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Ecological Survey of Al-Gharaf Canal at Thi Qar Province, Iraq.

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Abstract

Ecological survey on some invertebrates of three stations (Al-Nasir, Al-Shatra, Al-Gharaf), in Al-Gharaf River was conducted. Some chemical and physical factors of the study area have been measured also species diversity, evenness and richness of the invertebrates has been quantified.

58 species of invertebrates were recorded comprised: 3 Annelida, 10 Mollusca, 3 Copepoda, 17 Cladocera, 20 Rotifera, 2 Ostracoda, 3 Crustacean larva. The highest density were recorded in st_2 (3201.2 ind/m^2 and 5742.22 ind/L) in comparison with st_1 (3327 ind/m^2 and 423.32 ind/L) and st_3 (2369.2 in/m^2 and 400.18 ind/L).

Mollusca had higher values of diversity in all stations (1.3, 0.9, 0.85 in st_1, st_2 and st_3 respectively), moreover st1 was higher than that in other stations in ecological indices. Evenness was found to be 0.57, 0.62 for Cladocera and Copepoda in st_1 in comparison to st_2 (0.53, 0.8) and st_3 (0.31, 0.51) respectively. Annelida had a comparable in seasonal values and low in all ecological indices among three stations.

Evenness varied inversely to the temperature. Invertebrate species diversity was positively correlated with chlorophyll a and nitrate, but negative correlated with temperature, salinity , and BOD.

1- Introduction

Al-Gharaf canal is of essential importance for domestic and agricultural uses and its water masses are essential to satisfy requirement of Basrah and Thi Qar provinces.

A search of literature revealed that there are no previous studies on the area, except several works concerned with physical – chemical condition at this canal (Hussein and Fahad, 2008 (a, b); Hussein *et al*., 2009), also level of heavy metal accumulation within various organs of aquatic organisms were reported a previous paper (Hussein and Fahad, 2008c, 2009).

Iraqi literature on invertebrates that established on neighboring habitats as Shatt Al-Arab were that (Gurney, 1921; Ahmed, 1975; Al-Saboonchi *et al*., 1986; Al-Adhub & Hamza, 1987; Abdul-Saheb, 1989).

The aim of the present study to give some information about the quantity and quality of major group of invertebrates (Annelida, Mollusca, Zooplankton) and its relationship with chemical-physical condition and some ecological indices like species diversity, evenness and richness.

Description of The study Area

Tigris is one of the two main rivers feeding Iraq with essential quantities of freshwater. It split, after passing Kut Dam into two major branches, the former moves towards Maysan province and the other branch (Al-Gharaf canal) is penetrating Thi Qar governorate and directed towards Al-Nasir (st_1) our study area (Fig. 1) and so on. The canal is distinguished at this location with low gradient and moving current creating considerable loads of sediment.

The adjusted lands influenced by domestic sewage, waste from land cultivation and some private factories. St_1 (Al-Nasir) is situated at distance 90 km from Kut Dam, st_2 (Al-Shatra) is located at distance 12 km from st_1 and st_3 (Al-Gharaf) is situated at distance 21 km from st_2. all stations affected by disposal of Al-Gharaf district and also affected by drainage water from cultivated lands. Quite little aquatic vegetation was detected in the region including *Phragmites australis*, *Typha* sp., *Potamogeton* sp., *Ceratophyllum demersum* and *Vallisineria spiralis*.

2-Materials and Methods

Quantitative samples were taken bimonthly interval from three stations in Al-Gharaf canals from October 2010 till September 2011.

Zooplankton were collected by plankton net (mesh size 0.5µm). at each stations 100L of water were taken from the surface (ten replicates). Mollusca (Mussels and snail) were collected by wooden quadrates (30 × 30 cm) eight times and means were taken, quadrate was pressed inside clay in depth 12 cm. Annelida were collected in the same quadrate eight times also, screening with sediment sorting series (mesh size 0.2 mm) in all cases the organisms were preserved in 70% alcohol for later examination (Lind, 1979). Identification of some organisms to species, others as far as necessary according to special references for each group (Edmondson, 1959; Al-Hamed, 1966;

Brinkhurst and James, 1971; Frandsen, 1983).

The following environmental parameter were investigated: Chlorophyll a, water temperature, chlorine, comparative degree of pollution were obtained by the 5- day Biochemical Oxygen Demand test (BOD). pH meter was used to determined the hydrogen ion concentration. Dissolved oxygen, total phosphate and nitrate also measured(Lind, 1979).

Statistical Evaluation

Diversity (H) were computed by Shannon and Weaver equotient (1948).

$$\mathbf{H= \sum_{i=1}^{s} Pi \log pi}$$

Where H= diversity, S= No. of species in sample

Pi= proportion of total sample belonging to the species

Richness index were computed by Margalefe equotient (1968)

$$\mathbf{D= S-1/ \ln N}$$

Where D= Richness index, N= No. of individual

S= No. of species.

Evenness were also determined by Pielou equotient (1966)

$$\mathbf{J= H/\ln S}$$

Where J= Evenness of index, H= Shannon index

S= No. of species in the sample

Correlation Coefficient (r) between these parameters were then determined (Suedecar and Cochram, 1976)

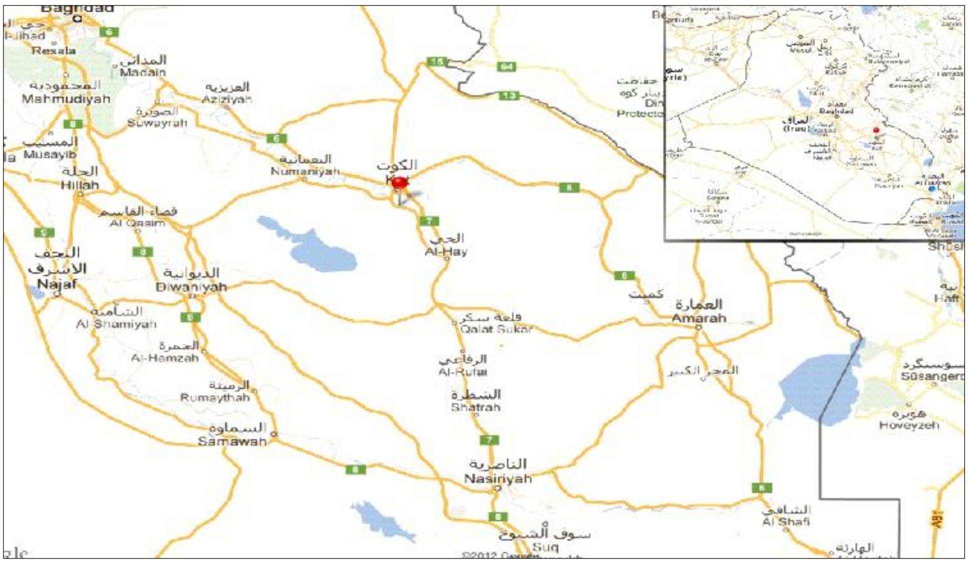


Fig (1) Location of sampling area

3-Result

Chemical Physical Condition

Condition at all stations were generally similar in temperature, dissolved oxygen biochemical oxygen demand, salinity, chlorophyll a, and phosphate except for nitrate and pH (Fig. 2, 3)

The annual range of the water temperature in the Al-Garaf canal is about 11-35ºC at st_3 are however approximately 1-1.5ºC lower than those at st_1 and st_2. Unlike the temperature the monthly means of dissolved oxygen content are higher at st_1 (12 mg/L) in January than those of st_2 and st_3 (6.1, 7.8 mg/L) in May respectively.

The PH value was varied between (8.0 – 8.9) in April, but is lowered where mean value fluctuate (7.2 – 7.8) at June in all stations

During the warmer months chlorine (in chloride) of the canal grades from (0.3 – 0.36) mg/L in all stations. While in winter these values increased to (0.9 – 1.02) mg/L.

The comparative degree of pollution (as inferred from the BOD) at the three stations were ranged from (0.98 – 6.8), (2.57 – 8.3) and (0.83 – 8.69) mg/L at st_1, st_2 and st_3 in December and April respectively.

Monthly changes in nitrate (NO_3) concentration were showed fluctuating pattern. St_1 showed lower values than those at st_2 and st_3. The lowest values were in May counting from (3.9-6.8) mg/L and the highest were recorded in June and October (12.1-12.9) mg/L.

Monthly differences in phosphate concentration for the selection stations, were ranged from the minimum value at October (0.1-0.2) mg/L, and the maximum values however, (2.7-5.1) mg/L were measured in July.

The monthly and localized changes in chlorophyll a. The monthly means fluctuating between (0.15-9.2, 0.92-11.95, 0.71-12.85) mg/L at st_1, st_2 and st_3 respectively. Means values of dissolved oxygen and salinity showed reverse trend to temperature (r= - 0.46, -0.57) respectively.

Biotic Condition

Table (1) showed density of some invertebrates in Al-Gharaf canal. 58 species were recorded in all stations comprised. 3 Annelida, 10 Mollusca, 3 Copepoda, 17 Cladocera, 20 Rotifera, 2 Ostracoda, and 3 Crustacean larvae. The maximum density of Benthos (Annelida and Mollusca) were (989, 974, 775) ind/m^2 during autumn and spring in st_1, st_2, and st_3 respectively, while the maximum density of zooplankton (Copepoda, Cladocera, Rotifera, Ostracoda, and Crustacean larve) were (185.5, 228.7, 248.6) ind/L during winter in st_1, st_2, and st_3 respectively (fig 4). The minimum density of Benthos were (716, 620, 462.1) ind/m^2 during winter and summer in st_1, st_2, and st_3 respectively, while the minimum density of zooplankton were (7.32, 7.42, 10.78) ind/L during autumn in st_1, st_2, and st_3 respectively (Fig. 5).

There was no significant correlation between total invertebrates and chlorophyll a ($r= 0.095$, $P> 0.05$), also such correlation found with water temperature ($r= 0.39$), while invertebrate density had negative correlation with salinity ($r= -0.4$, $P>0.05$). Temperature had inverse relationship with dissolved oxygen and salinity ($r= -0.17$, -0.36) respectively.

The species composition of the three stations was Annelida, Mollusca, Copepoda, Cladocera, Rotifera, Ostracoda, and Crustacean larva. Mollusca group was high density in st_1 while in st_2 exhibit in a low density in comparison with st_1. Unlike to Annelida which were recorded in high number in st_1 in comparison with other stations.

Table (2) showed occurrence of species of the invertebrates in Al-Gharaf canal. Maximum number of species were recorded in st_1, 47 species including 3 Annelida, 10 Mollusca, 3 Copepoda, 17 Cladocera, 20 Rotifera, 2 Ostracoda, and 3 Crustacean larva, while in st_2 53 species were recorded including 3 Annelida, 10 Mollusca, 3 Copepoda, 12 Cladocera, 20 Rotifera, 2 Ostracoda, and 3 Crustacean larva. Similar number of species were recorded in st_3 including: 3 Annelida, 10 Mollusca, 3 Copepoda, 16 Cladocera, 16 Rotifera, 2 Ostracoda, and 3 Crustacean larva.

(Fig. 6, 7, 8) explained percentage of main group of invertebrates in selected stations. In st_1, Annelida have maximum percentage in all over the year followed by Mollusca which ranged between (25 – 37%) in summer and winter respectively. In st_2 the minimum percentage 35% in winter, while Mollusca have higher percentage (59%) in autumn. In st_3 percentage of Mollusca increased to 92% in Autumn in comparison to Annelida which was decreased to 7%. Other groups were very few and comprised (0.1-7.5%) in different season in the three stations.

The ecological indices (diversity, richness and evenness) values were low for all groups except Mollusca due to dominance of few species of Rotifera and Cladocera. The result showed high value of diversity, richness and evenness indices of Mollusca in st_1 in comparison to values in st_2 and st_3. Table (3, 4, 5) explained seasonal changes in diversity, richness and evenness in each group of the invertebrates in st_1, st_2 and st_3. generally, st_1 was higher than other stations in biological indices. Mollusca has higher values of diversity (1.3, 0.9, 0.85) in st_1, st_2 and st_3 respectively.

Evenness was found to be (0.57, 0.62) for Cladocera and Copepoda in st_1 in comparison with st_2 (o.53, 0.8) and st_3 (0.31, 0.51) respectively. While Annelida had a comparable in seasonal values and low in all ecological indices between the three stations. Species diversity were positively correlated with chlorophyll a and nitrate (r= 0.45, 0.5), but negatively correlated with temperature and salinity (r= - 0.45, - 0.52). similarly evenness had negatively relation with temperature (r= - 0.53).

Table (1): Density of some invertebrates in the study area

Group	St_1				St_2				St_3			
	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring
Annelida ind/m	539	657	382	583	366	390	309	530	123.9	42.5	46	329
Mollusca ind/m	218	332	334	282	269.2	582	311	444	338.2	612	432	346
Copepoda ind/L	15	3	18	19	29	2.9	25.1	26	7.9	5	13.4	6.8
Cladocera ind/L	33	3.1	54	34	25	2.9	121	24.1	3.4	1.13	155	16.4
Rotifera ind/L	21.3	0.42	1.5	20.4	10.3	0.42	36.1	17.3	1.9	0.71	28.5	22
Ostracoda ind/L	14.7	0	45	14.1	46.4	0.64	19.2	32.1	5.3	0.42	23.2	19.2
Crustacean ind/L	22	0.8	67	35	62	0.56	27.3	65.9	36.7	3.5	28.5	21.2
Total ind/m^2	757	989	716	865	635.2	972	620	974	462.1	654.5	478	775
Total ind/L	108	3.32	185.5	122.5	172.7	7.42	228.7	165.4	55.2	10.78	248.6	85.6

Table (2) Occurrence of some invertebrates in the study area ((+) Present, (-) absent)

Group	St_1				St_2				St_3			
	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.	Spr.	Sum.	Aut.	Win.	Spr.
Annelida												
Tubifex tubifex	I	I	I	I	I	I	I	I	I	I	I	I
Branchiura sworby	+	+	+	+	+	+	+	+	+	+	+	+
Limnodrilus cluparadiana	I	I	I	I	I	I	I	I	I	I	-	I
Mollusca												
Physa acuta	-	-	+	+	+	+	+	+	+	+	+	+
Lymnaea auricularia	-	-	I	I	I	I	I	I	I	I	I	I
Melanopsis nodosa	+	+	+	+	+	+	+	+	+	+	+	+
Melanopsis costata	I	I	I	I	I	I	I	I	I	I	I	I
Corbicula fuminalis	-	+	-	+	+	+	+	+	+	+	-	+
Uno tigrids	I	I	-	I	I	I	I	I	I	I	I	I
Psudodontopsis euphratica	-	+	-	-	+	+	+	+	+	+	+	+
Theodoxus jordani	I	I	I	I	-	I	-	I	I	I	I	I
Mollusca												
Bellamya bengalensis	-	-	-	-	I	I	I	I	-	-	I	I
Melanoides tuberculata	+	-	+	+	+	+	+	+	+	+	+	+
Mollusca												
Copepoda												
Cyclops sp.	I	I	I	I	I	I	I	I	I	I	I	I
Diaptomus arapohoenis	I	I	I	I	I	-	I	I	I	-	I	I
Harpact coid	I	-	I	I	I	I	I	I	I	I	I	I
Cladocera												
Bosmina longirostris	+	-	+	+	-	+	+	+	+	+	+	-
Moina affinis	I	I	I	I	-	I	I	I	I	I	I	-
Simocephalus vetulus	+	+	+	+	-	-	+	+	-	-	-	-
Alona affinis	+	-	+	+	+	+	+	+	+	+	+	-
Chydorus sphearicus	+	-	+	+	+	+	+	+	+	+	+	-

Acropterus sp.	+	-	+	+	+	+	+	+	+	+	+	-
Cladocera												
Camptocerus rectrostris	I	-	I	I	I	-	I	I	I	I	I	I
Eurycera sp.	-	-	+	-	-	-	+	-	-	-	-	-
Diphanosoma branchyurum	+	+	+	+	+	-	+	+	-	-	+	-
Latoropsis fasciulata	-	-	+	-	-	-	-	-	-	-	+	-
Macrothrix spinosa	-	-	-	-	-	-	-	-	-	-	+	-
Daphnia lumholtzi	-	-	-	-	-	-	-	-	-	-	+	-
Leydigia sp..	-	-	-	-	-	-	-	-	-	-	I	-
Sidia sp.	-	-	-	-	-	-	-	-	-	-	+	-
Ceriodaphnia reticulate	-	-	-	-	-	-	-	-	-	-	I	-
Scapholebris kingi	-	-	-	-	-	-	-	-	-	-	I	-
Holopedium sp.	-	-	-	-	-	-	-	-	-	-	I	-
Biparalona sp.	-	-	-	-	-	-	-	-	-	-	-	-
Rotifera												
Asplanchna sp.	+	+	+	+	+	+	+	+	+	+	+	+
Keratella sp.	I	-	-	I	I	I	-	I	I	I	I	I
Branchionum sp.	I	-	-	I	I	-	-	I	I	I	I	I
Trichocera sp.	I	-	I	-	I	I	-	I	I	I	I	I
Ascomorpha sp.	+	-	-	+	+	+	-	+	+	+	+	+
Pleosoma sp.	-	-	-	+	+	-	-	+	-	-	-	-
Platyis sp.	+	-	-	-	+	-	-	-	-	-	-	+
Synchaeta sp.	+	-	-	+	+	-	-	+	-	-	-	+
Lecane sp.	I	-	-	I	I	-	-	I	-	-	-	I
Habotocha sp.	+	-	+	+	+	-	+	+	-	-	-	+
Rotaria sp.	-	-	-	I	-	-	-	I	-	-	-	I
Euchlanis sp.	I	-	I	I	I	-	I	I	-	-	-	I
Monostyla sp.	+	-	+	+	-	-	-	+	-	-	-	-
Epiphanies sp.	-	-	+	+		-		+	-	-	-	-
Hamingia sp.	+	-	-	-	+	-	+	-	-	-	-	-
Prompholyx sp.	-	-	-	-	+	-	+	+	-	-	-	-
Notholca sp.	-	-	-	-	-	-	+	-	-	-	-	-
Concochiloides sp.	-	-	-	-	-	-	+	+	-	-	-	-
Filira sp.	-	-	-	-	-	-	-	-	-	-	+	-
Macrotrachela sp.	-	-	-	-	-	-	-	+	-	-	+	-
Bipalpus sp.	-	-	-	-	-	-	-	-	-	-	-	-
Testudinella sp.	-	-	-	-	-	-	-	-	-	-	-	-
Ostrcoda	-	-	-	-	-	-	-	-	-	-	-	-
Species 1	-	-	-	-	-	-	-	+	+	+	-	+
Species 2	-	-	-	-	-	-	-	-	+	+	+	+
Crustacean larvae	-	-	-	-	-	-	-	+	+	+	-	+

Table (3): Seasonal diversity richness and evenness for each group of invertebrate in st_1

	Summer			Autumn			Winter			Spring			Total		
	Div.	Rich.	Even.	Div.	Rich.	Even.	Div.	Rich.	Even.	Div.	Rich.	Even.	Div.	Rich.	Even.
Annelida	0.2	0.32	0.1	0.5	0.31	0.45	0.4	0.34	0.36	0.4	0.32	0.36	0.38	0.34	0.31
Mollusca	0.43	0.74	0.58	1.6	1.03	0.53	1.5	1.2	0.53	1.2	1.25	0.4	1.3	1.05	0.51
Copepoda	0.98	0.7	0.89	0.31	1.03	0.44	0.45	0.69	0.41	0.8	0.68	0.73	0.63	0.8	0.62
Cladocera	0.94	1.7	0.48	0.67	1.16	0.97	1.05	1.76	0.46	1.5	2.27	0.37	1.04	1.72	0.57
Rotifera	0.78	3.93	0.3	0.41	1.16	0	0.5	9.3	0.31	0.82	3.6	0.33	0.63	4.4	0.31
Ostracoda	0.31	0.37	0.44	0.2	0	0.29	0.3	0.27	0.43	0.12	0.38	0.17	0.23	0.34	0.33

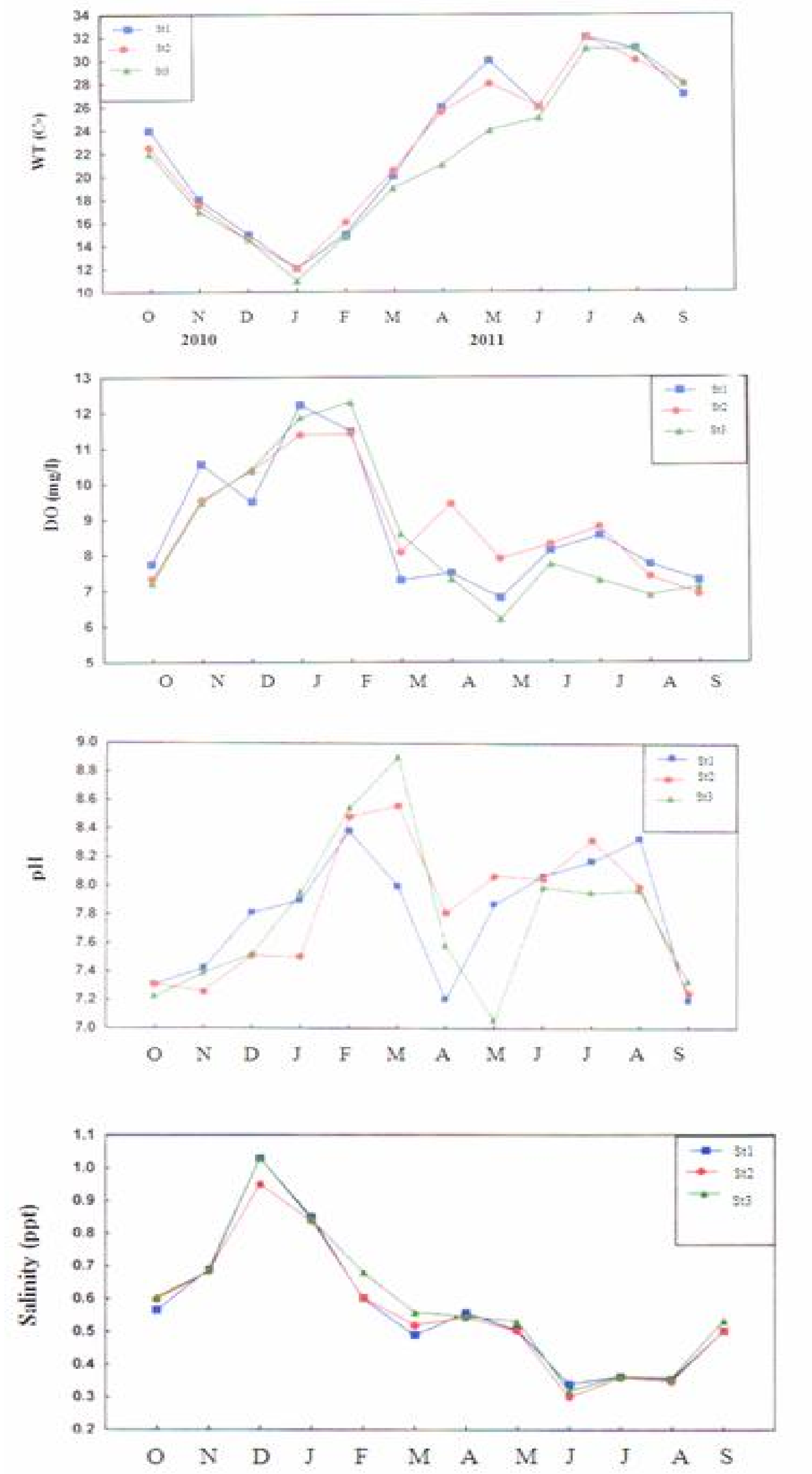
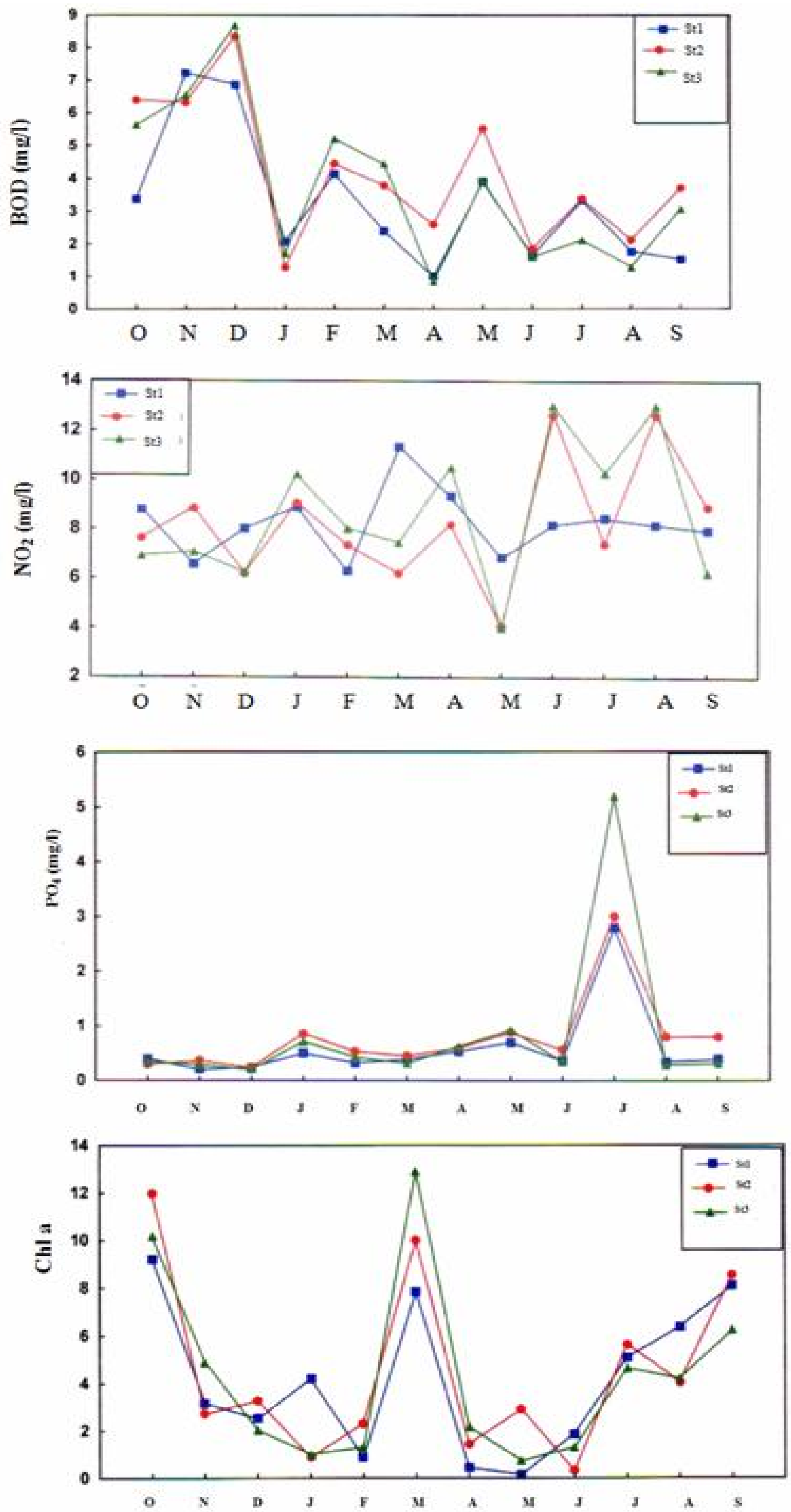


Fig (2) Environmental factors of study area



Fig(3)Environmental factors of the study area

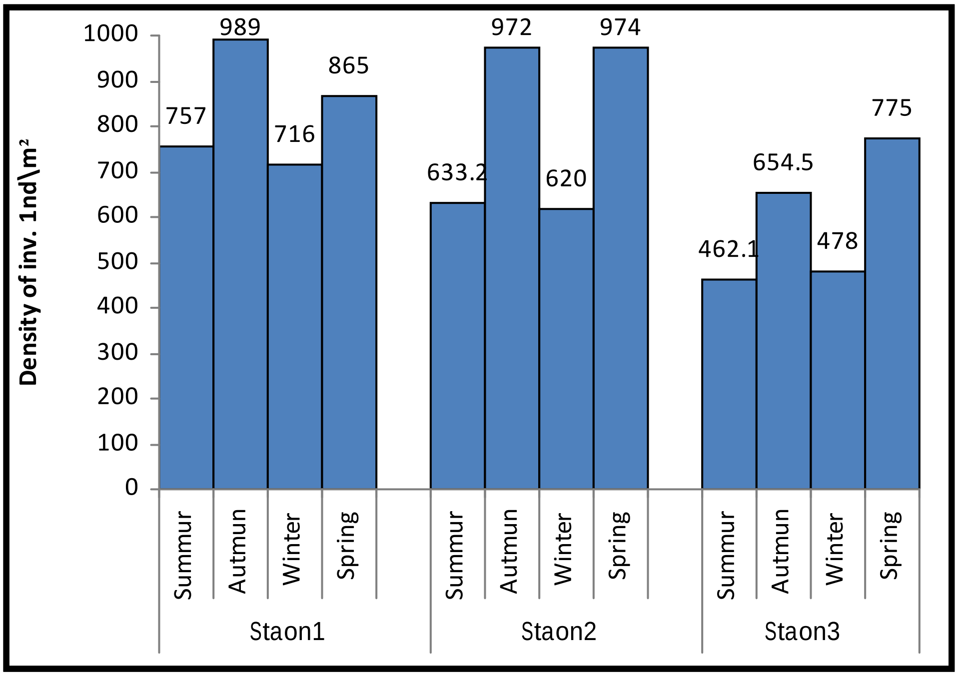


Fig (4) Density of invertebrates (Annelides& Mollusca) in three stations

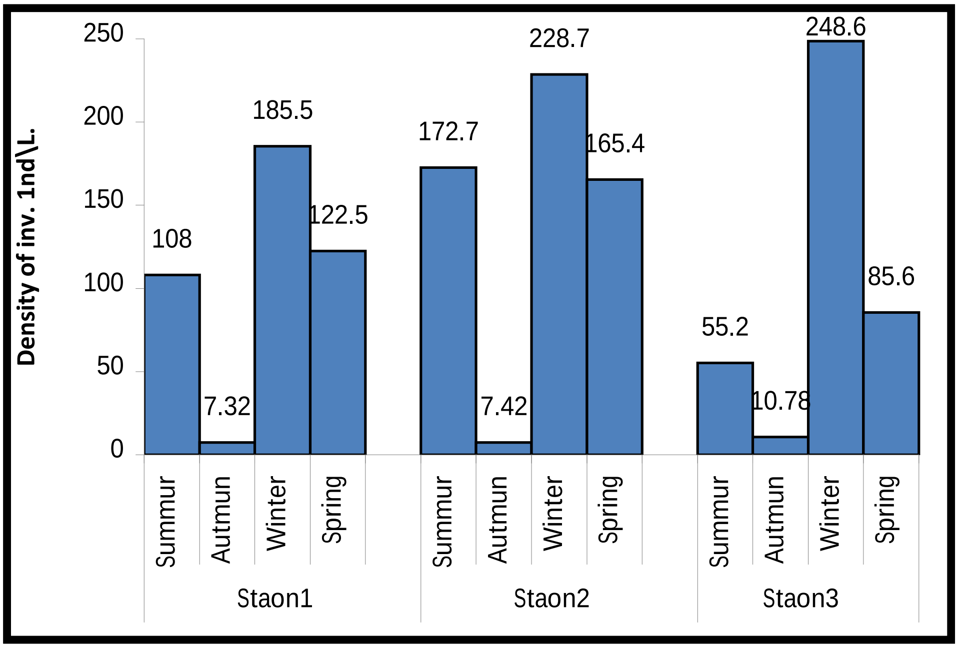


Fig (5) Density of invertebrates (Zooplankton) in three stations

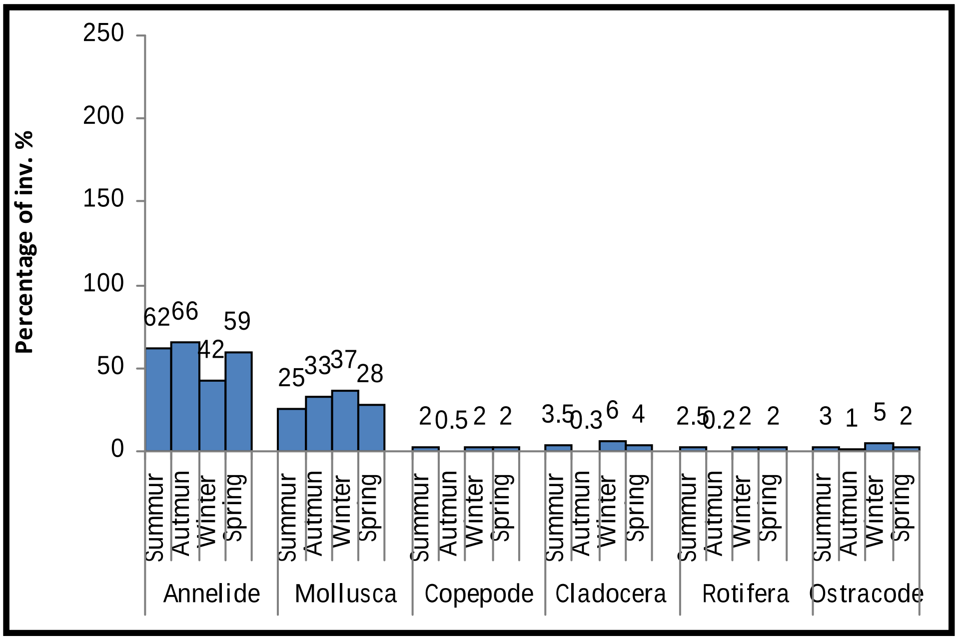


Fig (6) percentage of invertebrates in station 1

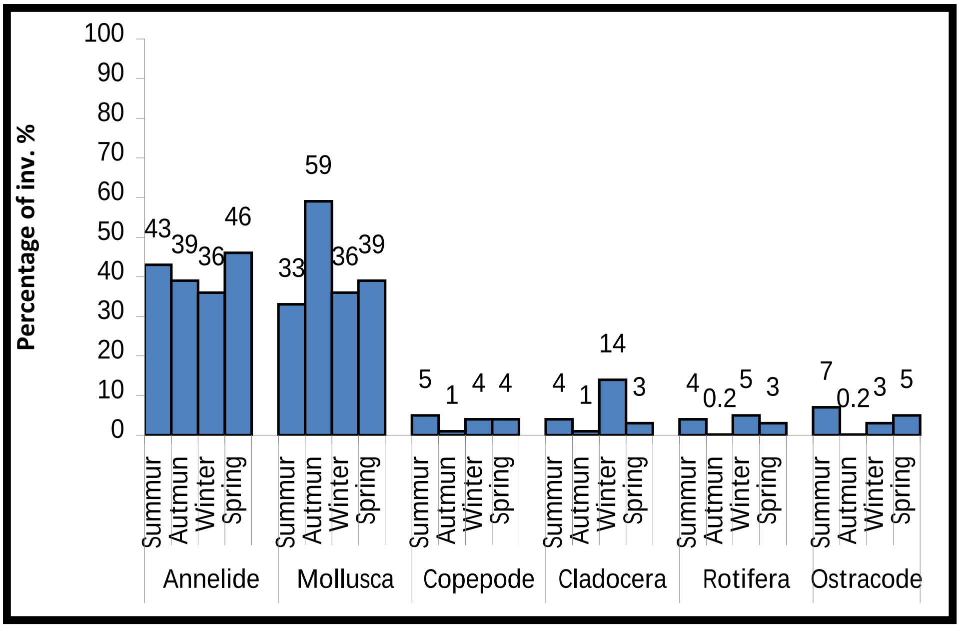


Fig (7) percentage of invertebrates in station 2

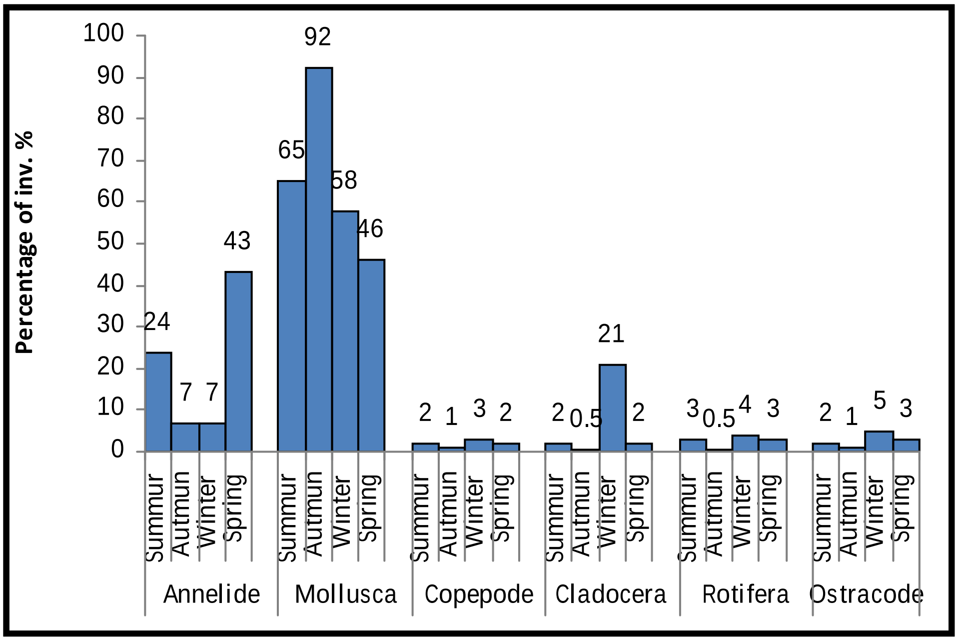


Fig (8) percentage of invertebrates in station 3

4-Discussion:-

The highest number of invertebrates were recorded in st_2 (3201.2 ind/m^2 and 5742.22 ind/L) in comparison with st_1 (3327 ind/m^2 and 423.32 ind/L) and st_3 (2369.8 ind/m^2 and 400.18 ind/L) that could be related to physicochemical characters of water substratum and water region.

The greatest damage of the canal is done by domestic and agricultural wastes discharged to the river, and because of that's waste, the hydrogen ion concentration goes towards alkaline side

Annelida was the dominant group in all studies stations followed by Mollusca the Cladocera. Variation was found in other group which presence in low density and it's very important as food item for fish and other aquatic organism. Most species of invertebrates in selected stations were previously recorded in Iraqi rivers and lakes (Hamzah, 1980; Frandson, 1983; Rasheed, 1985; Daoud *et al*., 1986; Al-Hamed, 1966; Saood, 1987; Al-Adhub and Hamzah, 1987; Abdul-Saheb, 1989; Al-Qarooni, 2005, 2011).

According to the little data available about density and abundance of invertebrates in Al-Gharaf canal so there were many investigations performed on surrounding area such as Al-Qarooni (2005) was recorded only four species of snail (*Lymnaea auricularia*, *Physa acuta*, *Bellamya bengalenis* and *Gyrulus* sp.) in three southern marshes, but the recent study was recorded 10 species of Mollusca. Also

Alsoodani *et al*. (2007) identified 87 species of Zooplankton in marshes including: 53 species of Rotifera, 24 species of Cladocera, 4 species of Copepoda and 6 species belong to insect, Ostracoda and Nematode, while our study were recorded 58 species in Al-Gharaf canal including: 3 species of Annelida, 10 species of Mollusca, 3 species of Copepoda, 17 species of Cladocera, 20 species of Rotifera, 2 species of Ostracoda, 3 species of crustacean larva.

Few specific articles were deal with Zooplankton of marshes such as (Al-Saboonchi *et al*., 1986; Al-Qarooni, 2005; Al-Soodani, 2007).

We deduced that highest density of individual of invertebrates recorded in spring in all studied stations which conceded with increase of phytoplankton and zooplankton, while the lowest density of invertebrates were recorded in summer. Similar results were reported in previous studies (Mohammad, 1965, 1986; Winner *et al*., 1980; Mangalo and Akbar, 1986, 1988).

Diversity indices of invertebrates varied inversely as the degree of the organic pollution (as inferred from BOD). This was an evident of higher value of Ecological indices in st_1 in comparison to st_2 and st_3 because of the lowest value of BOD. The observation accords well those of (Hynes, 1960; Mohammed, 1980; Al-Gizany, 2005; Abaa, 2010). In the Annelida however, species diversity with the increase of organic matter (Mohammed, 1980; Akbar, 1999).

Within the invertebrates species richness and evenness were equal important in predicting species diversity at all stations. This indicates that the increase in the diversity index could be result from an increase on both component's evenness and richness.

5-Conclusions

1. In a 12 months ecological survey of Al-Gharaf canal. Selected physical – chemical features were measured and the diversity richness and evenness of the invertebrates were quantified.

2. The fauna of the canal composed 58 species include: 3 Annelida, 10 Mollusca, 3 Copepoda, 17 Cladocera, 20 Rotifera, 2 Ostracoda, 3 Crustacean larva.

3. The density of invertebrates were recorded in st_2 (3201.2 ind/m^2 and 5742.22 ind/L) in comparison with st_1 (3327 ind/m^2 and 423.32 ind/L) and st_3 (2369.8 ind/m^2 and 400.18 ind/L)

4. Mollusca had the highest values in ecological indices in all stations. Unlike to Annelida which had the lowest values in ecological indices.

6-References

Abass, M. F. (2010). Abundance of Cladocera and some other zooplankton and diversity in the northern part of Shatt Al-Arab river. M. Sc. Thesis, Basrah Univ. 119 pp.

Abdul-Saheb, I. M. (1989). Life history and productivity of two species of freshwater mussels *Corbicula fluminalis* and *C. fluminaea* in Shatt Al-Arab river. M. Sc. Thesis, Basrah Univ. 92 pp.

Ahmed, M. M. (1975). Systematic study on Mollusca from Arabian Gulf and Shatt Al-Arab, Iraq. Bull. Basrah Nat. Hist. Mus., (3): 89 – 94.

Ajeel, S. G. (1998). Population dynamics and bioenergetics of two species of Cladocera *Simocephalus vetulus* (Muller) and *Daphnia magna* (Straus) in Basrah with a reference to zooplankton. Ph.D. Dissertation, Basrah Univ., 154 pp.

Akbar, M. M. (1999). Experimental and field study of the population dynamics of *Tubifex tubifex* (Annelida: Oligochaeta). Ph.D. Dissertation, Babylon Univ., 103 pp.

Al-Adhub, A. H. Y. and Hamzah, H. A. (1987). Caridina *Babaulti basrensis* sub sp. Nov. from the Shatt Al-Arab region, Iraq. Crustacea, 52 (3): 225 – 228.

Al-Gizany, H. R. (2005). Organic pollution and its effect in diversity and abundance of plankton in Shatt Al-Arab, Ashar and Rubat canal. M. Sc. Thesis, Basrah Univ. 82 pp.

Al-Hamed, M. I. (1966). Limnological studies on inland water of Iraq. Bull. Iraq Nat. Hist. Mus. 3: 1- 22.

Al-Qarooni, E. H. M. (2005). Study of seasonal abundance of aquatic invertebrates in southern Iraqi marshes. M. Sc. Thesis, Basrah Univ. 97 pp.

Al-Qarooni, E.H.M. (2011). Estimation of some heavy metals concentration, sediment and bioaccumulation in some invertebrates of Shatt Al-Arab river and Shatt Al-Basrah canal, southern Iraq. Ph.D. Dissertation, Basrah Univ., 243pp.

Al-Saboonchi, A.A.; Barak, N.A. and Mohamed, A.M. (1986). Zooplankton of Garma marshes. Iraq J. Biol. Sci. Res., 17 (1): 33 – 40.

Al-Sodani, H.M.; Abed, J.M.; Al-Essa, S.A.K. and Hammadi, N.S. (2007). Quantitative and qualitative study on zooplankton in restored southern Iraqi marshes. Marsh Bull., 2 (1): 43–63.

Brinkhurst, R.O. and James, B.C. (1971). Aquatic Oligochaeta of the world. University of Toronto Press, Toronto.

Daoud, Y.T.; Shihab, A.F. and Hassan, K. S.(1986). Preliminary survey of invertebrates in the Shatt Al-Arab river, Iraq. Bull. Basrah Nat. Hist., 6: 87 – 93.

Edmondson, W. T. (1959). A field guide to freshwater snail in countries of the WHO eastern Mediterranean region. Danish Bilharziasis Laboratory, 45pp.

Frandson, F. (1983). A field guide to freshwater snail in countries of the WHO eastern Mediterranean region. Danish Bilharziasis laboratory, 45 pp.

Gurney, R. (1921). Freshwater Crustacean collected by Dr. P. A. Buxton in Mesopotamia and (Persia). J. Bombay Natural History Society, 27(4): 835–844.

Hamzah, H.A. (1980). Study of some biological and ecological aspect of freshwater shrimp *Caridina basrensis* Al-Adub and Hamzah, 1979 in Shatt Al-Arab. M. Sc. Thesis, Basrah Univ. 57 pp.

Hussein, S.K. and Fahad, K.K. (2008, a). Seasonal variation in a biotic ecological condition in Al-Garaf canal one of the main branches of Tigris river at Thi-Qar province, Iraq. Basrah J. Sci., (B): 26 (1): 38 – 47.

Hussein, S.K. and Fahad, K.K. (2008, b). Seasonal variation in nutrient and chlorophyll concentration in Al-Gharaf canal one of the main branches of Euphrates southern Iraq. Basrah J. Agri. Sci., 21.

Hussein, S. K. and Fahad, K. K. (2008, c). Monthly variation in concentration of trace element of water from Al-Gharaf, one of the main branches of Tigris river. Proc. Of 4th Sci. Conf. of UK.

Hussein, S.K.; Shawi, I. J. and Abdullah, A. M. (2009). Impact of Al-Najebiya thermal energy power plant on aquatic ecosystem of Garmet Ali canal. III monthly difference in nutrient Budget and TDS. J. Thi Qar Sci., 4: 51–59.

Hussein, S.K. and Fahad, K. K. (2009). Seasonal variation in levels of heavy metals in muscles of crab *Seasarma boulengeri* collected from Al-Garaf canal at Thi-Qar Province, Iraq. J. Thi-Qar sci., 4: 42-50.

Hynes, H.B.N. (1960). The biology of polluted water. Liverpool Univ. Press. Liverpool, 202p.

Lind, O.T. (1979). Handbook of common method in limnology. 2nd ed. London, 199pp.

Margalefe, R. (1968). Perspectives in ecology theory. University of Chicago Press, Chicago. 111 pp.. Cited by Nash, R.D.M. and Gibson, R. N. 1982.

Mangalo, H.H. and Akbar, M. M. (1986). Seasonal variation in pollution density of zooplankton in the lower reaches of Diyala river, Baghdad. Iraq J. of Biol. Sci. Res., 17(3): 99–114.

Mangalo, H.H. and Akbar, M. M. (1988). Comparative study of two population of Cladoceras in the Tigris and Diyala rivers at Baghdad. J. Biol. Sci. Res., 19 (1): 117–128.

Mohammed, M. B. (1965). A faunal study of the Cladocera of Iraq. Bull. of the Biol. Res. Cen., 1: 1–11.

Mohammed, M.B. (1980). A hydrobiological survey of polluted canal. Hydrobiology, 74: 179 – 186.

Mohammed, M.B. (1986). Association of invertebrates in the Euphrates and Tigris rivers at Falluja and Baghdad, Iraq. Fur. Hydrobiology, 106 (3): 337 – 350.

Pielou, E.C. (1966). Shannons formula as measure of specific diversity: its use and misuse. Am. Nat., 100: 463 – 465.

Rasheed, K.A. (1985). Study of some biological aspect of freshwater shrimp *Ataephyra demarestii orientalis* Bouvier, 1913, in Shatt Al-Arab, Iraq. M. Sc. Thesis, College of Science, Basrah Univ.

Saood, K.D. (1987). Population dynamics secondary production and swimming behavior of *Sphaeroma annandalei annandalei* sttebing , 1911. M. Sc. Thesis, Basrah Univ. 134 pp.

Shannon, C. E. and Weaver, W. (1948). The mathematical theory of communication, Uinv. Illinosis Press, Urbana. 1, 11.117p. cited by Fausch, K.D.; Lyons, J.D.; Karr, J.R. and Angermeier, P. L. (1990).

Snedecor, G.W. and Cochran, W.G. (1976). Statistical methods. Iowa state Univ. Press. XIV, 593 pp.

Winner, J. M.; Patrick, P.H. and Wallen, D. G. (1980). Zooplankton species diversity in lake st. Clair, Ontario, Canada. Hydrobiology, 75:57–63.

دراسة بيئية لنهر الغراف، ذي قار، العراق

منال محمد أكبر
كلية التربية – قسم علوم الحياة

الخلاصة

يتضمن البحث دراسة هيدروبايولوجية لبعض أنواع اللافقريات من ثلاث محطات (النصر، الشطرة و الغراف) **في** نهر الغراف. قيست بعض العوامل الفيزيائية الكيميائية فضلاً عن حساب التنوع و التكافؤ و الغنى للافقريات.

سجل 58 نوعاً من اللافقريات تضمنت 3 ديدان حلقية، 10 **نواعم**، 3 مجذافية الأقدام، 17 متفرعة اللوامس، 20 دولابيات، 2 درعيات و 3 برقات القشريات. تراوحت الكثافة السكانية للافقريات (863 – 994.25)، (807 – 1139.4)، (517.5 – 750.6) **فرد**/لتر في المحطات الأولى و الثانية و الثالثة على التوالي.

دليل التنوع للنواعم كان مرتفعاً في جميع المحطات (1.3، 0.9، 0.85) في المحطة الأولى و الثانية و الثالثة على **التوالي**. فضلاً عن أن المحطة الأولى كانت أعلى في جميع قيم الأدلة البيئية.

قيم التكافؤ لمتفرعة اللوامس و مجذافية الأقدام كانت (0.57 **و** 0.62) **و** (0.53 **و** 0.8) **و** (0.31 **و** 0.51) في المحطة الأولى و الثانية و الثالثة على التوالي. كما أظهرت الديدان الحلقية قيم منخفضة في الأدلة البيئية لجميع المحطات.

إرتبطت كثافة اللافقريات بعلاقة طردية مع الكلوروفيل و درجة الحرارة و بعلاقة عكسية مع الملوحة، أما التنوع فقد إرتبط طردياً مع الكلوروفيل a و النترات عكسياً مع درجة الحرارة و الملوحة و الـ BOD، أما التكافؤ فقد إرتبط عكسياً مع درجة الحرارة.

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MARSH BULLETIN

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Study of some Biochemical Parameters in liver of fresh water fish *Liza abu* (Heckel,1843) in Shatt Al-Arab River

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Abstract

This study aimed to assess the influence of the environment on fish health . Samples of *Liza abu* fish were collected from four sites near some pollution sources in Shatt Al-Arab river / south of Iraq . Determination of glycogen , proteins and lipids contene in liver and GOT and GPT enzymes activity in blood plasma were carried out .The results showed that the biochemical changes induced in the liver were mainly represented by decrease of the glycogen, proteins and lipids content, as will as , GOT and GPT enzymes of fishs from Khandic canal and Shatt Al-Arab river (site 3) compared with other sites. significant different 0f biochemical parameters of fishes from near the Al-Najibyia power sites 1, and near of the electric power sites 2 ,were recorded compared with Mashab station site 4.

Key words : *Liza abu*, Glycogen , Proteins , Lipids , GOT , GPT .

1- Introduction

Fish are generally considered as a good model organisms for monitoring of the aquatic environment, since they are present in virtually all aquatic environments, and many species have been found to be very susceptible to environmental pollutants (van der Oost *et al*., 2003). In addition, fish play a central role in aquatic ecosystems. Hence, understanding toxic responses in fish is of high ecological relevance. Biomarkers are currently used in environmental monitoring as “early warning” signals. A biomarker can be defined as a “change in a biological response (ranging from molecular through cellular and physiological responses) that can be related to exposure to or toxic effect of environmental chemicals” (Peakall, 1994). Fish population are susceptible to environmental impact caused by the introduction of exotic species , industrial wast, oil spills, pesticides and other agents that directly affect ecology and the survival of species . methods diagnosis and monitoring the quality of life of theses populations ought to be used (Alam and Morghan,1995) . In freshwater there was only few studies have been done using of biomarker as indicator to aquatic environment pollution (Pawert *et.,al* 1998) , however , the rivers is often carry high burdens from pollutants by the different pollution sources is locate near theses rivers such as factories , agriculture areas , electric power stations and sewage water , however most pollutants often spill directly into water without any treatments (Al- Sabonchi 1998) . Toxic effects of organic products regarded as pollutants upon the biochemical and physiological system of an organism can be assessed through the study of cellular and sub cellular morphological alterations(Meyer *et al*., 1998). Some of the aquatic pollution is in the form of sub-lethal pollution, which results in chronic stress conditions that have negative effect on aquatic life (Mason, 1991) ,The stress response is characterized by physiological changes and the effect of pollutants on fish is assessed by acute and chronic toxicity tests (Heath, 1991) .

Aim of study to used some the physiological parameter as biomarker of aquatic pollution in some local environmental.

2-Materials and Methods

Specimen Collection in October 2010 from Forty Adult of the freshwater fish, ***Liza abu*** were collected from four sites from Shatt Al-Arab river (Figure 1) :-

1- 10 fish were collected from site1 near the Al-Najibyia power in deer /Basrah / Iraq .

2- 10 fish were collected from site 2 is the near of the electric power station / Basrah / Iraq .

3- 10 fish were collected from site 3 near the meeting between the Khandic canal and Shatt Al-Arab river.

4- 10 fish were collected from site 4 Mashab station. The size and weight of the fishes were ranged from (14 ± 0.9) cm and (32.5 ± 1.95) gm respectively .

These Fishes were brought to the laboratory and kept overnight in water alive in glass aquaria (40 X 30 X 30 cm) .

Blood Sampling and Analysis

Fish were sacrificed and liver tissue was removed, the tissues were then blotted and weighed before homogenization. They tissues were homogenized using a glass homogenizer with chilled distilled water and were centrifuged at 10,000 rpm for 15 minutes. The GOT and GPT concentrations was determined in blood according of Reitman and Frankel (1957).Glutamateoxaloacetate transaminase (GOT) and glutamate-pyruvate transaminase (GPT) from the supernatant was determined according to Reitman and Frankel (1957). The Liver content of the Glycogen, Lipids and proteins were estimated by (Kemp and Andrienne 1954; Erichson 1993; Lovell , 1979).

Statistical analysis

The result of present study were analyzed according to ANOVA and CRD test at the significant level ($p<0.05$) AL-Zogbi and AL-Tlafeha(2000). The similarity between stations was calculated according to Jaccard similarity coefficient, using SPSS software (version 11, 2001), statistical, and peanel correspondence analysis (PCA) Assessment relationship between Biochemical factors with study stations correlation used program canoco (TerBrak,1995).

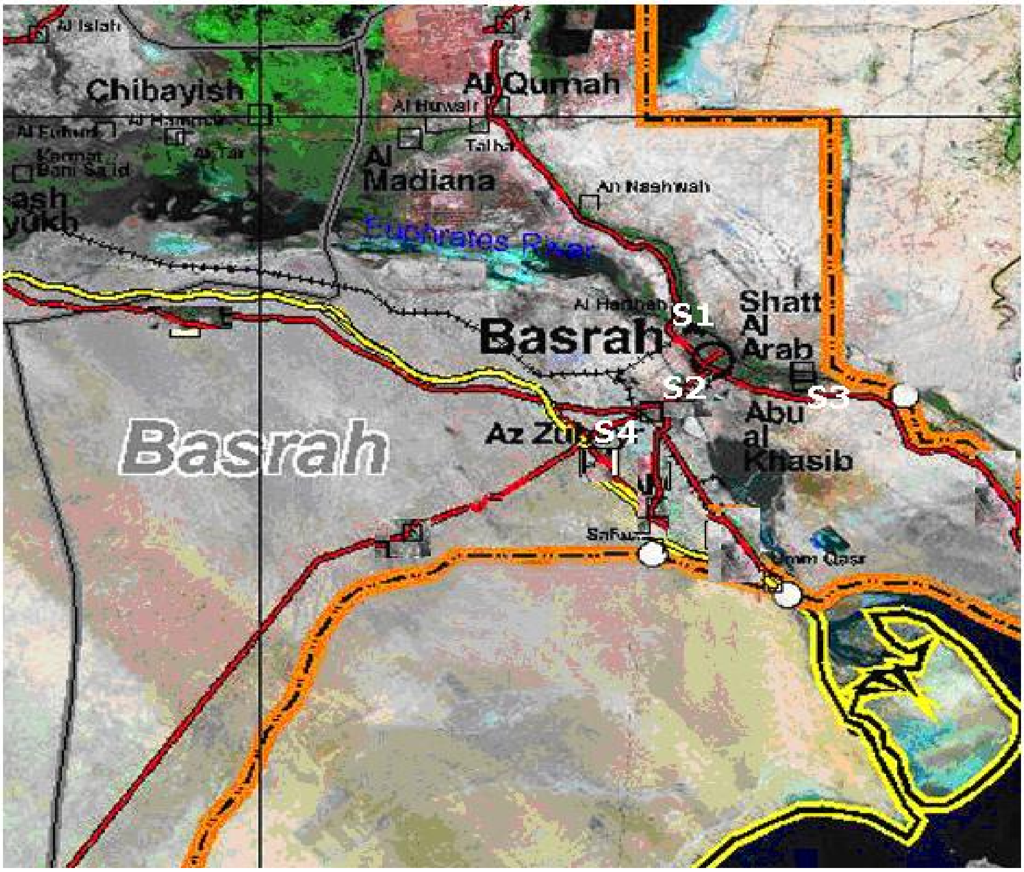

Figure (1) sample station in Shatt- Al Arab River

3- Results

The glycogen , proteins and lipids content in liver showed that there was significant between individuals collected from the different areas (table,1) in liver glycogen of fish was recorded the lower value for site 3 was showed significantly increase ($P \leq 0.05$) in liver glycogen compared with other sites, while site 2 was recorded the higher values.

Content of liver proteins in site 1 was showed significantly decrease ($P \leq 0.05$) compared with other sites , while did not found any significantly different ($P \geq 0.05$) between sites 2 and 4 , However the lower rates for proteins content was showed in site 1 while the higher rates was recorded in site 4.

Content of liver lipids in site 3 was showed significantly decrease ($P<0.05$) compared with other sites , while other sites, don't showed significant different between them ($P>0.05$),however content the lower was show in site 3 , while was in site 4 the higher values compared with other sites.

The similarity dendrogram between the sites for biochemical factors for the infected fishes that were taken (figure, 2) shows two main groups. Group I consists Site2 and Site4 of a similarity level 98% ,. Group II, also consists Site1 and Site3 of a similarity level 98%, The cluster analysis explains the sites and Similarity level with Glycogen , proteins and lipids content in fish liver of *Liza abu* in sites.

The result showed significant positive correlation between site 2 and 4 while Lipids content show positive significant correlation with site 2 $r=0.11$,while wee king positive correlation in site 4 $r=0.09$.

Proteins percentage also appeared wee king positing correlation with site 2 $r=0.12$ and significant positing correlation with site 4 $r=0.20$.

The Glycogen showed significant Negative correlation with site1 r-0.1, while don't appear any significant correlation with site 3 and 4 (Figure .3).

Table (2) showed the GOT and GPT activity enzymes in blood plasma 0f fish collected from sites 1 , 2 , 3 and 4 .

Levels of GOT and GPT enzymes in site 1 and 3 were significantly differences($P<0.05$) compared with the other sites .

Table (1) Glycogen , proteins and lipids content in fish liver of *Liza abu* collected from different sites on Shatt Al-Arab River

Parameters	Stations			
	Sites 1	Site 2	Site 3	Site 4
Glycogen mg\g	3.58 ± 0.08	3.88 ± 0.07	1.77 ± 0.05	2.99 ± 0.05
Proteins %	50.75 ± 6.4	66.43 ± 3.0	53.8 ± 2.98	69.8 ± 3.05
Lipids %	2.85 ± 0.098	3.11 ± 2.05	2.05 ± 0.048	3.25 ± 0.06

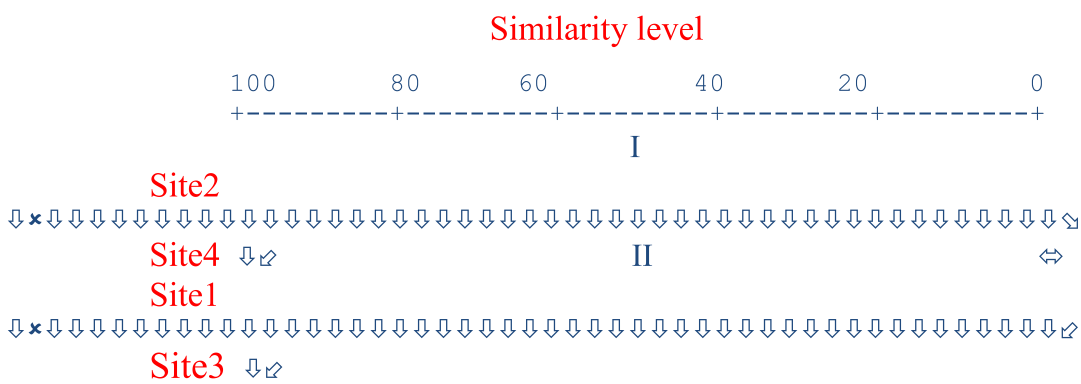

Fig.(2) Similarity dendrogram between sites with Glycogen , proteins and lipids content in fish liver

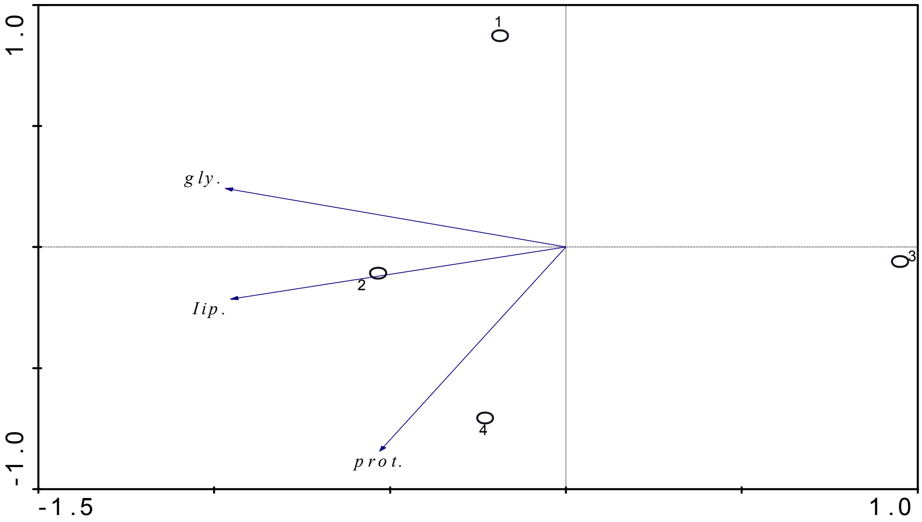

Fig.(3) principal correspondence analysis for Assessment relationship of correlation between Glycogen , proteins and lipids content in fish liver of *Liza abu* and study sites

Table (2) GOT and GPT levels in blood plasma of *Liza abu* collected from different sites on Shatt Al-Arab River.

parameters U\L	Stations Site 1	Site 2	Site 3	Site 4
GOT	4.99 ± 0.88	4.00 ± 0.56	6.76 ± 0.77	4.00 ± 0.81
GPT	11.65 ± 0.94	9.88 ± 1.21	15.99 ± 1.50	11.10 ± 1.2

4-Discussion

In present study show in rates of Physiological parameters in fish *Liza abu* collected from sites 1 , 2 , 3 and 4 , however , site 2 and 3 were recorded the higher and lower rates respectively in glycogen ,and may be certain correlation relationship PCA with station 3 ,4 don't appear any significant correlation, proteins and lipids of liver , while , GOT and GPT enzymes were showed the lower and higher rates respectively compared with other sites .

Any pollution, either physical or chemical, cause changes to the quality of the receiving waters (Nchumbeni *et,.al* 2007; Sanders, 1997). and the addition of toxic substances which can have either acute or chronic effects on aquatic organisms (Roy,2002 ; Sanders, 1997). According to Mason (1991), heavy metal pollution is one of the five major types of toxic pollutants commonly present in surface waters. The important environmental pollutants are those that tend to accumulate in organisms, those which are persistent because of their chemical stability or poor biodegradability, and those which are readily soluble and therefore environmentally mobile (Steven *et.,al* 1972; Sanders, 1997). Heavy metals possess all of these characteristics and are one of the major contributors to the pollution of South Africa's natural aquatic ecosystems (Sanders, 1997). The liver have a play amajor role in detoxification lipids soluble compounds, so that it will be affected by many pollutants which it will cause rapid changes in hepatocytes, also it will cause damage in normal function (Rez, 1986), many of physiological and biochemical parameters is effected by pollution levels in aquatic environmental ,such as the GOT and GPT enzymes consider very sensitive toward the aquatic contaminations for that many of studies used of as biomarkers or bioindicator for determination the pollution in aquatic environmental (Mason ,1991) In fact, the stressor which it result by the exposure to different contaminations may cause increase in glycogenolysis process because the need to excess energy demands (Hamlton *et al.,* 1998), while , the decrease of protein content may be caused by the increase of proteolysis process after the directly contact with aquatic pollutants (Alam and Morghan, 1995), however , the decrease of lipid content usually result of cytotoxicity because of directly effect of aquatic pollutants on plasma membranes in hepatocytes, which will results damage in oxidation and hydrolysis process and oscillation in lipids content (Viarengo, 1989) .the present study showed the site 3 is more pollution compared with other sites.

5- References

Alam, M. K. and Morghan, O. E. (1995**)** **.** Acute toxicity of heavy metals to common carp (*Cyprinus carpio*) . J. Environ. Sci. Health , Part A 30(8) : 1807-1816.

AL-Sabonchi, A. A. (1998) **.** Benthic algae as biological indicator for pollution in the Shatt- Al-Arab River and some of its canal . Ph.D. Thesis , Collage of agriculture , University of Basrah , PP: 108 .(in Arabic).

AL-Zogbi ,Mohamed Jalal and AL-Tlafeha, Abbas(2000) Significant system SPSS understanding significant data analysis .158pp. .(in Arabic).

Erickson, M. C. (1993) Lipid extraction from channel catfish muscle: Comparison of solvent systems. J. Food Sci., 58: 84-89 .

Hamilton, D. P. ; Malik, D. S. and Sastry, K. V. (1998) . Effects of zinc toxicity on biochemical composition of muscle and liver of murrel (*Channa punctatus*) . Environ. Inter. 24(4): 433-438 .

Heath,A.G.(1991). Physiological effects of contaminate. Dynamics on fish. Ib. aquatic toxicology-J. Biochem 213p.

Kemp, A. and Andrienne, J. M. K. V. A. (1954) .A calorimetric micro method for determination of glycogen in tissue. Biochem. J., 56: 646-648 .

Lovell, R. T. (1979). Formulating diets for aquaculture species.J. Food sci, 51: 29-32 .

Meyer, M. S. ; Johnson, L. L. ; Collien, T. K. ; Stein, J. E. and Varanasi, U. (1998). Toxipathic hepatic lesion in subadult English sole (*Pleurinectes vetulus*) from Puget sound, Washington, USA: Relationship with other biomarker of contamination Exposure. Marine Environmental Research,45:(1):47–67

Mason, J.M. (1991) A direct measure of the uptake efficienty of axenobiotic chemical across of gills of rainbow trout.comp.Biochemi,Physiol.77(3):85-99.

Nchumbeni, H. ; Reza, D.B.G. and Bhavita, C. (2007). Effect of Arsenic on the enzymes of the Rohu carp, *Labeo Rohita* (Hamilton, 1822). Raff. Bull. Zool., 14: 17 – 19 .

Peakall,A.S.(1994) Cardiovascular and respiratory changes during heat stress in *rainbow trout* (Salmonella. gairdneri). Journal Biology.69:243-255p.

Pawert, M.; Muller, E.; and Triebskon, R. (1998). Ultrastractural changes in fish gills as biomarker to assess small stream pollution. Tissue Cell, 30: 617-626. .

Reitman, S. and Frankel, S. (1957) . Calorimetric method for determination of serum alanine and asparatate aminotransferase . Amer. J. Path., 28 : 56-62.

Rez, G. (1986) . Electron microscopic approaches to environmental toxicity . Acta. Biol. Hung., 37 : 810 .

Roy, S. S. (2002). Some toxicological aspects of chlorpyrifos to the intertidal fish *Boleopthalmus dussumieri*. Ph.D. thesis, University of Mumbai, India. 52-71 Pp.

Sanders, B. M. (1997). Stress proteins in aquatic organisms : an environmental perspective. Crit. Rev. Toxicol. , 23 : 49 – 75 .

Steven,E.D.;Bennion,G.R.;Rendall,D.J.and Shelton,G.(1972) Factors affecting arteries pressune and fiow blood from the heart in intact unrestrainal lingcod *Ophiodon elongates*. Comp. bioch. physiol. 45:681-695.

TerBraak.C.J.F(1995)Ordination.In:R.H.G.Jongman,C.J.F.terbraak,O.F.R.VanTorgern(eds),Data Analysis in Community and Landscape Ecology. Cambridge University press.91-173.

Van Der Oost, H; Paker, H.M; Smith, A.A (2003) Partical clinc biochemical 4th (William,H.ed) Medical book Ltd, London 40-45pp.

Viarengo, A. (1989**)** . Heavy metals in marine invertebrates: Mechanisms of regulation and toxicity at the cellular level . Rev. Aquat. Sci. , 1: 295-317

دراسة بعض القياسات الكيموحيوية في كبد اسماك الخشني ***Liza abu* (Heckel,1843)** المصادة من مياه شط العرب

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الخلاصة

هدفت الدراسة الحالية في تقيم تأثير المتدفقات الصناعية في مياه شط العرب على مستوى التقيم الصحي لأسماك المياه العذبة *Liza abu* المصطادة من أربعة مناطق تقع قرب بعض من مصدر التلوث الصناعي في نهر شط العرب – جنوب العراق .تم قياس مستوى كلايكوجين وبروتين ودهون الكبد فضلا عن مستوى تركيز إنزيمي GOT وGPT كان قد اختبرت وقد سجل خلالها انخفاض بعض المتغيرات المدروسة في المحطة الثالثة التي تكون بين نهر الخندق وشط العرب مقارنة مع المواقع الأخرى . بينما سجلت المحطتين الأولى القريبة من معمل الورق والثانية القريبة من محطة النجيبية الكهربائية بعض التغيرات المعنوية مقارنة مع محطة السيطرة الرابعة محطة المسحب.

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MARSH BULLETIN

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Assessment of Sediment Quality Collected from AL-Hawizeh Marsh, Southern Iraq

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Abstract

A study was carried out to investigate the concentrations and spatial distribution of trace metals in the sediments of AL-Hawizeh Marsh in the southern part of Iraq . Sediment samples were taken from five sampling stations (Al-Adaim-1, Al-Adaim-11, Um El-Nia'j , Al-Soudah , Al-Baida).

Mean of concentrations of metals in the sediments ranged from 1365 to 3735 for Fe, 4.50 to 10.50 for Zn, 4.15 to 8.15 for Cu and 6.00 to 7.70 $mgkg^{-1}$ for Pb . The degree of contamination in the sediments has been evaluated using Enrichment factor (EF), Geoaccumulation index (I_{geo}), Contamination factor (CF) and pollution load index (PLI) . EF indicates that Fe, Zn, Cu and Pb in sediments ranged from depletion to significantly enrichment while at station 1 Pb are very highly enriched. Igeo values showed that the sediments were background contamination ($I_{geo}<1$) for all stations . CF also show that the sediments have low contamination (CF<1) .PLI of the studied area ranged from 0.107 to 0.163 which indicated that the Marsh sediments were unpolluted (PLI=0-1).

Key words: AL-Hawizeh Marsh; heavy metal concentration; enrichment factor; geoaccumulation index; pollution load index

1- Introduction

The Iraqi Marshlands are one of the finest and most extensive natural wetland ecosystems (Evans, 2002). The Mesopotamian marshlands are located mostly in south-eastern Iraq but also extend across the border into Iran. They once covered an area 20000 km^2 between the three Iraqi cities of Amarah in the north, Basrah in the south, Naseriyah in the west and the Iranian town of Hawizeh in the east. The marshlands straddled the Euphrates and Tigris rivers and part of the Shatt Al-Arab which forms when these two rivers join together. The area consisted of interconnected lakes, mudflats and wetlands, and supported an indigenous population of 500,000 as well as numerous endemic species of birds, mammals, amphibians, reptiles, fish and invertebrates (Dehghanp-isheh, 2003).

The Mesopotamian marshlands compr-ised of three major wetland areas; the Al-Hawizeh, Al-Hammar and Central marshes. All three were connected by the Tigris and Euphrates rivers from Iraq and the Karkeh River from Iran which converged to form the Shatt Al-Arab waterway in the centre of the three marshes (Ghadiri and Afkhami, 2005a). Around 85% of the Mesopotamian Marshlands have been lost mainly as a result of drainage and damming, (UNEP, 2002), restoration by reflooding of drained Marshes is proceeding, and the ecological effects of this massive water diversion need elaborated research. Hence, the reflooding of southern Iraq's Mesopotamian Marshes is a giant ecosystem-level experiment (Richardson & Hussain, 2006).

Sediments are important carriers of trace metals in the environment and reflect the current quality of the system, sediments usually provide a record of catchments inputs into aquatic ecosystems, natural sediment formed during weathering process might be modified markedly during transportation and deposition by chemical of anthropogenic origin (Chapmann, 1992).

Trace metals are among the most common environmental pollutants and their occurrence in waters, sediments and biota indicate the presence of natural or anthropogenic sources. The existence of trace metals in aquatic environments has led to serious concerns about their influence on plants and animals life (Sheikh et al., 2007 ; Zvinowanda *et al.,* 2009).

The behavior of metals in natural waters is a function of the substrate sediment composition, the suspended sediment composition and the water chemistry (Shrestha *et al.,* 2007 ; Harikumar *et al.,* 2009). Recent studies reveal that the accumulation and distribution of hydrocarbons, trace metals and chlorinated compounds in soil, water and environment are increasing at an alarming rate causing deposition and sedimentation in water reservoirs and affecting aquatic organisms (Hobbelen *et al.,* 2004).

To assess the environmental impact of contaminated sediments, information on total concentrations is not sufficient and particular interest is the fraction of the total trace metal content that may take part in further biological processes (Al-Haidarey, 2009).The overall behavior of trace metals in an aquatic environment is strongly influenced by the associations of metals with various geochemical phases in sediments (Forstner and Wittmann, 1983 ; Horowitz, 1991).

The aim of this study is measure the concentration of trace metals and their association with various geochemical substrates in sediments of Ai-Hawizeh Marsh and to assess the contribution of anthropogenic activities in sediment pollution .

Study area

Al-Hawizeh Marsh lies between 31°00'-31°45' N, 47°25'-47°50' E (Figure 1). The Iranian section of the Marshes is known as Al-Azim Marsh , were it is fed primarily by the Karkeh River. In Iraq, this Marsh is largely fed by two main distributaries departing from the Tigris River near Amarah city, known as Al-Musharah and Al-Kahla.

2- Materials and Methods

Sediment sampling

Five stations in Al-Hawizeh Marsh were selected in this study. Two stations in Al-Adaim, one station in Um El-Nia'j, one station in Al-Soudah and one station in Al-Baida (Figure 1). Sediment samples were collected on February, 2009. The sample mass collected by hand in each case was about 500gm. Samples were air dried in the laboratory at room temperature, ground in fine mixture using mortar and pestle before sieved under 2 mm mesh. The samples were then stored in a polyethylene container ready for digestion and analysis (Jose *et al.,* 2005).

Analysis of sediments

One gram of dried sediment sample was transferred to 100 mL quartz tube and digested in concentrated HNO_3 and HCL (1:3 v/v) on a hot plate . The tubes were cooled and volumes prepared with double distilled water in volumetric flask. The digested samples were analyzed for Fe, Zn, Cu and Pb according to APHA (1998) on Atomic Absorption spectrophotometer Technique .

Determination of enrichment factor

To evaluate the magnitude of source material to that found in the Earth's crust (Huheey, 1983) and following equation was used to calculate the EF_C as contaminants in the environment, the enrichment factors (EF) were computed relative to the abundance of species in proposed by Atgin *et al.,* (2000) .

$$EF = (C_M / C_{Fe})_{sample} / (C_M / C_{Fe})_{Earth's\ crust}$$

Were, $(C_M / C_{Fe})_{sample}$ is the ratio of concentration of trace metal (C_M) to that of Fe (C_{Fe}) in the sediment sample and $(C_M / C_{Fe})_{Earth's\ crust}$ is the same reference ratio in the Earth's crust. The average abundance of Zn, Cu and Pb (70 , 55 and 12.5 µg /g, respectively) and the reference value of Fe is 5.2% was selected as the reference element, due to its crustal dominance and its high immobility (Huheey, 1983).

Determination of geoaccumulation index

The geoaccumulation index I_{geo} values were calculated for different metals as introduced by Muller (1969) is as follows :

$I_{geo} = \log_2 C_n / 1.5\ B_n$

Where, C_n is the measured concentration of element n in the sediment and B_n is the geoaccumulation background for the element n which is either directly measured in precivilization sediments of the area or taken from the literature (average shale value described by Turekian and Wedepohl , 1961) . The factor 1.5 is introduced to include possible variation of the background values that are due to lithologic variations.

Determination of pollution load index

The pollution load index (PLI) proposed by Tomlinson *et al.,* (1980) has been used in this study to measure PLI in sediments of AL-Hawizeh Marsh. The PLI for a single site is *n*th root of n number multiplying the contamination factors (CF values) together . The CF is the quotient obtained as follows :

$CF = C_{\text{Metal concentration}} / C_{\text{Background concentration of the same metal}}$ and ***LI for site*** $= {}_{n}\text{th}\sqrt{CF_1 \times CF_2 \ldots\ldots \times CF_n}$

Figure 1. The studied stations in Al-Hawizeh Marsh. Al-Adaim-I & II (1 and 2), Al-Soudah(3), Um-El-Nia'i(4) and Al-Baida (5)

3- Results and Discussion

In order to asses the metals content in AL-Hawizeh Marsh sediments, it is important to establish the allowable levels of these metals, heavy metals may be incorporated in to the aquatic system from anthropogenic sources. However, knowledge of the distribution and concentrations of the heavy metals in the sediments will help to detect the source of pollution in the aquatic systems (Elias *et al*., 2011) .

The total concentration of heavy metals in sediments for each station in this study were shown in Table 1. Metal contents were ranging over following intervals: Fe: (1365–3735) ; Zn: (4.50–10.50) ; Cu: (4.15–8.15) and Pb: (6.00–7.70) mg kg^{-1} respectively. Mean contents of this metals were : Fe (2465) ; Zn (7.10) ; Cu (5.79) and Pb (7.06) mg kg^{-1} respectively, allowing to arrange the metals from higher to lower mean content in this area as : Fe > Zn > Pb > Cu .

The background value gives the normal abundance of an element. The mean concentration of Fe, Zn, Cu and Pb in sediments of all the stations are lower than the background values (Table 1) (Martin and Meybeck, 1979). This may be attributed to the removing of these metals by many ways such as adsorption by particulate matter, precipitation deposition and removal by organism (Mohiuddin *et al.,* 2010). On the other hands, sediments of marshes containing high amount of organic materials are be complex compound with elements by exchangeable and chemical reactions (Al-Haidarey *et al.,* 2009).

From the EF values in tables 2&3, EF value of Zn was ranged from depletion to minimally enriched at Um El-Nia'j station (1.72) and Al-Baida station (0.89) while other stations, AL-Adaim-1 (4.35), AL-Adaim-11 (3.22) and Al-Soudah (2.33) tends towards moderately enriched . Cu at all stations tends towards moderately enriched . EF value of Pb at AL-Adaim-1 station (22.85) is very highly enriched while others, AL-Adaim-11(14.42), Um El-Nia'j (13.67), Al-Soudah (8.73) and Al-Baida (8.57) tends towards significantly enriched.

Elements which are naturally derived have an EF value of nearly unity while elements of anthropogenic origin have EF values of several orders of magnitude (Sekabira *et al.,* 2010). According to Harikumar and Jisha (2010), EF values greater than 1.5 have such heavy metals derived from other sources suggesting environmental contamination by those particular heavy metals. It is presumed that high EF values indicates an anthropogenic source of trace metals mainly from activities such as accumulation of organic materials , decompositions, and export of particulate organic matter (Al-Saffar, 2006). Science the bioavailability and toxicity of any heavy metal in sediment depend on chemical from and concentration of the metal (Kwon *et al*., 2001), it can be inferred that trace metals in sediments samples with high EF values, along with higher labile fractions in sediments are potential sources for mobility and bioavailability in the aquatic ecosystems (Ameh et al., 2011).

The high concentrations of EF values in some locations above may be attributed to the land base activities, sewage wastes and also from the erosion of
soil (Al-Haidarey et al., 2009).

Geoaccumulation index (I_{geo}) values were shown in Table 4. The negative I_{geo} values are indicating that there are no significant contaminations or background level of element in sediments of AL-Hawizeh Marsh, base on Muller (1981) classification (Table 5). All stations can be categories as background concentration with Fe, Zn, Cu, and Pb (I_{geo} values < 0).

The I_{geo} values for Fe, Zn, Cu and Pb fall in class ″0″ in all the five stations indicating that there is no pollution from these metals in sediments of AL- Hawizeh marsh because all values were below 0 (Table 4).

Contamination factor (CF) and pollution load index (PLI) values was shown in Table 6a&b . The concentration of metals Fe, Zn, Cu and Pb were present at much lesser concentrations. From the contamination factor calculations, it was found that all stations were low contamination (CF < 1).

PLI values were ranged from 0.107 – 0.163 clearly indicated that the overall sediments of AL-Hawizeh Marsh can be classified as unpolluted sediments (PLI= 0-1).The PLI value of >1 is polluted whereas <1 indicates no pollution. Lower values of PLI imply no appreciable input from anthropogenic sources. There is, in general, a decrease in PLI values at all stations indicating dilution and dispersion of metal content with increasing distance from pollution sources (Ameh et al., 2011 ; Chakravarty and Patgiri , 2009).

Table (1): Total concentration of heavy metals (mg kg^{-1} dry weight) in sediment samples collected from AL-Hawizeh Marsh

Stations	Fe	Zn	Cu	Pb
AL-Adaim-1	1365	8.00	4.15	7.50
AL-Adaim-11	1730	7.50	4.40	6.00
Um El-Nia'j	2160	5.00	5.00	7.10
Al-Soudah	3335	10.50	7.25	7.00
Al-Baida	3735	4.50	8.15	7.70
Mean	2465	7.10	5.79	7.06
Maximum	3735	10.50	8.15	7.70
Minimum	1365	4 .50	4.15	6.00
Background	35900	129	32	20

Table (2): Enrichment Factor (EF) of heavy metals in sediments of AL-Hawizeh Marsh .

Heavy metals	**Sample stations**				
	AL-Adaim-1	**AL-Adaim-11**	**Um El-Nia'j**	**Al-Soudah**	**Al-Baida**
Zn	**4.35**	**3.22**	**1.72**	**2.33**	**0.89**
Cu	**2.87**	**2.40**	**2.18**	**2.05**	**2.06**
Pb	**22.85**	**14.42**	**13.67**	**8.73**	**8.57**

Table(3): Enrichment Factor (EF) of heavy metals with respect to each location and class classification (Sutherland *et al.*, 2000).

EF Indices	**Degree of Enrichment**	**Heavy metals**
EF < 2	**Depletion to minimal enrichment**	**Zn**
2 < EF < 5	**Moderate enrichment**	**Zn, Cu**
5 < EF < 20	**Significant enrichment**	**Pb**
20 < EF < 40	**Very high enrichment**	**Pb**
EF > 40	**Extremely high enrichment**	

Table(4): Geoaccumulation index (I_{geo}) of heavy metals in sediments of studied stations.

Stations	I_{geo} Fe	I_{geo} Zn	I_{geo} Cu	I_{geo} Pb
AL-Adaim-1	- 5.83	- 3.71	- 4.31	- 1.32
AL-Adaim-11	- 5.49	- 3.81	- 4.23	- 1.64
Um El-Nia'j	- 3.58	- 4.39	- 4.04	- 1.40
Al-Soudah	- 4.55	- 3.32	- 3.51	- 1.42
Al-Baida	- 4.38	- 4.54	- 3.34	- 1.28

Table (5): The seven classes of the Geoaccumulation index (Muller, 1981)

Class	Range	Interpretation (Quality)	Heavy metals
0	Igeo≤ 0	Practically uncontaminated	Fe,Zn,Cu,Pb
1	0 <Igeo< 1	Uncontaminatedto moderately contaminated	
2	1 <Igeo< 2	Moderately contaminated	
3	2 <Igeo< 3	Moderately to heavily contaminated	
4	3 <Igeo< 4	Heavily contaminated	
5	4 <Igeo< 5	Heavily to very heavily(extremely)contaminated	
6	Igeo> 5	Very heavily (extremely) contaminated	

Table 6 a&b : Contamination factor (CF), pollution load index (PLI) of heavy metals in sediments and classes (Hakanson , 1980)

Heavy metals	Stations				
	AL-Adaim-1	AL-Adaim-11	Um El-Nia'j	Al-Soudah	Al-Baida
Fe	0.026	0.033	0.041	0.064	0.072
Zn	0.114	0.107	0.071	0.150	0.064
Cu	0.075	0.080	0.091	0.132	0.148
Pb	0.600	0.480	0.568	0.560	0.616
PLI	0.107	0.108	0.111	0.163	0.143

Contamination Factor (CF) Indices	Degree of contamination	Heavy metals
CF< 1 **1 ≤ CF < 3** **3 ≤ CF < 6** **6 ≤ CF**	**Low contamination** **Moderate contamination** **Considerable contamination** **Very high contamination**	**Fe, Zn, Cu , Pb**

4- Conclusion

This study revealed that the enhanced concentration of some trace metals in wetlands areas like AL-Hawizeh Marsh is due to anthropogenic influences. Distribution pattern of trace metals in the sediments according to EF were ranged from minimally to significantly polluted with Zn, Cu and Pb at all stations, while was very high polluted with Pb at AL-Adaim-1 station, Geoaccumulation index (I_{geo}) of all sediments can be classified as background polluted (I_{geo}< 0). Contamination factor (CF) of sediments can be classified as low contamination (CF< 1). However, the PLI values can be classified as unpolluted (PLI=0-1).

5- References

Ameh, E. G.; M. S. Kolawole and E. G. Imeokparia. 2011. Using Factor-Cluster Analysis and Enrichment methods to evaluate impact of cement production on stream sediments around Obajana cement factory in Kogi state, North Central Nigeria. Pelagia Research Library., 2 (1): 76-89.

Al-Haidarey, M.J.S.2009. Distribution of Some Heavy Metals in Mesopotamian Marshes. Ph.D. Thesis. College of Pharmacy. University of Kufa, Iraq.

Al-Saffar, M. T. (2006). Interaction between the Environmental Variables and Benthic Macro invertebrates Community Structure in Abu Zirig Marsh, Southern Iraq, M.Sc Thesis, Biology Department, Science Collage, Baghdad University.

APHA, 1998. Standard methods for the examination of water and wastewater. 20th Ed., published jointly by American Public Health Association, American Water Works Association, Water Pollution Control Federation, Washington. D.C.

Atgin, R. S.; O. El-Agha; A. Zararsiz ; A. Kocatas ; H. Parlak and G. Tuncel. 2000. Investigation of the sediment pollution in Izmir Bay : trace elements. Spectrochim. Acta B., 55 (7), 1151-1164.

Chakravarty, M. and A. D. Patgiri. 2009. Metal pollution assessment in sediments of the Dikrong River, N.E. India. J. Hum Ecol, 27(1): 63-67.

Chapmann, D. 1992. Water Quality Assessment. A Guide to the Use of Biota, Sediments and Water in Environmental Monitoring. 1st Edn., Chapman and Hall, London, pp: 585.

Dehghanpisheh, B. (2003). Fall Of Eden: Rehabilitation Needed for Marshlands of Southern Iraq. Newsweek International, June 23, p48.

Elias, M.S.; M.S. Hamzah; S.A. Rahman; W.B. Siong and N.A.A. Salim. 2011. Assessment of Sediment Quality Collected from Tunku Abdul Rahman Park, Sabah. Empowering Science, Technology and Innovation Towards Better Tomorrow.

Evans, M. I. (2002). The ecosystem. Pages 201–219 in Nicholson E, Clark P, eds. The Iraqi Marshlands: A Human and Environmental Study. London: Politico's.

Forstner, U. and G.T.W., Wittmann. 1983. Metal pollution in the Aquatic Environment. Springer-Verlag, Berlin, Heidelberg, New York, Tokyo.

Harikumar, P. S. and T. S. Jisha . 2010. Distribution pattern of trace metal Pollutants in the sediments of an urban wetland in the southwest coast of India Int. J. Eng. Sci. Tech., 2(5): 840-850.

Harikumar, P. S.; U. S. Nasir and M. P. Mujeebu Rahman. 2009.Distribution of heavy metals in the core sediments of a tropical wetland system. Int. J. Enveron. Sci. Tech., 6 (2), 225-232.

Hobbelen, P. H. F.; J. E. Koolhaas and C. A. M. Van Gestel . 2004. Risk Assessment of heavy metal pollution for detritivores in floodplain soils in the Biesbosch, the Netherlands, taking bioavailability into account. Environ. Pollut., 129 (3), 409-419.

Horowitz, A. J. 1991. A primer on sediment-trace element chemistry. 2nd Ed., Lewis Publishers, Chelsea (Michigan), 136.

Huheey, J. E. 1983. Inorganic chemistry : Principles of structure and reactivity. Harper and Row Publishers, New York, 912.

Jose, A. B. N.; M. Crapez; J. J. McAlister and C. G. Vilela. 2005. Concentration and Bioavailability of Heavy Metals in Sediments from Niteroi Harbour Harbour (Guanabara Bay/S.E. Brazil). J. Coas. Res., 21: 811-817.

Kwon, Y. T ; C. W. Lee and B. Y. Ahn. 2001. Sedimentation pattern and sediments bioavailability in a wastewater discharging area by sequential Metal analysis. Microchem. J., 68(2-3), 135-141.

Martin, J. M. and M. Meybeck . 1979. Elemental mass balance of materials carried by major world rivers. Mar. Chem. 7: 173-206.

Muller, G. 1969. Index of Geoaccumulation in sediments of the Rhine River. Geol. J. 2, 109-118.

Muller, G. 1981. Die Schwermetallbelstung dervsedimente des Neckars und seiner Nebenflusse: eine estandsaufinahme. Chem. Zeitung, 105, 157-164.

Richardson, C.J. and N.A. Hussain. (2006). Restoring the Garden of Eden: An ecological assessment of the Marshes of Iraq.Bioscience.56(6): 477-489.

Sekabira, K.; H. Oryem Origa ; T.A. Basamba; G. Mutumba and E. Kakudidi. 2010. Assessment of heavy metal pollution in the urban stream sediments and its tributaries. Int. J. Environ. Sci. Tech., 7 (3), 435-4465.

Sheikh, M. A.; N. M. Noah ; K. Tsuha and T. Oomori. 2007. Occurrence of tributyltin compounds and characteristics of heavy metals. Int. J. Environ. Sci. Tech., 4(1), 49-60.

Shrestha, R.; R. Fischer and M. Sillanpaa. 2007. Investigations on different positions of electrodes and their effects on the distribution of Cr at the water sediment interface. Int. J. Tech., 4(4), 413-420.

Sutherland, R. A.; F. M. G. Tack ; C. A. Tolosa and M. G. Verloo. 2000. Operationally defined metal fractions in road deposited sediment, Honolulu, Hawaii. J. Environ. Qual., 29: 1431-1439.

Tomlinson, D.L.; J.G. Wilson; C.R. Harris and D.W. Jeffery. 1980. Problems in the assessment of heavy metals levels in estuaries and the formation of a pollution index. Helgol Wiss. Meeresunters, 33 (1-4), 566-575.

Turekian, K.K. and K.H., Wedepohl. 1961. Distribution of the elements in some major units of the earth's crust. Geol. Soc. Am. 72, 175-192.

UNEP, United Nations Environment Programme (2002). Partow , H. The Mesopotamian Marshlands: Demise of an Ecosystem Division of Early Warning and Assessment United Nations Environment Programme Nairobi, Kenya. ISBN: 92—807-2069-4.

Mohiuddin, K. M.; H. M. Zakir and K. Otomo. (2010). Geochemical distribution of trace metal pollutants in water and sediments of downstream of an urban river. Int. J. Environ. Sci. Tech., 7(1), 17-28.

Zvinowanda, C.M.; J.O. Okonkwo; P.N. Shabalala; N.M. Agyei. 2009. A novel Adsorbent for heavy metal remediation in aqueous environments. Int. J. Environ. Sci. Tech., 6 (3), 425-434.

تقييم نوعية رواسب مختارة من هور الحويزة ، جنوب العراق

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الخلاصة

أجريت الدراسة لفحص توزيع تراكيز بعض العناصر النادرة (Pb , Cu , Zn , Fe) في رواسب هور الحويزة في الجزء الجنوبي من العراق . أخذت العينات من خمس محطات (العظيم–1 ، العظيم–11 ، السودة ، أم النعاج ، البيضة) . تراوح معدل تركيز هذه العناصر من 1365 إلى 3735 ملغم/كغم حديد ، ومن 4.50 إلى 10.50 ملغم/كغم زنك ، ومن 4.15 إلى 8.15 ملغم/كغم نحاس ، ومن 6.00 إلى 7.70 ملغم/كغم رصاص . قُيِّمَت درجة تلوث الرواسب باستعمال معامل الأغناء Enrichment Factor (EF) ودليل التجمع الجيولوجي (I_{geo}) Geoaccumulation index ومعامل التلوث Contamination Factor (CF) ودليل التلوث Pollution Load Index (PLI) . تراوحت درجة تلوث الرواسب بالعناصر المدروسة من الضئيلة جداً إلى المعنوية وفقاً إلى معامل الأغناء لجميع المحطات عدا المحطة الأولى كانت عالية التلوث جداً بالرصاص . أما قيم دليل التجمع الجيولوجي فقد أظهرت عدم تلوث الرواسب في جميع محطات الدراسة (Igeo<1) . في حين أظهرت الرواسب درجة تلوث واطئة وفقاً إلى قيم معامل التلوث (CF<1) . أما قيم دليل التلوث PLI فقد تراوحت بين 0.107 إلى 0.163 حيث بينت النتائج عدم تلوث الرواسب بالعناصر النادرة قيد الدراسة . (PLI=0-1)

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Physiochemical Properties of Basrah oil refinery discharges and its potential effects on Shatt Al-Basrah Canal

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Abstract

The study was from October 2009 to July 2010 to identify the efficiency of the wastewater treatment system within Basrah Oil Refinery, the discharges posed by drainage pipe, which flows near Shatt Al-Basrah Canal Monitoring was executed on Monthly basis included 18 criteria for the quality of discharged water, including, Water temperature, pH , Total Alkalinity, Turbidity , Total Suspended Solids, Total Dissolve Solids, Hydrogen Sulfide , Sulfate, BOD_5, COD, Oil and Grease , Phenols, Nitrates, Phosphates and some Heavy Metals (Lead , Copper, Cadmium and Zinc). Some physiochemical values of refinery wastewater treatment unit were reduced in output(drainage pipe) in comparison with input .The values of some properties were acceptable depending on Iraqi limiting criteria except turbidity ,Total dissolved solids, Sulfide, Sulfate ,COD, Oil &Grease, Phenols. Water quality of Shatt Al-Basrah canal was influenced by some extreme values of refinery discharges seasonally. The study concluded that the wastewater treatment system was relatively efficient to reduce levels of oils and grease and total suspended solids, but it lacks for an integrated treatment units. There were potential impact of Basrah oil refinery discharge on Shatt Al-Basrah canal because of some problems in the treatment system that minimizes hazardous waste in the refinery.

1- Introduction

The degradation of the environment due to discharge of polluting effluent from industrial sources such as oil refinery effluents is a real problem in several countries. This situation is even worse in countries like Iraq where little or no treatment is carried out before disposals. It is a general knowledge that the activities of oil producing companies affect the environment and the health of the people living within the immediate vicinity of the crude oil processing plant. The attendant hazards may trigger processes that may have adverse effects on the ecosystem of such area (Reed and Johnsen, 1995).

The wastewater can contain physical, chemical and/or biological pollutants in any form or quantity and cannot adequately be quantified without actual measuring and testing. The degree of wastewater treatment varies, In some cases industrial wastewater either discharged directly into a receiving body of water or into the sewerage system of a municipality, or it will be reused or recycled, and major industrial facilities may have comprehensive in-plant treatment (Alley, 2006; Doorn *et al*.,2006).

Waste waters released by crude oil-processing and petrochemical industries are characterized by the presence of large quantities of crude oil products, polycyclic aromatic hydrocarbons, phenols, metal derivatives, surface-active substances, sulfides, naphthylenic acids and other chemicals (Suleimanov,1995). Due to the ineffectiveness of purification systems, wastewaters may become seriously dangerous, leading to the accumulation of toxic products in the receiving water bodies with potentially serious consequences on the ecosystem (Beg *et al* .,2003). Different studies were concerned about pollution by refineries discharge that alerts water quality leading to diverse effects on some organism (Namminga and Wilhm ,1976;Bleckmann *et al*.,1995;Asia *et al*,2006;Aziz *et al* .,2006;Al-Kazwini *et al*.,2009).

Basrah oil refinery is one of industrial plants that generate large quantities of wastewater vary in physiochemical characteristics .This refinery contain API separator in purpose to perform the initial separation of solids from liquids and oil from water .The wastewater discharged from the refinery ended in open area near Shatt Al-Basrah canal. Shatt Al-Basrah is artificial canal constructed for multi purposes ;total length of the canal 37 km .water speeds exceeds 2 m/s(Al-Bahili,1997).

This study aimed to: Assessment of Basrah oil refinery wastewater treatment system

2- Potential impact of refinery wastewater on Shatt Al-Basrah canal.

2- Materials and Methods

Description of the study area

Basrah oil refinery : Basrah oil refinery located in the east of Basrah citiy ,Effluent discharge point near Shatt Al-Basrah canal was located 11.2km from the refinery (Fig .1). The sampling sites were divided into three stations consist of St1(API separator),St2(represent round basin for collecting wastewater from API separator) and St3 (large open basin that collecting and naturalized wastewater).

Shatt Al-Basrah canal : Three points in Shatt Al-Basrah canal were chosen in this station . Human activities like fishing were observed in this station ; also it received different diluted inputs of sewage from Hamdan station**.**

Sample collection and analysis

Samples of water from Shatt Al-Basrah canal and waste water from Basrah oil refinery that were collected monthly from the study stations during October 2009 and July 2010. Water samples were collected using glass and polyethylene containers capacity of 1 liter ,They were rinsed several times with water or effluent samples at the point of collection . Measurement of some physiochemical characteristics of water, including pH and Total Dissolved Solids were done using the Water quality multi meter (lovibond Sensodirect 150) . All samples were transported in ice chests and analyzed for pH and TDS within 12 hours of collection. Other physicochemical parameters were analyzed later using refrigerated samples. The procedures of sampling and measuring were done depending on APHA(2005).

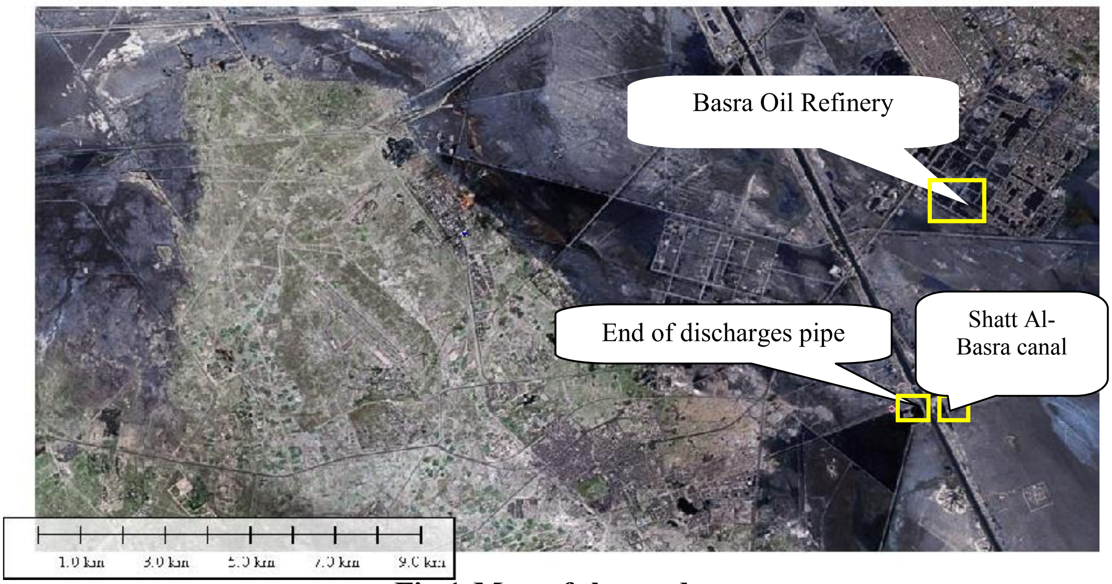

Fig.1:Map of the study area

Table 1: Mean of some physiochemical factors in wastewater samples from Basrah oil refinery wastewater system.

No.	Parameter	Station		
		1(input)	2	3(output)
1	Temperature(C°)	-	-	26.25
2	pH	8.2	7.9	7.65
3	Alkalinity (mg /L)	103	96	72
4	Turbidity (NTU)	-	-	23
5	TSS (mg /L)	31	30	20.5
6	TDS(mg /L)	4330	3562	3887
7	Sulphate (mg /L)	1806	1325	1544
8	Sulfide (mg /L)	20.7	22.6	21.3
9	Oil Grease(mg /L)	33.4	25.1	21.8
10	Phenols(mg /L)	0.81	0.77	0.62
11	Nitrate (µg /L)	24.1	24.2	22.3
12	Phosphate (µg /L)	1.1	2.1	3.2
13	BOD5 (mg /L)	-	-	23
14	COD(mg /L)	-	-	461.5
15	Pb(µg /L)	-	-	13.85
16	Cu (µg /L)	-	-	11.45
17	Zn (µg /L)	-	-	38.39
18	Cd (µg /L)	-	-	6.25

3- Results &Discussion

Assessment of Basrah oil refinery wastewater treatment system

The results of physiochemical factors of water in Basrah oil refinery showed the decrease in most of values of different factors throughout the treatment system.

All refineries employ some form of wastewater treatment so water effluents can safely be returned to the environment or re used in the refinery . the design of wastewater treatment plants is complicated by the diversity of refinery pollutants including oil, phenols, sulfides , dissolved solids, and toxic chemicals .Although the treatment processes employed by refineries vary greatly ,Basrah oil refinery included neutralizers ,oil/water API separator ,settling chambers. Refinery water effluents collected from various processing unites and was conveyed through sewer and ditches to the treatment plant. Most of the treatment occurs in open ponds.

The results showed the ability of Basrah oil refinery treatment to reduce different types of pollutants except in some cases (Table 1 and figures 2 and 3).The highest values of some parameters like Turbidity ,TSS,TDS, Phenol ,Oil and Grease and Sulfide were during January 2010 that may also be attributed to the malfunction and sometimes blockage of the API unit and skimmers stop resulting in accumulation of these pollutants The variation in the pollutant concentration among months reflected continuous quantity of wastewater generated in the refinery. Variation in the values of the wastewater temperature degree was noted and ranged from 18.5- 34.5c° ,While the values were taken seasonal pattern during the study month .pH values were ranged from 5.6- 10.5 as shown in Fig (2). but, it were often alkaline direction ,with the exception of the change in the cases of failure and blockage of API unit led to the accumulation of discharge ,increasing in anaerobic digestion and the production of hydrogen sulfide ,which in turn operates to reduce the pH values (Fukui *et al*.,1990) . The study also showed that first station(API unit) had the highest values of pH compared to the other stations and that may be attributed to the receipted discharge with a high concentration of dissolved salts. Odjadjar and Okoh (2010) pointed out ,that high concentration of dissolved salts is working to raise the values of pH to alkaline direction. The concentrations of total alkalinity were fluctuated during the study period that varied among stations the lowest was in the third station, followed by the second station (fig.2) and that may be attributed to the lack of the receipted water except the third station as it receives additional quantities of water from other unites of the refinery ,which led to obtain dilution and thus lower the concentrations of alkalinity as well as low pH values Statistical analysis showed signification positive correlation between the values of pH and total alkalinity ($r=0.69;p<0.05$).

Turbidity values were high in the third stations all through the study period especially in cases of API unit blockage as it resulted in the accumulation of oils and grease. The values were ranged from 5.7- 44.17 NTU, and the correlation was significance between the values of turbidity and oil and grease ($r=0.61;p<0.05$), and this is agreed with what El-Tohami(2009) found in his study of the impact of wastewater of the oil industry in Sudan .The study showed fluctuating in values of total suspended solids during the study period ,first station had the highest values during January 2010 that may also be attributed to the blockage of API unit and may also due to the corrosion of metals within installation of pipes that transport effluents among stations, the statistical analysis showed differences in values of total dissolved solids that ranged from 1420-9130 mg/l during the months of the study ,as the highest values were in the first station during February 2010.Because of lack of oil refinery to integrated treatment unites, so this station receive continuous effluents after the separation process of oil from water only, as well as high concentrations of sulfates. Significance correlation was between total dissolved solids and sulfate concentrations (r=00.96;<0.05) and this is agreed with the results of Noaman(2008) in the effluents of northern Iraq refineries .A significant increase in the values of hydrogen sulfide in all stations during January and April 2010 and that may be attributed to stop of discharges pump resulting in the accumulation of wastewater containing high concentrations of suspended solids .As the material loose at the deposition a layer of mud (sludge) will be formed, which represents a suitable media for the reactions of anaerobic process as a result of organic compounds containment and lack of dissolved oxygen in water . These interactions led to the formation of sulfur ,phosphorus , and ammonia compounds (Galil and Rebhun,1990). Statistical analysis recorded a significant correlation between the concentrations of hydrogen sulfide and suspended solids . The results showed a clear variation in the values of sulfates for stations first station had the highest values during February 2010 that may be attributed to the blockage of API unit and accumulation of oily effluents containing a high concentrations of sulfates .Sulfur was one of oil components (GESAMP,1993), and this is agreed with the results of Noaman(2008).

As recorded, Nitrate concentrations were high in all stations in February 2010 as shown in Fig.(3) ,and that may be attributed to a malfunction of discharges pump which led to Nitrate accumulation as well as its derived from the sludge formed during the process of separating water from oil (Asia *et al.*,2006) ,which is not subject to any treatment in the Basrah oil refinery .Lower values in all stations were observed during March 2010 that may be due to continuous discharges of refinery effluents .No significant differences in phosphate concentration among months. The third station recorded the highest values in October 2009 compared with other stations ,this was due to the fact that the third receives additional discharge from the other units of the refinery containing a high concentrations of waste cleaning equipment and devices ,which is consider as one of the main source of phosphorus compounds in the water (USEPA,1986;Abawi and Hassan,1990).

The results of statistical analysis showed significant differences in oil and grease concentrations among stations and months, as the highest values were the first station during October 2009 in and this may be due to malfunction of separation unit and accumulation of oil discharge in large quantities because of a blockage in the unit with no separation of water from oil. The second station recorded the lowest concentrations in October 2009 and that may be attributed to the lack of discharge access to this station through effluent carrying pipes among the wastewater treatment plant in the refinery. No significant differences in phenols concentrations were recorded among the stations ,but the study has recorded differences among months. The highest value recorded in January 2010 in third station and that may be attributed to the reason of fail of discharge pump and stop of skimmers ,which led to the accumulation of oil in the basin as well it is the main source of phenols in wastewater oil is one of thermal cracking of hydrocarbons incident during the refining and the liquidation of crude oil (Otokunefor and Obiukwu,2005).

We could not measure COD and BOD**5** in the first and second stations while, high values of COD and BOD**5** were showed in the third station through study period, which indicated the presence of high concentrations of organic materials such as oils and grease. organic wastes in high concentrations were decreased the values of dissolved oxygen as a result of microbial activity as well as it formed insulting layer led to prevent the exchange of gases and thus contributed to the high value of BOD**5** (Wake,2004) also high concentration of total dissolved solids and turbidity that recorded in the study may increase values of COD and BOD**5**. Statistical analysis showed significant differences among study months in the values of COD .

It's clear from pattern of monthly change in the study stations , the rates of oil and grease, total suspended solids , BOD**5**and COD were taken the same direction in most months of study and that is due to the lack of integrated treatment system in the refinery of Basrah that lesser concentrations of pollutants to the lowest levels . Different concentrations of metals were measured during the study (Fig.5), which included Lead, Copper, Zinc and Cadmium and this may be due to the lack of Basrah oil refinery treatment system. It can be seen from the results that the oily wastewater treatment system used in Basrah oil refinery was good in reducing the concentrations of certain pollutants prior they release to the environment, which included pH and alkalinity and also there was a relative decrease in the concentration of oils and grease and suspended solids during the study period except cases of repeated failure of separation unit and discharge pump.

The potential impact Basrah oil refinery on Shatt Al-Basrah canal

There are two groups of results taken from the discharges of Basrah oil refinery (Appendix 1); first showed different physic-chemicals parameters that were within local permission limits .while other group was exceed it. The second group has potential impact on Shatt Al-Basrah canal. The results of the characterization carried out on water samples obtained from Shatt Al-Basrah canal are presented in Table 2. Variation in the values of water temperature of Shatt Al-Basrah canal was showed. temperatures values(23.8± 5.7) felt within the aquatic organism requirements in this region (Abaychi *et al.*, 1991 and Al-Handal *et al.*,19910), while high values of temperature may be reduced the dissolved oxygen, affect on the level of dissolved salts concentration and on the interactions of chemical in aqueous media (Smith,2004).The pH value was 8.48±0.26 and this indicated that water of Shatt Al-Basrah canal was in alkaline direction and within local permission limits . This pH value play an important role in the chemical reactions occurring in aqueous media (Demirci *et al.*,1998;Abawi and Hassan,1990), while low pH is toxic to alkalinity values were appreciably low.

The total suspended solids were within local permission limits(<60 mg/l)..The main reasons of suspended solids presence in the water of Shatt Al-Basrha canal attributed to Basrah refinery discharges, rising of water table in addition to human activities in fishing and boat movement. However ,he values of H_2S,SO_4,NO_3 and PO_4 were lower than local permission limits. Sulfate significantly distributed in most of the industrial wastewater (Irshad *et al.*,1997) and approximately 80% of sulfate in some of the waste liquids were reduced by anaerobic bacteria and by presence of organic wastes turn to hydrogen sulfide ,which gives objectionable odor of water and cause corrosion to processing units(Fukui *et al.*,1999) .The sulfide is one of pollutants types generated in effluents of oil refineries resulted from sulfates reducing by sulfate reducing Bacteria(Fukui *et al.*,1999) . The main potential impact of high concentration of NO_3 and PO_4 were eutrophication.

Some heavy metals presence in different properties in the composition of crude oil included Nickel , Vanadium ,Lead, Iron, Cobalt ,Cadmium ,Zinc and Copper (Concaw, 2004) . The values of all metals were within acceptable local permission limits .water analysis of Shatt Al-Basrah canal indicated the other group of results . Turbidity values for the station were higher than the local permission limits. The turbidity of 18±3.8 NTU showed that colloidal matter in the water was high and by implication the wastewater contained high solids concentration ,in addition to high concentrations of oil and grease (Ahmed, 2008).On the other hand ,TDS values of 3167±822 mg/l were generally high and suggest that the wastewater contain high concentration of ions which can be removed by coagulation and flocculation. Shatt Al-Basrah canal was subjected to Basrah oil refinery effluents in addition to natural process like evaporation in summer , as well as the high concentrations of nitrates and phosphates and sulfates, which sometimes combined with ions of some elements such as (Ca, Mg, Fe ,and K) composed ionized salts that rise the concentration of TDS(Al-Fhedawi,1999).

Oil and grease values of 22.3±3.6 mg/l were high when compared to local permission limits of 10 mg/l .These pollutants are known as a mixture of organic compound s ranging in molecular weights and include fatty acids, oils and fat. Fraction of these substance soluble in the water and other parts of them settle at the bottom after loss the volatile parts ,while the bulk of them was keeping floating on the surface of the water (Abawi and Hassan,1990),which will effect on different aquatic organisms .The phenol is one of the most dangerous persistent organic pollutants in water and the organisms are subjected to the formation of chlorophenols with a bad smell(Abawi and Hassan,1990) .The mean value of phenols was 0.3±0.1 mg/l that exceeded local permission limits. The values of COD and BOD_5 were quite high when compared to local permission limits and USEPA standard. This indicated strong pollution potential and therefore calls for treatment before disposal. The high COD values indicate the high potential of aqueous effluents to cause gross inorganic and organic pollution in receiving surface water bodies .This could cause a reduction on the population of fishes and other aquatic organism (Osibanjo,1992;Asia *et al*.,2006). The high values of COD (ranged 302-473 mg/l) may resulted from the nature of Basrah oil refinery discharges containing high concentration of oil and grease and dissolved salts that reduce dissolved oxygen (Lehatine ,1996).

Table 2: physico—chemical properties of Shatt Al-Basrah canal during study period

parameter	Unit	Max.	Min	Mean	± SD
W.T.	C°	30.0	17.8	23.8	5.7
pH	-	8.9	7.3	8.48	0.26
Alkalinity	mg /l	100.0	35.0	68.2	31.6
Turbidity	NTU	33.4	9.0	18.1	3.8
TSS	mg /l	39.0	20.0	29.0	7.8
TDS	mg /l	5010	1930.0	3167.0	822
Sulfate	mg /l	2102	1011.0	1569.0	450.0
Sulfide	mg /l	28.2	20.0	24.0	3.6
Oil &Grease	mg /l	43.0	5.0	22.3	3.6
Phenols	mg /l	0.4	0.3	0.3	0.1
Nitrate	mg /l	39.7	4.5	22.9	18.8
Phosphate	mg /l	4.4	0.8	2.2	1.6
BOD5	mg /l	22.0	12.0	17.0	4.4
COD	mg /l	473.0	302.0	368.5	56.5
Pb	mg /l	14.5	10.3	12.6	2.1
Cu	mg /l	11.8	11.1	11.5	0.3
Zn	mg /l	43.4	24.3	34.7	8.0
Cd	mg /l	4.4	3.8	4.5	0.7

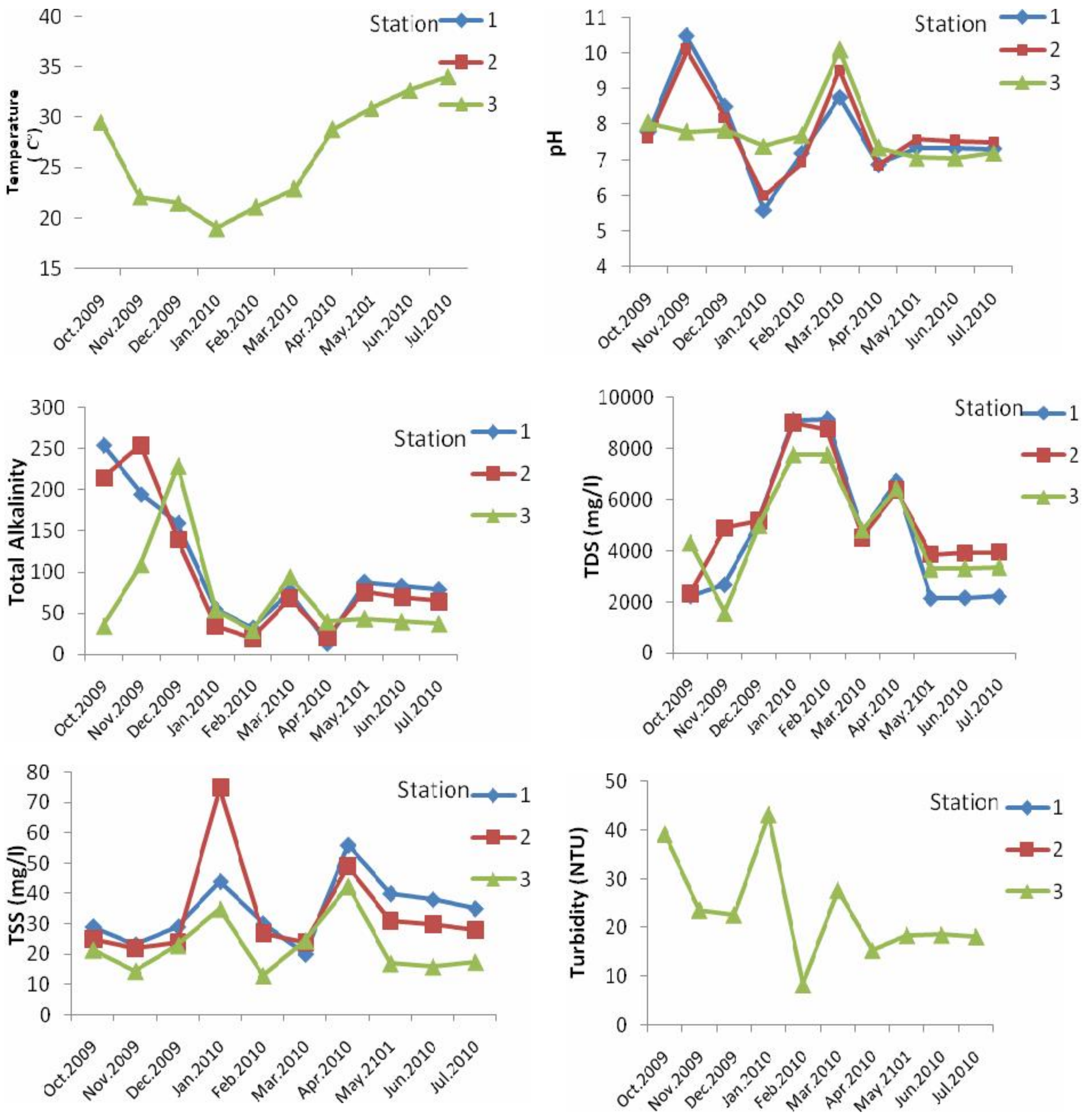

Fig.2: Monthly changes of some wastewater properties (Water temperature, pH, Alkalinity, TSS, TDS and turbidity) within Basra oil refinery treatment system

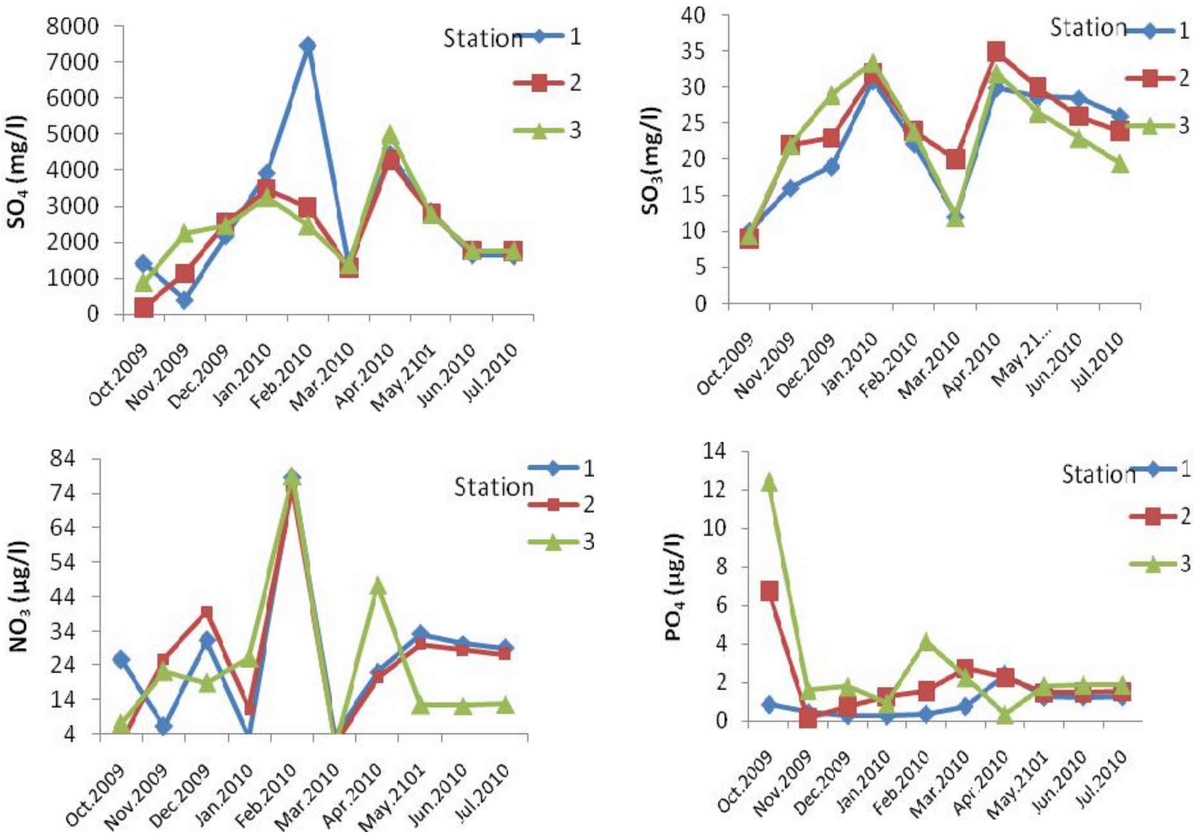

Fig.3: Monthly changes of some wastewater properties (SO_4, SO_3, NO_3, and PO_4) within Basra oil refinery treatment system

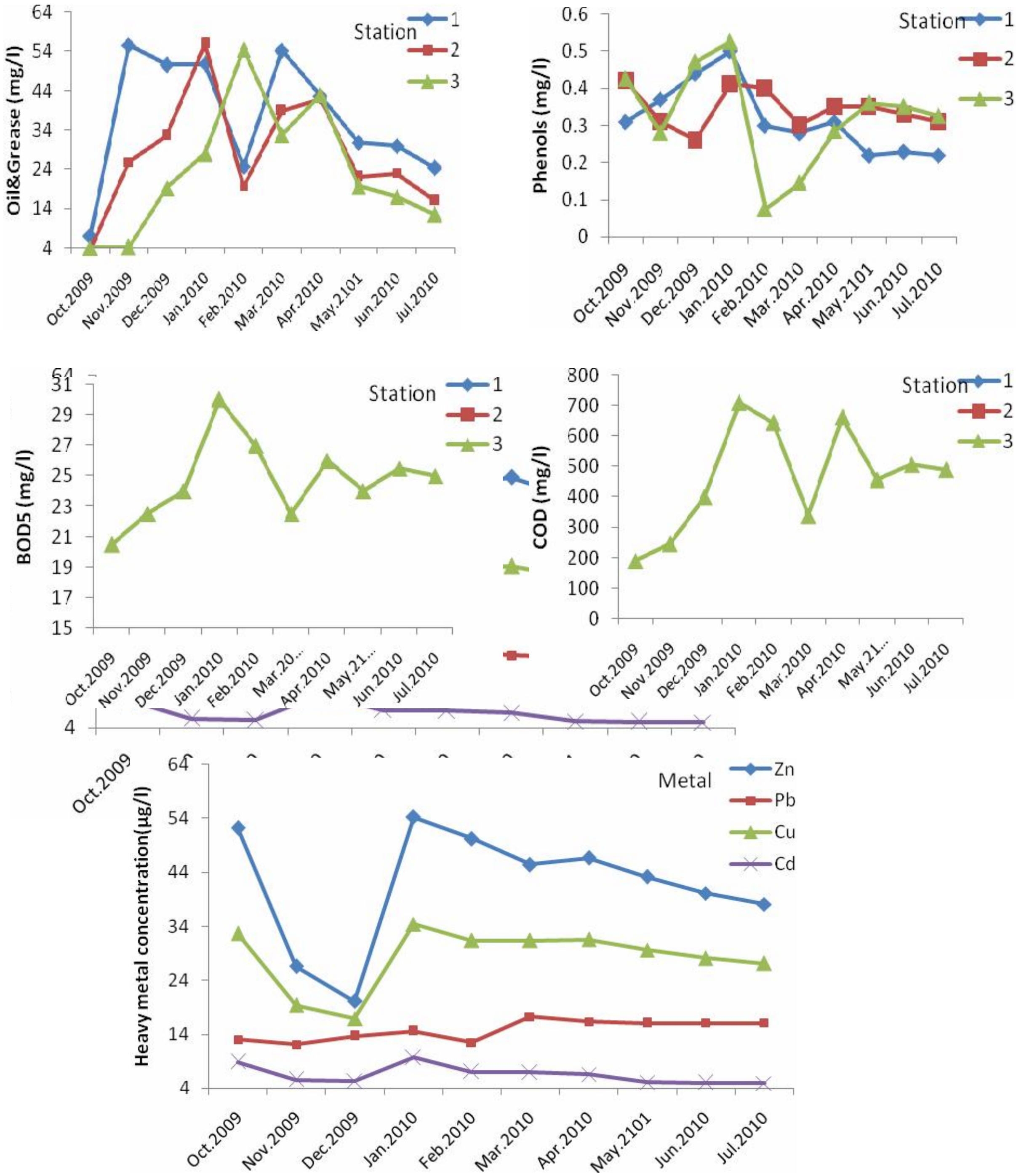

Fig.4: Monthly changes of some wastewater properties (Oil&grease, Phenols, BOD_5, and COD) within Basra oil refinery treatment system

4- Conclusion

It appears that there were potential impact of Basrah oil refinery discharge on Shatt Al-Basrah canal because of some problems in the treatment system that minimizes hazardous waste in the refinery .Improvement of operating procedures and more efficient equipment are two types of waste minimization practices that the refinery could adopt .It is necessary to work with individual facilities to determine the specific activities they engage in, to estimate the amount of waste they generate and how it is managed ,and to assess the current level of waste minimization practiced .

5-References

Abawi ,S.A.and H.S.Hassan(1990).The Practical Engineering for Environment, Water Tests. AlHikma for printing and publishing center, Mousil.296p. (In Arabic).

Abaychi, J.K. Jawad, A. H.M.and Majeed, A.A. (1991).The influence of low salinity discharge through the Shatt AL-Basrah canal on the hydrography of the Khor AL- Zubair.N.W.Arabian Gulf. Mar. Meso.6 (2):209-244.

Ahmed , A.I. (2008).Positive, economic and social development output of Sudan's oil industry ,The study of Falaj filed ,Master Thesis ,Institute of Disaster and Refugee Studies ,International University of Africa .p.75.(In Arabic).

Al-Bahili, N.K.M. (1997).Physical and mechanical properties of Shatt Al-Basrah canal and its effect on erosion .MSC.thesis, Agti.Coll.Basrah Univ., 177p. (In Arabic).

Al- Fhedawi, H.J.(1999). Effects of some wastes of industrial units in Maysan on the characteristics of the Tigris River, MSC. Thesis, Edu. Coll. Basrah Univ., 72p.(In Arabic).

Al-Handal ,A.Y.; Mohamad, A. R. M. and Abdullah, D.S.(1991). The Ditoma Flora of the Shatt AL-Basrah canal. South Iraq. Mar.Meso.6(2)169-181.

Al-KazwiniM.J.;F.H. Al-Ani and M.A. Al-Najar(2009).Environmental Study for the oil pollutants Treatment of Wadi AlNaft Water /Kirkuk.J.Eng. & Tech. 27 (8).

Alley,E.R.(2006).Water Quality Control Hand Book.McGraw-Hill Inc

APHA (American Public Health Association) (2005). Standard Methods for Examination of Water and Wastewater . 21^{th} ed, Washington D.C.1193p .

Asia ,I.O. ; Enweani , I.B. and Eguavoen , I.O. (2006). Characterization and Treatment of sludge from the petroleum industry. Afr. J. Biotechno. 5(5):461-466.

Aziz, N.M. ; Al-Adhub, A.H.Y. and Al-Imarah, F.J. (2006). *Phragmites australis* and *Typha domengensis* as bioaccumulators and biomonitors of three trace metals along Shatt Al-Basra canal, south of Hammar marsh. Mar. Bull. 1(2):173-18.

Baker, J. Schofield, C.(1982). Aluminum toxicity to fish in acidic waters Water, Air and Soil Pollut.18:289-309.

Beg,M.U.,T.Saeed, S.Al-Muzaini ,K.R.Beg, and M.Al-Bahloul (2003). Distribution of petroleum hydrocarbon in sediment from coastal area receiving industrial effluents in Kuwait.-Ecotoxicol Environ Saf .54:47-55.

Bleckmann,C.A.,B.Rabe,S.J.Edgmon and D.Fillingame.(1995).Aquatic toxicity variability for fresh- and saltwater species in refinery wastewater effluent. Environ.Toxicol.Chem.14(7):1219-1223.

Concawe (2004). Trends in Oil Discharged With Aqueous Effluent from Oil Refineries In Europe: 2000 Survey. Concawe (The Oil Campanies'European Association For Environment , Heath and Safety in Refinery and Distribution , Beljum) Report No. 4/04, 9pp.

Demirci , S. ; Erdogan , B. and Ozcimder , R. (1998). Wastewater Treatment at the Petroleum Refinery , Kirikale , Turkey . Using Some Coagulants and Turkish Clays as Coagulant Aids , Water Res. 32(11):3494-3499.

Doorn,M.R.J. Towprayoon , S. Vieira, S.M.M., Irving ,W. Palmer ,C. Pipatti, R .and Wang, C.(2006). Wastewater treatment and discharge. IPCC Guidelines for National Greenhouse Gas Inventories. Intergovernmental Panel on Climate Change (IPCC), IPCC/OECD/IEA, Paris, France

El-Tohami , A.E.A. (2009). Upstream and Downstream Impact of Wastewater of Oil Industry in Sudan . Second Kuwait Waste Management Conference and Exhibition . 12 p.

Fukui , M. ; Harms , G. ; Rabus , R. ; Schramm , A. ; Widdel , F. ; Zangler , K.; Boreham , C. and Wilkes , H. (1999). Anaerobic Degradation of Oil Hydrocarbons By Sulphate Reducing and Nitrate Reducing Bacteria . Proceeding of The 18th International Symposium On Microbial Ecology Bell CR , Brylinsky M , Johnson-Green P (ed). Atlantic Canada Society for Microbial Ecology , Halifax , Canada .

Galil , N. and Rebhun , M. (1990). A comparative Study of RBC and Activated Sludge In Biotreatment of Wastewater from Integrated Oil Refinery . Pure. Ind. Waste Conf. 29:7-711.

GESAMP (Group of Experts on the Scientific Aspect of Marine Pollution).

(1993). Impact of Oil and Related Chemicals and Wastes on The Marine Environment . Report and Studies No. 50, 1M0, London , 180p.

Irshad , A. ; Ali , S. and Jan M.R. (1997). Physiochemical Studies of Industries Pollutant. Environ. Poll. :93-99.

Lehatin , C.M.(1996). Environmental Impact Studies of Refinery Effluents- A challenge to The Analytical Chemist In : Giam , C.S. ; Dou , H.G.M. (eds), Strategies and Advanced Techniques for Marine Pollution Studies. Mediterr-anean Sea. Springer-Verlag , Berlin ,pp 315-326.

Namminga H.E.and J. Wilham (1976). Effects of high discharge and an oil refinery cleanup operation on heavy metals in water and sesiments in skeleton creek.Proc.Okla.Acad.Sci.56 133-138.

Noaman , M.M. (2008). Effect of Industrial Influent on Water Quality of Tigris River and Upon The Performance of Water Treatment Plant Within Sector Baji -Tikrits. M.Sc. Thesis. Collage of Engineering. Tikrit University.119 p.

Osibanjo,(1992).Present water quality status in Nigeria .Federal Environment Protection Agency (FEPA), Nigeria 35-40.

Odjadjar, E.and Okoh ,A.(2010). Physioch-emical Quality of Urban Municipal Wastewater Effluent and its Impact on the Receiving Environment .Environ. Assess. 170:383- 394.

Otokunefor , T.V. and Obiukwu , C.(2005). Impact of Refinery Effluent on The Physiochemical Properties of Water Body in The Niger Delta. App. Eco. Environ. Res. 3(1): 61-72.

Reed , M. and Johnsen, S. Eds (1995).Produced Water: Environmental Issues and Mitigation Technologies. Second, New York: Plenum Press. pp. 14 – 56

Smith , A.L. (1974). The Effect of Effluent from The Canadian Petrochemical Industry on Aquatic Organisms . Canadian Fisheries and Marine Service Technical Report . 472 pp.

Smith ,R.(2004).). Current methods in aquatic science. Waterloo, Canada: University of Waterloo. 382p.

Suleimanov , R.A. (1995). Conditions of Waste Fluid Accumulation at Petrochemical and Processing Enterprises and Prevention of Their Harm to Water Bodies, Medistina Trudi Promy Shennaia Ecologia . 12: 31-36.

USEPA (United State of Environmental Protection Agency). (2008). Environmental Standards For Petroleum Oil Refineries Effluent . EPA

Notification G. S. R. 186(E). dt 18th March ,2008.

USEPA(United State Environmental Protection Agency) (1986). Waste Minimization Issues and Options , EPA/ 530 - SW-86-042,. 23p.

Wake , H. (2004). Oil Refineries : A review of Their Ecological Impacts on the Aquatic Environment . Estuarine , Coastal Self Science , 62: 131-140.

Appendix 1:Comarison of wastewater in current study and Iraqi standard and USEPA limitation.

NO.	Physic-chemical properties	Current Study (Basrah oil refinery discharge)	Iraqi Standard limits (2009)	USEPA(2008)
1	Temperature(C°)	26	35	30
2	pH	9.02	6.5 – 9.5	6.5 – 8.5
3	Alkalinity (mg/L)	73	-	-
4	Turbidity (NTU)	25	10	-
5	TSS (mg/ L)	31	60	20
6	TDS (mg/ L)	4962	-	500
7	Sulphate (mg/ L)	1960	400	250
8	Sulfide (mg/ L)	29	-	0.5
9	Nitrate (mg / L)	0.02	50	10
10	Phosphate (mg / L)	0.0014	3	3
11	O&G (mg/ L)	27	10	5
12	Phenols (mg/ L)	0.4	0.05 – 0.01	0.35
13	BOD 5 (mg/ L)	24	40	15
14	COD(mg/ L)	721	100	125
15	Pb (mg/ L)	0.014	0.1	0.1
16	Cu (mg/ L)	0.012	0.2	1
17	Zn (mg/ L)	0.041	2	5
18	Cd (mg/ L)	0.0062	0.01	0.005

الخصائص الفيزيائية والكيميائية لمطروحات مصفى نفط البصرة و احتمالية تأثيرها في نوعية مياه شط البصرة

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الخلاصة

أجريت الدراسة للفترة من تشرين الأول 2009 إلى تموز 2010 وبمراقبة شهرية شملت 18 معياراً لنوعية المياه الناتجة عن مصفى نفط البصرة بهدف التعرف على مدى كفاءة نظام معالجة المياه العادمة داخل المصفى و التصاريف التي يطرحها عبر أنبوب التصريف الذي يصب بالقرب من قناة شط البصرة .تضمنت الدراسة قياس درجة الحرارة و الأس الهيدروجيني والقاعدية الكلية و الكدرة والمواد الصلبة الذائبة الكلية والمواد الصلبة العالقة الكلية والمتطلبين الحيوي والكيميائي للأوكسجين والزيوت والشحوم والفينولات وكبريتيد الهيدروجين والنترات والفوسفات والكبريتات وبعض المعادن الثقيلة (الرصاص والنحاس والكادميوم والخارصين).

سجل انخفاض في قيم بعض الخصائص الفيزيائية والكيميائية عند دخول المياه العادمة في وحدات المعالجة داخل المصفى وبين وصولها لمضخة التصريف كقيم الأس الهيدروجيني و القاعدية والمواد الصلبة العالقة الكلية والزيوت والشحوم والفينولات والنترات. أوضحت نتائج الدراسة موافقة في بعض خصائص مياه تصريف مصفى نفط البصرة مع المحددات العراقية ، إلا أن هناك تطرفا واضحا في قيم كل من الكدرة والمواد الصلبة الذائبة الكلية والكبريتات وكبريتيد الهيدروجين والفينولات والزيوت والشحوم وقيم المتطلب الكيميائي للأوكسجين. أثرت بعض المعايير المتطرفة من مطروحات المصفى على نوعية المياه في شط البصرة بشكل موسمي.

استنتج من الدراسة أن نظام معالجة المياه العادمة كان كفوءا نسبيا في تقليل تراكيز الزيوت والشحوم والمواد الصلبة العالقة الكلية ، لكنه يفتقر إلى وحدة معالجة متكاملة. يوجد تأثير كامن للتلوث في شط البصرة من مصفى النفط بفعل بعض المشاكل في نظام المعالجة التي تقلل من مستويات الخطر.

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Effect of pH on hatching and survival of Larvae of common carp *Cyprinus carpio* (Linnaeus, 1758)

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Abstract

Artificial hatching of common carp eggs was fulfilled in Marine Sciences Center hatchery. Fertilized eggs was taken from hatchery and was distributed in seven concentrations of pH (4.5, 5.5, 6.5, 7, 8.5, 9, 9.5). The results show that segmentation of eggs begin in each concentration especially in the critical concentrations (4.5, 5.5, 9 and 9.5). Then the eyes were formed and other organs respectively. After 48 hours hatching occurs by 85% in all concentrations. Hatched larvae were distributed on the same concentrations, survival rates of larvae in concentrations (4.5, 5.5, 6.5, 7, 8.5, 9 , 9.5) were 50% , 54% , 60% , 95% , 90% , 20% , 0 respectively after 24 hours from hatching.

1- Introduction

pH of the water is one of the most important environmental factors affecting fish farming. Excessive acidification as well as alkalization are detrimental to fish development. According to EIFAC criteria (1971) water pH safe for fish ranges from 6.5 to 8.5. The effect of acidity on fish was confirmed at first once by Dahl (1926). In carp ponds temporary alkalisation may occur during hot summer, usually due to algal blooms, reaching sometime pH over 10.0 (Alabaster and Lloyd 1980).

Chemical parameters of water in lakes and rivers regard that have effect on organisms by any food of level in ecological systems (Wright *et al.* 1975). Researchers often interested in the impact of low and high concentration of pH on the survival of fish, especially salmon when there is a significant loss of stock due to a low concentration of pH in the rivers, west

Norway (Munize *et al*.,1975). Leivestad and Munize (1976) explained that the mortality of fish is due to differences in ion balance, and this happened due to the low concentration of pH in the water. The acidity (low value of pH) can affect on reproduction, the composition of communities, growth and food choice (Almer, 1972; Andersson, 1972; Beamish, 1974; Carrick, 1979). Also Milbrink and Johansson (1975) noted that the development stages of eggs and larvae in the fish are most sensitive at low levels of pH. The embryo stage was found to be particularly sensitive in fish (Brown and Sadler, 1989). Low pH leads to denaturation of the hatching enzyme and subsequently to deformation of the embryos and high embryonic mortality as well as hatching delay in various fish species (Kwain and Rose, 1985; Ingersoll *et al.*, 1990). The aim of this work is to study the effects of different pH values on embryonic development and survival rates of common carp larvae.

2-Materials and Methods

Three adult females and two males of common carp *Cyprinus carpio* were selected from aquaculture experimental station at the Marine Science Center (*www.msc-basra.com*). Adults were transferred to the fish hatchery, then were weighed. The quantity of pituitary gland hormone was estimated, which was injected in the adults fish depended on weight of adults. The standard quantity of pituitary gland hormone, which inject in common carp for artificial spawning (3-4 mg / kg weight of fish). The quantity of hormone divided into two injections. The first was 0.1 from total quantity of hormone, and the second after 12 hours, the females was injected with residual (0.9) from total quantity of hormone. At the next day the eggs were taken from females and put in plastic bowls and fertilized by sperm of male by dry method. Then the fertilized eggs was washed by fertilization solution for one hour. Then it was towed by tannic acid. Seven different concentrations of pH were supplied (4.5, 5.5, 6.5, 7, 8.5, 9, 9.5) and distributed these concentrations in the flasks capacity 750 ml. This system ready for hatching by three replicates for each concentration. Eggs was flipped by air which provide by three pumps instead of current of water (Fig. 1). The fertilized egg were distributed to 100 eggs for each replicate. The water temperature was fixed to 24 c˚. The same concentration of pH were prepared in plastic basins (3 liters) to receive the hatched larvae. The statistical analysis SPSS was used for data analysis, and test LSD (Least Significant Deference) to test the significant difference between the treatments (P<0.o5).

Fig. 1. Photograph for system of the artificial hatching.

3- Results

Effect of pH on embryonic development and larval hatching

Cell division of eggs began in all concentrations after two hours of putting the fertilized egg in different pH concentrations was examined. After 24 hours the embryo was formed until it reached to the stage of eye formation and is clarity of heart beats and the appearance of tail movement. Any stoppage did not appear in embryonic development at whichever stage in any concentration of pH. The hatching occurs after 48 hours. The hatching rate of larvae was 85% in all concentrations .

Effect of pH on the survival rate of larvae

After the distribution of hatched larvae on concentrations of pH which it used in the experiment to observe the effect of these different concentrations on the survival of larvae during the next 24 hours. The survival rates of larvae survival in pH concentrations of 4.5, 5.5, 6.5, 7, 8.5, 9 and 9.5 were 50% ,54 % , 60% , 95% , 90% , 20% and 0% respectively (Fig. 2). From statistical analysis appeared that there is significant differences in survival rates ($p<0.05$) among most concentrations beyond pH 7 and 8.5 no any significant differences was shown ($p>0.05$).

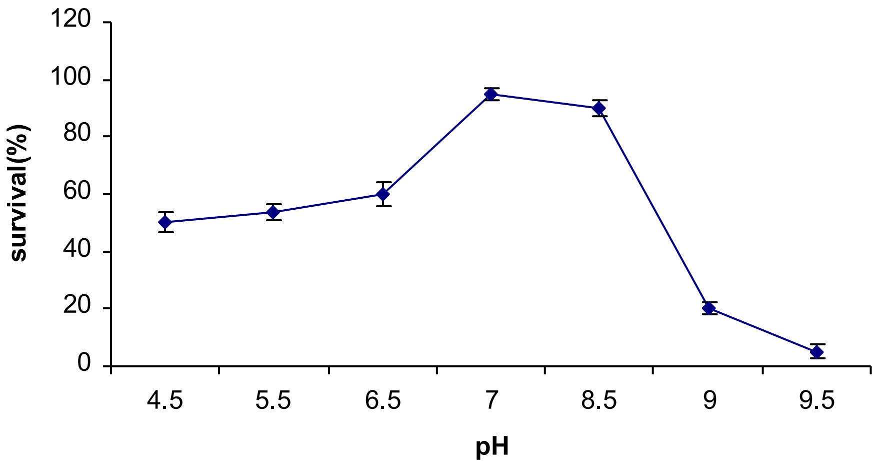

Fig. 2. Survival rates of common carp larvae after 24 hours from hatching in Different pH concentrations.

4- Discussion

The pH regards one of the environmental factors that have effect on some stages of the life of fish, especially in the larval stage. This study proved that the eggs of common carp *Cyprinus carpio* exposed to different concentrations of pH hatched at suitable time and with high percentage (85%). When the hatched larvae were transferred to the same concentrations of pH, showed deferent survival rates. A higher specific mortality rate often occurs immediately following the period of strictly endogenous yolk feeding, and during the period of first exogenous feeding (Sifa and Mathias, 1987). As any environmental change can lead to high mortality and it is consistent with what the Claiborne and Heisler (1986) said that any change in the pH of the fish environment of fish have an impact on the pH of blood plasma and this has a negative effect can lead to mortality in fish larvae. This happened when larvae of common carp exposed to different concentrations of pH. Also the results explained that the low and high concentration of pH leads to mortalities of many fishes larvae. While it was noted by Brownell (2003) when he put the fish larvae in different concentrations of during 24 hours and observed ability to first feeding. Where the larvae are sensitive during the first four hours to nutrition in the concentrations of the high pH. Our study showed high mortality in larvae which exposed to high pH (9 , 9.5). Reduced oxygen consumption in fish exposed to alkaline water was observed by Murthy *et al*. (1981), it resulted from difficulties in oxygen uptake by gills and disturbances in oxygen transport by blood. Similar changes were observed by Jezierska (1988) in fish exposed to alkaline environment. Damage or covering with mucus of gill epithelium and chloride cells may also result in impaired ion exchange. Muniz *et al.* (1975) reported that disturbances in ionic regulation, especially loss of sodium, were a direct cause of fish mortality. Also from results noted high mortality in larvae when displayed to low pH. Fish larvae sensitivity begin in all levels of the low pH where it harmful to them, especially in the lower levels from 6.0. And the cause of mortalities that obtain to fishes at low levels of pH is the imbalance between the place where the fishes live and the content of body fluids (Wilson *et al*. 1999).

5- References

Alabaster J.S. and Lloyd, R.(1980) Water Quality Criteria for Freshwater. Fish - London: Butterworths.

Almer, B. (1972) Forsurningens inverkan pa fiskbestand i vastkust- sjoar. Information fran Sotvattenslaboratoriet. Drottingholm , 12: 1 – 47 in Rask , 1983.

Andersson , B. (1972) Abbrrens naringsval iforsurade vastkust- sjoar. Information fran Sotvattenslaboratoriet. Drottingh-olm , 17: 1 – 21 in Rask , 1983.

Beamish , R.J. (1974) Growth and survival of the white sucker (Catostomus commersoni) in an acidified lake . J . Fish .Res. Board Can. 31: 49 – 54 .

Brown, D.J.A and Sadler, K. (1989) Fish survival in acid waters. In: Morris R, Taylor EW, Brown DJA, and Brown JA (eds), Acid Toxicity and Aquatic Animals, Cambridge University Press, Cambridge, pp 33-44.

Brownell, C. L. (2003). Water quality requirements for first-feeding in marine fish larvae. II. pH, Oxygen, and Carbon dioxide. Journal of Experiments and Marine Biology and Ecology. 44(2):285-298.

Carrick, T. R. (1979) The effect of acid water on the hatching of salmonid eggs .J.Fish Boil . 14 : 165 - 172

Claiborne, JB. and Heisler, N. (1986). Acid-base regulation and ion transfers in the carp (Cyprinus carpio): pH compensation during graded long –and short-term environmental hypercapnia, and the effect of bicarbonate infusion. Journal of Experimental Biology. 126(1):41-61.

Dahl ,K . (1926) vandest surhtesgrad og deres virkninger pa orretyngel . Tidsskr

Norges Landbrukshogskol, 33:232- 242. in Rask , 1983.

EIFAC/FAO, (1971) Kryteria jakooeci wód dla europejskich wód s³odkowodnych. Zesz. Prob. Post. Nauk. Roln., Z.116.

Jezierska B., (1988) The influence of water pH on early stages of carp (Cyprinus carpio L.) (in Polish) Agricultural and Teachers College in Siedlce, Research Report No 25

Kwain W and Rose GA (1985) Growth of brook trout, Salvelinus fontinalis subject to sudden reductions of pH during their early life history. Trans. Am. Fish. Soc. 114: 564-570.

Ingersoll, CG.; Mount, DR. ; Gulley, DD. ; La Pont, TW. and Bergman (1990) Effects of pH, aluminum, and calcium on survival and growth of eggs and fry of brook trout (Salvelinus fontinalis). Can. J. Fish Aquat. Sci. 47: 1580-1592.

Milbrink , G. and Johansson, N. (1975). Some effects of acidification on roe of roach Rutilus rutilus L,. and perch, Perca fluviatilis L,.- with special reference to the Avaa lake system in eastern Sweeden . Rep . Inst. Fresh water.Res. Drottingholm , 54: 52 – 62 .

Muniz, I.p; Leivestad ,H. ; Gjessing , E; Joranger, E and Svalastog ,D. (1975) . Fiskededi forbindelse med snosmelting i Tovdlsvassdraget varen SNSF-project , IR 13/75 .60pp.

Murthy V.K., Reddanna P., Garindappa S. (1981) Hepatic carbohydrate metabolism in Tilapia mossambica (Peters) aclimated to low environmental pH. Can. J. Zool., 59: 400-401

Leivestad , H. and Muniz, I.P. (1976). Fish kill at low pH in a Norwegian river. Nature, 259: 391 - 392 .

Sifa, Li. and Mathias,A. J. (1987) The critical period of high mortality of larvae fish —A discussion based on current research. Chines J. of Oceanography and Limnology. Vol. 5 P: 80-96.

Wilson RW, Wood CM, Gonzalez RJ, Patrick ML, Bergman HL, Narahara A, and Val A.L. (1999) Ion and acid-base balance in three species of Amazonian fish during gradual acidification of extremely soft water. Physiol Biochem Zool 72: 277-285.

Wright, R.F ; Dale,T ; Gjessing, E.T ; Henrey, G. R ; Henriksen, A; johann-essen, M and Muniz, I.P.(1975). Impact of acid precipitation on freshwater ecosystems in Norway . SNSF. Project, FR 3/75 .16pp.

تأثير الأس الهيدروجيني على تَفْقيس واعاشــة يرقاتِ اسماك الكارب الشائع *Cyprinus carpio* (Linnaeus, 1758)

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الخلاصة

أجريت عملية تلقيح اصطناعي لبيضِ اسماك الكارب الشائعَ في مفقسِ مركز علوم البحار. أُخِذتْ كمية من البيض المُخَصَّبِ مِنْ المفقسِ ووُزِّعتْ في سبعة مِنْ تراكيز الأس الهيدروجيني (9.5 ,9 ,8.5 ,7 ,6.5 ,5.5 ,4.5). وَضعتْ هذه التراكيز في قناني زجاجية سعتِها 750 مل بثلاثة مكررات. بَدأَ انقسام خلايا البيضِ في كُلّ تركيز خصوصاً في التراكيز الحرجةِ (4.5، 5.5، 9 و9.5)، ثمّ تكونت العيون والأعضاء الأخرى على التوالي. فقّستْ اليرقاتِ بنسبة 85 % بعد 48 ساعةِ. وُزّعتْ اليرقات الفاقسة على نفس تراكيز الـ pH ثم حسبت نِسَب بقاءِ اليرقاتِ في التراكيز (4.5، 5.5، 6.5، 7، 8.5، 9 ، 9.5) كَانتْ 50 % ، 54% ، 60% ، 95% ، 90% ، 20% ، 0 على التوالي بعد 24 ساعةِ مِنْ التَفْقيس.

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Comparison of total hardness, calcium and magnesium concentrations in drinking water (RO), and municipal water with WHO and local authorities at Basrah province, Iraq.

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Abstract

Different drinking water including RO (reversed osmosis water) and municipal water where collected from ten principal locations at Basrah city through January, May and December 2012, using three samples a month, to obtain the concentrations of total hardness, calcium and magnesium ions, for comparison with Iraqi and WHO guidelines for drinking water. Results showed a decrease of total hardness, calcium and magnesium ions in RO water in comparison with permitted levels according to Iraqi and WHO guidelines. The average concentrations of total hardness, calcium and magnesium for RO water were 19.5-60 ppm, 5.9-11.8 ppm and 4.4-13.9 ppm respectively. The municipal water gave high or acceptable levels of hardness, calcium and magnesium ions in all study locations except Al Zubair region which recorded low concentration of magnesium ions at municipal water compared to Iraqi and WHO guidelines. According to the obtained results at the present study, RO water used for drinking in Basrah city is not found suitable for health, due to the deficiency of calcium and magnesium ions, such ions are demanded for human health.

Key word: RO water, hardness, calcium and magnesium, health, Basrah, Iraq.

1- Introduction

Drinking water is considered as one important topic that has been received a great attention due to the high demand of human consumption used daily, as water is one essential element of life. The individual daily demand from drinking water is 2 Liter providing that average weight is 60 kg according to climate, human activity and society culture (Frewtrell and Bratram, 2001). The drinking water should be pure, sterilized and is suitable for human consumption, and free from chemical pollutants such as lead, arsenic and benzene. Also should be free from microbiological epidemic such as bacteria of cholera *vibrio cholera,* hepatitis A virus and protozoa parasites such as *cryptosporidium parvum*, such microorganisms which are very dangerous for human health (OECD, 2003). Iraq is a part of arid and semi arid regions, it suffer from deficient of pure water, so the need for RO water is argent especially at the southern part of Iraq. The important issue in RO water lies in the deficiency of calcium and magnesium elements. Calcium and magnesium are both essential elements for human health. Calcium is a substantial component of bones and teeth. In addition, it plays a role in neuromuscular excitability (i.e., decreases , the proper function of the conducting myocardial system, heart and muscle contractility, intracellular information transmission and the coagulability of blood (WHO, 2009). Magnesium plays an important role as a cofactor and activator of more than 350 enzymatic reactions including glycolysis, ATP metabolism, transport of elements such as sodium, potassium, and calcium through membranes, synthesis of proteins and nucleic acids, neuromuscular excitability and muscle contraction (WHO, 2009). For all these reasons and others, this study in significant for Basrah citizens, because of the people in Basrah drink RO water, which is low in calcium and magnesium.

2- Materials and Methods

Different RO water samples, and municipal (governorate) water were collected from 10 populated regions with high populations at Basrah city, namely: Hartha, Qurna, Abul Khaseeb, Jazaaer, Junaina, Kebla, Khour Al Zubair, Tanuma, Hyania and Al Zubair, through January, May and December 2012, using triplicate samples for each month. The water samples were collected in polyethylene with 1 liter per each sample. Samples were collected in cool box, and transferred to the laboratory for analysis. Titration methods were used by titrating with Na2EDTA solution to measure total hardness for calcium and magnesium ions, according to APHA (2005).

3- Results and Discussion

Table 1 and figures 1, 2 and 3 show average concentrations of total hardness, calcium and magnesium ions for RO and municipal waters respectively, compared to Iraqi and WHO guidelines for drinking water.

The present study showed a decrease in the total hardness of RO water substantially in all regions of study, compared to Iraqi and WHO guidelines (Table 1 ,Fig. 1), the lower average of total hardness 19.5 ppm at Junaina region, and the highest value in at Qurna region 60 ppm. Also, the present study documented that RO water is low in calcium and magnesium in all investigated regions. The reported results gave 5.9-11.8 ppm and 4.4-13.9 ppm for calcium and magnesium respectively. Therefore, the recorded concentrations of total hardness, calcium and magnesium ions in RO water are less than, the excepted according to the Iraqi and WHO guidelines (Table, 1 ,Fig. 2,3). The difference in total hardness, calcium and magnesium concentrations in RO water may be attributed to the process of desalinization which remove the minerals from the raw water, and without the introduction of remineralization step. For the municipal water, the averages for total hardness are found within or higher than the proposed in all study regions, except Al Zubair region which gave hardness concentration lower than the permitted levels, according to Iraqi and WHO guidelines (Table, 1 and Fig. 1). Also, the municipal water showed higher concentrations than reported for calcium and magnesium ions, except for Qurna, Jazaair and Hyania regions; as those were within the permitted levels. Al Zubair region gave lowest concentration for municipal water compared to Iraqi and WHO guidelines (Table, 1, Fig. 2,3). The high concentrations of hardness, calcium and magnesium ions particularly in municipal water is due to the presence of these elements in water sources that taken from these regions (Moyel, 2010). Also, it is due to the low efficiency of the purification stations, which are contributed substantially for elements removals from water supplied in these regions.

Since early 1960's, epidemiological studies in many countries all over the world have reported that soft water (i.e., RO water) and water low in magnesium are associated with increased morbidity and mortality from cardiovascular disease (CVD) compared to hard water and water high in magnesium (Sauvant and Pepin 2002; Donato *et al.* 2003; Monarca *et al*. 2003. Recent studies also suggest that the intake of soft water, i.e. water low in calcium, may be associated with higher risk of fracture in children (Verd Vallespir *et al*. 1992), certain neurodegenerative diseases (Jacqmin *et al.*

1994), pre-term birth and low weight at birth (Yang *et al*. 2002) and some types of cancer (Yang *et al*. 1997; Yang *et al*. 1998). In addition to an increased risk of sudden death (Eisenberg 1992; Bernardi *et al*. 1995; Garzon and Eisenberg 1998), the intake of water low in magnesium seems to be associated with a higher risk of motor neuronal disease (Iwami *et al*. 1994), pregnancy disorders (so-called preeclampsia) (Melles & Kiss 1992), and some types of cancer (Yang *et al*. 1999a; Yang *et al*. 1999b; Yang *et al*. 1999c; Yang *et al*. 2000). More studies have provided additional information about minimum and optimum levels of minerals that should be in demineralised water, Based on this studies, various researchers have recommended that the following levels of calcium, magnesium, and water hardness should be in drinking water: For magnesium, a minimum of 10 mg/l (Novikov *et al*. 1983; Rubenowitz *et al.* 2000) and an optimum of about 20-30 mg/l (Durlach *et al.* 1989; Kozisek 1992); for calcium, a minimum of 20 mg/l (Novikov *et al*. 1983) and an optimum of about 50 (40-80) mg/l (Rakhmanin *et al*. 1990; Kozisek 1992); for total water hardness, the sum of calcium and magnesium should be 200 to 400 mg/l (Plitman *et al.* 1989; Lutai 1992; Muzalevskaya *et al.* 1993; Golubev and Zimin 1994). When comparing the concentrations of total hardness, calcium and magnesium ions in drinking water in the current study with the concentrations proposed by researchers above, we find that RO water used for drinking in Basrah city is not suitable from health, due to the deficiency of calcium and magnesium ions, such ions are demanded for human health.

Table 1: Average concentrations of total hardness, calcium and magnesium in drinking water (RO), and municipal water in comparison with Iraqi and WHO guidelines.

		Hartha	Qurna	Abul Khaseeb	Jazaaer	Junaina	kebla	Khour Al Zubair	Tanouma	Hyania	Al Zubair
Total Hardness (ppm)	RO Water	24	60	33	22	19.5	32	28	30	36	25
	Tap Water	488	340	710	340	480	370	650	630	340	180
	WHO guideline	250	250	250	250	250	250	250	250	250	250
	Iraqi guideline	400	400	400	400	400	400	400	400	400	400
Ca (ppm)	RO Water	8.6	11.8	8.6	9	5.9	9.8	10.4	8.2	7.9	7
	Tap Water	86	90	88	122	88	66	56	110	102	86
	WHO guideline	50	50	50	50	50	50	50	50	50	50
	Iraqi guideline	75	75	75	75	75	75	75	75	75	75
Mg (ppm)	RO Water	5.4	13.9	7.5	4.8	4.4	7.2	6.2	6.8	8.3	5.7
	Tap Water	74.6	48	128.5	46.8	82.1	56	111.8	107.7	47.9	23
	WHO guideline	30	30	30	30	30	30	30	30	30	30
	Iraqi guideline	50	50	50	50	50	50	50	50	50	50

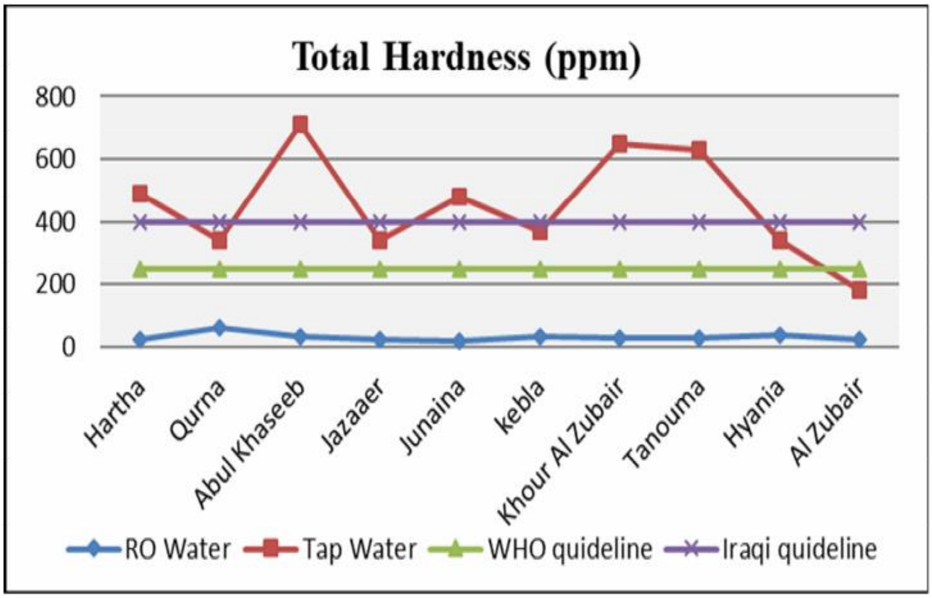

Fig. 1 : Average concentrations of total hardness in drinking water (RO), and municipal water in comparison with Iraqi and WHO guidelines

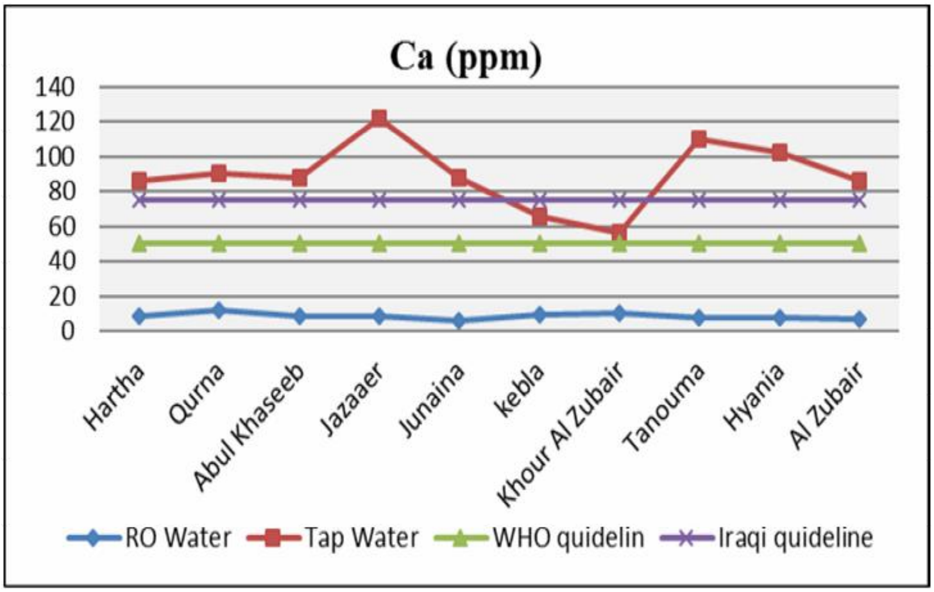

Fig. 2 : Average concentrations of calcium in drinking water (RO), and municipal water in comparison with Iraqi and WHO guidelines

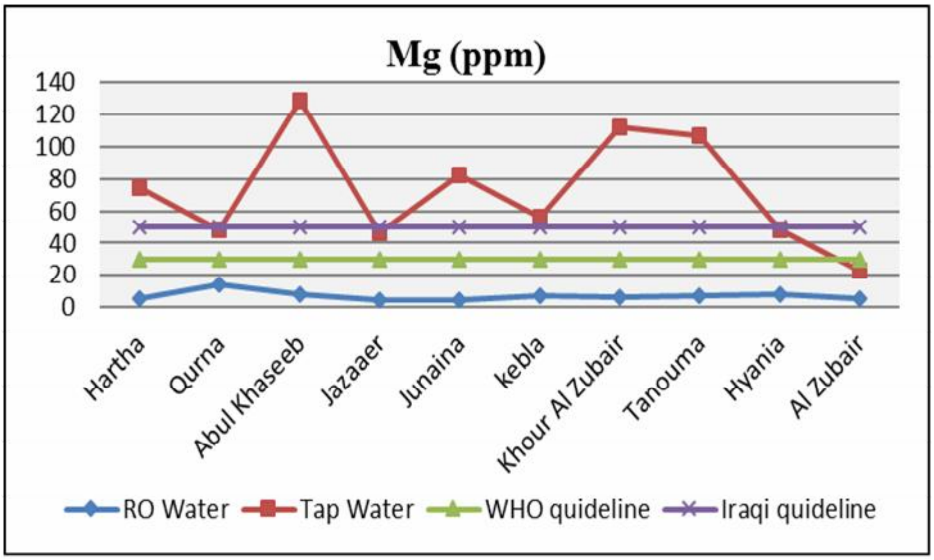

Fig. 3 : Average concentrations of magnesium in drinking water (RO), and municipal water in comparison with Iraqi and WHO standards.

4- Recommendations

To guarantee the lower permitted concentrations of calcium and magnesium ions in drinking water according to Iraqi and WHO guidelines, the following points are recommend:

1- Formulation of limited laws concerning water treatment and technology for decreasing calcium and magnesium in drinking water (such as RO water) to maintain the contents of calcium and magnesium within healthy limited ranges.

2- For the use of RO for drinking, the amounts of mineral contents has to be adjusted by using filter containing calcium carbonate or passing carbon dioxide in water or addition of calcium compounds, such as lime water (calcium hydroxide), which is added directly to the water. Unfortunately, such additions will increase the magnesium ions slightly. Therefore, a filter should be developed using calcium carbonate and magnesium carbonate or calcium carbonate and magnesium oxide to adjust the amounts of calcium and magnesium together.

3- The ratio of calcium to magnesium should be maintained at 1:2 calcium to magnesium.

4- Increasing the medical awareness for society and attention to educate people for the importance of mineral containing water, such as bottles containing calcium and magnesium ions, instead of drinking the available RO waters, which do not contain the accepted levels of calcium and magnesium ions

5-References

APHA, AWWA, WEF. (2005). Standard Methods for The Examination of Water and Wastewaters, 21st Edition .American public Health Association. Washington DC.

Bernardi, D., Dini, F.L., Azzarelli, A., Giaconi, A., Volterrani, C. and Lunardi, M. (1995) artery disease and low hardness of drinking water. *Angiology* 46, 145-149.

Donato, F., Monarca, S., Premi, S., and Gelatti, U (2003) Drinking water hardness and chronic degenerative diseases. Part III. Tumors, urolithiasis, fetal malformations, deterioration of the cognitive function in the aged and atopic eczema. *Ann. Ig.* **15**, 57-70.

Durlach, J., Bara, M. and Guiet-Bara, A. (1989). Magnesium level in drinking water: its importance in cardiovascular risk. In *Magnesium in Health and Disease* (ed. Y.Itokawa and J.Durlach), pp. 173-182, J.Libbey & Co Ltd, London.

Eisenberg, M.J. (1992). Magnesium deficiency and sudden death. *Am. Heart J.* 124, 544-549.

Fewtrell, L. and Bartram, J. (2001). Water Quality Standards and Health. Assessment of Risk and Risk Management for Water Related Infectious Disease. IWA Publishing, London, UK.

Garzon, P. and Eisenberg, M.J. (1998) Variation in the mineral content of commercially available bottled waters: implication for health and disease. *Am. J. Med.* 105, 125- 130.

Golubev, I.M. and Zimin, V.P. (1994) On the standard of total hardness in drinking water. *Gig. Sanit.* No. 3: 22-23.

Iwami, O., Watanabe, T., Moon, Ch.S., Nakatsuka, H. and Ikeda, M. (1994) Motor neuron disease on the Kii Peninsula of Japan: excess manganese intake from food coupled with low magnesium in drinking water as a risk factor. *Sci. Total Environ*149, 121-135.

Jacqmin, H., Commenges, D., Letenneur, L., Barberger-Gateau, P. and Dartigues, J.F. (1994). Components of drinking water and risk of cognitive impairment in the elderly. *Am. J. Epidemiol.* 139, 48-57.

Kozisek, F. (1992). *Biogenic value of drinking water.* Ph.D. thesis. National Institute of Public Health, Praha.

Lutai, G.F. (1992). Chemical composition of drinking water and the health of population. *Gig. Sanit.* No. 1: 13-15.

Melles, Z. and Kiss, S.A. (1992). Influence of the magnesium content of drinking water and of magnesium therapy on the occurrence of preeclampsia. *Magnes. Res.* 5, 277-279.

Moyel, M.S., (2010). Assessment of water quality of the northern part of Shatt Al Arab River, using water quality index

(Canadian version). M. Sc.thesis. Basrah University, Iraq.

Muzalevskaya, L.S., Lobkovskii, A.G. and Kukarina, N.I. (1993). Incidence of chole - and nephrolithiasis, osteoarthrosis, and salt arthropathies and drinking water hardness. *Gig. Sanit.* No. 12/1993, 17-20.

Novikov, J.V., Plitman, S.I., Levin, A.I. and Noarov, J.A. (1983) Hygienic regulation for the minimum magnesium level in drinking water. *Gig. Sanit.* No. 9: 7-11.

OECD. (2003). Assessing Microbial Safety of Drinking Water: Improving Approaches and Methods, IWA Publishing, Alliance House. London, UK.

Plitman, S.I., Novikov, Yu.V., Tulakina, N.V., Metelskaya, G.N., Kochetkova, T.A. and Khvastunov, R.M. (1989). On the issue of correction of hygenic standards with account of drinking water hardness. *Gig. Sanit.* No. 7 :7-10.

Rakhmanin, Yu.A., Filippova, A.V., Michailova, R.I., Belyaeva, N.N., Lamentova, T.G., Kumpan, N.B. and Feldt, E.G. (1990). Hygienic assessment of mineralizing lime materials used for the correction of mineral composition of low-mineralized water. *Gig. Sanit.* No. 8: 4-8.

Rubenowitz, E., Molin, I., Axelsson, G. and Rylander, R. (2000) Magnesium in drinking water in relation to morbidity and mortality from acute myocardial infarction. *Epidemiology* **11**: 416-421.

Sauvant, M-P. and Pepin, D. (2002) Drinking water and cardiovascular disease. *Food Chem. Toxicol.* 40**,** 1311-1325.

The Iraqi standards for drinking water no. 417 (1981). Ministry of planning and development cooperation. The central institute for standardization and quality central. Republic of Iraq.

Verd Vallespir, S., Domingues Sanches, J., Gonzales Quintial, M., Vidal Mas, M., Mariano Soler, A.C., de Roque Company, C. and Sevilla Marcos, J.M. (1992). Association between calcium content of drinking water and fractures in children. *An. Esp. Pediatr.* 37: 461-465.

WHO (2009). Calcium and magnesium in drinking water: public health significance. World Health Organization, Geneva, 194 p.

Yang, Ch.Y., Chiu, H.F., Chiu, J.F., Tsai, S.S. and Cheng, M.F. (1997) Calcium and magnesium in drinking water and risk of death from colon cancer. *Jpn. J. Cancer Res.* 88, 928-933.

Yang, Ch.Y., Cheng, M.F., Tsai, S.S. and Hsieh, Y.L. (1998) Calcium, magnesium, and nitrate in drinking water and gastric cancer mortality. *Jpn. J. Cancer Res.* 89, 124-130.

Yang, Ch.Y., Chiu, H.F., Cheng, M.F., Tsai, S.S., Hung, Ch.F. and Lin, M.Ch. (1999a) Esophageal cancer mortality and total hardness levels in Taiwan's drinking water. *Environ. Research*, Section A 81, 302-308.

Yang, Ch.Y., Chiu, H.F., Cheng, M.F., Tsai, S.S., Hung, Ch.F. and Tseng, Y.T. (1999b) Pancreatic cancer mortality and total hardness levels in Taiwan's drinking water. *J. Toxicol. Environ. Health* A 56, 361-369.

Yang, Ch.Y., Tsai, S.S., Lai, T.Ch., Hung, Ch.F. and Chiu, H.F. (1999c) Rectal cancer mortality and total hardness levels in Taiwan's drinking water. *Environ. Research*, Section A 80, 311-316.

Yang, Ch.Y., Chiu, H.F., Cheng, M.F., Hsu, T.Y., Cheng, M.F. and Wu. T.N. (2000) Calcium and magnesium in drinking water and the risk of death from breast cancer. *J. Toxicol. Environ. Health*, Part A 60, 231-241.

Yang, Ch.Y., Chiu, H.F., Chang, Ch. Ch., Wu, T.N. and Sung, F.Ch. (2002) Association of very low birth weight with calcium levels in drinking water. *Environ. Research*, Section A 89, 189-194.

مقارنة تراكيز العسرة الكلية وأيونات الكالسيوم والمغنسيوم في مياه RO المستخدمة للشرب ومياه الإسالة مع المواصفات المحلية والعالمية (WHO) لمياه الشرب في محافظة البصرة، العراق.

محمد سالم مويل، علي حسين امتيغي، طارق كاظم ناصر، ايناس عوني مهدي، بثينه مهدي يونس ومحاسن غفار هاشم

قسم الكيمياء البيئية البحرية، مركز علوم البحار، جامعة البصرة

الخلاصة

جمعت نماذج من مياه RO (Reverse osmosis water) (وهي مياه صناعية يكون محتواها من المعادن والأملاح الضرورية للجسم قليل جداً) المستخدمة للشرب ومياه الإسالة من عشرة مناطق رئيسة في محافظة البصرة خلال أشهر كانون الثاني وحزيران وتشرين الثاني لعام 2012 وبواقع ثلاث عينات شهرياً، لتقدير تراكيز العسرة الكلية وأيونات الكالسيوم والمغنسيوم ومقارنتها مع المعايير والمواصفات القياسية المحلية والعالمية. أوضحت نتائج الدراسة انخفاض تراكيز العسرة الكلية وأيونات الكالسيوم والمغنسيوم في مياه RO عن الحدود المسموح بها حسب المعايير والمواصفات القياسية، إذ تراوح معدل تراكيزها بين (19.5–60 ppm) و (5.9–11.8 ppm) و (4.4–13.9 ppm) على التوالي. أما مياه الإسالة فقد كانت معدلات تراكيز العسرة الكلية وأيونات الكالسيوم والمغنسيوم فيها ضمن أو أعلى مما هو مقرر في المعايير والمواصفات القياسية لمياه الشرب المحلية والعالمية في جميع مناطق الدراسة، عدا منطقة الزبير التي سجلت فيها تراكيز أوطأ لأيون المغنسيوم في مياه إسالتها عند مقارنتها مع المعايير والمواصفات القياسية المحلية والعالمية. اعتماداً على النتائج المستحصلة من الدراسة الحالية تبين أن مياه RO قد تكون غير آمنه صحياً لانخفاض تراكيز العسرة الكلية وأيوني الكالسيوم والمغنسيوم فيها والتي تمثل عناصر مهمة للصحة العامة.

كلمات دالة: مياه RO ، العسرة، الكالسيوم والمغنسيوم، الصحة، البصرة، العراق.

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MARSH BULLETIN

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Factors Affecting Three Species Of The Emergent Macrophytes Assemblages Along East Hammar marsh

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Abstract

The communities of emergent macrophytes and environmental factors were studied in four sites of East Hammar marsh (Harer, Al-Sadda, Al-monthory and Burka)during January to December of 2010. This research aimed to identify possible present and past data of some environmental factors and human activities in the surrounding land-use. Quantitative data were collected on emergent macrophytes density, vegetation cover, biomass and their relationships with environmental factors and human activities(cutting and grazing processes). Three different perennial species *Typha domingensis*, *Phragmites australis* and *Schoenoplectus litoralis* were dominated in East Hammar is subject to many anthropogenic activities and impact of human toward emerged plants vegetation cover and biomass was more than changing in water quality of the marsh.

Key word: emergent macrophytes, water quality, human impact, East Hammar marsh

1- Introduction

Macrophytes species are of crucial importance in aquatic ecosystems as they serve ecological roles in their environment (Gouder and Mahy,2004), such as determining water quality, quantity and providing a structured habitat (Arts *et al.*, 1990; Toivonen and Huttunen, 1995). Emergent macrophytes grow in the littoral region of the most wetlands and they are biologically and ecologically adapted to a variety of aquatic ecosystem(Sculthorpe, 1985). Some environmental conditions such as water depth, clarity, pH, salinity or temperature influencing both the distribution and aquatic macrophytes productivity (Madsen *et al*.,2001; van Geest *et al*.,2005). However, aquatic plants have large distributional ranges.

The vegetation cover is a useful tool for monitoring the condition of the water surface and the health of wetland. Human population growth and its associated activities have altered the landscape, hydrologic cycles, and the flux of nutrients essential to plant growth at accelerating rates over the last several centuries. Humans have had a major impact on the earth's waterways: rivers, lakes, oceans. The detrimental effects of human activities are starting to become apparent. One such location where this is evident, is East Hammar marsh. Many authors had recorded diverse aquatic macrophytes in previous studies of this marsh (Alwan,2006; IMRP,2007; Al-Abbawy,2009; Al-Abbawy and Al-Mayah,2010). Al-Abbawy(2009) studied E.Hammer in details for the period extended to 24 months began from November 2006 including water quality and macrophytes assemblage.

The aims of this paper are:

-To bring out changes in emergent macrophytes vegetation cover and biomass.

-Assessment of water quality status.

-To compare present data with past data of Al-Abbawy 2009.

2- Material and methods

Study site

East Hammar marsh is a tidal freshwater marsh which is the largest lakes in the southern Iraqi marshes. Diverse aquatic plants included emergent, submergent and others consist the marsh landscape. Four sites were chosen in East Hammer marsh named (1)Harer, (2)Sadaa, (3)Manthori and (4)Burga (Figure 1).

Plant samples and analysis

Plants were sampled during January to December 2010 in four sites of the tidal marsh E. Hammar. Assessment and analyses of the emergent plant communities were based on transect method using randomly sampling plots(Braun-Blanquet, 1964), within each plot a square of 1m × 1m at every meter mark was situated at random , ten transects were established and is listed the species present in each quadrate. After sampling, the samples were taken to the laboratory for confirmative identification and deposited in Basra University Herbarium (BSRA). The plants were identified based on Flora of Iraq(Townsend and Guest, 1968; Townsend and Gest,1985). Each site was monitored to detect the biomass of the emergent macrophyte communities. Biomass was determined by harvest , Five permanent blocks around each study site were chosen for the dominant species by using quadrates 1x1 m^2 separated by 20m were randomly chosen at July 2010(Peak of biomass) from each block.

Environmental analysis

In each site, estimation of some parameters by monthly monitoring of water depth(cm),Dissolved Oxygen(DO) mg/l, pH, electrical conductivity µS/cm(EC) and nutrient mg/l (Nitrate and Phosphate).

Statistical analysis

Examination of variation in the density of emergent macrophytes among study sites. The values were computed, analyzed and presented as mean ± standard deviation. Regression analysis was conducted to determine spatial and temporal correlations between locations and seasons respectively. Differences were regarded to be significant at 95% confidence limit ($p \leq 0.05$).

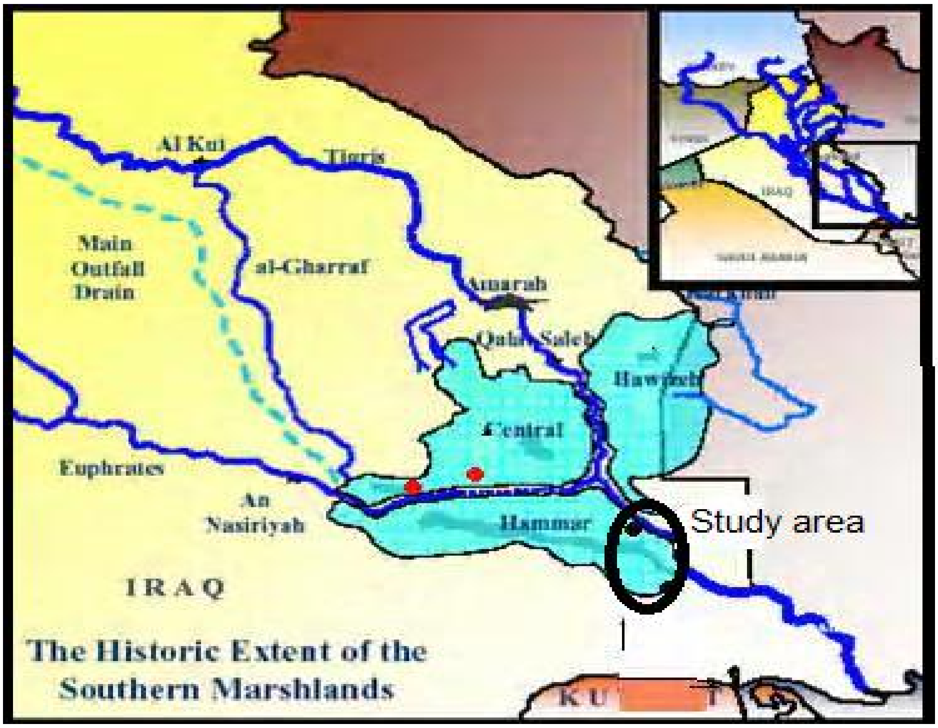

Figure1: Map of study area

3-Results

This study provides data on the physico-chemical parameters and inorganic nutrient load of water of East Hammer marsh. The figures 2&3 and table 1 showed the seasonally changes in water depth, that varied between 40-300 cm. Dissolved Oxygen values were ranged between 4.54 to

11.2 mg/l, with mean 7.57±1.3 mg/l. The variation in pH values at each season for study area ranged from 7.02 to 8.4, the values of the pH reached top during the summer months and least during winter months.

Seasonally rate of change in the values of electrical conductivity among the stations ranged between 4630-7600 µS/cm and mean of 6075±366 µS/cm. Contrast, quarterly and a clear distinction between the stations, reached to top during the summer months and least during winter months . It was clear that the highest values for nitrate were during the winter season and the least of which was during the summer season. There were significant difference among different seasons in the means of NO_3 ($P<0.05$). Results of the assessment of some parameters during present and past are presented in table 1.

It was clear that the values of conductivity and nutrient were higher in present study than the past data.

Emergent Macrophytes

Table 2 shows a list of notable emergent aquatic plants that have been recorded during environmental survey in E. Hammar marsh, the count of three common species returns to three different families. Noticeable variations in the rates of quarterly percentages of vegetation cover in the stations of the study (figures4,5 and 6), the highest values of vegetation were recorded in summer season. The highest values of *Phragmites* community vegetation at the station 2, while the communities of *Typha* and *Schoenoplectus* in the station 4. Highly significant relationships($P<0.05$) were recorded among vegetation, density and plant height for both *Phragmites australis and Typha domingensis ,* while only vegetation cover-density relationship was significant for *Schoenoplectus litoralis.* Biomass values were varied between species and stations. The highest values record in *Typha* reached 356 g/m^2 followed by *Phragmites* and *Schoenoplectus* respectively.

Figure 7 explains that the biomass of emergent aquatic plants in E. Hammar marsh were lower than that of past data, while figure 8 showed a weak relationship between cover and biomass of studied plants.

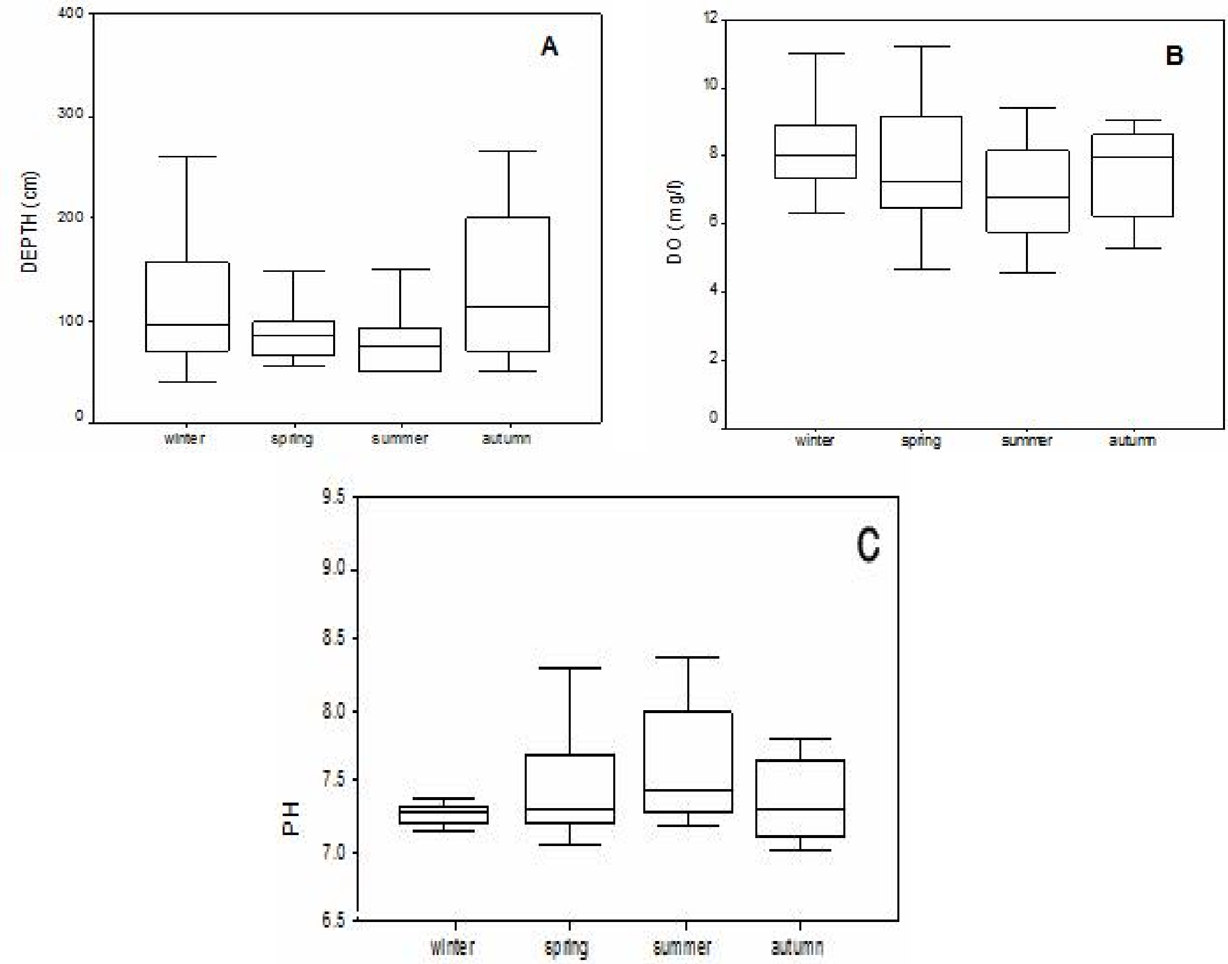

Figure 2(A-C): Box plot comparisons of East Hammar marsh seasonal conditions of water depth(cm), DO(mg/l) and pH.

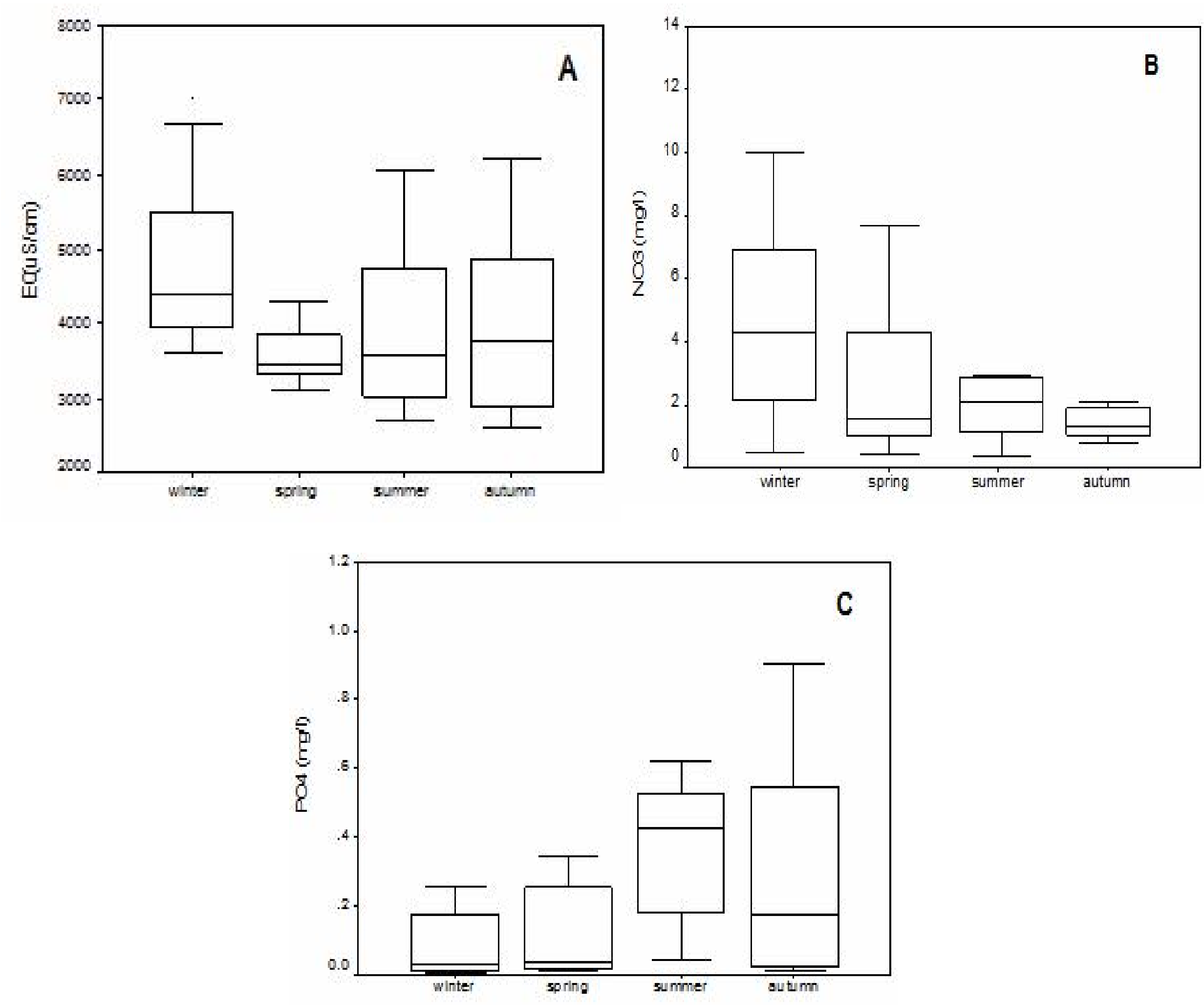

Figure3(A-C): Box plot comparisons of East Hammar marsh seasonal conditions of conductivity(µS/cm), NO_3(mg/l) and PO_4(mg/l).

Table 1: Annual mean of some water parameters of present and past data for East Hammar marsh.

Pareameter	Unit	Present data	Past data (Al-Abbawy,2009)
DEPTH	cm	107.95	113.8
DO	mg/l	7.57	10.4
pH	-	7.54	8.8
EC	µS/cm	6076	4280
NO_3	mg/l	0.25	5.9
PO_4	mg/l	3.20	0.7

Table 2: Occurrence of emergent aquatic plants in different stations of East Hammar marsh during 2010 .

Month	Station 1 (Harer)			Station 2 (Sadaa)			Station 3 (Manthori)			Station 4 (Burga)		
January	Ph.	Ty.	Sch.	Ph.	Ty.	Sch.	Ph.	Ty.	Sch.	Ph.	Ty.	Sch.
February	+	+	+	+	+	+	+	+	+	+	+	+
March	+	+	+	+	+	+	+	+	+	+	+	+
April	+	+	+	+	+	+	+	+	+	+	+	+
May	+	+	+	+	+	+	+	+	+	+	+	+
June	+	+	+	+	+	+	+	+	+	+	+	+
July	+	+	+	+	+	+	+	+	+	+	+	+
August	+	+	+	+	+	+	+	+	+	+	+	+
September	+	+	+	+	+	+	+	+	+	+	+	+
October	+	+	+	+	+	+	+	+	+	+	+	+
November	+	+	+	+	+	+	+	+	+	+	+	+
December	+	+	+	+	+	+	+	+	+	+	+	+

Ph : *Phragmites australis* , Ty : *Typha domingensis* and Sch : *Schoenoplectus litoralis*

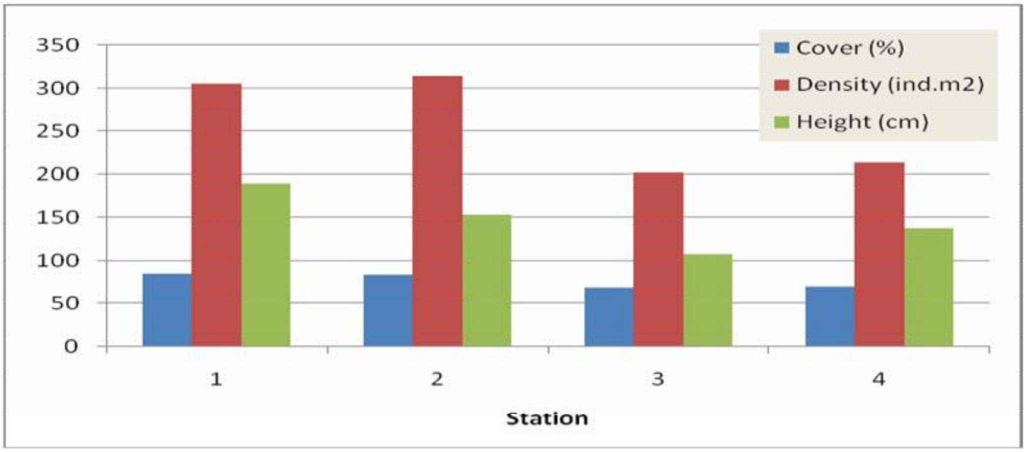

Fig. 4: Percentage of cover vegetation, density and height of *Phragmites australis* in different stations of E. Hammar marsh during 2010.

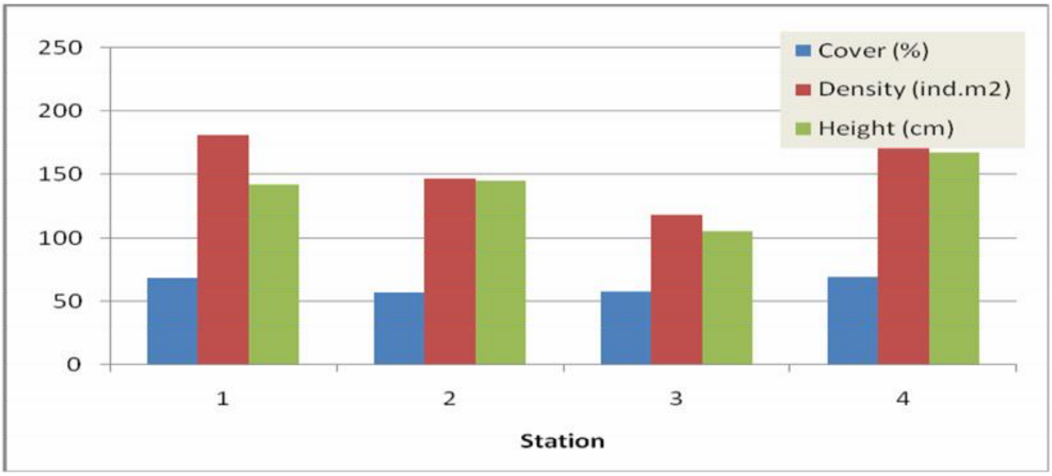

Fig. 5: Percentage of cover vegetation, density and height of *Typha domingensis* in different stations of E. Hammar marsh during 2010.

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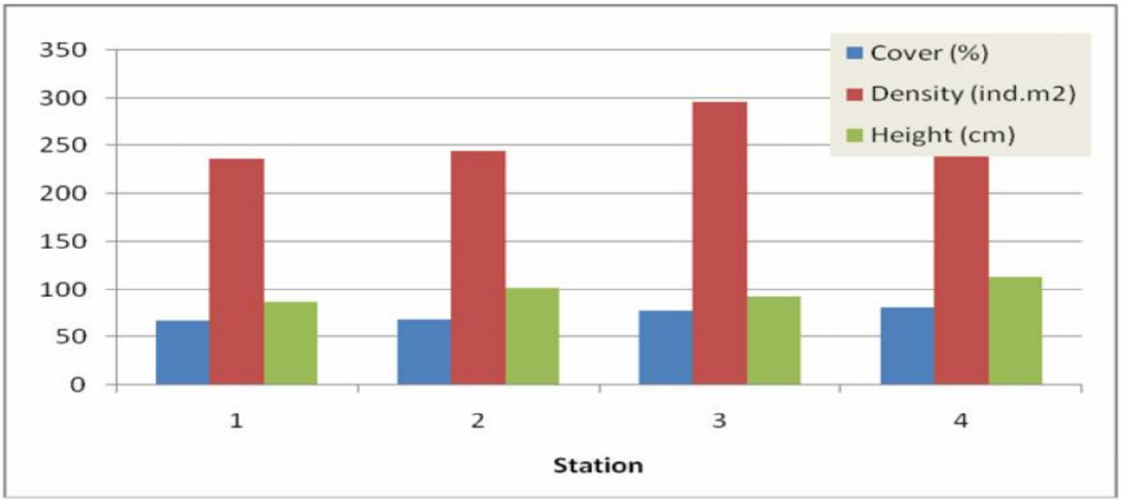

Fig.6: Percentage of cover vegetation, density and height of *Schoenoplectus litoralis* in different stations of E. Hammar marsh during 2010.

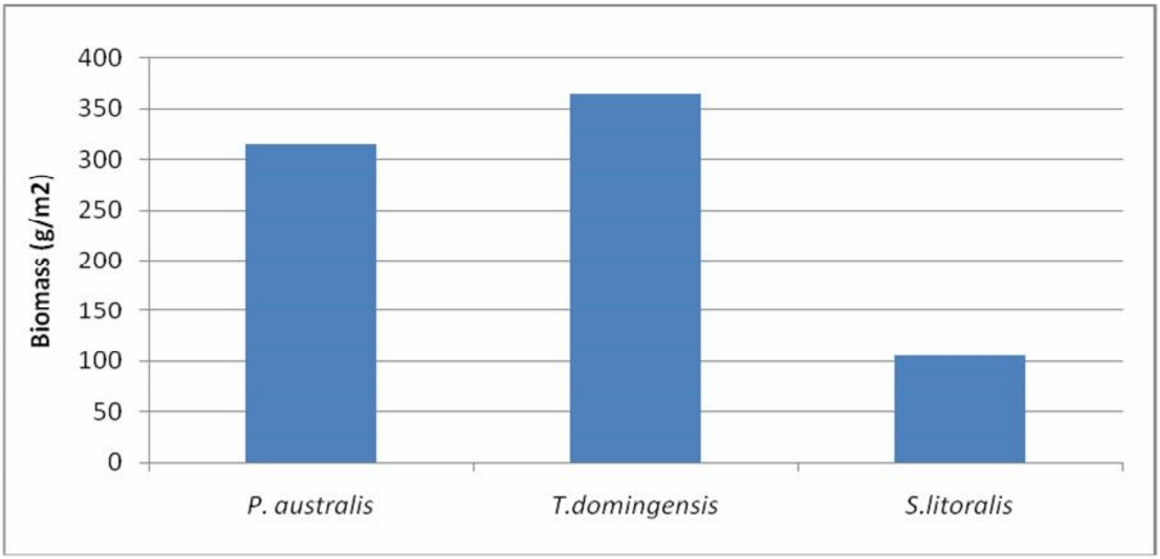

Figure 7: Variation of biomass among different species of common emerged plants in E. Hammar marsh during summer 2010.

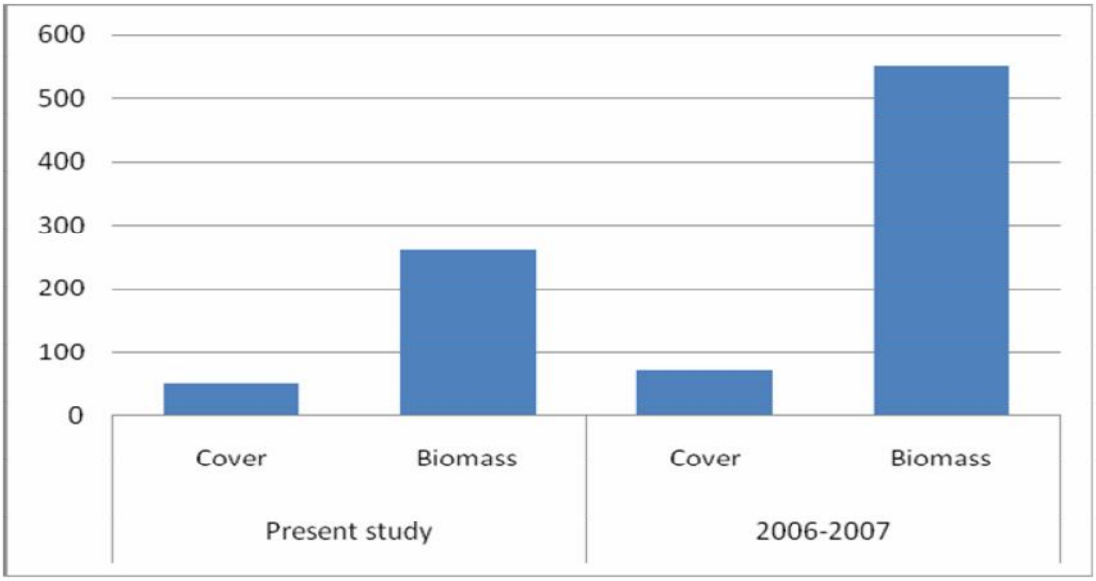

Figure 8: Variation of biomass and cover vegetation of common emerged plants in E. Hammar marsh during summer 2010 and summer 2006-2007.

4- Discussion

Wetland phenomenology is partially defined by plants and animals in residence, but a biotic factors are also crucial in depicting the entirety of the habitat. This study provides data on the physic-chemical parameters and inorganic nutrient load of water in East Hammar marsh. Water depth is a factor which segregates populations. According to different authors explained tolerance of emerged macrophyte to changing in water levels (van der Valk *et al*., 1994; Al-Hilli, 2009). Grace and Wetzel (1982) reported that *Typha* species can grow in well in deeper water (50-115cm) because of its taller leaves and larger rhizome storage system. Grace and Wetzel also suggest that *Typha* can grow in shallow water. Dissolved-* oxygen is considered a primary indicator of the quality of natural water because most aquatic forms of life need oxygen to survive. The values of dissolved oxygen was significantly lower (p=0.05) during the present study season compared to data before 2010 seasons (Al-Abbawy, 2009). The lower dissolved oxygen also implies that the marsh was polluted compared with past data.

Domestic, agricultural, and waste discharge into the marsh directly and indirectly from Shatt Al-Arab River which is a usual practice in this areas. Severity of local declines in dissolved oxygen concentration varies with the waste loading in the marsh. The accumulation of litter increases the amount of organic matter in the wetland. Organic matter provides sites for material exchange and microbial attachment, and is another source of variability of dissolved oxygen among months and sites.

Aquatic organisms are affected by pH because most of their metabolic activities are pH dependent and optimal range for sustainable aquatic life is pH 6.5 – 8.2 (Wang *et al*., 2002; Murdoch *et al*., 2001). Results of the present study showed existence of minor differences among stations and seasons in the slight alkalinity values of pH. Values of electrical conductivity (EC) are a measure of dissolved salts in the water. The highest value of EC were in July of 2010, this may due to salts from Shatt Al-Arab that affected by Persian Gulf, evaporation and evapo-transpiration.

In general, human disturbance in areas adjacent to marsh had the greatest impact on the marsh. The accumulation of such contaminants as one of human impacts can result in changes in structure, function, and processes and alteration in the floral composition can be detected. The shorter turnover time associated with herbaceous vegetation perhaps partially accounts for the greatest impacts being detected in depressional marshes (Reiss *et al*., 2009). The complex environments of the tidal marsh contain a variety of living resources that are ecological and commercial assets. The plants require a delicate balance among the dynamic physical and chemical processes that alter their habitats and affect their distribution. Changes in macrophyte community structure and composition have also been noted through the direct physical impact of cattle trampling wetland vegetation and soil disturbance and to selective grazing by cattle, this was also noted by Jansen and Healey(2003); Coles-Ritchie *et al*.(2007); van Oene *et al*.(1999) and Vulink *et al*.(2000).

The composition of the emerged aquatic plant community and the changes that result from human activities can be used as sensitive indicators of the biological integrity of wetland ecosystems. Aggressive, fast growing species such as cattail (*Typha* spp.), and other clonally species may eventually come to dominate the macrophyte community. The species composition of East Hammar marsh was dominated by the common reed *Phragmites australis*, followed by bulrush *Schoenoplectus litoralis* and less dense of the cattail *Typha domingensis* . The site-specific environmental variables affect species composition. Plant diversity was decreased as conductivity increased. Similar results were observed by Herault and Thoen(2009), who found a negative relationship of hydrophyte species richness with electrical conductivity. *Phragmites* is especially common in alkaline and brackish (slightly saline) environments (Haslam, 1972). Salinity and depth to the water table are among the factors which control the distribution and performance of *Phragmites*. Maximum salinity tolerances vary from population to population; reported maximum range from 12 ppt(1.2%) in Britain to 29 ppt in New York State to 40 ppt on the Red Sea coast (Hocking *et al*.,1983). Dense stands normally lose more water through evapotranspiration than is supplied by rain (Haslam,1970). However, rhizomes can reach down almost 2 meters below ground, their roots penetrating even deeper, allowing the plant to reach low lying ground water(Haslam,1970). Assessment of *Phragmites* , *Typha* and *Schoenoplectus* spreading, quantitative measurements were made for percentage of aerial cover, stem density and culm height, especially at the periphery of the stand. Seasonal data were compared to detect if the colony is expanding and the stand gaining vigor.

Cutting has been used for its importance as food for cattle. If cut just before the end of July, most of the food reserves produced that season are removed with the aerial portion of the plant, reducing the plant's vigor. This regime may eliminate a colony if carried out annually for several years. Grazing is other methods that have often been used to reduce stand vigor(Howerd *et al*.,1978). Grazing may trample the rhizomes and reduce vigor. This regime may eliminate a colony if carried out annually for several years. Grazing is other methods that have often been used to reduce stand vigor(Howard *et al*.,1978). Results of biomass showed that one factor influencing productivity of Typha biomass is that of plant density. Density has an impact on the plant canopy and hence, the stand´s efficiency as a solar collector. Density also influences the degree of competition from other plants. Another factor that increased the plant biomass is the accumulation of such contaminants such as nutrient that can result in changes in structure, function, and processes and alteration in the floral composition. Boyd(1971) found a significant increase in density, shoot height and aboveground yield with increasing fertility levels. It can be concluded that emerged aquatic plants of E. Hammar marsh may susceptible to degradation if subjected to continuous hydrological changes and pollution inputs. The activity that can impair E. Hammar marsh vegetation was grazing by domestic animals and human activities.

4-References

Al-Abbawy, D.A.H. (2009). Qualitative, Quantitative and Ecological study of aquatic macrophytes in southern Iraqi marshes during 2006 and 2007. Ph.D. Thesis, Basrah Univ. Iraq, 205pp.

Al-Abbawy, D.A.H. and A.A.Al-Mayah (2010). Ecological survey of aquatic macrophytes in restored marshes of southern Iraq during 2006 and 2007. Marsh Bull. 5(2):177-196.

Al-Hilli, M.R.A., B.G. Warner, T. Asada and A. Douabul. (2009). An assessment of vegetation and environmental controls in the 1970s of the Mesopotamian wetlands of southern Iraq. Wetlands Ecol. Manage. 17:207-223.

Alwan, A.R.A. (2006). Past and present status of the aquatic plants of the Marshlands of Iraq. J. Marsh Bull. 1(2): 120-172.

Braun-Blanquet, J. (1964). Pflanzensoziologie. Grundzuge der vegetationskunde. pp.856.

Boyd, C.E. (1971). Further studies on productivity, nutrient and pigment relationships in *Typha latifolia* populations. Bull. Torrey Botanical Club. pp 100. 125-131.

Coles-Ritchie, M.C., D.W. Roberts, J.L. Kershner and R.C. Henderson. (2007). Use of a wetland index to evaluate changes in riparian vegetation after livestock exclusion. J. Am. Water Resour.Assoc. 43(3):731-743.

Grace, J.B.and R.G. Wetzel.(1981). Habitat partitioning and competitive displac-ement in cattail (*Typha*) experimental field studies. American Naturalist. 118. pp,463–474.

Haslam, S.M. (1970). The performance of *Phragmites communis* Trin. In relation to water supply. Ann. Bot. N.S.34: 867-877.

Haslam, S.M. (1972). *Phragmites communis* Trin. Biological flora British lsles. J. Ecol. 60:585-610.

Heralut, B. and D. Thoen. (2009). How habitat area, local and regional factors shape plant assemblages in isolated closed depressions. Acta Oecologica, 35:385-392.

Howard, R., D. G. Rhodes, J. W. Simmers. (1978). A review of the biology and potential control techniques for *Phragmites australis*. U.S. Army Engineer Waterway Experiment Station, Vicksburg, MS. 80 pp.

IMRP. (2006). Iraq Marshlands Restoration Program. Final report USAID. 528p.

Jansen, A. and M. Healey. (2003). Frog communities and wetland condition: relationships with grazing by domestic live-stock along an Australian floodplain river. Bio Conserv. 109:207-219.

Murdoch, T., M. Cheo and K. O´Laughlin. (2001). Streamkeeper´r Field Guide: Watershed Inventory and Stream Monitoring Methods. Adopt.-A-Stream Foundation, Everett, W.A. 297 pp.

Reiss, K.C., M.T. Brown and C.R. Lane. (2009). Characteristic community structure of Florida´s subtropical wetlands: the Florida wetland condition index for depressional marshes, depressional forested, and flowing water forested wetlands. Wetlands Ecol. Manage. Springer(Published online).

Sculthorpe, C. D. (1985). The biology of aquatic vascular plants. Koeltz Scientific Books, Knigstein. 610p.

Townsend, CC. and E. Guest. (1968). Flora of Iraq. Gramineae. Ministry of Agriculture. Baghdad. Vol. 9.

Townsend C.C. , E. Guest.and S.A. Omar. (1985). Flora of Iraq .Ministry of Agriculture Republic of Iraq. University Press Glasgow. Monocotyledons:587 pp. Vol. 8.

Van der Valk, A.G., L. Squires and C. H. Welling. (1994). Assessing the impact of an increase in water level on wetland vegetation. Ecol. Appl. 4: 525-564.

Van Geest, G.J., F.C.J.M. Roozen, H. Coops, R.M.M. Roijackers, A.D. Buijse, E.T.H.M. Peeters and M. Scheffer. (2003). Vegetation abundance in lowland flood plain lakes determined by surface area, age and connectivity. Freshw. Biol. 48: 440-454.

Van Oene, H., E.J. Mieleke van Deursen and F. Berendse. (1999). Plant herbivore interaction and its consequence for succession in wetland ecosystems: a modeling approach. Ecosystems(N.Y., Print)2: 122-138

Vulink J.T., H.J. Drost, and L. Jans. (2000). The influence of different grazing regimes on *Phragmites* and shrub vegetation in the well-drained zone of a eutrophic wetland. App. Veg. Sci. 3:73-80.

Wang, W., A. Wang, L. Chen, Y. Liu, and R. Sun. (2002). Effects of pH on survival, phosphorus concentration, adenylate energy charge and Na^+ K^+ ATP ase activities of *Penaeus chinensis* Osbeck Juveniles, Aquatic Toxicology, 60, 75-83

العوامل المؤثرة في ثلاثة أنواع من مجتمعات النباتات المائية البارزة في هور شرق الحمار

دنيا علي حسين العباوي و وداد مزبان طاهر و مهنا قاسم حبيب

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الخلاصة

تم دراسة المجتمع النباتي البارز والعوامل البيئية في أربع محطات محددة في هور شرق الحمار (حرير والسدة والمنذوري والبركة) خلال المدة من كانون الثاني إلى نهاية كانون الأول 2010. هدف البحث الحالي إلى إبراز أهمية بعض العوامل البيئية وفعاليات الإنسان الحالية والماضية ضمن المنطقة المحيطة بمحطات الدراسة . سجلت البيانات الكمية للنباتات البارزة مثل الكثافة والغطاء النباتي والكتلة الحية وعلاقتها بالعوامل البيئية وفعاليات الإنسان مثل الحش ورعي الجاموس.

ساد في منطقة الدراسة ثلاثة أجناس نباتية دائمة الخضرة هي البردي والقصب والجولان . سجلت تغيرات شهرية في التغطية النباتية لمحطات الدراسة المختلفة وأشارت النتائج إلى إن هور شرق الحمار عرضة للعديد من الفعاليات البشرية التي كان فيها تأثير الإنسان أكثر ضررا من التغير في بعض العوامل البيئية على الغطاء النباتي والكتلة الحية لمجتمعات النباتات البارزة .

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Aims and scope

Marsh Bulletin is a perfect Journal stated by AMAR International Charitable Foundation concerned with all aspects of wetlands biology, ecology, hydrology, water chemistry, Geochemistry Biodiversity conservation, Agriculture and Fisheries, Pollution, Natural Resources, Social and Health issues and Tourism.

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4. The numbers of pages should not be more then (15). The researches should be printed in a form of two columns from the introduction to the end. This should not be applied to the abstract.
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3. After the agreement on the research, the rights of publication should be handed to the researcher.
4. During three months, the researcher should be acquainted with the apology or acceptance or any required corrections on his research.

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