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IMPACT OF LOW DISCHARGE AND DROUGHT ON THE WATER QUALITY OF THE SHATT AL-ARAB AND SHATT AL-BASRA RIVERS (SOUTH OF IRAQ)

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ABSTRACT

Low discharge of Shatt al Arab and Shatt al Basra affects water quality and suitability for various human uses. This study assists discharge and water quality at selected sites in the Shatt al Arab and Shatt Al Basra; during the four seasons of 2009-2011.

The results showed the presence of an essential effect of climatic elements on water coming to the Tigris and Euphrates rivers. The study exhibited an increasing in temperature averages since 1923 which its value had been to be 0.2 degrees Celsius per decade with an increase of 1.7 C^{o} for the period (1923-2009), and decreasing in rainfall precipitation about 10%. So discharge of the two Rivers reduced to 80% of the Tigris River and 25% of the Euphrates River, on this basis the Shatt Al-Basra had been influenced by the hydrological characteristics.

The results has been shown that the quality of water in the north part of the Shatt Al-Arab affected by the discharge and human control like establishing dams and barrages on the Tigris River. In the south part of Shatt Al-Arab, the effect of the water from the Arabian Gulf during the tide is the main factor effect the quality of water. Also the water influenced by agricultural activities, sewage water and waste from plants in addition to marine incursion of salt water.

Higher salinity values for all studied stations during the summer is syncing with low discharge and high temperature, decline relative humidity and absence of rain, while the values decreased during the winter because of the increasing of the discharge, decreasing temperature, increasing humidity and increasing of rainfall. Also it had been recorded significant differences in discharge and salinity in most study sites.

KEYWORDS: Water Resources, South Iraq, Shatt Al Arab, Shatt Al Basra, Water Quality, Discharge And Salinty.

INTRODUCTION

Shatt Al Arab is a river formed from a confluence of Euphrates and Tigris rivers in Qurna city, north of Basra Governorate. The river is the end stage of Euphrates and Tigers, where pouring in the Arabian Gulf. It was flowing more than 190 Km from Qurna to Fao city, southern Basra (Fig-1). (Almahmood et al. 2011). Only the Tigris River tributaries was joined the Shatt al Arab during its course also Karun Riverjoined Shatt Al- Arab about 15 km south of Basra city center.

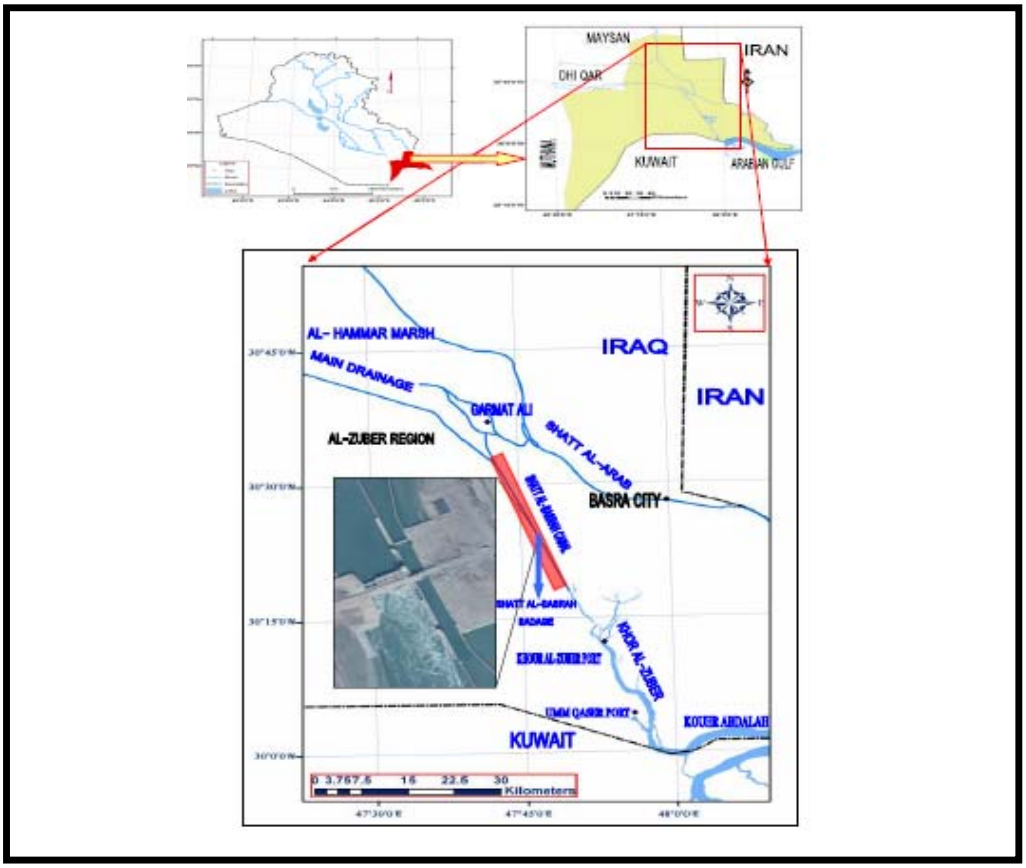


Fig. 1: Study area map

Shatt Al-Basra river is an artificial Channel operated in 1983 to transfer the flood water from the Euphrates River through Hammar marshes during the flood periods, then to drain it toward Khor Al-Zubayr channel, and then, to the Arabian Gulf (Al-Aesawi, 2010). The discharge in this channel is about 325 m3/sec during the flood and 1050 m3/sec during the ebb tides. The water velocity exceeds 2m/sec(Al-Badran., at el.,1996).

The water discharge is the important factor affect the water quality and both are the main factors which specified the water uses for human activities. There are two type of water in Basrah , the fresh water from Shatt Al-Arab which takes water from at present Tigris only

and break water from Shatt Al-Basra which takes water from Main Gulf Outfall Darin (MOD) which holding drainage water from north Baghdad area toward southerner Nasyraih.

The water system in southern Iraq faced many problem because of the decreasing of water discharge by the controlling process upstream the channels. This study was deal with changing of discharge on water quality of Shatt Al-Arab for the period of (2009-2011) .

There are a lot of study deals with Shatt Al-Arab water because of it was used for many purpose , While studies on Shatt al-Basra's were limited because of it is drainage water in the north part of the point of Hor Al-Hammar, and water brackish water as a result of getting mixed with the marine water of the Arabian Gulf from Khor Al-Zubayr. it is supposed to study Shatt al-Basra in deeper because of the fact that the expansion of the city of Basra is expanding westward and the fact that Shatt al-Arabs has become more salinity during this time, approaching the quality of specifications of Shatt Al-Arab, Shatt al-Basra's water can also be used in some investments such as agriculture, water and salt fish farming or in tourism investment. One of the most important studies of Shatt al-Basra is the study of the Author of (the history of the establishment of the Shatt al Basra) in year 19 and the motives of the establishment of Shatt al- Basra in 1983, after placing it's basic designs since 1971 for the purpose of diverting water from frequent floods in that period and converted from the Shatt Al-Arab to Khor Zubayr and then to the Arabian Gulf. This study aims is to investigation of the physical and chemical parameters for water in southern Iraqi Shatt Al Arab and Shatt Al-Basra Rivers.

METHODS

Water samples were collected from one depth for four seasons (wet and dry and two transitions) during the years 2009-2011 from 11 stations along the Shatt al-Arab. Climatic data of Al-Basra station were selected for (4) climatic courses during the period 1970-2011,The Shatt Al-Basra water samples were collected for four seasons and from three stations during 2009-2010 (Figure 2). The studies relied on river discharge in Shatt al-Arab from (the Tigris River is it's only source), and from MOD the only source of Shatt al-Basra's water.

The Cations and Anions (Ca, Mg, Na, K, HCO_3, Cl and SO4) were analyzed by using the standard procedure of (APHA 1992). Potassium and Sodium were determined by flame photometer (JENWAY PEP7). Magnesium and Calcium were titrated with 0.01N Na_2EDTA.

Chloride was determined volumetrically by titration with 0.01N $AgNO_3$ and Sulphate was also determined by spectrophotometer (CEIL CE292) using turbidity method.

RESULTS AND DISCUSSION

***Metrological conditions*:**

The climatic elements represent one of the most important variables of the specific hydrological and hydrogeological conditions in any region. The climate is characterized by climatic extremes of temperature and humidity as well as the rainfall between the seasons (Al-Shalash, 1988 In Al-Aesawi, 2010).

Climate is the average of the physical state of the Atmospheric with statistical differences in the time and places .The climate is the main factor effecting the temperature, Precipitation and evaporation which determine the river discharge, causing the effects on the characteristics and quality of water. Hydrologist studied the climate changes because of its direct impact on human life, especially the severe drought in the some parts of the world is offset by a sweeping flood sweeping in others. The reason of this change is the irrational use of natural resources on one hand and other reasons , climate scientists and astronomers attribute this change to fluctuations in activity solar and chemical reactions taking place inside the sun atmosphere , or for physical changes in the solar system (Almamori and Abdul Hussain 2012).

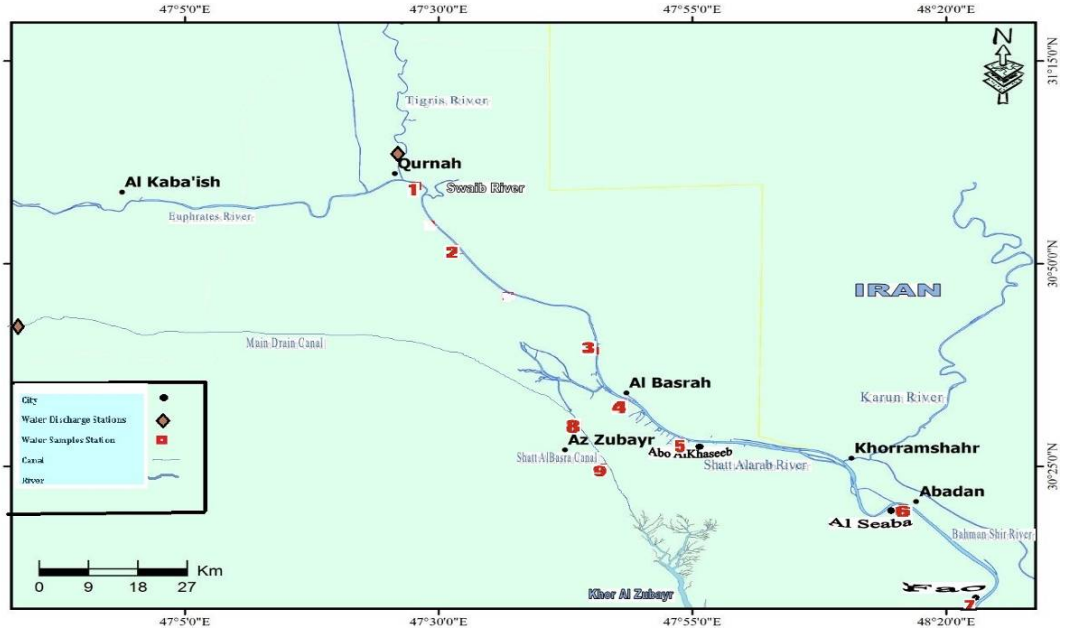
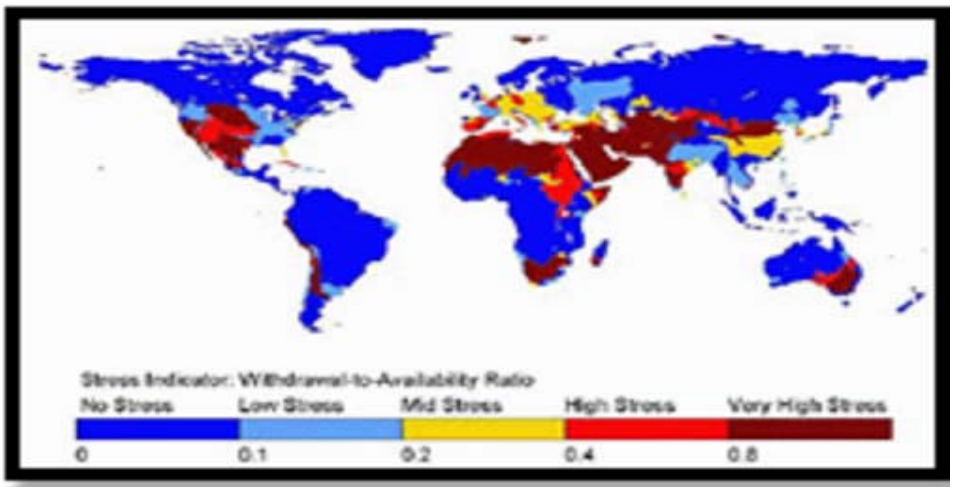


Figure (2): Sampling location map

Figure 3 shows that the global financial situation is pressing on water resources with the increasing of temperature and lack of rainfalls, especially in the Arabian region, including

Iraq, Figure 4 shows that all areas of Iraq, including the study area are at a rate of 50% (Husseini and Al Sundooq, 2009).



(Figure 3) Expecting global water situation in the year 2015

The United Nations reports 2002 also shows that the temperature at the region of the upstream of the Tigris and Euphrates rivers is rising since 1923, it has been appreciated by 0.2 degrees Celsius per decade (increasing about 1.7 degrees Celsius in 2009) was offset by a decrease in precipitation reached 10% leaving the discharge decrease to 80% for the Tigris River and 25% for the Euphrates River. These conditions impact on the per capita of water in Iraq, it is 2200 m3/ year while 7000 m3 / year as global average (while the rate of 500-1000 m 3 / year is a critical limit between scarcity and abundance), the per capita decreased to 2000 m 3 / year for the period between 2009 to 2011 (Jassim 2011).

The climate of the study area:

The climate of the study area is classified as a dry climate with winter rain and it is Symbolized (BWhs) according to the classification of Koppen (1900). This affects the amount of discharge and quality of surface water, where water quality is affected by the amount of discharge sharing with region's climate. So there are seasonal variations in river's discharge which has cause clear impact on the water properties in Shatt al-Arab and Shatt al-Basra.

The changes in runoff water lead to a change in Ecosystems. The change in water flow of rivers depends on the climatic changes, especially the change in the time and the amount of rain, change in surface evaporation and variation in temperature. Therefore, The drought has become a common phenomenon in some areas of tropical and subtropical (Al-Asadi, 2012).

Nazemosadat et. al, 2006 studied the rain precipitation on Abadan city, Iran (adjacent to the city of Basra) and confirmed that there is a decrease in the rates of precipitation since the mid-seventies of the last century caused by the influence of NINO. (Alhathal,2009) indicated that there is increasing in the temperature average, especially in Basra at a rate of 4.5 Celsius degree.

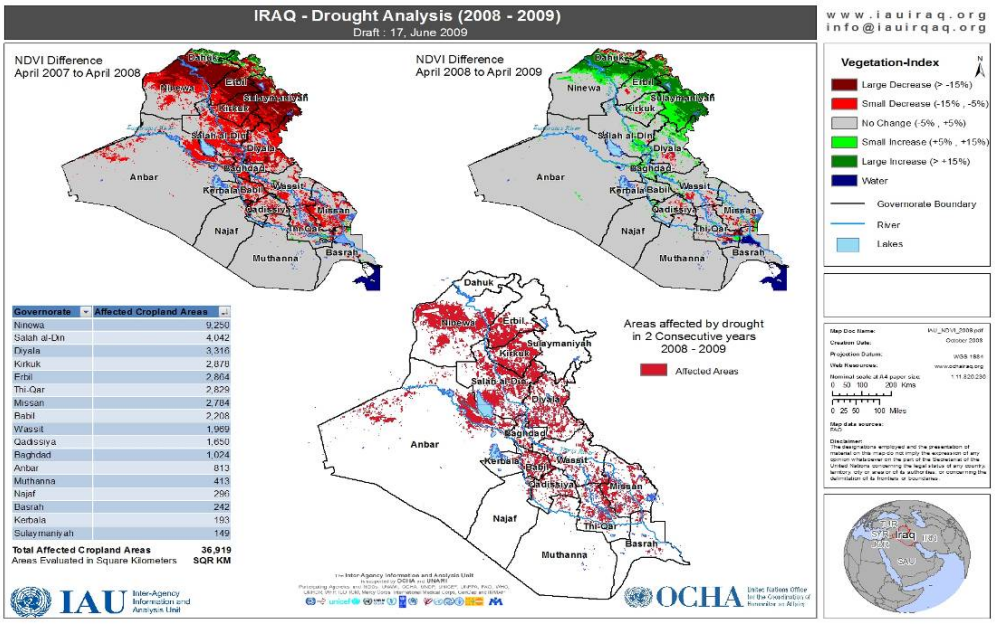


Figure 4: Drought Rate in Iraq for the period 2008 to 2009

During recent decades the temperature has risen above its rates (in summer and winter) and the decline of rainfall and frequent dust and sand storms. These variations can be explained by many reasons (locally and externally) which can be summarized as the following:

- Desertification and drying of large areas of agricultural land and decreasing of vegetation cover causing effective impact on the local climate of the area.
- Drought and lack of water resources in southern area of Iraq, especially in the marshes which dried during the eighties and nineties of the past century.
- Lack in water discharge toward Iraq in the Tigris and Euphrates rivers and their tributaries, which led to an imbalance between fresh and salt water in Shatt al-Arab and Shatt Al-Basra, causing to turning them to marine channels.
- Poor management and planning for expansion projects.
- The deterioration of the Green cover and the expanding of desert regions.
- Some studies also indicated that the climate of Iraq especially Basrah is influenced by global phenomena such as NENO happening in the Pacific Ocean (the movement of warm current).

The records of atmospheric properties in the study area (Hay Al-Hussein station in Basra) for the period 1970 to 2011 shows an increase in monthly temperatures (minimum and maximum), as well as an increase in relative humidity, and decreasing in rainfall.

The temperature is the factor affecting the amount of evaporation. The min. and max. average annual temperature in the Basra province in the period between 1980 to 2011 was 19-31.1 degrees Celsius. The figures (5 and 6) shows annual minimum. and maximum temperature in the province, where it is noted that the highest rate 20-34.5 degrees Celsius in 2003-2011, while the lowest 17.65 and 31.9 degrees Celsius occurs in the 1980-1990. Figures (5 and 6). The temperature follows a different behavior with the rainfall, where the months characterized by high precipitation rates occurring at low temperatures while the months characterized by zero rain rates occurring at highest temperatures. Average annual temperature for the above period is 26.3 degrees Celsius

The relative Humidity defines that the ratio between the actual water vapor pressure to saturate vapor pressure in the air at the same temperature (Shaw, 1999 In Al-Aesawi 2010). Relative humidity relates with an inverse relationship of direct correlation with the falling rain-fed areas. The highest annual rate of relative humidity for the period between (1970 - 2011) as shown in Figure (7), where in the year of 1980-1990 was 51.6%, while the lowest annual rate of relative humidity of moisture in the year of 2003-2011 32.5%, and therefore there is a decrease in relative humidity during the summer months due to increased temperatures and the lack of rain and the opposite in winter, (Figure 7).

The annual of rainfall rate for the period 1980 to 2011 is 127.0 mm / year, at the yearly rates of rainfall ranges between (98.1 - 158.0) mm /year see Fig. (8). The period of drought begins in the month of June and continue to September, except for some very wet years when little local rainfall take place.

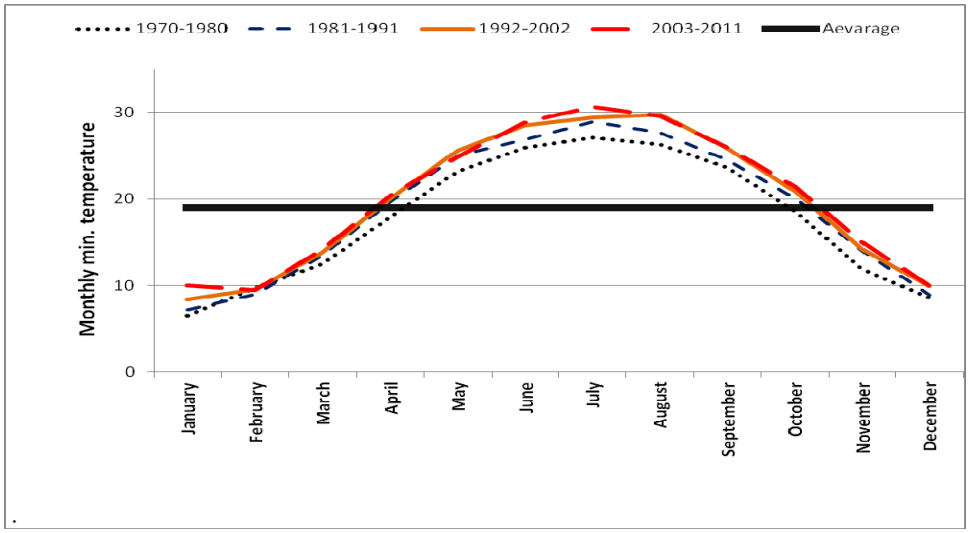


Figure 5: Monthly min. temperature (c) for Al-Basra station

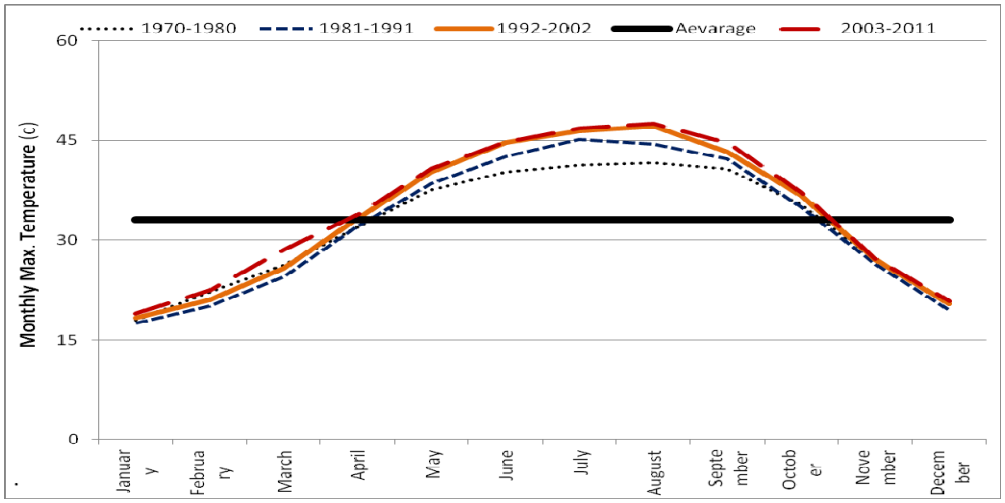


Figure 6: Monthly max. Temperature (c) for Al-Basra station

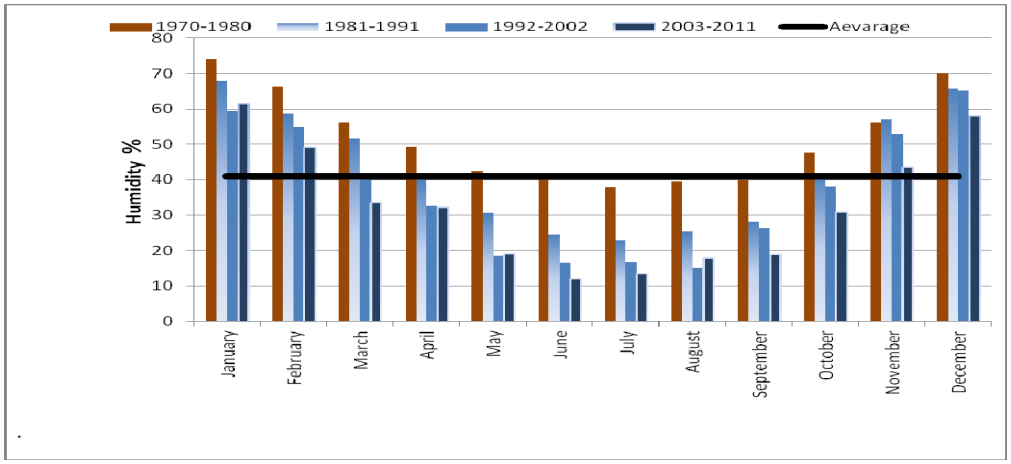


Figure 7: Monthly mean relative humidity (%) for Al-Basra station

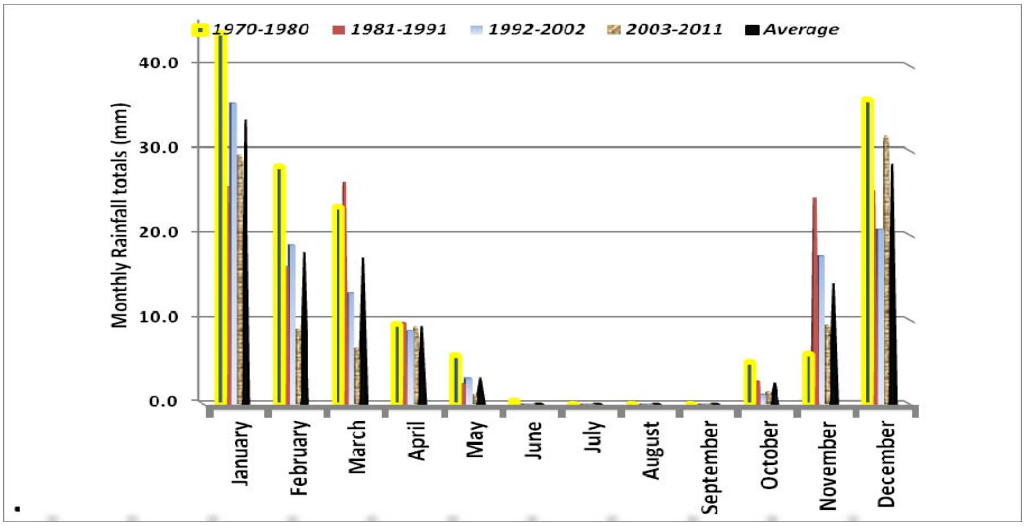


Figure 8: Monthly rainfall totals (mm) for Al-Basra station

Rivers Discharge:

There is a seasonal difference in the Shatt al-Arab discharge in 2009-2010, minimum discharge was recorded in the fall of 2009 at a rate of 23.45 m^3/s, which is less than seasonally average (28.50 m^3 /sec). The discharge is increasing gradually during the winter, spring and summer (Table 1), This attributed to human control activity on the Tigris River before the water reaches Shatt al-Arab river, with addition to the effect of climatic characteristics during the seasons of the year.

The rate of seasonally discharge of Shatt Al-Basra 44.50 m^3/sec, the highest discharge recorded during the winter of 49 m^3/sec in the same time of increasing discharge of the Tigris and the Euphrates, while the low discharge was recorded during the summer and Autumn of 41-40 m^3/sec. (Table 1), Another fact that there is a significant change in discharge occurred in Shatt Al-Basra during the agricultural season (Winter) because of large amounts of drainage water.

Electrical conductivity:

The results in Table 2 show significant increase values of electrical conductivity with a trend towards the bottom in water column of the Shatt Al-Arab river (Table 2) from 1.78 mS/cm at St1 to 21.28 mS/cm at St7 sequentially. The lowest values of EC during the study period were found in St1 which located in upper part of the river, while the highest values were found in St7 , which is located downstream of the river. This is due to the influence of the marine waters from the Gulf, this influence increase with distance toward the upstream river (Hassan et al 2011, Al-Maliky et al 2012). The main reason of the variation was the

decreasing of water discharge to the Shatt Al-Arab River mostly from the Euphrates and Tigris Rivers, which had significant declines in their discharge as a result of dam constructions in upstream countries. (Hassan et al. 2011).

The Average values of EC in Shatt Al-Basra Channel (St8) ranged from 13.10 to 2.46 mS/cm with mean of 6.28 mS/cm . The main source of water for Shatt Al-Basra channel is the water coming from Main outfall Drain and the downstream part of the channel affected by marine phenomena of semi diurnal tidal (Al-Aesawi 2010) . There are also seasonal variation in the values of EC, it decreased from 18.15 mS/cm during Autumn 2009 to 2.92 mS/cm to during Spring 2010. It can be indicate that Shatt Al-Basra Channel have the same trend results of Shatt Al- Arab, the highest values of E.C. were appeared in Winter and Autumn of 2009 .

Table-1: Seasonal discharge m3 / sec. in Shatt Al Arab and Shatt Al-Basra

Seasonal discharge	Summer 2010 (August)	Spring 2010 (May)	Winter (Dec. 2009-Jan. 2010)	Autumn 2009 (Oct.-Nov.)	Average
Shatt Al Arab River	23.45	27.73	30.17	32.51	28.50
Shatt Al-Basra Canal	41	48	49	40	44.50

Table 2: Mean Electrical Conductivity of Shatt Al Arab and Shatt Al-Basra Canal water during the study period

Station		1	2	3	4	5	6	7	8	Total
Winter2009		1.4	7.5	12.71	15.83	11.61	18.67	46.65	11.65	13.32
Autumn2009		1.48	6.09	11.93	17.02	24.65	43.43	58.78	13.1	18.15
Winter2010		1.89	3.39	2.59	4.7	7.45	5.28	10.1	5.43	4.61
Spring 2010		2.04	2.4	2.78	2.97	2.91	3.88	5.8	2.74	2.92
Summer 2010		1.31	1.71	2.31	2.61	1.88	1.99	20.9	2.46	3.93
Spring 2011		2.11	4.14	2.99	2.83	2.64	2.92	11.45	2.86	3.82
Total		1.78	3.73	4.72	6.19	7.42	10.48	21.28	6.28	6.65
LSD P=0.05	Station					4.07				
	Season					9.63				

Physical-Chemical Characteristics:

Chloride constitutes is the dominant anions (1323-10121) mg/l and Na is the dominant cations (281.4- 902.76) mg/l in Shatt Al Arab water and 2401 mg/l in Shatt Al-Basra Channel (St8) water . Statistical analysis showed that there were significant difference in cations and anion with stations and seasons at P=0.05 (Table 3-4). Water types can be

described by the concentrations of the active cations and anions which have a concentration above 15 meq%. The sea water cations and anions can be is intrend as: Na > Mg > Ca, and Cl> SO_4 > CO_3. However, in fresh water this trend takes the following: Ca > Na >Mg, CO_3 >SO_4 > Cl (Hem 1992). This classification system was used to identify the Shatt Al-Arab River's water type and the results showed that the major cations and anions were appear as Ca-Mg-Sodium -SO_4 Chloride at all stations, indicating that sodium chloride salt is the dominant salt. The water of the Shatt Al-Arab River and Shatt Al-Basra Channel can be classified as marine waters, thus giving a clear indication of the impact of the Arabian Gulf's saline water on that river (Al-Maliky et al 2012, Al-Aesawi, 2010).

Table 3 Mean concentrations of actions and anions in the water of Shatt Al Arab and Shatt Al-Basra Canal

St	Cl	Ca	HCO_3	Mg	Na	K	SO_4
				mg/l			
1	1497	118	305	138	281	50	591
2	1323	145	297	168	343	60	790
3	2122	152	297	185	368	110	906
4	2560	148	301	228	449	144	866
5	3005	132	301	222	456	168	837
6	5268	151	300	240	464	209	816
7	10121	227	299	511	902	296	1132
8	2401	168	308	246	461	108	1103
Total	3064	150	301	223	436	126	844

Table 4: Mean concentrations of actions and anions in the water of Shatt Al Arab and Shatt Al-Basra Channel during the study period.

Season	Cl	Ca	HCO_3	Mg	Na	K	SO_4
Winter2009	594	92	350	77	184	11	271
Automn2009	514	87	216	67	123	10	189
Winter2010	656	102	308	108	246	12	405
Spring 2010	720	121	311	116	-	-	1320
Summer2010	3141	80	353	91	227	21	168
Spring 2011	4100	222	305	377	905	19	394
Total	1497	118	305	138	281	50	591

RECOMMENDATION:

It is very important to exploitation further resources to offer water for human agricultural and industrial uses by recreational techniques such as the use of seawater desalination, purification and re-recycling sewage and drainage water.

It is to give priority to human uses of Shatt al-Arab water, which it is still to be suitable for other uses such as navigation.

It is very important to expand the scientific studies on the impact of climate on water quality and setting water policy based on these studies.

It is loud to offer water rationing for marshes and applying scientific management plan according to scientific studies to deciding the areas which able to be flooded or rehabilitation in the marshes. It is very important to following the environmental impact of the flooding and mixing with fresh water by following the system of nature reserves which are subject to monitoring, management and maintenance on a permanent plan.

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REFERENCES

1. Al Imarah F.J., Al-Mahmood H. K. H., Ashawi, E.J.M and Hmood, A.Y.(2010) Study of Some Physical and Chemical Characterizations of water from Southern Iraqi Marshlands after Rehabilitation/2003. Uruk Refereed Scientific Journal. Al-Muthanna University. Iraq. (in Arabic).
2. Al-Aesawi Q. M. (2010).Hydraulic Operation of Shatt Al-Basra Canal using on dimensional model . A thesis of degree of master. College of science. University of Baghdad. 105 p.
3. Alhadil, Y.M(2009). drying the marshes and its impact in different climatic characteristics of the south of Iraq, Diyala University Magazine, (in Arabic), Issue (41) .
4. Al-Husseini, A. S. and and ALSoundooq, M.E. (2009). article about the water situation in Iraq and the world, the Faculty of Engineering and Physics, UK (University of Surrey.(in Arabic).
5. Al-Katib, M.T., 1972. Shatt Al-Arab and Shatt Al-Basra and the history. Iraqi Port Estab. Publ. (in Arabic), 190p.
6. Al-Mahmood H. K. H (2011) , Hazim A. Al-Sayaab , Dawod S. B. Al-Miahi , Mahmoud, Ali B. & Wissam R. Mutasher. One dimensional model to study hydrodynamics properties for north part of Shatt Al Arab River (south Iraq). Basrah Journal of Science. College of Science. University of Basrah.Vol.28(1)1-14.
7. Al-Maliky ,HA., Peterso A., Hassan,FW. Callow Nick (2012). Analysis of water quality and the impact of the salt wedge from the Arabian Gulf on the Shatt Al-Arab River, Iraq. School of Geography, Planning and Environmental Management. University of Queensland.
8. Almamori, B. J and Abdul Hussain A. K. (2012) manifestations of volatility, climate change and the factors influencing it, Journal of the Faculty of Education, University of Baghdad, Issue 1 (the number of special research), (in Arabic). pp. 61-76 .
9. Hassan, FW, kream, SM, Khasaf, DK & Aliwi, YJ 2011, 'The quality of irrigation water in Al-Faw city Basra research magazine, vol. 37, pp. 33-41.
10. Hem, JD 1992, Study and interpretation of the chemical characteristics of natural water. U.S.Geol.Surv.water supply Pap.2254.
11. Jassim, T.(2011) Climate change and water resources management strategy in Iraq, Proceedings of a symposium on World Water Day, Faculty of Education, University of Diyala(in Arabic).
12. Nazemosadat, M. J. Samani, N. Barry, D. A. and Molallniko, M.(2006)Enso forcine on climate change in Iran: Precipitation analysis. Iranian Journal of Science & Technology, Transaction B, Engineering, Vol. 30, No. B4Printed in The Islamic Republic of Iran, 2006 © Shiraz University.

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