Seasonal Variations of Some Physio-Chemical Parameters of Al-Auda Marsh in Maysan Province

Basim M.H. Al-Thahaibawi1*, Sedik.A.K.Hiyaly2, Ithar K.A. Al-Mayaly1
1Department of Biology, College of Science, University of Baghdad, Baghdad, Iraq. 2Environmental Research center, University of Technology, Baghdad, Iraq.

Abstract
Seasonally variations in Physiochemical parameters of Al-Auda Marsh were investigated from November 2012 to July 2013. In this research examine pH, turbidity, EC, DO, BOD5 and Ca2+, Mg2+, NO2-, NO3-, PO43-, SiO32- ions. Six sites were randomly located and water samples. pH values varied from (7.3 ±0.0) in site 4 during autumn to (8.5±0.5) in site 6 during winter, EC values ranged from (2020±186) μ.s/cm in site 5 during autumn to (6390±875) μ.s/cm in site 6 during summer, mean turbidity data were found to vary from (6.5 ±1.8) NTU in site 4 in summer to (31.0 ±1.6) NTU in site 3 in autumn. DO highest mean value (10.9 ± 0.6) was for site 6 in autumn and the lowest value (6.5±0.9) mg/l for site3 in spring. In case of BOD5 highest and lowest mean values were (4.8 ±0.3) mg/l in site 3 during autumn and (1.2 ±0.3) mg/l in site 2 during winter. Mean Ca2+ ions ranging from (46±9.4) mg/l in site 4 during autumn to (361±19.6) mg/l in site 1 during summer, mean value of Mg2+ ion varied from (18 ±9.5) mg/l in site 5 in autumn to (247 ±44.2) mg/l in summer for site 1. Also, mean PO43- values of varying from (0.01±0.0) mg/l in sample of site 6 during winter to (0.3±0.08) mg/l in sample of site 6 during spring. The mean NO3 values was varied from (1.8±0.8) mg/l in site 6 during winter to (6.9 ±0.5) mg/l in site 5 during autumn while in case of NO2 were (0.1±0.0) mg/l in both sites 5 and 6 during spring to (0.35 ±0.01) mg/l in site 1 during autumn. SiO32- data found to vary from (1.0±0.5) mg/l in site 6 during autumn to (6.35 ±0.5) mg/l in site 2 during summer.

Key words: Al-Auda marsh, physical variables, DO,BOD5, inorganic ions.
Introduction:

Marshlands are generally defined as wetlands inundated in water continuously or frequent characterized by prominent vegetative cover emerge herb by soft legs, and which adapts to water saturated soil conditions which remains at or above the level of water permanently or temporarily [1].

The Iraqi marshlands constitute the largest wetland ecosystem in the middle east and western eurasia .These marshes covered more than 15,000 km². However, Iraqi marshes often referred to as the “Garden of Eden” having been the cradle of Western civilization [2-4].

In 2002, 85% of permanent marshes defined in 1973 had been totally destroyed, and only 3% of the central marshes, 14.5% of the Hammar marshes and 35% of the Hawizeh marshes remained [5-6]. In other words the total area of the permanent marshes was about 9000 km² in 1973 while these marshes left to cover about only 760 km² after last years of previous century [6-7].

Hour Al-Auda forms part of mesopotamia wetlands. Al-Auda marsh was drained during 1990's and in 2003 it has been re-inundated a total area of (50%). An area of about (7,500 ha), length 20 km, width 10 km and up area 105 km² [8].

The present study was aimed to examine water physical and chemical parameters such as temperature, turbidity, EC, pH, DO, BOD₅, Cu²⁺, Mg²⁺, NO₂⁻, NO₃⁻, Po⁴⁺, SiO₃⁻. Materials and Methods

Al-Auda marsh (Latitude/ Longitude: 31°33'N, 46°51'E) is one of the water bodies located in Maysan province southern Iraq. Approximately 35 km of Al-Amara city in Maysan province and it is 5 km away from Al-Maymuna district. It is one of the marshes in western side of Tigris River within Maysan province.

Six randomly sites within Al-Auda marsh were selected. Site 1 were (Braudah), GPS reading (N: 31 36 25, E: 46 50 10), site 2 were (Al-Adla), GPS reading (N: 31 35 22, E: 46 50 25), site 3 were (Center Al-Auda marsh), GPS reading (N: 31 34 30, E: 46 49 47), site 4 were (Al-Auda), GPS reading (N: 31 34 55, E: 46 51 13), site 5 were (UM Al-Meshashf), GPS reading (N: 31 33 49, E: 46 52 07) and site 6 were (Al-Battat), GPS reading (N: 31 32 55, E: 46 54 09) shown in Figure 1.
Water sampling was carried out from six sites once a month for the period of November 2012 to July 2013. Water samples were collected from each site 20-30 cm beneath water surface using various volume containers where a 100 ml polyethylene containers were used for the reactive silicate test while Duran glass containers (500ml capacity) used to measure the other nutrients (dissolved nitrate, dissolved nitrite and dissolved reactive phosphate). Also polyethylene containers (2 litters) were used for collecting water samples for the analysis of turbidity, calcium and magnesium ion concentrations. However, further sterile dark Winkler bottles (250ml) for water samples to be used for the teats of dissolved oxygen and biological oxygen demand.

Results and Discussion
Table-1 shows mean value ± Sd of pH, turbidity (NTU), EC (μ.s/cm), DO (mg/l), BOD₅ (mg/l) and Ca²⁺, Mg²⁺, NO₂⁻, NO₃⁻, PO₄³⁻, SiO₃ ions in water samples collected from six studied sites within Al-Auda marsh from November 2012 to July 2013.

Values of pH were found to range from 7 to 8.5. These data are expected for Iraqi waters due to the gypsum nature of the bottom and soil of the marshes. However, similar studies [9-11] have reported almost similar results.

For EC, the current results showed that the lowest value (2020±186μ.s/cm) was recorded in site 5 during autumn, while the highest value (6390±875μ.s/cm) were found in site 6 during summer season in Figure-2. Seasonal variations in water conductivity may be linked to water decreasing levels and increasing of evaporation ratio as suggested by different studies [12-14].
### Table 1 - Shows mean value ± SD of physical and chemical characteristics of water samples collected from six sites within Al-Auda marsh during study period.

<table>
<thead>
<tr>
<th>Season</th>
<th>Site</th>
<th>Tur.(N/TU)</th>
<th>pH</th>
<th>EC (µS/cm)</th>
<th>DO (mg/l)</th>
<th>BOD 5 (mg/l)</th>
<th>Ca&lt;sup&gt;2+&lt;/sup&gt; (mg/l)</th>
<th>Mg&lt;sup&gt;2+&lt;/sup&gt; (mg/l)</th>
<th>PO&lt;sub&gt;4&lt;/sub&gt; (mg/l)</th>
<th>NO&lt;sub&gt;3&lt;/sub&gt; (mg/l)</th>
<th>NO&lt;sub&gt;2&lt;/sub&gt; (mg/l)</th>
<th>SiO&lt;sub&gt;3&lt;/sub&gt; (mg/l)</th>
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</thead>
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<td>6210±245</td>
<td>8.5±0.3</td>
<td>3.6±0.1</td>
<td>272±1.3</td>
<td>225±0.5</td>
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<tr>
<td></td>
<td></td>
<td>2</td>
<td>15.6±0.0</td>
<td>7.7±0.2</td>
<td>2135±205</td>
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<td>3.6±0.1</td>
<td>138±1.4</td>
<td>71.4±1.4</td>
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</tr>
<tr>
<td></td>
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<td>8.2±0.7</td>
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<td>302±3.2</td>
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<td>34±12.6</td>
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<td>158±24.5</td>
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<td>295±1.6</td>
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<td>2.6±0.8</td>
<td>247±3.6</td>
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<td>57±13.0</td>
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<td>7.6±0.0</td>
<td>6191±440</td>
<td>8.4±0.9</td>
<td>3.0±0.7</td>
<td>361±1.9</td>
<td>274±4.4</td>
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<td>7.5±2.4</td>
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<td>3.2±0.8</td>
<td>310±2.8</td>
<td>196±38.5</td>
<td>0.14±0.03</td>
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<td>4.6±0.2</td>
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<td>2.0±0.5</td>
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<td>6390±875</td>
<td>7.0±0.4</td>
<td>2.6±0.4</td>
<td>309±2.1</td>
<td>211±31.5</td>
<td>0.12±0.0</td>
<td>2.2±0.4</td>
<td>0.25±0.3</td>
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</tbody>
</table>

960
Mean turbidity results from water samples of all examined sites during study period are presented in Figure 3. This means values were found to vary from 6.5 ±1.8 NTU in site 4 during summer to 31.0 ±1.6 NTU in site 3 during autumn. In general, the seasonal variations in the turbidity values were clear where maximum values were found in autumn and winter while the minimum values were recorded in summer in all studied sites.

This may be due rainfall in these seasons which causes erosion for edges of rivers and marsh. Another reason could be due to the probable river flooding and thus the flow of large amounts of water across Al-Haddam River and all the branches that feeding Al-Auda marsh. Also the movement of fishermen boats may be another cause as well as to fishermen who use toxic materials for fishing. In general, similar findings were reported by different works of similar marsh environments [15,16].

In case of dissolved oxygen, this study has found that the mean dissolved oxygen values were varied from 6.5±0.9 mg/l in site 3 during spring to 10.9 ±0.6 mg/l in site 6 during autumn in Figure 4. However, the maximum values were found in winter while the minimum values were in summer in all examined sites.
There are many factors that may play an important role linked to dissolved oxygen such as photosynthesis and aquatic organisms respiration as suggested by similar work [17]. Also, rising temperature may lead to decline dissolved oxygen concentration in water [18,19]. In addition to the nutrients materials [20] and the levels of EC particularly in summer [15,21]. In the other hand the highly of Electrical Conductivity (EC) values at summer that led to decreasing the solubility of oxygen gas in water.

Regarding biological oxygen demand (BOD$_5$), the obtained results showed that the mean value was varied from 1.2 ±0.3 mg/l in sample collected from site 2 during winter to 4.8 ±0.3 mg/l in water sample of site 3 during autumn in Figure 5.

Lower BOD$_5$ values may be caused by two reasons, firstly there are no industrial activities that throw pollutants directly to the marsh and the human pollution is extremely low because limited villages surrounding Al-Auda Marsh. Secondly the spreading of plants and flow slow water that contributes to decrease BOD$_5$ concentration as recommended by [22].

By contrast, higher BOD$_5$ values in autumn and summer may due to increasing water temperature which increases organic substances decay and leading to decrease in DO value as suggested by previous study [23].

Data of calcium ions are presented in Figure 6. Ca$^{2+}$ ions values were found to range from 46±9.4 mg/l in site 4 during autumn to 361±19.6 mg/l in site 1 in summer. It is well known that these ions form the major inorganic, positive ions in freshwater ranging from zero to several hundred milligrams per liter depending on the source and treatment of the water [24]. It could be originate from the dissociation of salts, such as calcium chloride or calcium sulfate.
In case of magnesium ions (Mg$^{2+}$), the data were displayed in Figure 7. The highest mean value (274 ± 44.2 mg/l) was recorded in site 1 during summer while the lowest (18 ± 9.5 mg/l) in autumn for site 5.

Hardness of water depends on the amounts of calcium and magnesium salts dissolved in water, in addition to several seasonal variations factors such as evaporation, rainfall and the amount of discharges [25]. In general, highest values of both Ca$^{2+}$ and Mg$^{2+}$ ions were found in site 1 during summer while declined mean values again of both ions were found in sites 4 and 5 respectively during autumn.

Figure 8. Shows mean value of PO$_4$ ions of water samples from all examined sites collected during the current work.
The current results showed mean value of reactive phosphate (PO$_4^{3-}$) in all studied sites were varied from 0.01±0.0 mg/l in site 6 during winter to 0.3±0.08 mg/l again in site 6 but during spring. Apparently, maximum PO$_4^{3-}$ values were recorded in spring while the minimum values were found in winter. This may be due to climatic factors such as rain and dust particles suspended in the atmosphere as a result of human activities [26] and also may be related to organic waste of certain animals such as water buffalo and birds [27] or may due to the leaching agricultural residuals [28].

In the other hand, the lower PO$_4^{3-}$ concentrations may due to the dilution caused by rainfall and flooding in addition to the increased uptake by aquatic plants [29] and phytoplankton during this season [30].

Regarding nitrate and nitrite ions, the results of this study showed that the mean nitrate values was varied from 1.8±0.8 mg/l in site 6 during winter to 6.9±0.5 mg/l in site 5 during autumn in Figure 9.

It seems clearly that the maximum values were in autumn season while the minimum values were in winter season. However, this variation may be due to the amounts of nitrate being taken by the aquatic plants and phytoplankton and to the decreasing water levels during this season as have been reported by different studies [14,31,32].

In case of nitrite ions, the mean values was varied from 0.1±0.0 mg/l in both sites 5 and 6 during spring to 0.35±0.01 mg/l in site 1 during autumn in Figure 10.
This study showed clear seasonal changes in concentration of \( \text{NO}_2 \) during the study period, where the maximum values observed in autumn while the minimum values were in spring. This may be due to the reduction of the nitrate to nitrite and to increasing the solubility of the organic materials in autumn and winter [33,34] and to erosion of some amounts by rainfall water from rivers and marshes banks. Also, in this season the uptake of the nitrite by the aquatic plants and phytoplankton is extremely limited [35,36].

Data of Silica or silicon trioxide (\( \text{SiO}_3 \)) is shown in Figure 11. It seems clearly that the mean values of \( \text{SiO}_3 \) were higher in summer and much lower in autumn. In general, the data were found to vary from 1.0±0.5 mg/l in site 6 during autumn to 6.35±0.5 mg/l in site 2 during summer.

Seasonal variations however may be due to the dilution of water by rainfall and to the uptake by the diatoms that consume large amounts of reactive silicate in building structures [37] and higher plants [38]. Also, water temperatures which affect the release of silicon from sediments as reported by several works [39,40,41].

References: