Mesopotamian Marshlands: Demise of an Ecosystem".** Report United Nations Environmental Program, 58pp, http://earthobservatory.nasa.gov/Newsroom/NewImages/meso2.pdf.

UNEP, Hassan Partow., (2001), **"The Mesopotamian Marshlands: Demise of an Ecosystem. Early Warning and Technical Assessment Report".** UNEP/DEWA/TR.01-3 Rev.1, Division of Early Warning and Assessment, United Nations Environmental Programme, Nairobi, Kenya.

UNEP, (2003), **" Environment in Iraq: UNEP Progress Report".**NEP. Geneva, Switzerland.

U.S. Environmental Protection Agency (USEPA), (2008),**"Marshes",** http://www.epa.gov/owow/wetlands/types/marshes.

Water and Land Resources, (1998),**" Wetlands, Bogs, Ponds, Marshes and Meadows"**, http://dnr.metrokc.gov/wlr.

Figure (1): The Iraqi Marshes (Partow, 2001)

Table(1):- The Tests Results for Al-Hawizeh Marsh (from Iraqi foundation).

Date	Air Temp. (°C)	Water Temp. (°C)	Turbidity (FTU)	Salinity (ppt)	Conductivity (µs/cm)	pH	BOD (mg/L)	TDS (mg/L)	TSS (mg/L)	Total Hardness (T.H.) (mg/L)	DO (mg/L)	Ca^{+2} (mg/L)	Mg^{+2} (mg/L)	HCO_3^- (mg/L)	Cl^- (mg/L)	SO_4^{-2} (mg/L)
NOV, 2005	28.25	17.70	17.69	0.83	1688.5	7.88	7.53	1050	6.77	785	4.55	97.46	108.38	206.67	451.38	485.50
DEC, 2005	22.00	16.00	17.74	0.63	1138.75	7.50	6.23	905.75	11.76	905	4.31	110.23	152.85	244.21	336.81	265.10
JAN, 2006	22.10	12.20	19.12	0.71	1314.5	7.79	5.78	942.75	16.63	635	7.35	72.43	109.36	170.83	487.2	324.26
FEB, 2006	18.30	15.09	23.66	0.73	1290	7.79	7.35	1142.5	18.25	650	3.48	160.32	60.78	213.29	212.59	264.00
MAR, 2006	22.50	18.20	22.13	0.85	1987.5	8.01	5.73	1501	14.25	495	4.95	83.19	60.57	207.71	274.74	436.71
APR, 2006	26.75	22.73	15.52	0.38	1186.25	7.69	9.00	873.5	13.25	340	5.30	66.13	42.54	298.95	310.19	242.26
MAY, 2006	30.15	27.28	24.63	0.40	1237.5	7.86	6.23	983	40.78	395	4.85	66.12	43.36	274.54	465.65	247.88
JUN, 2006	35.55	25.68	24.86	0.25	957.5	7.65	4.30	810.5	29.50	220	6.68	56.12	21.97	250.14	194.99	128.11
JUL, 2006	39.60	27.60	19.10	0.25	970.25	7.86	3.58	741	35.75	350	5.13	80.15	36.45	219.64	159.57	143.75
AUG, 2006	36.00	31.48	16.01	0.50	1405	7.78	5.23	1210	35.25	515	4.97	112.23	57.12	237.97	354.51	366.44
SEP, 2006	33.00	28.35	30.51	0.40	1252	7.04	6.23	848	27.75	490	3.45	124.25	43.74	290.94	221.57	285.07
OCT, 2006	31.75	24.80	33.99	0.75	1796.25	7.43	6.37	788.5	29.5	616.5	5.03	122.20	78.35	204.43	425.35	437.93

Table (2): Showing the Type of Equation & Correlation Coefficient between Salinity & Electrical Conductivity for Al-Hawizeh Marsh.

Type of Equation	Linear	Logarithm	Polynomial	Power	Exponential
Correlation Coefficient, R^2 %	67	63.1	69.9	68.6	70.1

Table (3): Showing the Type of Equation & Correlation Coefficient between Turbidity & TSS for Al-Hawizeh Marsh.

Type of Equation	Linear	Logarithm	Polynomial	Power	Exponential
Correlation Coefficient, R^2 %	14	14.2	14.5	19.2	19

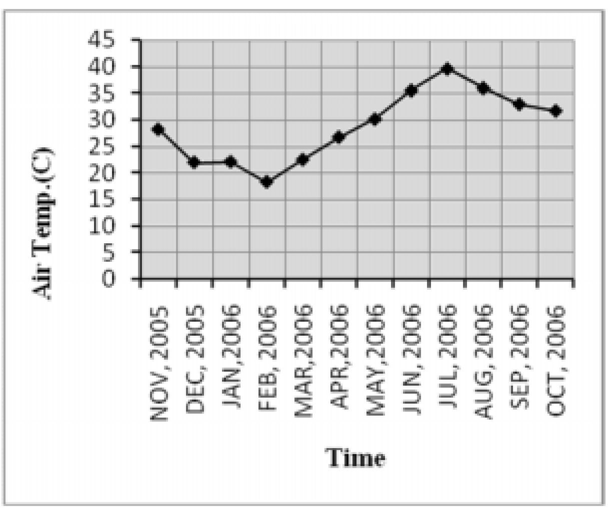

Figure (2): Air Temp. values of Al-Hawizeh Marsh.

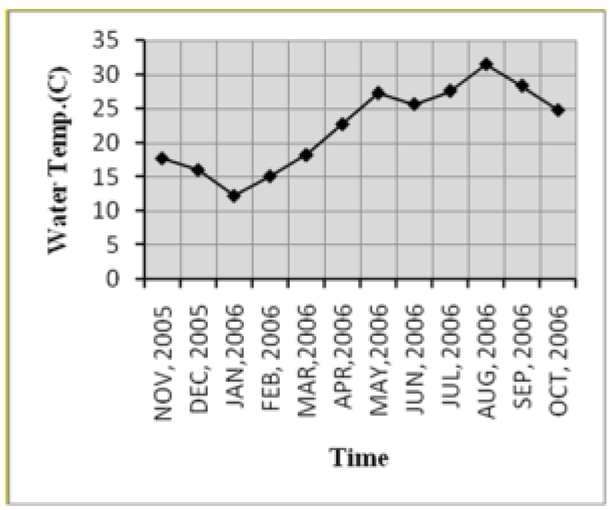

Figure (3): Water Temp. values of Al-Hawizeh Marsh.

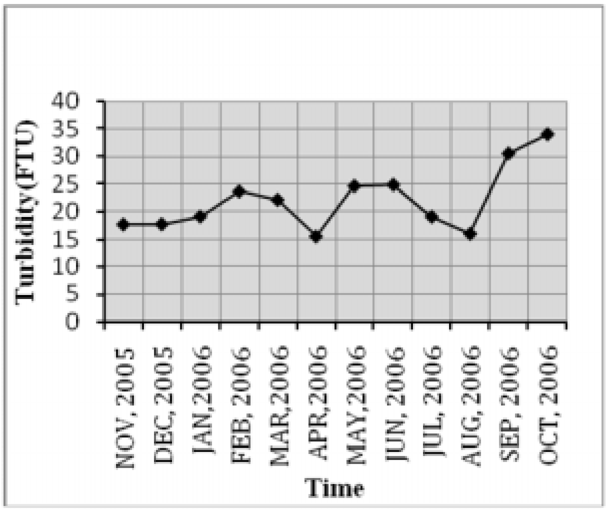

Figure (4): Turbidity values of Al-Hawizeh Marsh

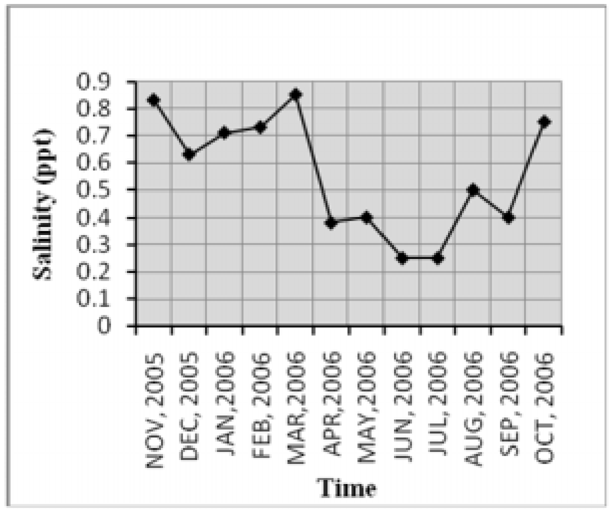

Figure (5): Salinity values of Al-Hawizeh Marsh

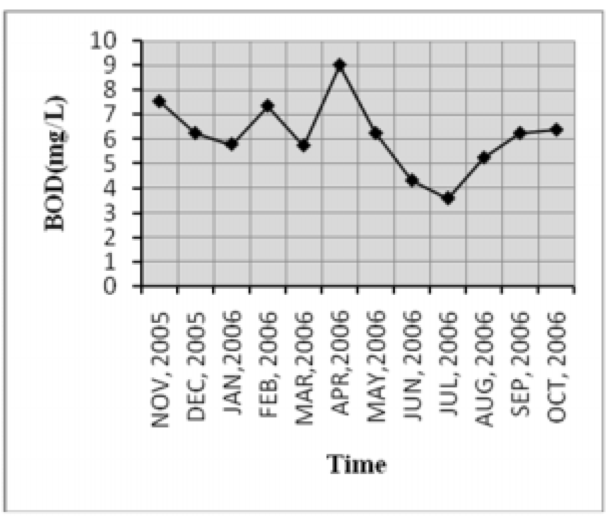

Figure (6): BOD values of Al-Hawizeh Marsh

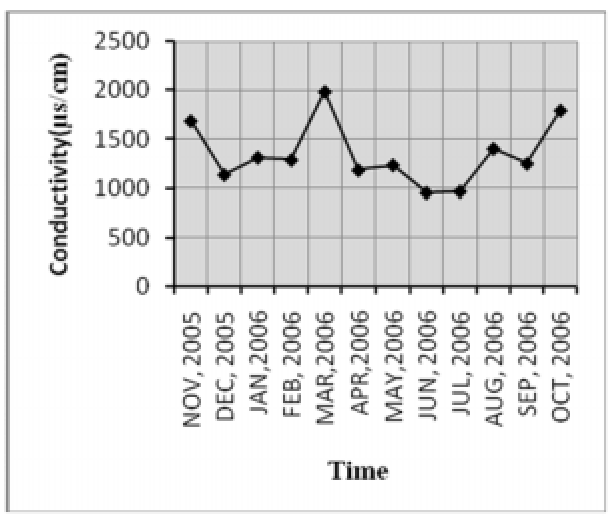

Figure (7): Conductivity values of Al-Hawizeh Marsh

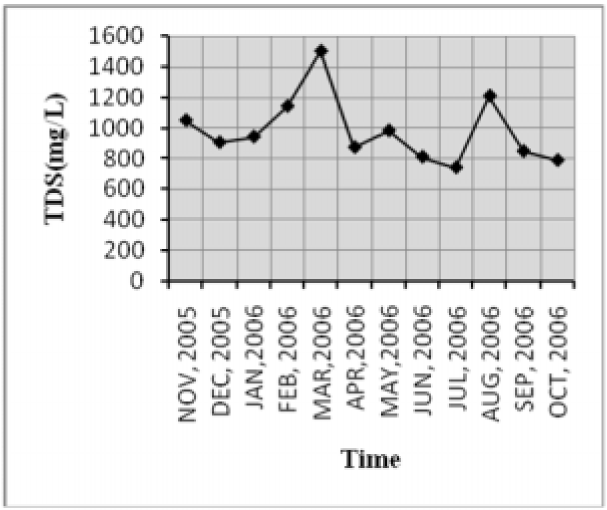

Figure (8): TDS values of Al-Hawizeh Marsh

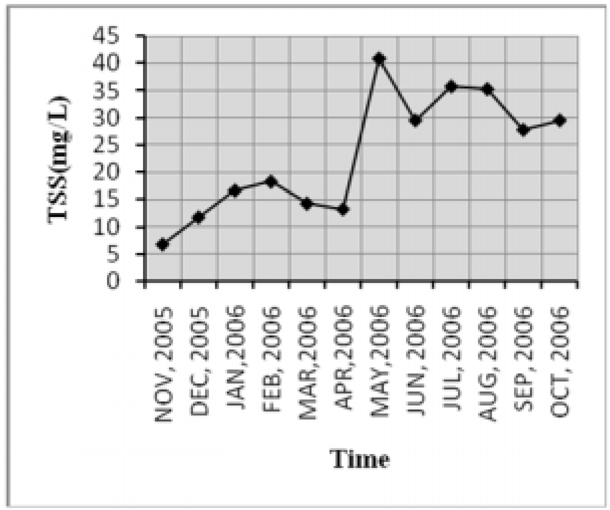

Figure (9): TSS values of Al-Hawizeh Marsh

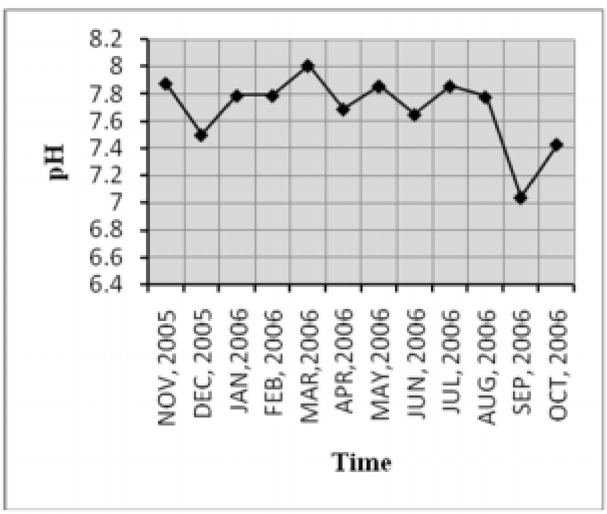

Figure (10): pH values of Al-Hawizeh Marsh

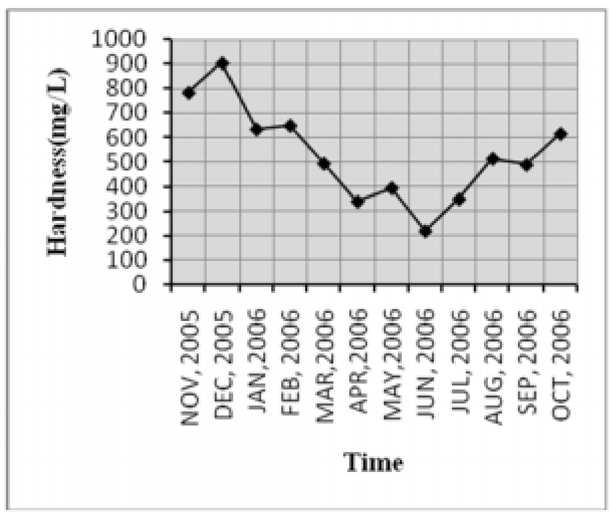

Figure (11): Hardness values of Al-Hawizeh Marsh

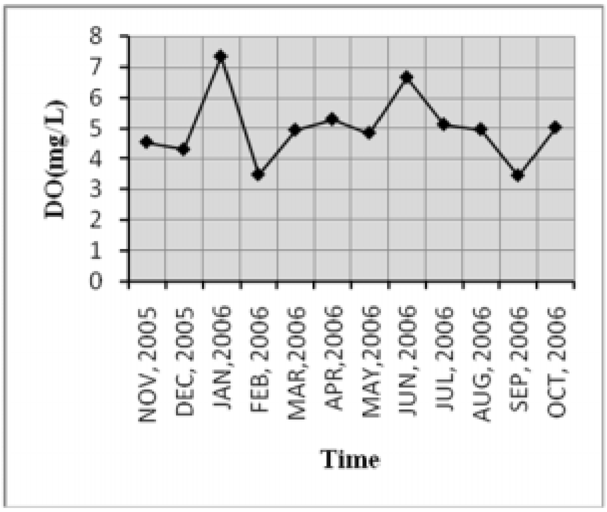

Figure (12):The dissolve oxygen values of Al-Hawizeh Marsh

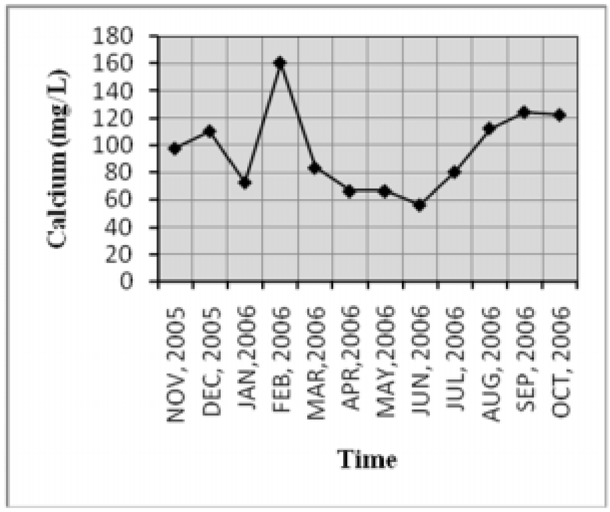

Figure (13):The calcium concentration of Al-Hawizeh Marsh

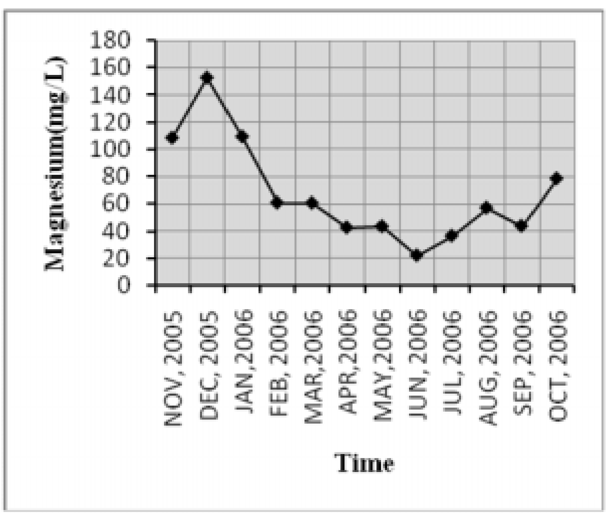

Figure (14):The Magnesium concentration of Al-Hawizeh Marsh

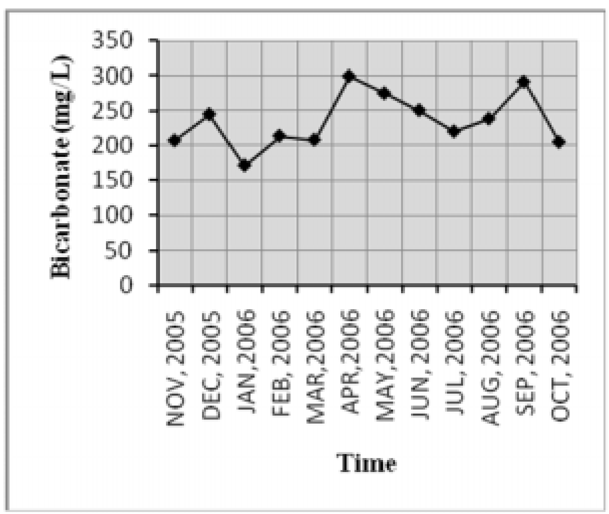

Figure (15):The bicarbonate concentration of Al-Hawizeh Marsh

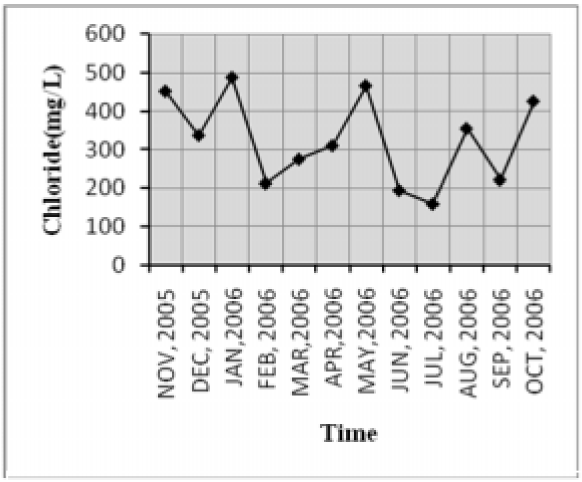

Figure (16):The chloride concentration of Al-Hawizeh Marsh

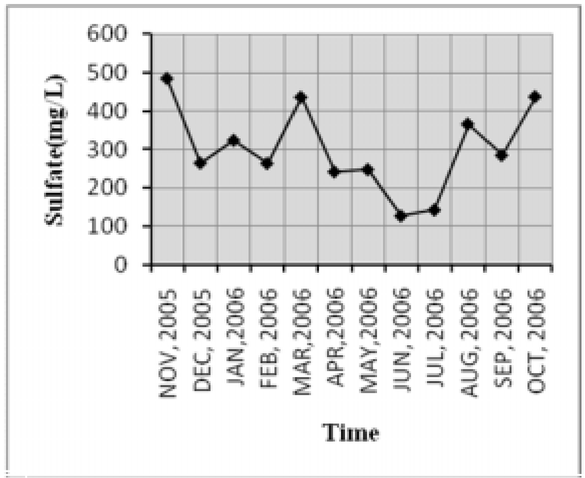

Figure (17):The sulfate concentration of Al-Hawizeh Marsh

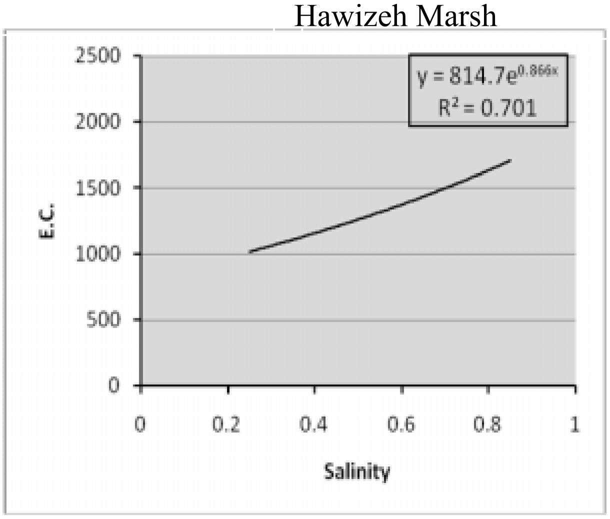

Figure (18) : Relationship between salinity and electrical conductivity.

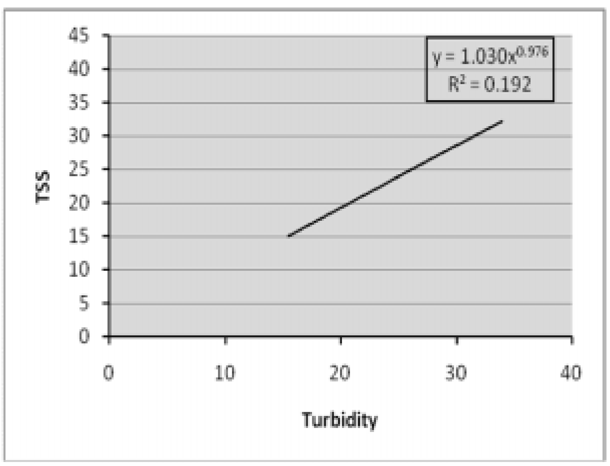

Figure (19): The Relationship between Turbidity & TSS for Al-Hawizeh Marsh.