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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 ($p \leq 0.05$).

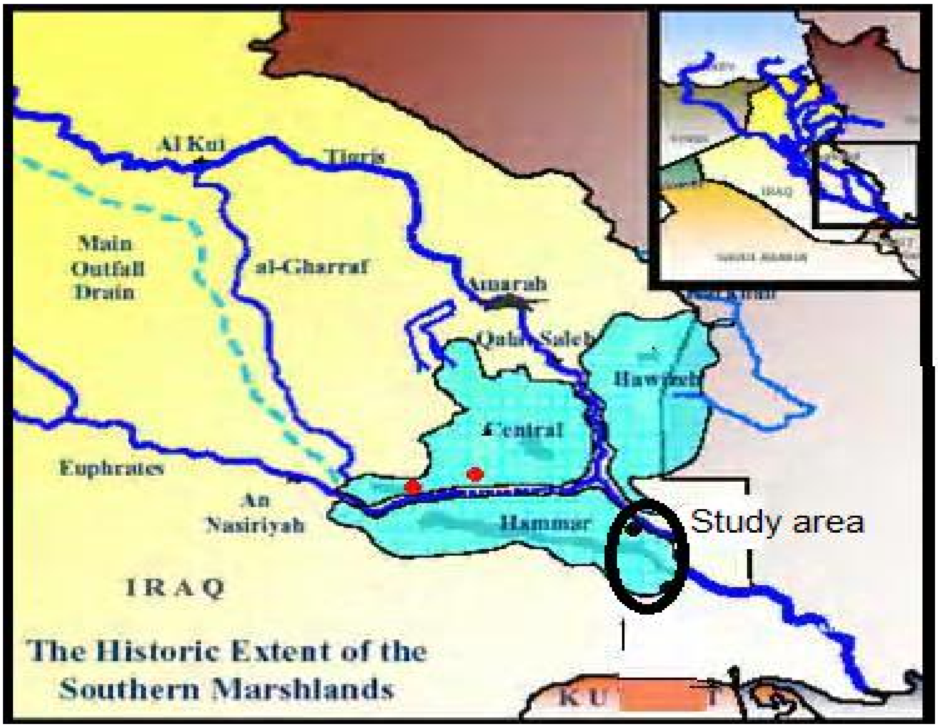

Figure1: Map of study area

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.

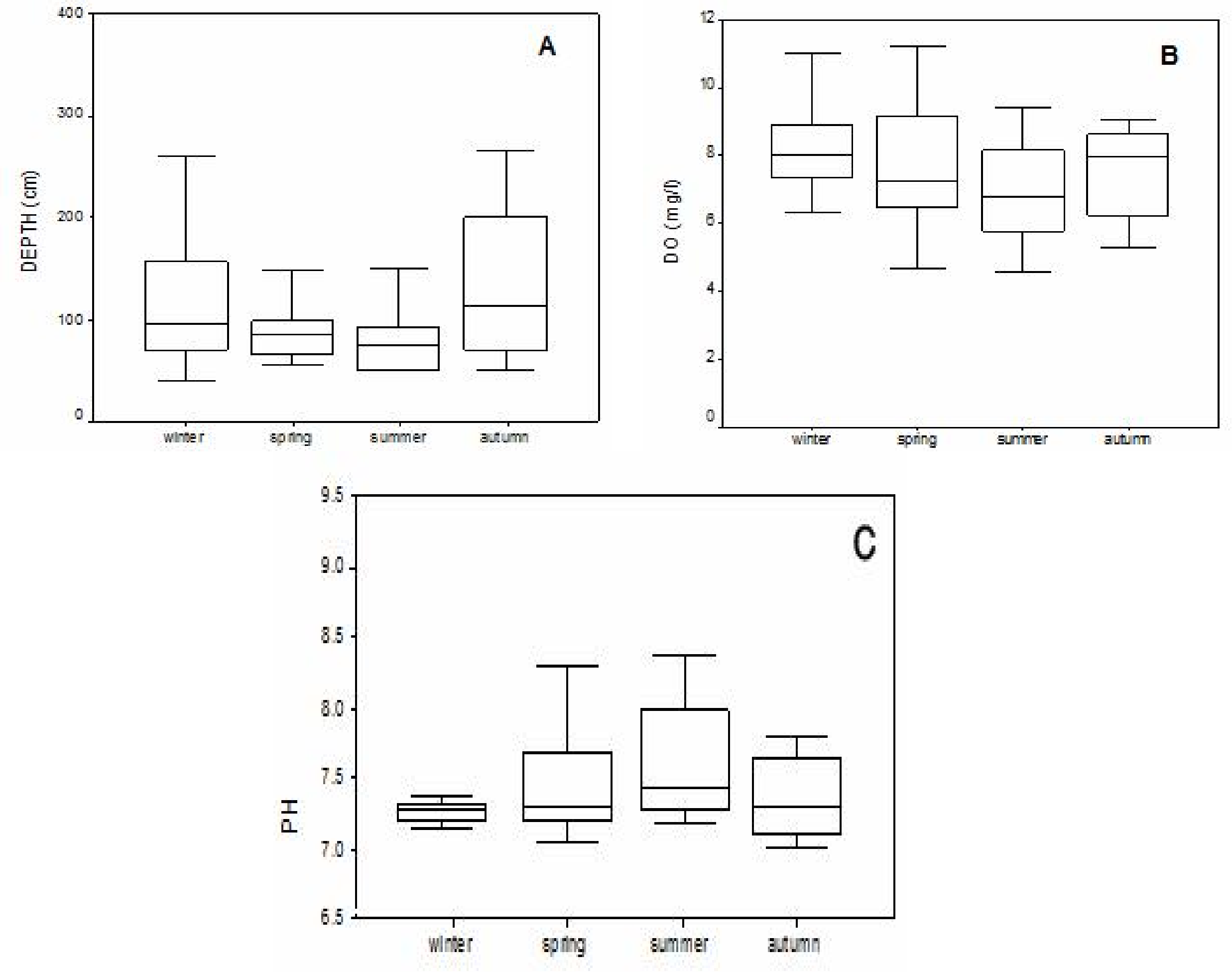

Figure 2(A-C): Box plot comparisons of East Hammar marsh seasonal conditions of water depth(cm), DO(mg/l) and pH.

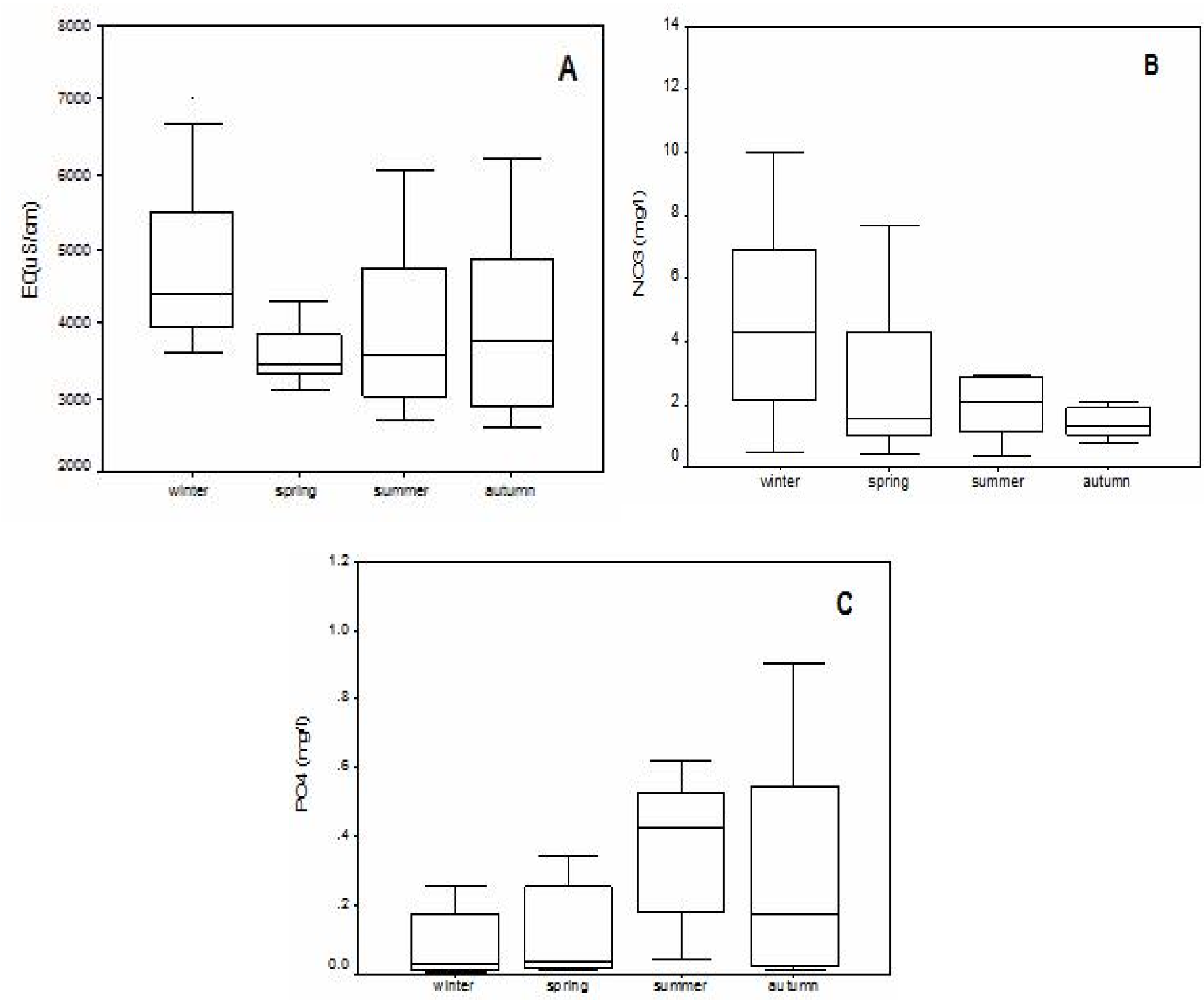

Figure3(A-C): Box plot comparisons of East Hammar marsh seasonal conditions of conductivity(µS/cm), NO_3(mg/l) and PO_4(mg/l).

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*

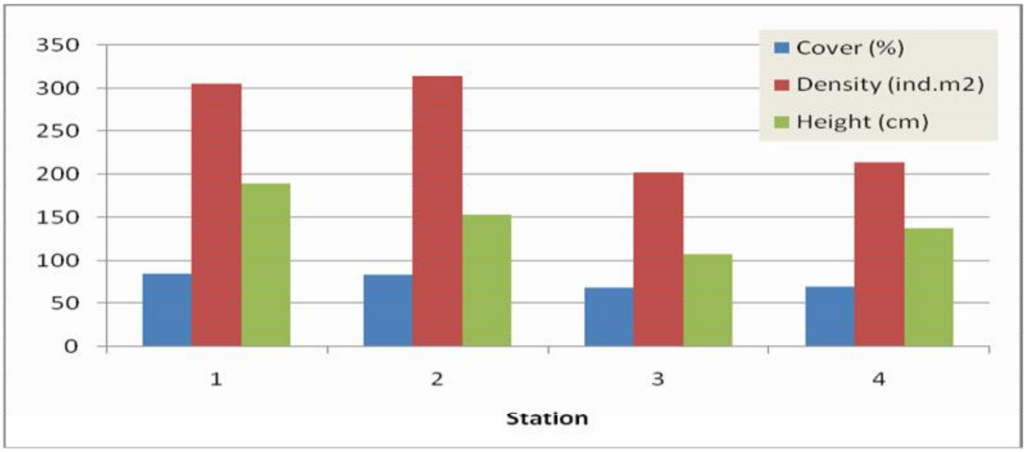

Fig. 4: Percentage of cover vegetation, density and height of *Phragmites australis* in different stations of E. Hammar marsh during 2010.

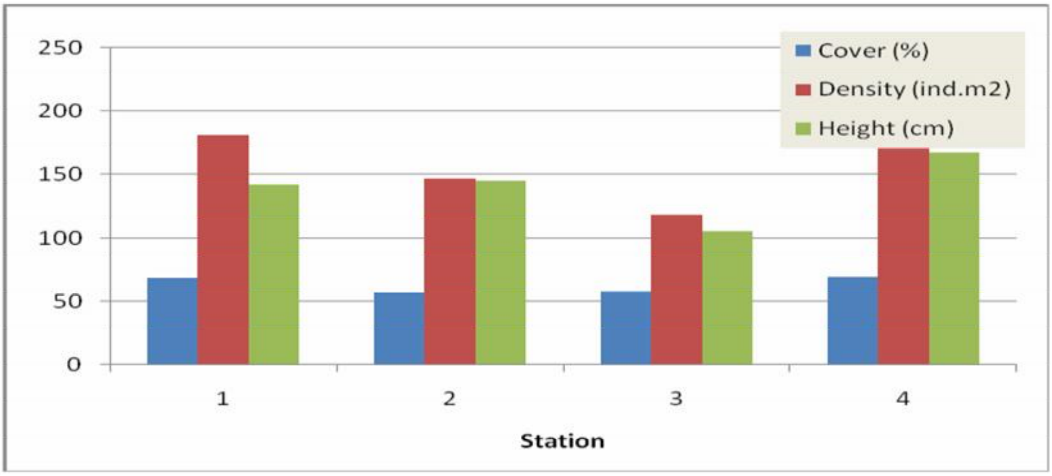

Fig. 5: Percentage of cover vegetation, density and height of *Typha domingensis* in different stations of E. Hammar marsh during 2010.

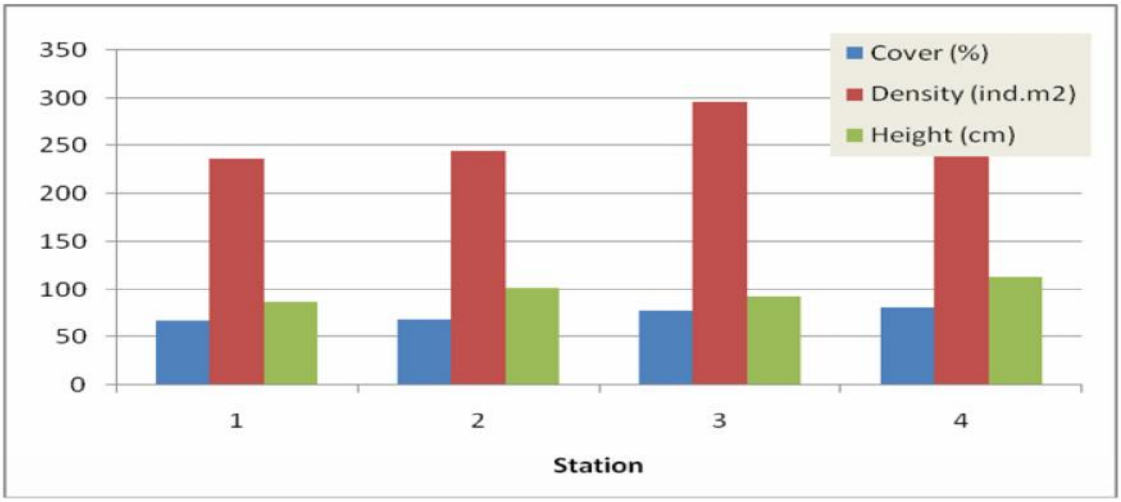

Fig.6: Percentage of cover vegetation, density and height of *Schoenoplectus litoralis* in different stations of E. Hammar marsh during 2010.

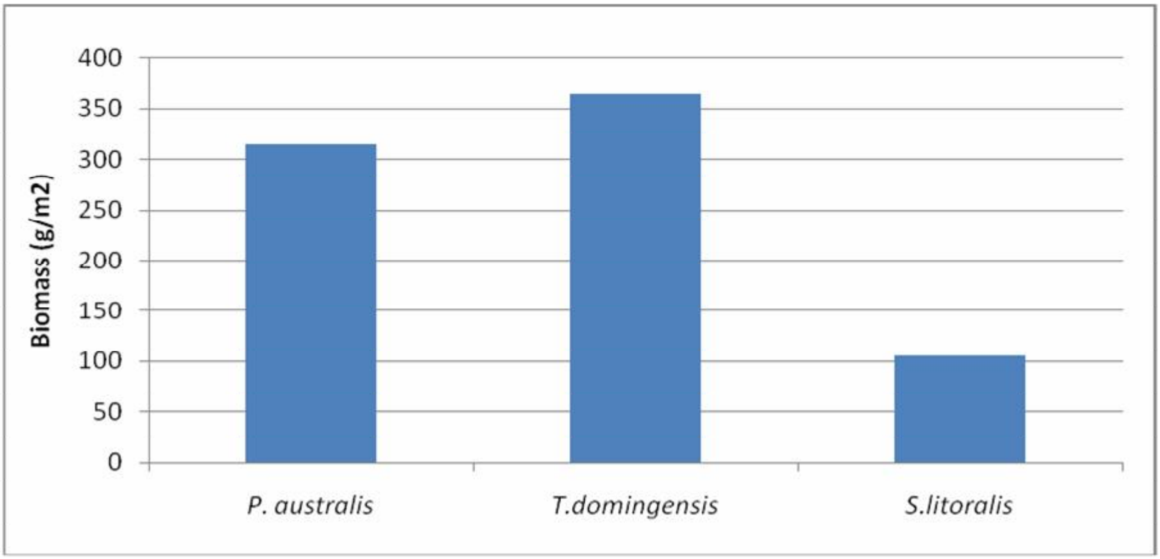

Figure 7: Variation of biomass among different species of common emerged plants in E. Hammar marsh during summer 2010.

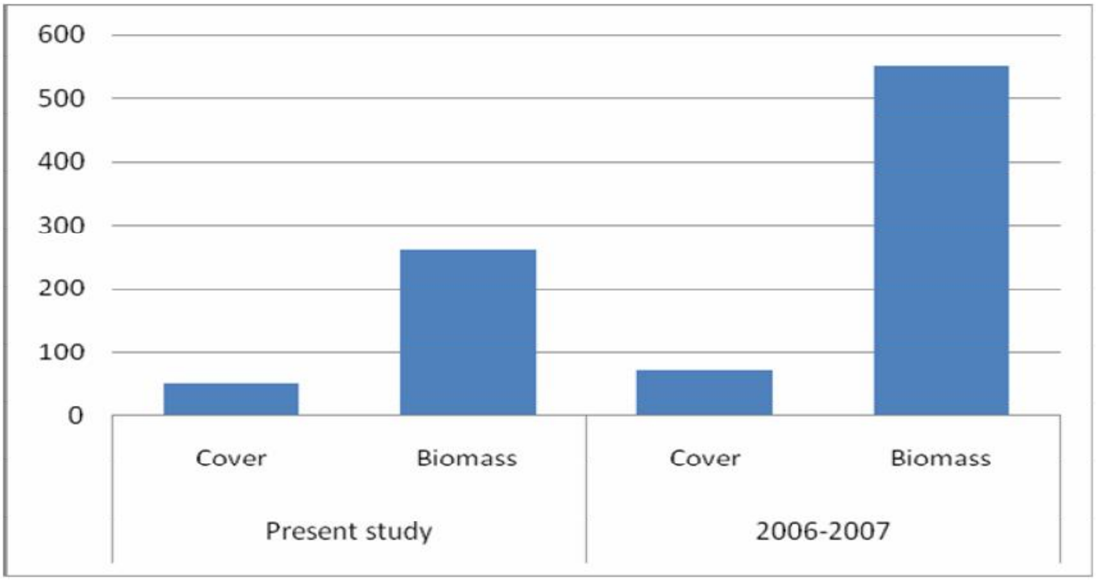

Figure 8: Variation of biomass and cover vegetation of common emerged plants in E. Hammar marsh during summer 2010 and summer 2006-2007.

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.

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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
جامعة البصرة – [illegible] – [illegible] البيئة

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 .