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Water Quality of Al-Dalmaj Marsh, Iraq

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Abstract - Samples of water were taken during February 2018 to November 2018 at ten stations in Al-Dalmaj Marshes, to cover all the marsh area. Physical and chemical properties including the natural water quality parameters, Total Dissolved Solids (8270-10781 mg/l), Turbidity (2.63-5.72 NTU), Electrical Conductivity (12.92-17.12mS/cm), Total Hardness (3204-4034 mg/l), Water Temperature (18-40 ºC), Air Temperature (20-45 ºC), Salinity (1.72-10.94 PSU), pH (6.98-7.61), Total Alkalinity (396.8-443 mg/l), Calcium (468-607 mg/l), Magnesium (492-687 mg/l), Chloride (2977-4286 mg/l), Sodium (568-1221 mg/l), Potassium (29-84 mg/l), Bicarbonate (137-1210 mg/l) and Sulfates (706-984 mg/l). The above values show the seasonal variations of water variables at the study stations using statistical methods to verify the results, and these results provide important reference information for further study.

نوعية المياه في هور الدلمج - العراق

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المستخلص - درست نوعية مياه هور الدلمج خلال الفترة من شباط 2018 إلى كانون الاول 2018 في عشر محطات، وتم اختيار هذه المحطات لتغطي جميع مياه الهور. فقد تناولت الدراسة الحالية المتغيرات الفيزيائية والكيميائية المتمثلة بنوعية المياه من قياس كمية المواد الصلبة والتوصيلة الكهربائية وحرارة الماء والهواء والدالة الحامضية والعكارة والملوحة والقاعدية الكلية فضلاً عن قياس تراكيز الايونات الموجبة والسالبة. تراوح معدل الدالة الحامضية (6.98-7.61) والتوصيلة الكهربائية (12.92-17.12 ملي موز/سنتمتر) والمواد الصلبة الكلية (8270-10781ملغم/لتر) والملوحة (1.72-10.94 PSU) والعكارة (2.63-5.72 NTU) والقاعدية الكلية (396.8-444 ملغم/لتر) والعسرة الكلية (3204-4034 ملغم/لتر) ودرجة حرارة الماء (18-40 درجة مئوية) ودرجة حرارة الهواء (20-45 درجة مئوية) والبيكربونات (137-1210 ملغم/لتر) والكالسيوم (468-607 ملغم/لتر) والمغنيسيوم (492-687 ملغم/لتر) والكبريتات (706-984 ملغم/لتر) اما قيم الكلور فكانت (2977-4286 ملغم/لتر) والصوديوم (568-1221 ملغم/لتر) والبوتاسيوم (29-84 ملغم/لتر). توضح القيم أعلاه التباينات الموسمية لمعاملات المياه عند محطات الدراسة وباستعمال الاساليب الاحصائية لإيجاد النتائج، وتوفر هذه النتائج معلومات مرجعية مهمة لمزيد من الدراسات.

الكلمات المفتاحية: نوعية مياه، هور الدلمج،متغيرات فيزيائية، الكاتيونات والأنيونات.

Introduction

Some specific wetlands of the southern part of Iraq play an important role in the conserving diversity of species in the Middle East, because of their large size, and the abundance of their aquatic flora and their separation from other systems (Bedair *et al.*, 2006). The marshes are considered as biological filters of the earth, and are often called " Earth's Kidney".

They are considered as intermediate region between aquatic and terrestrial systems and play a significant role in purifying the polluted water for centuries.

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The majority of the marshes have been exploited for their natural cleaning capacity in assimilating different contaminants (Joyce, 2012). The quality of the surface water is of great importance comparable to the importance of the presence of water and its quantity, particularly in arid and semi-arid areas. So, the physical and chemical properties can be used to recognize the quality of waters for the agricultural, industrial and irrigation purposes and others.

The study of the quality of water includes a description of its constituents and their relationship with the distance traveled by the river. Salinity coefficient is one of the most important factors affecting the quality of surface water, in addition to other parameters (Jazaa, 2009).

The marsh system can act as a sink of various compounds either through sedimentation or bioaccumulation (Mitsch and Gosselink, 2007).

There are several materials or energy that are introduced directly or indirectly to the aquatic environment as a result of various human activities, and that lead to harmful effects on human health and aquatic organisms, and also lead to disruptive kinds of water activities. Otherwise, a change in the properties of water will lose its validity for use in different purposes (GESAMP, 1993).

Most studies were focused upon the physical and chemical parameters, as well as ecological aspects (Al-Atbee, 2018; Al-Hejuje, 2017; Al-Hejuje, 2015; Khuzaie, 2015; Al-Haidary, 2009; Al-Saadi, 2008; Al-Saad and Al-Timari, 1993; Al-Saadi and Al-Mousawi, 1988; Al-Arajy, 1988; Al-Lamei, 1986). A field study was initiated to assess the extent and magnitude of water quality threats of the marsh area. The physical and chemical aspects of the water provide valuable indications of the overall health of the ecosystem in question.

Materials and Methods

Water samples were collected seasonally, for the period from February 2018 to November 2018. This study was carried out involving 10 fixed stations as shown in Figure (1). (St. 1, St. 2b (before feeding), St. 2a (after feeding), St. 3, St. 4, St. 5b (before discharge), St. 5a (after discharge), St. 6, St. 7 and St. 8) in the Al-Dalmaj marsh.

Parameters like water and air temperatures were measured by simple thermometers with a range of 10-100 ºC graduate at 0.2 ºC, pH was measured using pH meters model HANNA HI-9821. Electrical Conductivity (EC) was measured using portable digital conductivity meters (WTW3301). TDS, HCO_3 and SO_4 were analyzed according to the standard method given in APHA (2005), while the rest of parameters such as TH, Mg, Ca, Na, K and Cl were analyzed by Salinometer.

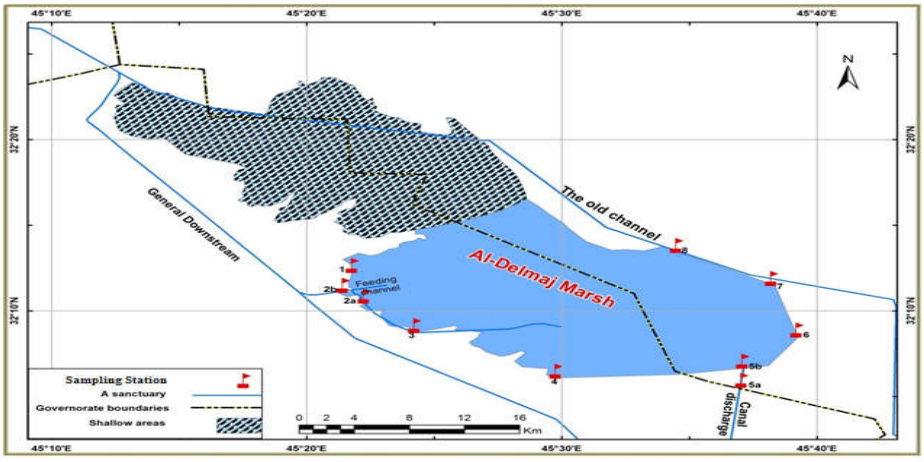

Figure 1. Map of Al-Dalmaj marsh showing sampling locations.

Results and Discussions

The results of the present study showed that air temperature in all stations were high during summer and low during winter (Tables 1, 2, 3 and 4). At all the stations during all seasons it ranged from (20-45 ºC), seasonal water temperature ranged between 18 and 40 ºC, no differences were recorded between the temperature at the surface and the lower layers within the water column due to shallowness of the water in the marsh (Maulood *et al.,* 1979).

The pH of water is the activity and effectiveness of hydrogen ion in the water, refers to the value of the (-Log) numerical focused as an ion hydrogen, ranges between 0 and 14 values of pH. Most natural waters are of values between 4 and 9. The decline in value is the result of the presence of pollutants in water. Tables (1, 2, 3 and 4), showed that the values of pH are varying between stations and seasons, the highest value was in summer (7.76) at station (7), and the lowest v*------alue was (7.06) at station (1) and the mean was (7.56). In the spring, the highest value of pH reached (7.45) at station (1), the lowest value (6.29) at station (6) and the mean was (6.98), whereas the highest value in winter reached (7.6) at station (6), the lowest value was (7.00) at station (1) and a mean of (7.22), in autumn the highest value was (7.76) at station (4), and the lowest value was (7.28) at station (6) and at a range of (7.61).

It is clear that pH values are between (6-8) and most the natural water values are within this rate. The pH has a unique value occurred in the basic side between 7.00 and 8.5 as those for other Iraqi waters due to the presence of Calsite ($CaCO_3$), nature of the bottom and to the soil of the marshes (Al-Saad *et al.,* 2010).

TDS is the total amount of travelable charged ions that include mineral salts or minerals dissolved in a certain volume of water, It is measured in (mg/l), organic sources of dissolved solids such as planktonic, industrial waste and sewage, inorganic sources such as rocks and air, which may contain calcium bicarbonate, phosphorus ions and sulfates. There are other sources such as runoff, fertilizer and pesticides, used in farms (Al-Ezerajawi, 2012). From Table (5), there is an approximation in the values of TDS at stations 1, 2 (before and after feeding), 3 and 4, the highest values in summer at these stations compared to the values of the rest of the stations, they are very high, the highest value reached was 11238 mg/l at station (7), while the lowest value 6617 mg/l was at station (4) with a mean 8954 mg/l.

The highest value of TDS in autumn reached 19840 mg/l at station (6), the lowest value was 4032 mg/l at station (1) with an average of 10781 mg/l, whereas in spring, the highest value was 11744 mg/l at station (6), and the lowest value reached 4928 mg/l at station (1) and the average 8270 mg/l. The highest value in winter reached 14528 mg/l at station (5) after and before discharge, the lowest value was 3891 mg/l at station (4) and the average was 8828 mg/l.

The high values may be due to high current at these stations causing the release of chemical elements and clay particles into the water (Al-Saad *et al*., 2010).

The EC is the sum of the constituents of dissolved salts in waters, and known as the ability of (1 cm^3) of water to connect the electrical measured unit (mS/cm). It is a function of the degree of salinity, as it moves power supply in the water through ions dissolved in it, has an electrical positive relationship with concentration of ions dissolved. There is a positive relationship between EC and TDS.

Any higher electrical conductivity is an indication of the increase in dissolved solids in the water. From Tables (1, 2, 3 and 4), the highest mean value of EC was in autumn and reached 17.12 mS/cm, and the lowest mean value was 12.92 mS/cm recorded in spring season.

The Turbidity of the water is caused by the presence of solids suspended in it, such as soil particles, sand, clay and organic, inorganic materials, or presence of bacteria and microorganism in the water column, which can affect the amount of light passing through the water, decreasing photosynthesis and productivity (Zakariya, 2013; Gonulol *et al.,* 1998). The temporal differences in turbidity values are due to the probability of rainfall and increased of erosion, the re-flourishing of algae and increased decomposition operations are taking place in

the water column by neighborhoods (Rosalofomanano, 2009). Tables (1, 2, 3 and 4), showed that a higher values of turbidity occurred in winter, which resulted from rainfall and high levels of water increasing the movement of the water, and thus increasing suspended materials such as silt and clay. Also, the highest values at station (2) after feeding in winter and summer are 14.65 and 12.7, respectively.

This is due to an increase in the flow velocity and suspended materials by the water borne (Chapman, 1996).

Hardness values varied depending on the chemical composition of the original rock. Table (5) showed that the highest mean value occurred in summer (4034 mg/l) and the lowest mean value (3204 mg/l) in spring. The reason for the high values of hardness in some stations is due to a high level of calcium, magnesium and sulfate in the water (Neal, 2001).

The TA is the susceptibility of water to an acids balancing (APHA, 2003), it is influenced by many factors such as the presence of CO_2, microorganisms activity, and dissolution of Bicarbonate, as well as the water content of salts, it is important to define the water alkalinity for the purpose of determining its use in industry or in water treatment (Al-Shawi *et al.,* 2007). Table (5) indicated that there are varied values of TA between seasons at different stations. The highest value appeared at station (4) (680 mg/l) in winter, the reason is that the microorganisms activity is reduced. The lowest value was reached 200 mg/l at stations (7 and 8) during the summer and the autumn, respectively and the reason is due to the consumption of aquatic plants for bicarbonate and carbonate in the process of photosynthesis.

The salinity of the water is affected by the quantity of water which entering into the area, and high temperature during summer and autumn lead to high evaporation, in addition to the semi-arid nature of the area with very low rainfall, so, salinity will be increasing during that period of the year.

The TDS and EC are alternative coefficients to reflect the content of dissolved salts (Rosalofomanana, 2009). Table (5) showed that the values of salinity are similar in terms of elevation, and decrease with EC at all stations and seasons, depending on the values of EC at the expense of salinity. The highest value of salinity appeared at station (6) in autumn reached 19 PSU, the lowest value was 1.3 PSU at station (2) before feeding in winter.

Ca is the most common elements of the earth, resulted from chemical weathering operations of rocks and minerals holding this ion, increasing concentration in the rivers in the dry areas more than a humid areas. It is considered as one of the constituents of the main cause of hardness. Tables (6, 7, 8 and 9) expressed the concentrations of the element fluctuating at a range from 320 to 640 mg/l in summer. The concentration in spring was at a range 304-656 mg/l. In winter, the concentration was ranged from 240 to 1000 mg/l and the concentration in autumn was ranged from 240 to 1120 mg/l.

Mg is necessary for the plants and animals. It contributes with calcium in the bodies building of plants and animals. It is the main components of ferromanganese which gives the dark color.

Tables (6, 7, 8 and 9) reported that the concentration of the element in summer was 470-922 mg/l, while in spring, the concentrations ranged between 267 and 705 mg/l. The concentration in winter was from 224 to 996 mg/l, whereas in autumn, the concentration was 258-802 mg/l.

Na is the most known elements of alkaline metals group in nature. The main source of it is feldspar weathering, alkali metals, clayey rocks and human activities (Hassan, 2007). As shown in the Tables (6, 7, 8 and 9), the concentration of the element in summer ranged from 1066 to 1384 mg/l, but in spring, the concentration ranged between 464 and 806 mg/l, while in winter the range was 423-948 mg/l. The concentration in autumn at a range between 358 and 827 mg/l.

K is a common element, and has high solubility salts. There are high concentrations in natural waters, whether surface or ground water (Hem, 1992). The concentration of this element is low during the seasons, compared to concentrations of other elements. It is clear from Tables (6, 7, 8 and 9) reported that the concentrations of K was from 24 to 43 mg/l in summer, and between

12 and 48 mg/l in spring, whereas in winter it ranged from 15 to 59 mg/l. In autumn, the concentrations ranged between 22 and 125 mg/l.

Chlorides are found in most natural water resources, as a result of melting of sedimentary rocks, puncture of agricultural lands is the most important source, in addition to human, animal and industrial wastes, because chloride salts are dissolved easily, and the difficulty of absorption on the surfaces of clay minerals (Hamington *et al.,* 2001). From Tables (6, 7, 8 and 9), it can be noted that the concentration of the element was high in all seasons. In summer, the concentrations ranged between 2382 and 4046 mg/l, and the concentrations at range of 1774-4228 mg/l in spring, while in winter, the concentrations were at range of 1321-5447 mg/l, but the concentrations of the element in autumn ranged from 1420 to 8733 mg/l.

Table 1. Physical properties values of the samples at Al-Delmaj Marsh during Summer season.

Stations	**pH**	**EC (mS/cm)**	**Turb. (NTU)**	**WT (ºC)**	**AT (ºC)**
1	7.06	10.60	7.97	40	45
2b	7.48	10.67	1.87	40	45
2a	7.48	10.67	12.7	40	45
3	7.51	10.57	3.97	40	45
4	7.57	10.34	5.23	40	45
5b	7.62	17.22	1.39	40	45
5a	7.70	17.29	1.25	40	45
6	7.74	17.46	2.12	40	45
7	7.76	17.56	1.50	40	45
8	7.71	17.54	1.74	40	45
Max.	7.76	17.56	12.7	40	45
Min.	7.06	10.34	1.25	40	45
Average	7.56	13.99	3.97	40	45

Sulfate ion is the common form of sulfur compounds in fresh water (Wetzel, 2001), and the sedimentary rocks of gypsum nature are the main source of dissolved sulfate in natural waters, the SO_2 gas in the atmosphere resulting from the combustion of fuels that reaches to the water by rain or as dry minutes is a source of sulfate in surface water (WHO, 1997).

From Tables (6, 7, 8 and 9), the analyses showed that the concentrations of SO_4 in summer, ranged between 622 and 1165 mg/l. In spring, the concentrations at range from 439 to 1515 mg/l. While in winter, the concentrations ranged between 286 and 1423 mg/l. The concentrations in autumn ranged from 444 to 1794 mg/l.

HCO_3 are essential ions in water, and reflect the importance of carbonate acid through weathering interactions. Tables (6, 7, 8 and 9), showed that the concentrations of bicarbonate in summer is ranged between 610 and 1830 mg/l, and in spring, the concentrations ranged from 159 to 207 mg/l, while the concentrations in winter at range from 110 to 159 mg/l, and in autumn, the concentrations ranged between 113 and 378 mg/l.

The concentrations of these elements increased in the region, for the most important reasons that Al-Dalmaj marsh is considered a trocar for the neighboring agricultural lands, in addition

to that its water source is from the Musab Alam project which is a main trocar for most of the lands, that use fertilizers and pesticides that affect the properties of water.

Table 2. Physical properties values of the samples at Al-Delmaj Marsh during Spring season.

Stations	pH	EC (mS/cm)	Turb. (NTU)	WT (ºC)	AT (ºC)
1	7.45	7.70	9.19	22	25
2b	7.43	7.77	3.54	22	25
2a	7.38	7.75	2.17	22	25
3	7.24	7.73	3.08	22	25
4	6.51	7.82	1.74	22	25
5b	7.35	17.73	2.69	22	25
5a	7.11	18.33	1.58	22	25
6	6.29	18.35	1.05	22	25
7	6.37	18.17	0.59	22	25
8	6.75	17.87	0.76	22	25
Max.	7.45	18.35	9.19	22	25
Min.	6.29	7.70	0.59	22	25
Average	6.98	12.92	2.63	22	25

Table 3. Physical properties values of the samples at Al-Delmaj Marsh during Winter season.

Stations	pH	EC (mS/cm)	Turb. (NTU)	WT (ºC)	AT (ºC)
1	7.00	6.20	8.26	18	20
2b	7.14	6.30	8.93	18	20
2a	7.24	6.21	14.65	18	20
3	7.16	6.24	4.58	18	20
4	7.13	6.08	6.29	18	20
5b	7.20	22.70	4.32	18	20
5a	7.20	22.70	3.53	18	20
6	7.60	21.30	3.24	18	20
7	7.30	20.30	1.62	18	20
8	7.29	19.91	1.85	18	20
Max.	7.60	22.70	14.65	18	20
Min.	7.00	6.08	1.62	18	20
Average	7.22	13.79	5.72	18	20

Table 4. Physical properties values of the samples at Al-Delmaj Marsh during Autumn season.

Stations	pH	EC (mS/cm)	Turb. (NTU)	WT (ºC)	AT (ºC)
1	7.71	6.30	8.28	19	21
2b	7.73	6.36	7.26	19	21
2a	7.65	6.35	2.54	19	21
3	7.67	6.62	2.89	19	21
4	7.76	7.01	2.03	19	21
5b	7.74	29.80	1.62	19	21
5a	7.69	29.60	1.54	19	21
6	7.28	31.00	1.31	19	21
7	7.28	18.52	1.20	19	21
8	7.62	29.60	1.09	19	21
Max.	7.76	31.00	8.28	19	21
Min.	7.28	6.30	1.09	19	21
Average	7.61	17.12	2.97	19	21

Table 5. Total Hardness (TH), Total Alkalinity (TA), Total Dissolved Solid (TDS) and Salinity values at Al-Delmaj Marsh.

Stations	Summer				Spring				Winter				Autumn			
	TH (mg/l)	TA (mg/l)	Sal. (PSU)	TDS (mg/l)	TH (mg/l)	TA (mg/l)	Sal. (PSU)	TDS (mg/l)	TH (mg/l)	TA (mg/l)	Sal. (PSU)	TDS (mg/l)	TH (mg/l)	TA (mg/l)	Sal. (PSU)	TDS (mg/l)
1	2800	420	6.90	6784	2000	428	4.80	4928	1560	480	1.40	3968	1760	420	3.40	4032
2b	3000	520	7.00	6828	2200	431	4.80	4973	1600	460	1.30	4032	2000	480	3.50	4070
2a	3100	480	7.20	6828	2200	506	4.80	4960	1600	485	1.50	3974	2000	520	3.50	4064
3	3000	480	6.90	6764	2000	531	4.80	4947	1800	475	1.40	3994	2100	480	3.60	4237
4	3000	600	6.70	6617	2040	481	5.00	5005	1800	680	1.97	3891	2400	600	3.80	4486
5b	5200	300	11.70	11020	4300	491	11.90	11347	6000	420	1.80	14528	5360	300	18.00	19072
5a	5000	360	11.70	11065	4400	428	12.00	11731	6000	480	1.90	14528	5300	360	18.00	18944
6	5040	328	11.90	11174	4400	221	12.30	11744	5800	422	1.90	13632	6100	328	19.00	19840
7	5100	200	11.90	11238	4200	272	12.10	11629	6600	255	2.00	12992	4161	280	18.50	10125
8	5100	280	12.00	11225	4300	285	11.80	11437	5600	276	1.98	12742	5400	200	18.10	18944
Max.	5200	600	12.00	11238	4400	531	12.30	11744	6600	680	2.00	14528	6100	600	19.00	19840
Min.	2800	200	6.70	6617	2000	221	4.80	4928	1560	255	1.30	3891	1760	200	3.40	4032
Average	4034	396.8	9.39	8954	3204	407	8.43	8270	3836	443	1.72	8828	3658	396.8	10.94	10781

Table 6. Chemical analysis of the samples for (Cations and Anions) at Al-Dalmaj marsh during Summer Season.

Stations	Ca^{++} (mg/l)	Mg^{++} (mg/l)	Na^{+} (mg/l)	K^{+} (mg/l)	Total Cations	Cl^{-} (mg/l)	SO_4^{2-} (mg/l)	HCO_3^{-} (mg/l)	Total Anion
1	320	480	1066	24	1890	2442	844	1281	4567
2b	320	528	1066	24	1938	2458	689	1586	4733
2a	400	504	1066	24	1994	2458	649	1464	4571
3	416	470	1044	24	1954	2435	622	1464	4521
4	320	528	1044	24	1916	2382	742	1830	4954
5b	544	922	1384	43	2893	3967	1023	915	5905
5a	520	888	1384	43	2835	3984	1035	1098	6117
6	560	874	1384	43	2861	4023	1112	1000	6135
7	640	840	1384	43	2907	4046	1161	610	5817
8	640	840	1384	43	2907	4041	1165	854	6060
Mean	468	687	1221	34		3224	904	1210	

Table 7. Chemical analysis of the samples for (Cations and Anions) at Al-Dalmaj marsh during Spring Season.

Stations	Ca^{++} (mg/l)	Mg^{++} (mg/l)	Na^{+} (mg/l)	K^{+} (mg/l)	Total Cations	Cl^{-} (mg/l)	SO_4^{2-} (mg/l)	HCO_3^{-} (mg/l)	Total Anion
1	360	267	484	15	1126	1774	590	207	2571
2b	360	316	474	18	1168	1790	658	200	2648
2a	304	350	464	12	1130	1786	732	185	2703
3	304	301	474	15	1094	1781	860	195	2836
4	320	301	484	15	1120	1802	483	183	2468
5b	560	705	696	42	2003	4085	472	166	4723
5a	656	671	806	42	2175	4223	480	166	4869
6	656	671	796	48	2171	4228	830	171	5229
7	640	632	736	48	2056	4186	1515	159	5860
8	560	705	625	39	1929	4117	439	159	4715
Mean	472	492	604	29		2977	706	179	

Table 8. Chemical analysis of the samples for (Cations and Anions) at Al-Dalmaj marsh during Winter Season.

Stations	Ca^{++} (mg/l)	Mg^{++} (mg/l)	Na^{+} (mg/l)	K^{+} (mg/l)	Total Cations	Cl^{-} (mg/l)	SO_4^{2-} (mg/l)	HCO_3^{-} (mg/l)	Total Anion
1	240	233	423	15	911	1321	387	151	1859
2b	256	233	454	18	961	1486	370	151	2007
2a	272	224	464	15	975	1321	334	159	1814
3	288	262	464	21	1035	1321	311	146	1778
4	320	243	454	24	1041	1321	286	151	1758
5b	800	972	948	59	2779	5282	1186	122	6590
5a	800	972	948	56	2776	5447	1423	110	6980
6	760	948	897	56	2661	5117	1368	122	6607
7	1000	996	867	54	2917	4952	1246	127	6325
8	720	923	605	51	2299	3962	1214	127	5303
Mean	546	601	652	37		3153	813	137	

Table 9. Chemical analysis of the samples for (Cations and Anions) at Al-Dalmaj marsh during Autumn Season.

Stations	Ca^{++} (mg/l)	Mg^{++} (mg/l)	Na^{+} (mg/l)	K^{+} (mg/l)	Total Cations	Cl^{-} (mg/l)	SO_4^{2-} (mg/l)	HCO_3^{-} (mg/l)	Total Anion
1	280	258	358	80	976	1420	452	195	2067
2b	240	340	380	80	1040	1420	494	195	2109
2a	240	340	358	80	1018	1420	444	195	2059
3	240	365	358	68	1031	1491	459	200	2150
4	280	413	402	91	1186	1598	489	220	2307
5b	1000	695	827	74	2596	7455	1708	342	9505
5a	1000	680	783	108	2571	7384	1654	342	9380
6	1120	802	783	114	2819	8733	1794	378	10905
7	632	786	629	22	2069	4124	760	113	4997
8	1040	680	805	125	2650	7810	1586	342	9738
Mean	607	536	568	84		4286	984	252	

Conclusions

1. Water and air temperatures are important factors in examination of water quality, so, increasing evaporation rates lead to an increase in the percentage of delete salts in the water.
2. Turbidity values increase during winter and summer seasons, as a cause of increased rain waters drainage or from adjacent areas, or water volume decreased, especially in summer.
3. pH value ranged between 6.98 and 7.61, indicate that the waters is slightly alkaline.
4. The region is located within desert hot and dry climate, so most of the coefficients values (K^{+}, Na^{+}, Cl^{-}, Mg^{+2}, Ca^{+2}, TH and HCO_3^{-}) increased with increasing temperatures, which increases the concentration of salts in the water.

References

Al-Arajy, M.J. 1988. Ecological study of phytoplankton and nutrients in Hor Al-Hammar, Iraq. M.Sc. Thesis, College of Science, University of Basrah, 113 p. https://scholar.google.com/scholar?cluster=15084527931623704870&hl=ar&as_sdt=2005&sciodt=0,5

Al-Atbee, R. 2018. Assessment of some Heavy Elements and Hydrocarbons in the water, sediments and Dominant Aquatic Plants at Al-Chibayish marshes. M.Sc. Biology, University of Basrah.https://faculty.uobasrah.edu.iq/uploads/publications/1622312533.pdf.

Al-Ezerajawi, W.M. 2012. Environmental study of Dalmaj Marsh area, Wassit Governorate, Iraq. M.Sc. Thesis, University of Baghdad.https://iqdr.iq/search?view=118fcd06a0d41ff1df88258ec0fbfe17

Al-Haidary, M.J.S. 2009. Assessment and sources of some heavy metals in Mesopotamian Marshes. Ph.D. Thesis, College of Science for Women, University of Baghdead, Iraq, 158 p. https://www.researchgate.net/profile/Mohammed-Jawad-Al-Haidarey/publication/295812649_Assessment_and_Sources_of_some_Heavy_Metals_in_Mesopotamian_Marshes/links/56cd883708ae85c8233e4a64/Assessment-and-Sources-of-some-Heavy-Metals-in-Mesopotamian-Marshes.pdf

Al-Hejuje, M.M. 2015. Application of water quality and pollution indices to evaluate the water and sediments status in the middle part of Shatt Al-Arab River. Ph.D. Thesis, Biology Department, College of Science, University of Basra, 239 pp.URL

Al-Hejuje, M.M., Hussain, N.A. and Al-Saad, H.T. 2017. Applied Heavy metals pollution index (HPI) as a water pollution indicator of Shatt Al-Arab River, Basrah-Iraq. Inter. J. Marine Sci., 7(35): 353-360.URL

Al-Khuzaie, D.K. 2015. Assessment of sediment quality collected from Shatt Al-Arab River, Basra, Southern Iraq. J. of Inter. Acad. Res. Multidisc., 3(6): 235-246.URL

Al-Lammi, A.A. 1986, Ecological study of phytoplankton of some southern Iraqi marshes. M.Sc. Thesis, College of Science, University of Basrah, 144p. https://scholar.google.com/scholar?cluster=9755903841789088317&hl=ar&as_sdt=2005&sciodt=0,5

Al-Saad, H.T., Al-Hello, M.A., Al-Taein, S.M. and DouAbul, A.A.Z. 2010. Water quality of the Iraqi southern marshes. Mesopot. J. Mar. Sci., 25(2): 188-204. https://doi.org/10.58629/mjms.v25i2.204

Al-Saad, H.A. and Al-Mousawi, A.H.A. 1988, some notes on the ecology of aquatic plants in the Al-Hammar marsh, Iraq. Vegtectatio, 75: 131-133. https://doi.org/10.1007/BF00045625

Al-Saad, H.T. and Al-Timari, A.K. 1993. Seasonal variations in dissolved normal alkanes in water marshes of Iraq. Mar. Pollut. Bull., 26: 546-559.https://doi.org/10.1016/0025-326X(93)90623-R

Al-Saadi, Y.I. 2008. Study of environmental and mineralogical geochemistry of Al-Chekka marsh, south of the Meshrah river, according to some of Ostracoda shell in Mayssan Governorate. M.Sc. Thesis, College of Science, University of Basrah, 208 p.

Al-Shawi, A.J., Al-Rubaie, A.A. and Abd, S.B. 2007. Limnological study to the south part of Tigris and Euphrates rivers and its effects on Physico-chemical characteristics of Shatt Al-Arab estuary. Univ. Teacher J., 6(11): 105-116.

APHA (American Public Health Association) 2003. Standard methods for the examination of water and wastewater. 20th ed., Washington, DC, USA.

APHA (American Public Health Association) 2005. Standard methods for the examination of water and wastewater. 21th Ed., Washington, DC, 1193 p. https://hero.epa.gov/hero/index.cfm/reference/details/reference_id/710779

Bedair, H.M., Al-Saad, H.T. and Salman, N.A. 2006. Iraq's Southern Marshes something special to be conserved; A Case study. Marsh Bulletin, 2(1): 99-126.URL

Chapman, D. 1996. Water quality assessments-A guide to use of biota, sediments and water in environmental monitoring. Second Edition, Printed in Great Britain at the University Press, Cambridge.URL

GESAMP 1993. IMO/FAO/UNESCO/WHO/IAEA/UN/UNE Join Group of Experts on the Scientific Aspect of Marine Pollution. (GESAMP) Impact off all and related chemicals and wastes on the marine environment. Report and studies, No. 50, Imo, London., 180 p.

Gonulol, A. and Obali, O. 1998. A study on the Phytoplankton of Hasan Ugurlu Dam. Lake (Samsun Turkey). Tr. J. Biology, 22: 447-461.URL

Hamington, G.A., Herzeq, A.L. and Cook, P.G. 2001. Ground Water Sustainability and Water Quality in the Ti-tree basih, Central Australian. Water Technical Report, 14 p.URL

Hassan, W.F. 2007. Geochemical and hydrochemical Study at Shatt Al-Arab Canal Sediments and Overlying Water. Ph.D. Thesis, College of Agriculture, University of Basrah, 205 p. URL

Hem, J.D. 1992. Study and interpretation of the chemical characteristics of natural water. 3rd ed., U.S. Geological Survey Water-Supply Paper 2254, 263 p.https://doi.org/10.3133/wsp2254

Jazaa, S.H. 2009. A study of physical, chemical and bacteriological properties of water of Al-Kahlaa river in Maysan Governorate, Iraq. M.Sc. Thesis, College of Science, University of Basrah, 67p.URL

Joyce, C. 2012. Preface; Wetland services and management. Hydrobiology, 692: 1-3.DOI 10.1007/s10750-012-1179-9

Maulood, B.K., Hinton, G.C.F., Kamees, H.S., Saleh, F.A.K., Shaban, A.A. and Al-Shahwani, S.M.H. 1979. An ecological survey of some aquatic ecosystems in southern Iraq. Tropical Ecology, 20(1): 27-40.URL

Mitsch, W.J. and Gosselink, G.J. 2007. Wetlands. 4th Ed., John Wiley and Sons, Inc., Hoboken, New Jersey.URL

Neal, C. 2001. The potential for phosphorus pollution remediation by calcite precipitation in UK freshwaters. Hydrology and Earth System Sciences, 5(1): 119-131.https://doi.org/10.5194/hess-5-119-2001

Rasolofomanana, L.V. 2009. Characterization of Ranomafana Lake Water Quality Antsirabe Madagascar. M.Sc. Thesis, University of Stavanger, Environmental Control.URL

Wetzel, R.G. 2001. Limnology Lake and River Ecosystem. Third edition. Academic Press, An Elsevier Science Imprint, San Francisco, New York, London, 1006 p.https://www.elsevier.com/books/limnology/wetzel/978-0-08-057439-4

WHO (World Health Organization) 1997. Guidelines for drinking-water quality. Vol. 2. 2nd ed., Amman, Jordan.https://apps.who.int/iris/handle/10665/38551

Zakariya, A.M., Adelanwa, M.A. and Tanimu, Y. 2013. Physico-Chemical characteristics and Phytoplankton Abundance of the Lower Niger River, Kogi State, Nigeria, IOSR. Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT), 2(4): 31-37. https://www.academia.edu/download/31445329/Zakariya_et_al_2013.pdf