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The Effect of Qarmmat Ali Channel on The Water Quality of Shatt Al-Arab River

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Abstract

Water samples were collected from six stations located at the end of Eastern Hammar marsh (stations 1&2), Qarmmat Ali canal (station 3), and the beginning of Shatt Al-Arab river (stations 4-6) as weekly from period 5th April to 14th of May, 2017 to determine 13 physical and chemical characteristics (Water temperature, turbidity, potential of hydrogen ions (pH), salinity, Total Dissolved Solid(TDS), Chloride ions (Cl^-), Potassium ions(K^+), Sodium ions(Na^+), Calcium ions(Ca^{+2})) , Total hardness (TH), Magnesium ions(Mg^{+2}) and Sulphate ions(SO_4^{-2}). Results showed that the lowest values of the studied characteristics were (19°C, 7.85 NTU ,6.6 , 0.878PSU , 1291mg/l ,387.37 mg/l , 8.35 mg/l , 379.31 mg/l , 62.52 mg/l ,400 mg as $CaCO_3$/l , 70.32 mg/l and 1154,24 mg/l) respectively , while the highest values of these characteristics were (28°C , 34.5 NTU , 8.1 , 5.09 ms/cm, 2.14 PSU, 3344 mg/l,1312.09 mg/l , 33.38 mg/l ,612.07 mg/l, 165.13mg/l , 1100 mg/l , 246.65 mg/l and 1931.04 mg/l) respectively . Also, results showed that station 1 had the highest concentrations of (Na, K, TDS, and salinity) compared with the other stations, so Hammar marsh affects the water quality at the Shatt Al-Arab river through the Qarmmat Ali channel.

Key Words: Qarmmat Ali canal, water characteristics, Shatt Al-Arab river

Introduction

Rivers are considered to be the major component of the natural ecosystem. The amount and quality of rivers reflect the long-term interaction between humans and the environment. Pollution of rivers affects the safety of drinking water and the landscape. Shatt Al-Arab river represents the main source of fresh water in the province of Basrah. It is reliable in many daily vital activities (Al-Hejuje *et al*.,2014).

Shatt Al-Arab River is suffering pollution resulting from industrial, agricultural, and civilian residential activities in addition to oil waste discharge, so this river has many studies to evaluate its chemical and physical characteristics (Al-Hejuje,2014; Al-Bidhani, 2014).

The water of Shatt Al-Arab is affected by the tribal phenomenon, so the type of estuary water is mixed of freshwater from the river and salty water of the Arabian Gulf, this kind of tide is mixed between daily and half days, the half days is more common in which tide occurs twice a day unevenly in time and range (difference between higher and lower tide) which reaches 3m in Fao city and 1m in Ma'akal city (Hussein *et al.*, 1991) while Ali *et al.*(2013) mentioned that the average tidal is about 1.75 m and 1.18 m in Faw and Basrah respectively.

Shatt Al-Arab water discharge increased in January due to the rainfall on its nourishing area. It reaches the peak at Ma'akal city in June and July because of the arrival of snow melting water on its nourishing area, the amount of discharges reach 1506 m^3/sec. and 1643

m^3/sec. Consequently. While the lower amount of discharges occur during October, which reaches about 224 m^3/sec. in Ma'akal and 360 m^3/sec. in Fao city (Al-Rubaie, 1986). Recently Al-Taei *et al*. (2014) estates that Shatt Al-Arab discharges reach 50 m^3/sec.

The lack of an efficient drainage system for Iraqi agricultural land and the lack of sewage, industrial and agricultural wastewater has made the quality of the surface water of rivers deteriorate (Hussein, 2014).

Shatt Al-Arab suffers from a significant increase in the concentration of salts due to the shortage of water imports that affected the water level in this river. The establishment of large dams in the countries of the Tigris and Euphrates basin resulted from a decrease in the amount of water reaching Iraq, which increased the concentration of salinity and pollution in all its forms as well as the direction diversion of the Karun watercourse (a big tributary for the southern part of Shatt Al-Arab) towards Iranian territory (Khalaf & Zayed, 2009; Hussein, 2014). Also, the salinity of Shatt Al-Arab was increased gradually from the upstream to the downstream of the river. This may be due to the inflow of seawater from the Arabian Gulf through tidal impact resulting from decreased riverine discharge from Tigris and the Euphrates. The advanced marine front (salt wedge) inter more to the northern reaches of the Shatt Al-Arab River. (Moyel, 2010; Al-Hejuje, 2014)

The present study aims to evaluate the influence of Qarmmat Ali canal on the water quality of Shatt Al-Arab by assessing the quality of Shatt Al-Arab's water in terms of physical and chemical characteristics.

Materials and methods

Study area

Shatt Al-Arab is a vital source for freshwater pouring in the Arabian Gulf, formed by the confluence of Tigris and the Euphrates in Qurna, it depending on its water on the Tigris and the Euphrates as well as several tributaries out of Hammar and Hawiza marshes (Khalaf & Zayed, 2009; Al-Hejuje,2014).

Al-Hammar marsh is one of the biggest three marshes in Iraq, which has an area of approximately 2800 Km^2 to 4500 Km^2 during flooding periods with width ranging from 1.8m to 3m (Al-Gburi *et al.*, 2017). Qarmmat Ali channel extends for 5-6 Km from Eastern Hammar marsh down to reach Shatt Al-Arab nearby Sindbad island (Hussein *et al.*, 1991; Al-Lafta & Abdulhussein, 2016) (Fig. 1). This channel is affected by the tide from the Arabian Gulf via the Shatt Al-Arab river; therefore, it functions as an outlet and as a feeder to the marsh depending on the water level in both the marsh and the river (Al-Musawi *et al.*,2018).

Water Physical and chemical characteristics:

Water samples were collected from stations (Table 1) weekly for six weeks, at ebb time, from 5th April till 14th of May 2017, during daylight, using 1.5L polyethylene bottles, to illustrate the effect of East Hammar marsh water on the water quality at Shatt Al-Arab river.

Table 1: Study stations' local names.

St.	Name
1	East Hammar marsh
2	Qarmmat Ali Channel
3	Shatt Al-Arab river

Water temperature was measured using a simple thermometer, turbidity using Lovibond T3 300 IR turbidity meter, the potential of hydrogen ions (pH) by using Waterproof pH tester 10, electrical conductivity (mS/cm) using Lovibond Senso Direct 150, salinity was measured by measuring EC multiplied by 0.64 factor.

Chloride ion concentrations were measured according to the titration method using $AgNO_3$, while K^+ and Na^+ ions were determined using a flame photometer (APHA,2005).Total hardness (TH) and Ca^{+2} ions were measured according to titration methods Lind(, 1979). Mg concentration in water samples was calculated according to total hardness (TH) and Ca^{+2} concentrations (APHA, 2005). Sulfate ions were measured according to UNEP &WHO(1996).

Results and discussion

Water temperature is an important factor for the richness and abundance of living organisms and water's other physical and chemical characteristics. It ranged from 19˚C in week 1 to 28˚C in week 6. (fig.1), according to Hussein *et al.*(1991), the water temperature of Shatt Al-Arab tends to rise relatively towards the southern according to its mixing with the warmer water of the Arabian Gulf, and the low current permits a long time exposure to the sunlight.

pH value ranged from 6.6 at Shatt Al-Arab river in week 5 to 7.9 at the marsh in week 3 (fig.2). The present study's narrow range of pH values may be due to the high regulation capacity of total alkalinity: carbonate and bicarbonate.This was in agreement with Balasim (2013) study on the Tigris River.

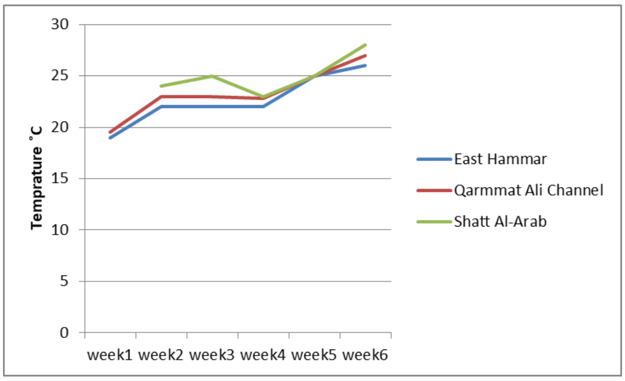

Fig (1): Water temperature (˚C) at studied stations during the study period .

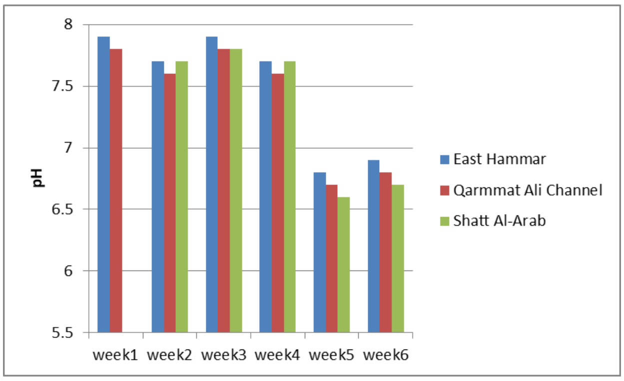

Fig (2): Potential of Hydrogen ions (pH) at studied stations during the study period

The salinity of water ranged from 1.08 the last week to 3.2 in east Hammar marsh in the first week (fig.3). Significant differences ($p<0.05$) were found among stations. East Hammar marsh had the highest values at most periods; this may be due to the elevated soil salinity compared with the other stations. According to Reid (1961) classification, the water in the present study can be classified as oligohaline (0.5- 5 PSU).

Turbidity ranged from 8.89 NTU at Shatt Al-Arab River in week 3 to 64.2 NTU in week 4 at East Hammar marsh. (fig.4). Turbidity values were exceeded the permissible Iraqi limits at all studied stations; this finding was in agreement with (Al-Hejuje *et al.* 2014). Turbidity in water is caused by suspended particles or colloidal matter that obstruct light transmission through the water. It may be caused by inorganic or organic matter or a combination of the two. Microorganisms (bacteria, viruses, and protozoa) are typically attached to particulates (WHO, 2011).

Total Dissolved Solids ranged from 1667 mg/l in Shatt Al-Arab in the fourth week to 2365 mg/l in East Hammar in the same week. A significant difference ($P<0.05$) was found among stations; East Hammar marsh had the highest values at most periods; this may be due to the elevated dissolved solids from the soil at these stations. Total dissolved solids (TDS) denote mainly the various kinds of minerals present in the water due to contamination of domestic wastewater and fertilizers (Pradeep *et al* . , 2012) (fig.5).

Total Hardness concentrations as $CaCO_3$ ranged from 446.6 mg/l, week 6 to 990 mg/l (fig.6). According to Lind (1979) categorization, the water of the studied area is considered as very hard water (hardness > 181).

The chloride ion concentration ranged from 487.34 mg/l in East Hammar at the last week to 1312.09 mg/l in the same station at the first week (fig.7). Chloride concentrations were elevated along the studied periods at all stations compared with the world and the Iraqi permissible limits (250 mg/l).

Potassium ions concentration was ranged from 15 mg/l in the last week to 22.3 mg/l in the first one. Significant differences ($p<0.05$) were found among stations, the highest mean concentration was found at st.1 and 2. (fig.8) contains a detailed diagram showing the real values of each one of the studied stations.

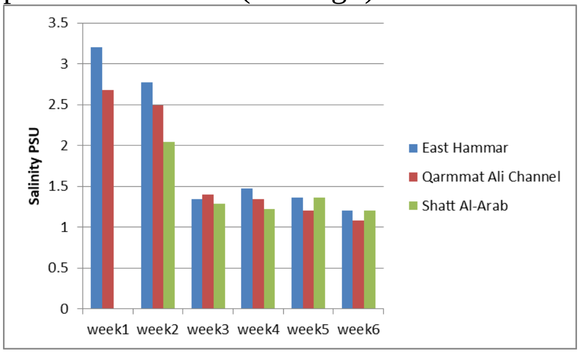

Fig (3):Water Salinity (psu) at studied stations the study period .

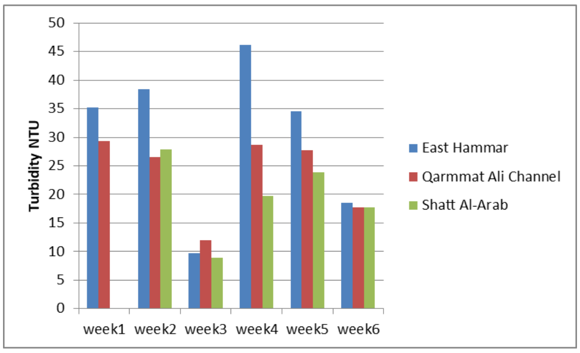

Fig (4): Turbidity NTU at studied stations during during the study period .

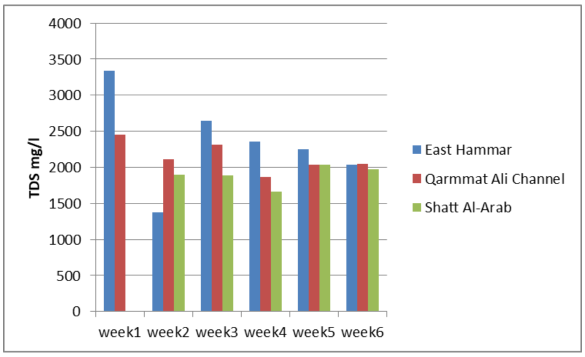

Fig (5):TDS (mg/l) at studied stations during the study period .

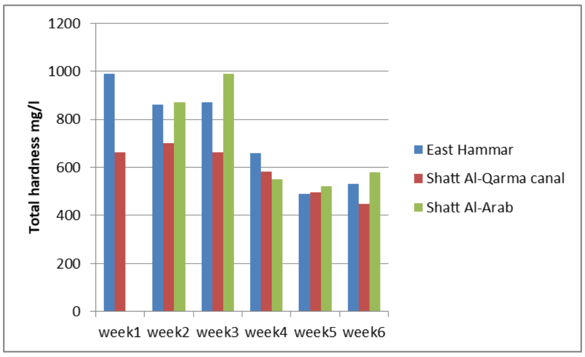

Fig (6): Total hardness (mg/l) at studied stations during the study period .

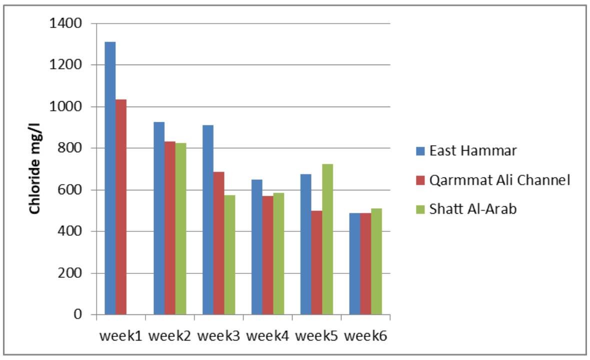

Fig (7): Chloride ions (mg/l) at studied stations during study period

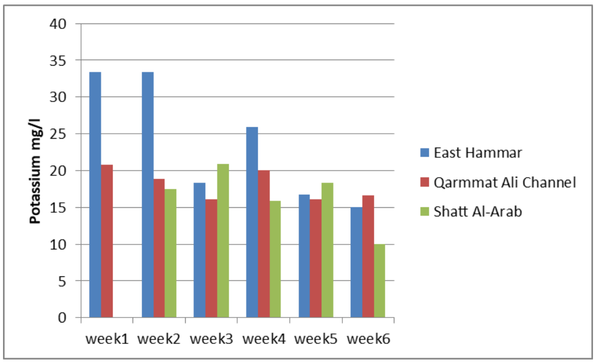

Fig (8): Potassium ions (mg/l) at studied stations during study period.

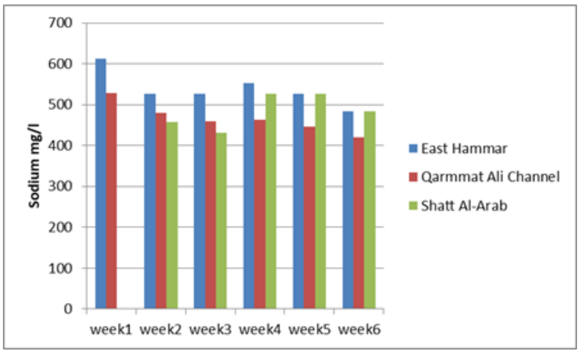

Fig (9): Sodium ions (mg/l) at studied stations during study period

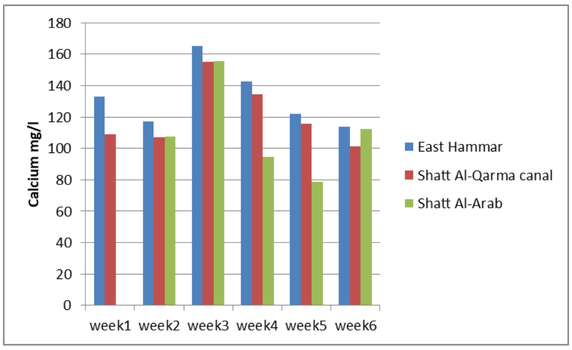

Fig (10): Calcium ions (mg/l) at studied stations during study period.

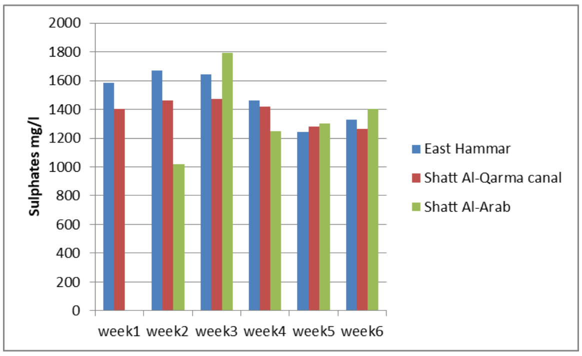

Fig (11): Sulphates (mg/l) at studied stations during study period.

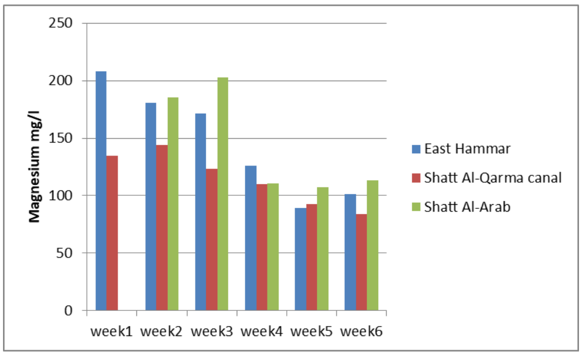

Fig (12): Magnesium (mg/l) at studied stations during study period.

Sodium ions ranged from 419.5 mg/l in Shatt Al-Qarma at week 6 to 612.06 mg/l in East Hammar at the first one (fig. 9). Significant differences ($p<0.05$) were found among stations, East Hammar had the highest mean concentration. Sodium is a natural constituent of raw water, but its concentration is increased by pollution sources such as precipitation runoff, soapy solution and detergents, or domestic wastewater discharge (Voral *et al.*, 2011).

In the fifth week, ca be ranged from 78.5 mg/l in Shatt Al-Arab to 165.1 mg/l, in East Hammar in the third week (fig.10). This high concentration agreed with the results Qzar (2009), Jaafar (2010), and Moyel (2010). Water with high concentrations of calcium, 25 mg or more per liter, is usually distinctly eutrophic (Lind , 1979). Al-Ganabi (2007) attributed the high concentration of Ca ions in water to the increased water temperature, which has a great role in dissolving rocks that form most of the rivers basin in Iraq.

The highest value of sulfate ions was 1794.1 mg/l, week 3, and the lowest was 1240.4 mg/l in East Hammar at week 5.Sulfate recorded concentrations exceeded the Iraqi and World permissible value (250 mg/l) that may be due to high petroleum compounds which used as fuel and released sulfate compounds to the environments that reach the water during wet precipitation. Also, it could be due to the presence of the Al-Najebbia electrical power plant that released sulfate compounds to the environment with its effluents. The agricultural activities in these areas also have a role in the increasing sulfate compounds. (fig.11).

Magnesium ions ranged from 83.8 mg/l, week 6 to 208.2 mg/l, in East Hammar, week 2 (fig.12). High magnesium concentration was recorded. This result may be due to the addition of magnesium salt by plants and other organisms decomposition to the water column. There were non-significant differences among stations (P>0.05) for all water temperature, pH, turbidity, electrical conductivity, and Calcium ions. At the same time, there were significant differences (P>0.05) for Na, K, TDS, and salinity. East Hammar marsh had higher concentrations than the other stations, therefore, the water of the Qarmmat Ali channel deteriorated the water quality of the Shatt Al-Arab river.

References

Ali , W.A. ; Farid , W.A. & Al-Eed , A. A.(2013)." Hydrocarbons Distribution in Shatt Al-Arab River Bacteria And Fungi ". Intern.J. Sci. Modern Engineering (IJISME) , 1(12):5-9.

Al-Bidhani, M.F.H. (2014). Qualitative composition of phytoplankton in the Shatt Al-Arab and the impact of environmental factors on the extent of some of production and accumulation of hydrocarbon compounds. Ph.D. Thesis, University Basrah, College of Education for Pure Science, Biology Department, 165p.

Al-Ganabi, M.A.A. (2007). An evaluation study of the Euphrates River and the factors with environmental impact from Deir Al-Zour to Al-Baghdadi using laboratory analysis and remote sensing technologies. Msc. Thesis, Anbar university, college of science. 121p.

Al-Gburi, H.F.A; Al-Tawash, B.S.& Al-Lafta, H.S. (2017). Environmental assessment of Al-Hammar marsh, southern Iraq. Heliyon 3(e00256):1-26.

Al-Hejuje,Makia M.; Al-saad, H. T & Hussain,N. A. (2014) .Application of (TRIX) Index to Evaluate The Trophic Status of The Middle Part of Shatt Al-Arab River, South of Iraq. Indian journal of applied research(Ecology) , 4 (5) : 131-136 ISSN - 2249-555X.

Al-Hejuje M (2014) Application of water quality and pollution indices to evaluate the water and the sediments status in the middle part of Shatt Al-Arab River. Ph.D. thesis, Basrah university-college of science. 239p

Al-Lafta, H.S. & Abdulhussein, F.M. (2016). Hydrochemical characteristics and seasonal variations of Al-Hammar marsh, southern Iraq. Iraqi Journal of Science,57(4B):2705-2716.

Al-Musawi, N.O. ; Al-Obaidi, S.K. & Al-Rubaie, F.M. (2018). Evaluating water quality index of Al-Hammar marsh, south of Iraq with the application of GIS technique. Journal of engineering science and technology, 13(12): 4118-4130.

Al-Rubaie, D. (1986). Hydrological study of Shatt Al-Arab/ the land and the battle. Basrah university publications, 135p.

Al-Taei, S., Abdullah, S. & Lafta, A.(2014). Longitudinal patterns of salinity in the mouth of Shatt Al-Arab River and causes. (U.O. Abdulaziz, Ed.). Journal of King Abdulaziz University, 25(2): 205-221.

APHA: American Public Health Association (2005). Standard methods for the examination of water and wastewater, 21st Edition. Washington, DC. USA.

Balasim , H. M.(2013) ."Assessment of some heavy metals pollution in water , sediments and Barbus xanthopterus (Heckel , 1843) in Tigris River at Baghdad city ". M.Sc Thesis.College of Science, University of Baghdad .159 pp.

Hussein, N.A., Al-Najar, H.H.K., Al-Saad, H.T., Yuosif, O.H& Al-Sabongi, A.A. (1991). Shatt Al-Arab- Basic scientific studies. Marine Science center publications, Basrah university, 391p.

Hussain, N.A. (2014) . Biotopes of Iraqi Marshlands. First edi .Difaf publishing P432 . (In Arabic).

Jaffer , E.M. (2010) . " Study quantity and quality of phytoplankton in some aquatic environment in south of Iraq" . ".M.Sc. Thesis, University of Basrah, college of science , biology department , 127pp. (In Arabic)

Khalaf, S.K. & Zayed, G.A. (2009). Shatt Al-Arab saline, the reality and the possible treatments. Iraq republic, ministry of environment, water quality monitoring and evaluation section. 12p. (in Arabic)

Lind, G.T. (1979). Handbook of common methods in limnology 2nd ed, London. 1991p.

Moyel, M.S.(2010).Assessment of water quality of the northern part of Shatt Al-Arab river , using water quality index (Canadian version).Msc. Thesis. University of Basrah, college of science , biology department: 100pp. (In Arabic) .

Pradeep, V. ; Deepika, C. ; Urvi , G & Hitesh , S.(2012)." Water Quality Analysis of an Organically Polluted Lake by Investigating Different Physical and Chemical Parameters ". Int. J. Res. Chem . Environ. , 2(1):105-111.

Qzar, I.A. (2009) Concentration of trace metals in environment and some Gastropoda (Mollusca) in East Hammar marsh. M.Sc. thesis, Basrah university, college of science, 121p. (In Arabic).

Reid , G. K. (1961)."Ecology of inland waters and estuaries " D. Van Nostrand Co. New York . 375 pp.

UNEP & WHO (United Nation Environmental Programme and World Health Organization) (1996). Water quality monitoring: A practical guide to the design and implementation of fresh water quality studies monitoring programmers. 400 pp.

Varol , M. ; Gökot , B. ;Bekleyen , A. & Ṣen ,B. (2011) " Water quality assessment and apportionment of pollution sources of Tigris River (Turkey) using multivariate statistical techniques – A case study ". River Res. Appl. , published online in Wiley Online Library .(Wileyonlinelibrary.com) DOI: 10.1002/rra . 1533.

WHO: World Health Organization .(2011)."Guidelines for Drinking-Water Quality". 4th edition. Geneva 27, Switzerland.(http://www.who.int).

تأثير قناة كرمة علي على جودة مياه شط العرب

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المستخلص

تم جمع عينات المياه من ست محطات واقعة في نهاية هور الحمار الشرقي (المحطتين 1 و 2) ، قناة كرمة علي (محطة 3) ، وبداية نهر شط العرب (المحطات 4-6) أسبوعياً من الفترة 5 أبريل حتى نهاية شهر أبريل. 14 مايو 2017 لتحديد 13 خاصية فيزيائية وكيميائية) درجة حرارة الماء ، العكارة ، الاس الهيدروجيني (pH) ، الملوحة ، إجمالي المواد الصلبة الذائبة (TDS) ، أيونات الكلوريد (-Cl) ، أيونات البوتاسيوم (K^{+})، أيونات الصوديوم (Na^{+}) ، أيونات الكالسيوم (Ca^{+2}) ، الصلابة الكلية (TH) ، أيونات المغنيسيوم (Mg^{+2}) وأيونات الكبريتات($SO4^{-2}$).أظهرت النتائج أن أقل قيم الصفات المدروسة كانت 19) درجة مئوية ، NTU 7.85 ، 6.6 ، PSU 0.878 ، 1291 مجم / لتر ، 387.37 مجم / لتر ، 8.35 مجم / لتر ، 379.31 مجم / لتر ، 62.52 مجم / لتر ، 400 مجم. مثل / CaCO3 لتر ، 70.32 مجم / لتر و 1154،24 مجم / لتر (على التوالي ، بينما كانت أعلى قيم لهذه الخصائص (28 درجة مئوية ، NTU 34.5 ، 8.1 ، 5.09 مللي ثانية / سم ، PSU 2.14 ، 3344 مجم / لتر ، 1312.09 مجم / لتر و 33.38 مجم / لتر و 612.07 مجم / لتر و 165.13 مجم / لتر و 1100 مجم / لتر و 246.65 مجم / لتر و 1931.04 مجم / لتر على التوالي. كما أظهرت النتائج أن المحطة 1 لديها أعلى تراكيزNa) ، K، TDS، and Malalph) مقارنة بالمحطات الأخرى ، لذا فإن هور الحمار يؤثر على جودة المياه في نهر شط العرب عبر قناة كرمة علي.