DETERMINATION OF SOME PHYSICAL AND CHEMICAL PARAMETERS IN THE WATER OF SOUTHERN IRAQI MARSHES.

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SUMMARY

During the period March/2006 – Jan/2007, water samples were collected from selected sites along the Southern Iraqi marshes: 1- Umm El-ward, 2- Umm Al-Naaje (Al-Hewizah marsh), 3- Abu Cholan, 4- Abu Sobatt, 5- Al-Ghebaysh (Central Marsh), 6- El-Nagarah, 7- El-Barghah and 8-Al-Maffraque (Al-Hammar Marsh). Physical parameters investigated were pH and electric conductivity (EC in mS/cm), Total suspended solids (TSS) and Total dissolved solids (TDS), while chemical parameters investigated were: Sodium (Na^+), Potassium (K^+), Chlorides (Cl^-), Sulfate(SO_4^{2-}) and Bicarbonate(HCO_3^-), following the standard methods. For all samples and during the period of study, waters were almost basic with pH range 7.1- 7.4 which is higher during summer months. EC were range from 0.79 – 1.56 mS/cm in Umm El-Ward (Hewizah marsh) to 1.95 – 4.61 mS/cm in El-Nagharah (Al-Hammar marsh). Sodium and potassium were within normal units set by WHO and Iraqi requlations, they decrease during summer while they increase during rainy months in Al-Hammar marsh sites 6-8 due to salty humidity from the Arabian Gulf. All other parameters behave in the same manner which do not exceed the world wide limits. Higher and lower TSS always recorded in sites 1 and 2 for the same marsh respectively. The higher and lower TDS were reported in sites 6-7 of Al- Hammar marsh and sites 1 and 2 of Al-Hewizah marsh. Chloride and sulfate have the same trends as TDS while bicarbonate mostly behave in reverse manner due to different sources of water flushing through the marshes.

Key Wards: Physico-chemical parameters, Iraqi Marshes, Seasonal variation, Water quality, Arabian Gulf.

Introduction

The Mesopotamian marshlands comprise the largest wetland ecosystem in the middle east and western Eurasia [1] . It represented as home to ancient communities rooted in the dawn of human history . They were recognized to constitute one of the words most significant wetlands on the earth [1] . Marshes provide habitat for important population of wild life including endemic and endangered species.

Certain studies for physical, chemical and biological parameters in the southern Iraqi marshes were conducted which foucused on Al-Hammar marsh [2-5].Following the end of the second Gulf war in Feb. 1991 and the ensuing civil unrest in southern Iraq , a massive hydro – engineering program was launched to drain the marshlands [1].

After the events of 2003 in Iraq, water was released to refload the drained southern Iraqi marshes, immediately researchers studied the characterizations of refloaded water after rehabilitation and restoration of the marshes [6-10]. Moreover, The southern Iraqi marshes are considered as an important habitat for a variety of wildlife that is under threat due to water polluting and land use activities leading to environmental degradation. Among threat which affecting these sites are, waste disposal, over-fishing and unplanned urbanizations [11]. This study was aimed at revisiting the physico-chemical environmental parameters of the marshes to investigate all the changes and the effects of desiccation upon them. There were certain sites of the marshlands were visited by scientists, others were left without any investigations especially sites were settlements are exist. Aim of the study

Water quality of Southern Iraqi marshes need to be investigated in order to strengthen marsh Arab's to return back to their ancient home and start their lives again.

Study area

Lower Mesopotamian marshlands are situated mainly in southern Iraq (29° 55' –32° 45' N) and (45° 25' - 48° 30' E) and covered an estimated area ranging from 15000- 20000 km^2 [Fig .1] .

The formation of lower water management projects for Tigris – Euphrates rivers system as following the topography of their lower part [1].

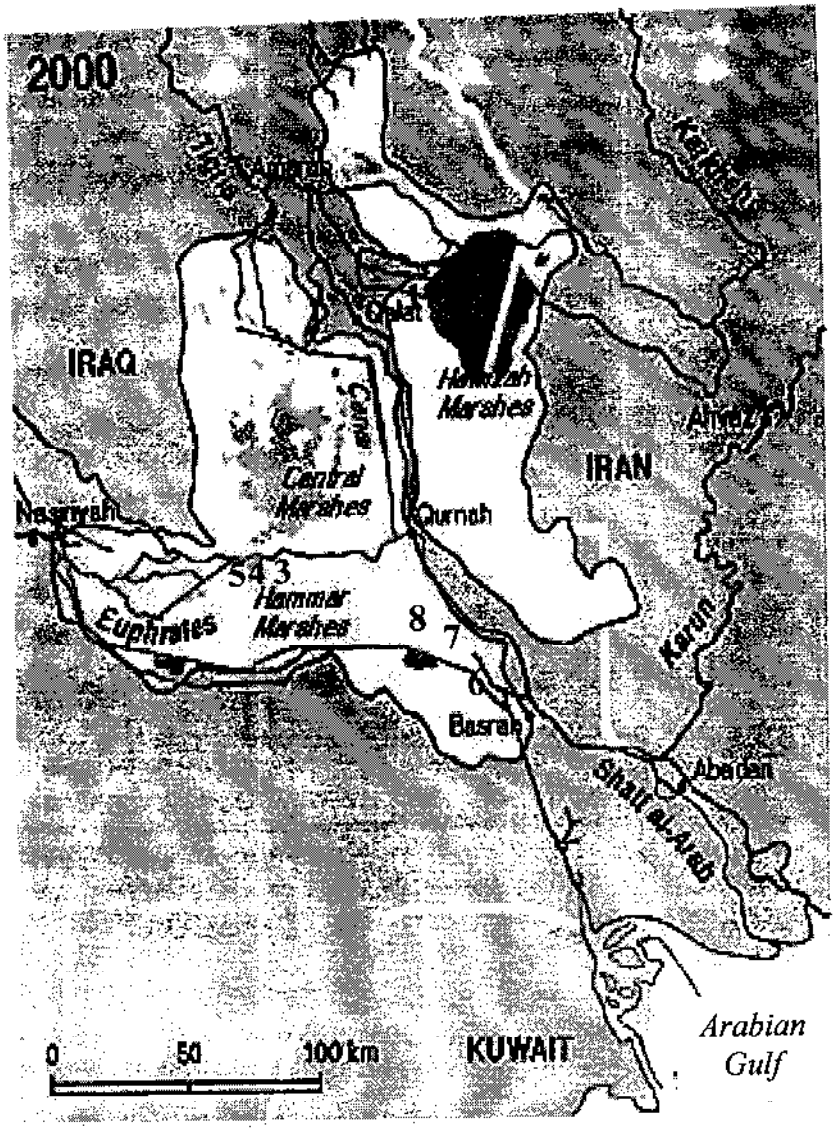

Fig. 1. Location map of Iraqi Southern Marshlands showing the sampling stations (1-8) Source : *www.unep.org*

Materials and Methods

Sub-surface water samples were collected in acid washed polyethylene one liter in volume containers from the selected sites as indicated in fig.1. pH and Electrical Conductivity was determined in the field by adopting portable tools (WTW Multimeter) which were previously calibrated, then water samples were transferred to the laboratory in cool box and stored in fridge prior to further analysis. In the lab Physico-Chemical parameters were determined according to standard methods [12]. Total Suspended Solids (TSS) was determined by filtration through 0.47 µm filter paper, Total Dissolved Solids (TDS) was determined by evaporation, Sodium (Na^+) and Potassium (K^+) were determined by flame photometry (Jenway PEP7), Chloride(Cl^-) was determined volumetrically

by titration with 0.01 N $AgNO_3$, Sulphate ($SO_4^{=}$) was determined spectrophotometrically by CEIL CE292 using turbidity method and Bicarbonate(HCO_3^-) was determined volumetrically by titration with 0.01 N H_2SO_4 .

Results

Parameters measured throughout this study during the period March 2006-Jan 2007 in water samples from the selected sites along the main three marshes in Southern Iraq are listed in table 1 and plotted in fig2 for Al-Hewaizah Marsh, Table 2 and fig.3 for Central Marsh and table 3 and fig. 4 for Al-Hammar Marsh.

Month	HCO3 (ppm)	SO4 (ppm)	Cl (pmm)	TDS (ppm)	TSS (ppm)	K (ppm)	Na (ppm)	E.C (mS/cm)	pH
May-06	274.5	276	550.5	883	40	12.7	136.3	1.82	7.25
Jun-06	254.6	128	194.98	810.5	29.5				
Jul-06	219.6	143.7	129	766	35.5	8.08	120	0.79	7.35
Aug-06	237.8	359.6	354.5	1210	35.5	9.92	125.5	1.25	7.35
Sept-06	237.8	283.8	217	548	36	9.23	106.4	1.09	7.4
Oct-06	204.3	438.5	425.4	787	29.5				
Nov-06									
Dec-06						9.92	106.4	0.92	7.4
Jan-07						9.92	120	1.18	7.3

Table 1. Physico- chemical parameters, pH, Electrical conductivity (EC in mS/cm).Total Suspended Solid (TSS), Total Dissolved Solids (TDS), Sodium (Na^+), Potassium (K^+), Chloride(Cl^-), Sulphate (SO_4^{2-}) and Bicarbonat (HCO_3^-) (all in mg/l) for Al-Hewaizh marsh.

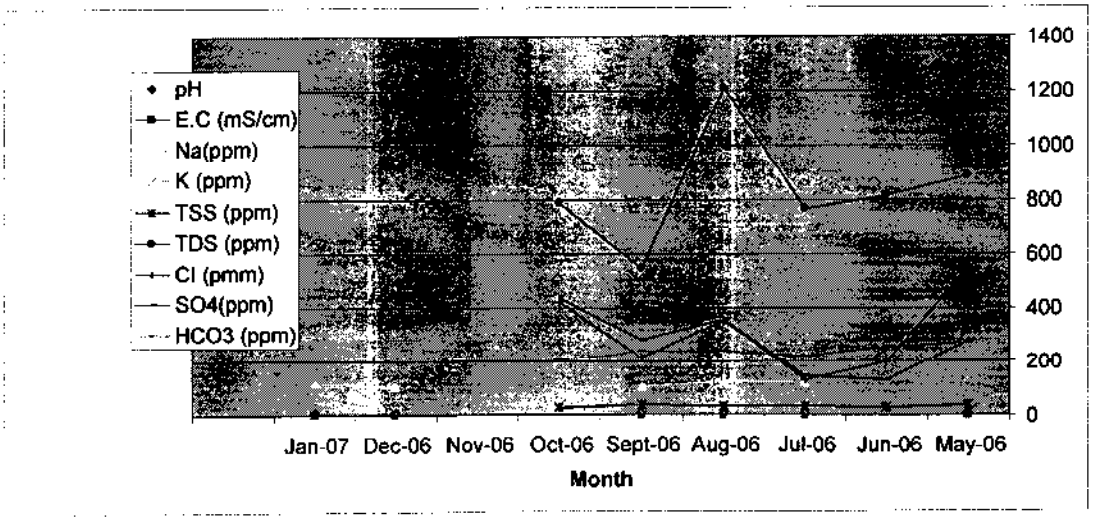

Fig.2 : Variation of studied parameters with time for Al-Hewaizh marsh .

Table 2. Physico- chemical parameters, pH, Electrical conductivity (EC in mS/cm).Total Suspended Solid (TSS), Total Dissolved Solids (TDS), Sodium (Na^+), Potassium (K^+), Chloride(Cl^-), Sulphate (SO_4^{2-}) and Bicarbonat (HCO_3^-) (all in mg/l) for Central marsh .

Month	HCO3 (ppm)	SO4 (ppm)	Cl (pmm)	TDS (ppm)	TSS (ppm)	K (ppm)	Na (ppm)	E.C (mS/cm)	pH
May-06	237.94	827.3	620.4	1879	14.5	13.6	128.6	1.31	7.4
Jun-06	244.04	706.1	1116.7	2526	6.5	21	166	3.19	7.1
Jul-06	274.5	736	694.8	3094	24	16.8	193	2	7.45
Aug-06	250.1	865.9	584.9	1920	37	11.86	117.28	1.4	7.35
Sept-06	250.1	506.8	549.5	1460	20	18.2	162.5	3.2	7.35
Oct-06	219.6	1109	638.1	1598	5	20.04	182.4	4.02	7.3
Nov-06						17.7		2.58	7.2
Dec-06						16.36	182.44	2.67	7.4
Jan-07						17.28	128.14	3.26	7.3

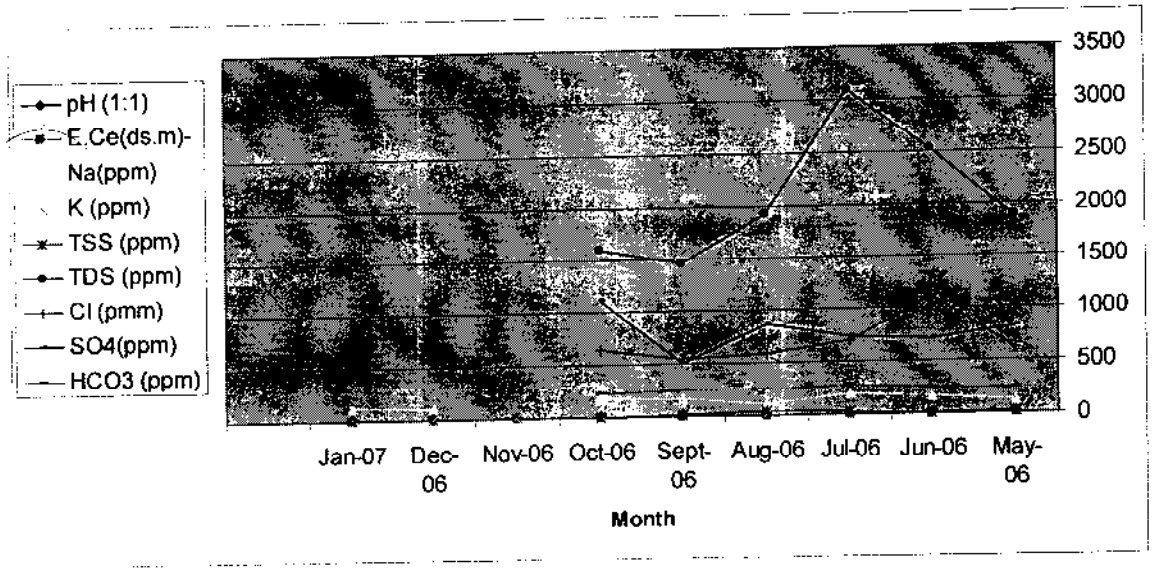

Fig.3 : Variation of studied parameters with time for Central marsh .

Table 3. Physico- chemical parameters, pH, Electrical conductivity (EC in mS/cm).Total Suspended Solid (TSS), Total Dissolved Solids (TDS), Sodium (Na^+), Potassium (K^+), Chloride(Cl^-), Sulphate (SO_4^{2-}) and Bicarbonat (HCO_3^-) (all in mg/l) for Al-Hammar marsh .

Month	HCO3 (ppm)	SO4 (ppm)	Cl (pmm)	TDS (ppm)	TSS (ppm)	K (ppm)	Na (ppm)	E.C (mS/cm)	pH
May-06	270	218.7	709	2093	22.3	15.4	144.4	2.58	7.3
Jun-06	188	549.9	957.1	2739	19.8	29.6	188	4.01	7.1
Jul-06	289	670.3	973.8	2798	36	20.5	171.5	3.6	7.13
Aug-06	198.2	628	593.7	2182.5	26.5	16.2	146	2.2	7.36
Sept-06	198.3	906.3	437.6	1281	26	15.6	170.1	2.46	7.26
Oct-06	234.8	652.7	654.8	1513	16	16.3	155.2	2.5	7.3
Nov-06						17.7	155.3	2.58	7.2
Dec-06						15.44	185.3	3.35	7.25
Jan-07						21.8	215.2	4.5	7.2

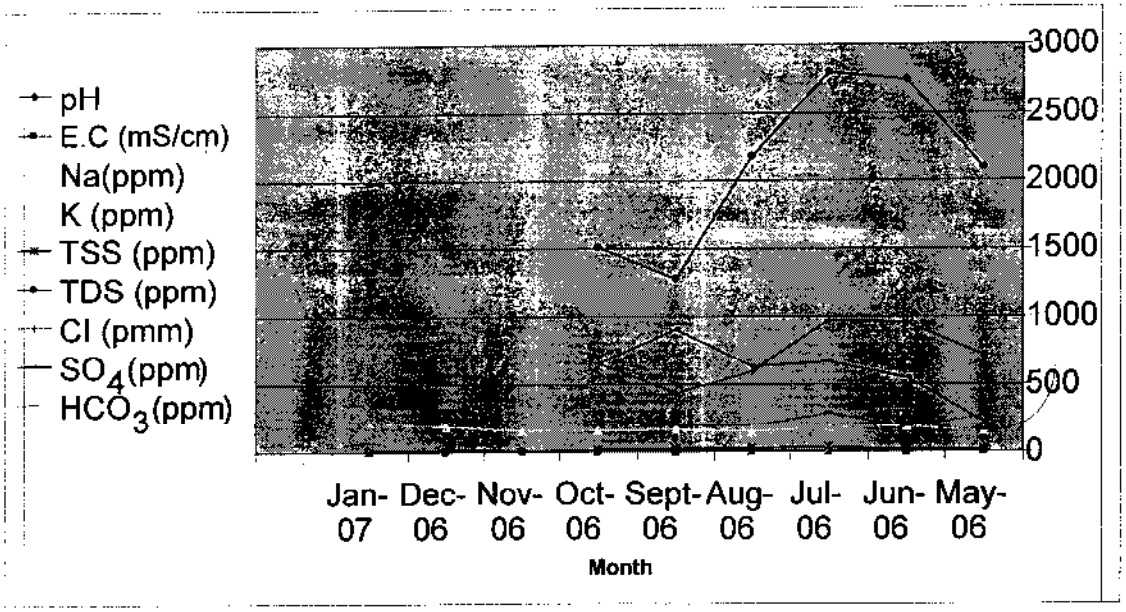

Fig.4: Variation of studied parameters with time for Al-Hammar marsh .

The variations in concentrations of sodium and potassium with time of the year were plotted and shown in figures 4 and 5 for the main three marshes Al-Hewaizah, Central and Al-Hammar.

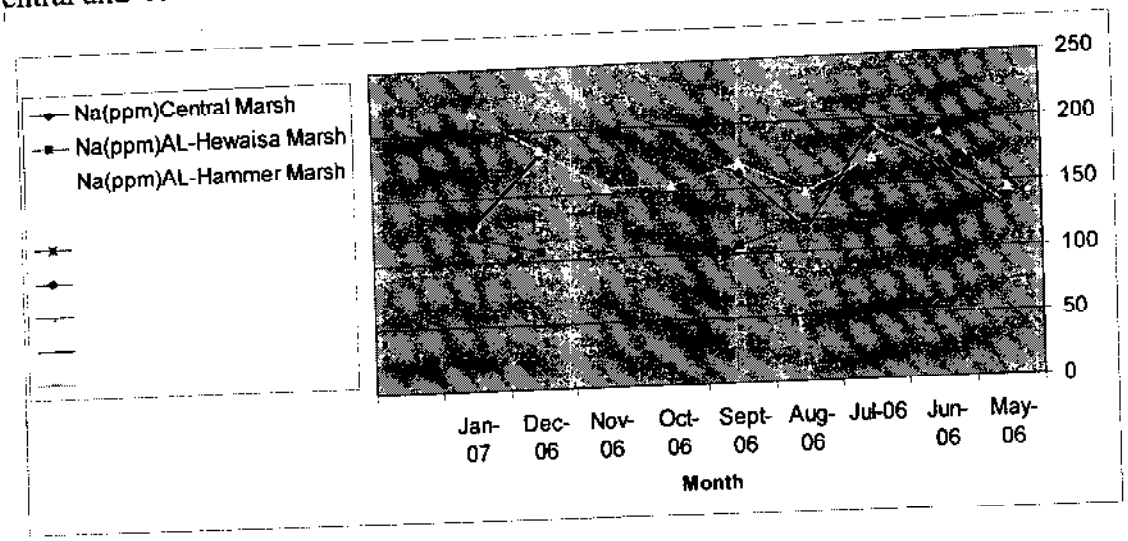

Fig. 5. Variation of Sodium in Iraqi marshes.

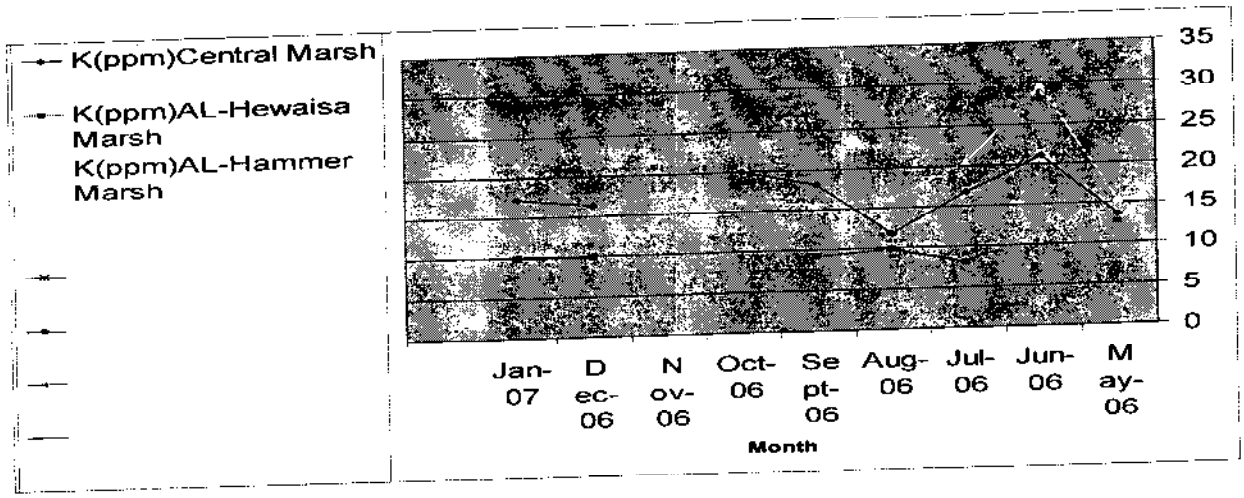

Fig.6: Variation of Potassium in Iraqi Marshes .

Discussion

Southern Iraqi marshes represented by the main three marshes Al-Hewaizah, Central and Al-Hammar which cover a wide area about 15,000 km^2.They suffered, in different levels, from desiccation for a decade and re-flooded at 2003. Due to their vast amount, it is prevented of full detailed water analysis for the re-flooded sites. Therefore, certain sites were selected within the marshes to represent those three marshes [10].

It was expected that during 2003 and 2004, only 15 and 20% of the drained wetlands will be restored due to excessive salinity of flushing

water, environmental pollution, lack of available high quality water and loss of native species, but Richardson et al.,(2005) dispelled this idea by their 2003 and 2004 surveys in which water flow into marshes through Tigris and Euphrates was in good quality[10]. All pH values recorded in this study were in the alkaline direction [8]. In Al-Hewaizah sites the range of pH was 7.2-7.5, in the Central marsh sites the range of pH was 7.1-7.6, while in Al-Hammar marsh sites the pH range was 7.0-7.4 being the lowes. Water of all marshes seems to be neutralize to partially alkaline.

Recorded Electrical conductivities in overall marshes were in the range of 0.79-4.02 mS/cm. According to water quality standard [13], water analysis in table 1 and tables 2&3 show low saline water in Al-Hewaizah Marsh, and moderate saline water in Central and Al-Hammar Marshes. This could be explained on the basis of flushing water into these marshes in which Al-Hewaizah Marsh receives it water from Tigris River with high quality water While Central and Al-Hammar Marshes (Sites3-4 & 6-8 respectively) receive water from Euphrates River with slightly saline water which is either naturally or affected by tide in Shatt Al-Arab River [9]. Due to low salinity in Al-Hewaizah marsh, reed displayed healthy vegetation, while in Central and Al-Hammar marshes most vegetations are reduced as salinities are little bit higher [7]. Values recorded for TSS were high in most studied sites. In Al-Hewaizah marsh, Umm Al-Ward with high TSS due to sampling from the discharging point of Tigris River in Al-Hewaizah Marsh with highly turbid water, while in Central and Al-Hammar Marshes sampling were proceeded from open water with highly turbid water because of crowded Buffalo with low vegetation which help in settling of particulate [5]. Partow (2001) indicated that the southern marshes serve as natural filter for the waste and pollutants in Tigris and Euphrates Rivers through sedimentation and uptake processes [1].

Mean values of TDS were ranged between 548-1210 mg/l in Al-Hewaizah marsh, 1460-3094 mg/l in Central marsh and 1513-2798 mg/l in Al-Hammar marsh. These values consistently exceeded permissible values [14] for drinking water quality adopted by World Health Organization [15] for the long-term planning which is 500 mg/l. As it is expected that concentrations of cations and anions are high following the fact that water bodies in arid regions evaporate significant amounts of water [7]. Moreover, Richardson and Hussain(2006) pointed out that the high evaporation rate have resulted in extremely high ion concentrations and increases in pH and TDS in some sites in the marshes [9].

Many areas of the marshes were severely burned after drainage in which intensity of burns in some areas with high surface organic matter covering sulfidic pyrite soils beneath resulted in soils being greatly altered

chemically and then exposed to oxygen for years of draining, resulting in formation of sulfuric acid [16] . Then sulfate release to the water and affect the water quality. Moreover, the burned soils with FeS_2 has been converted to iron oxide maghermite (Fe_2O_3) which has a texture like ceramic, meaning that the soil will not rewet and will not support plant life, all of these might be responsible for the lack of reestablishment of native vegetation such as rice and wheat in the reloaded areas [7].

Long time for water residence and stagnation allow the soil to leach compounds into the water increasing salinity including Na and HCO_3^- [9]. Moreover, as it is well known that the northern river waters of Iraq are alkaline due to the richness in HCO_3^-, therefore the waters of Iraqi marshes are also high in HCO_3^- [5,10].

Conclusion

Major ion concentrations in Al-Hewaizah Marsh were the lowest compared with Central and Al-Hammar Marshes.

High levels of pollutants such as sodium ions may prevent marsh restoration.

The studied parameters are among variables which are important to explain the variance in the structure of biological communities and control biodiversity in the marshlands.

The results for water quality in this study were variable among selected sites and generally ,water quality of those stations were within the permissible range. Even though, they indicate favorable signs for further successful restoration of southern marshes of Iraq.

Most of physico-chemical parameters especially salinity are quite important for plant growth which cause reduction in growth of rice and wheat, which are traditionally grown at the edge of the marshes.

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مجلة البصرة للعلوم الزراعية ، العدد (خاص) ، المجلد 21 ، 2008

تقدير بعض المتغيرات الفيزوكيميائية في مياه مناطق منتخبة من اهوار العراق الجنوبية

فارس جاسم الامارة دنيا خير الله و ميثاق صالح حمادي آمال احمد محمود

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الخلاصة

خلال الفترة اذار 2005 لغاية حزيران 2006 تم جمع عينات مياه تحت سطحية من ثمانية مواقع في اهوار العراق الجنوبية : 1) ام الورد و 2) ام النعاج (هور الحويزة) و 3) ابو جولان و 4) ابو سوباط و 5) الجبايش (الهور الوسطي) و 6) النكارة و 7) البركة و 8) المفرق (هور الحمار). تم قياس المتغيرات الفيزياوية الاس الهيدروجيني والتوصيلية الكهربائية (مللي سمنس / سم) والمواد الصلبة العالقة الكلية (TSS) والمواد الصلبة الذائبة الكلية (TDS) ، كما تم تقدير المتغيرات الكيمياوية التالية : الصوديوم (Na^+) و البوتاسيوم (K^+) والكلوريد (Cl^-) والكبريتات (SO_4^{2-}) والبيكاربونات (HCO_3^-) و ذلك

باستخدام الطرق القياسية في التحليل. ولكل العينات وخلال فترة الدراسة كانت حموضة المياه تتجه نحو الطبيعة القاعدية بمعدل اس هيدروجيني بحدود 7,1 – 7,4 وبقيم اعلى خلال اشهر الصيف. وكان حدود التوصيلية الكهربائية بمديات تتراوح بين 0.79 – 1.56 مللي سيمنس/ سم في ام الورد (هور الحويزة) الى 1.95 – 4.61 مللي سيمنس/سم في النكارة (هور الحمار). وكانت تراكيز الصوديوم والبوتاسيوم بالحدود الطبيعية المثبتة من قبل منظمة الصحة العالمية والمواصفات العراقية، وتتناقص تراكيزهما خلال الصيف وتزداد خلال موسم الامطار خصوصا" في مواقع هور الحمار(6 – 8) بسبب الرطوبة ذات الصفات الملحية من الخليج العربي. وكل المتغيرات الاخرى لها نفس التصرف والتي لاتتجاوز الحدود العالمية. وان اعلى وادنى قيم للمواد العالقة الكلية سجلت في الموقعين 1 و 2 ضمن هور الحويزة بينما سجلت اعلى وادنى قيم للمواد الصلبة الذائبة الكلية في المواقع 6 و 7 من هور الحمار و1 و 2 من هور الحويزة وكان كل من الكلوريد والكبريتات بنفس اتجاه المواد الصلبة الكلية بينما يتصرف البيكاربونات بعكس الاتجاه وذلك بسبب المصادر المختلفة للمياه الداخلة الى الاهوار.

كلمات دالة : المتغيرات الفيزيائية- الكيميائية ، اهوار العراق، التغيرات الموسمية ، نوعية المياه، الخليج العربي .