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Exploration About Fecal-Coliform bacteria of Al-Hawizeh Marsh Shorelines / Basrah / Iraq

التحري عن بكتيريا القولون في حواف هور الحويزة / البصرة / العراق

by

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ABSTRACT

Triplicate samples were collected in 250 ml sterile glass bottles from 13 wet stations in shoreline of Al-Hawizeh Marsh, during June, ِAug, Dec (2008), and March (2009) for investigated the total count of bacteria (TC), most probability number of Coliform bacteria (MPN), and some water parameters includes: electrical conductivity (EC), salinity (Sal), dissolved oxygen (DO), and pH were determined.

The results shown that the TC of bacteria were significant elevation in station 13 (5.167×10^3 CFU/ ml during Dec to 13.9×10^3 CFU/ ml during March), when compared with station 10 (0.031×10^3 CFU/ ml during Dec. to 0.327×10^3 CFU/ ml during Jun). However, *E coli* elucidate significantly in stations 5, 7, and 13 when compared with stations 3, 9, and 10 (varied between 1.7 × 103 CFU/100 ml in station 13, to 0.008 × 103 CFU/100 ml in station 10).

The significant differences between all sites for all months was clarified by the analysis of variance (ANOVA). The correlation between TC and MPN of bacteria with dissolved oxygen and pH were negative significant , with salinity and electrical conductivity were positive significant in level 0.01.

الخلاصة :

جمعت ثلاث مكررات في عبوات زجاجية معقمة سعة 250 مل من 13 محطة من حواف هور الحويزة في اشهر تموز واب و كانون الاول (2008) و اذار (2009)، لقياس المحتوى البكتيري الكلي و التحري عن بكتريا القولون بطريقة العد الاكثر احتمالاً، وتضمنت الدراسة مجموعة من القياسات الاخرى تمثلت بالتوصيلية الكهربائية و الملوحة والاوكسجين الذائب و قيمة الدالة الحامضية.

اوضحت النتائج بان هناك ارتفاع معنوي بقيمة العدد الكلي للبكتريا في المحطة 13 (5.167×10^3 CFU/ ml خلال شهر كانون الاول الى 13.9×10^3 CFU/ ml خلال شهر اذار) مقارنةً بالمحطة 10 (0.031×10^3 CFU/ ml خلال شهر كانون الاول الى 0.327×10^3 CFU/ ml خلال شهر تموز) ، بينما كان هناك ارتفاع معنوي بقيمة العد الاكثر احتمالاً لبكتريا القولون في المحطات 5 و 7 و 13 مقارنة بالمحطات 3 و 9 و 10 (تباين مابين 1.7×10^3 CFU/100 ml في المحطة 13 الى 0.008×10^3 CFU/100 ml في المحطة 10).

اوضحت نتائج تحليل التباين بان هناك اختلاف معنوي واضح ما بين جميع المواقع ولكل الاشهر، وكان هناك ارتباط معنوي سالب ما بين العدد الكلي للبكتريا والعد الاكثر احتمالاً لبكتريا القولون مع كل من الاوكسجين الذائب و درجة الاس الهيدروجيني وكان موجباً مع كل من الملوحة والتوصيلية الكهربائية عند مستوى معنوية 0.01 .

INTRODUCTION:

Diarrheal diseases, mainly due to the consumption of microbiologically contaminated drinking water, cause about one billion illnesses and 2.2 million deaths per year (1).

Fecal-Coliform bacteria (FCB) are commonly used to assess the hygienic quality of drinking and recreational waters: Their presence indicates the possible presence of pathogens of fecal origin, while their absence suggests that pathogens are absent (2), *Escherichia coli* (*E. coli*) has the highest sanitary significance (3), total count (TC) is often used as an additional, general water quality indicator. Most national legislations and international guidelines for drinking water quality demand that *E. coli* must be absent in a 100 ml sample (4).

Water quality monitoring and water treatment reduce the risk of waterborne diseases, but do not provide absolute safety. Specific pathogens, such as *Cryptosporidium* oocysts, may occur when FCB are absent and may resist water treatment (5). Existing microbial contamination requires careful monitoring in order to further minimize the risk.

Al Hawizeh Marsh lies to the east of the Tigris River, straddling the Iran-Iraq border (between 31° 00'-31º45' N, 47° 25'-47º 50' E) (6). The Iranian section of the marshes is known as Al-Azim Marsh where 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. During spring flooding the Tigris may directly overflow into the marshes. Al Hawizeh Marsh has a surface area of at least 3,000 km2. During periods of inundation the area expands to over 5,000 km2, a maximum depth of 1-3.5 m. (6).

In 2008 – 09, rainfall and runoff have been 40% below average in Iraq, due to reduced the marshes size almost to 2003. Under climate change, future droughts could be more frequent, longer and more extreme, and water in the marshes become more saline, there has been an increase in microorganisms like *E. Coli*, more magnesium, calcium, greater water hardness, lower pH lower dissolved oxygen and less plants, and the long monitoring term is such important to report all of that; **this study was investigated because of Al-Hawizeh Marsh communities (people and animals) depending on untreated water for drinking and life.**

MATERIALS AND METHODS

Study site

A total of 13 marshland monitoring stations have been established throughout the Al-Hawizeh Marsh (Fig: 1), which distributed with in the entire marsh but particularly focus on zones where more populations and more animals grassing (consuming the marsh water for drink).

Within each ecoregions sites have been located in areas representative of least-disturbed conditions (= natural) as well as agricultural and urban settings. These sites are semi-permanent to permanently inundated depressional marshlands that have a fringe of emergent vegetation as well as floating-leaved and submerged aquatic plant communities.

Triplicate Water samples were taken (20 cm under the water surface) in 250 ml sterile glass bottles during June, Aug, Dec (2008), and March (2009) to investigate the total count of bacteria (TC), most probability number of Coliform bacteria (MPN), and some water parameters includes: electrical conductivity (EC), salinity (Sal), dissolved oxygen (DO), and pH.

Collection vials, sample stabilization, and transportation to the laboratory (department of ecological and marine chemistry/ Marine Science Center/ University of Basrah) as well as sample storage were done considering the recommendations of Standard Methods (7).

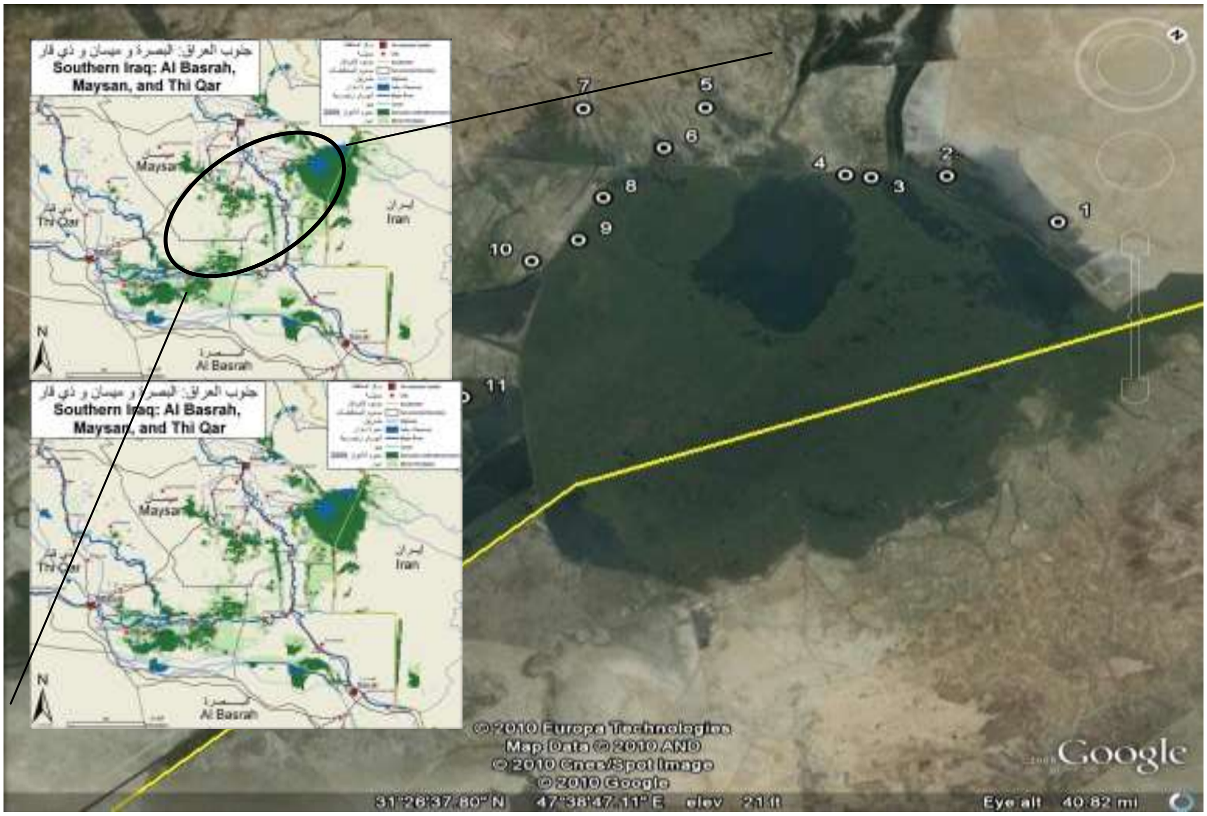

Fig. 1 Map of the study area in Al-Hawizeh Marsh.

1-13: No. of stations

Field determinations:

Electrical conductivity (EC ms.cm^{-1}), Salinity (ppt), dissolved oxygen DO (mgL^{-1}), and pH were measured with a WTW portable multi-meter instrument (WTW Multi 340i meter/Germany). The instruments were calibrated prior to use according to the manufacturer's directions. All quantifications were made in triplicate.

Microbiological analysis:

Total count of bacteria (TC CFU/ml) was calculated by power plate method, and fecal Coliform bacteria (FCB CFU/100ml)was calculated by most probability number method (MPN) that followed by APHA (7).

Statistical Analysis:

The Analysis of Variance (ANOVA) and the Correlations between the different parameters were carried out by using SPSS software version 17.

RESULTS AND DISCUSSION

Physiochemical characterization of the marsh:

The minimum values of DO (4.04 mg/l) were recorded at station 6 and maximum values were 9.84 mg/l at station 10, also the lowest mean values of dissolved oxygen were recorded during Jun, while the highest mean concentrations were during March (Fig. 2). There are many factors play an important role with fluctuations of dissolved oxygen concentration in water, in addition to photosynthesis and aquatic organism's respiration, such as temperature; the raise of temperature leads to decline dissolved oxygen concentration in water (8); as well as, the decomposed organisms use the dissolved oxygen to degradation of the organic matter by self-purification (9); in addition to that the salinity values were high at summer and that led to decreasing the solubility of oxygen gas in water (10-12).

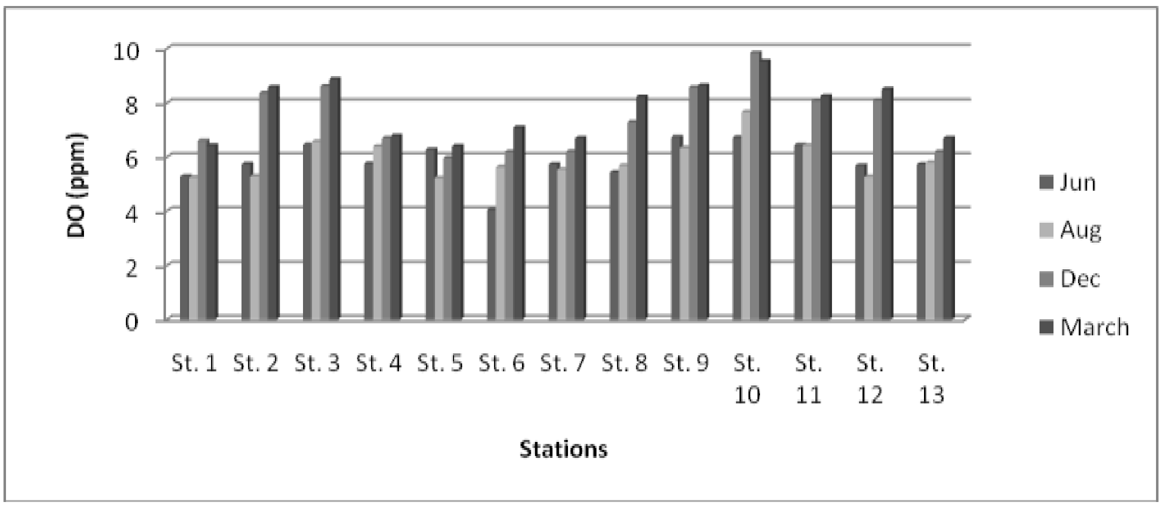

Fig. 2 the DO concentration during period of study (ppm) in Al-Hwaizeh marsh.

During the period of study, pH values in all the sites were higher in March than in Aug. and Dec. (max=9.47, man=6.24). The low pH values were because of the degradation of the aquatic plants, phytoplankton and organic materials, also production of dissolved carbon dioxide (13), While the high pH values were in March at the study period in all of the study stations, this agree with (10-12), that was because declining of carbon dioxide concentration and increasing the alkaline ions (14).

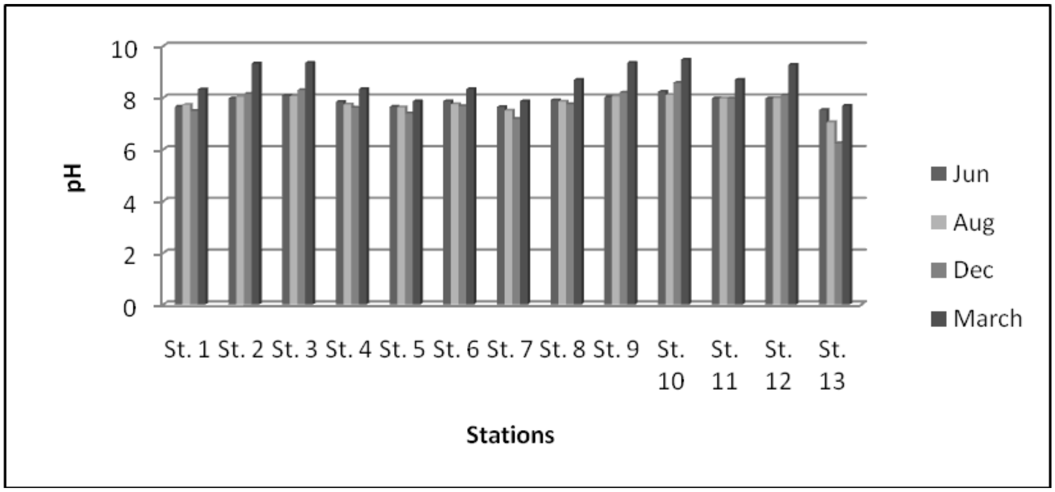

Fig. 3 the pH values during period of study (ppm) in Al-Hwaizeh marsh.

The present study showed that the variances in water salinity were ranged between 0.8ppt in station 10 during March to 3.03ppt in station 13 during Aug. The lowest salinity values were registered during the months of Dec. and March, that is caused by increasing of rainfall and raise of water levels whereas that dilute the concentration of dissolved salts and another dissolved solids materials (15-17). While the highest salinity values were registered during the months of Jun. and Aug., that was caused by decreasing of the water levels and increasing of the evaporation ratio (15, and 18). Furthermore, the dissolved ions are concentrated by evaporation and diluted by freshwater input; these results were agreement with the previous studies (10, 12, 15, and 17).

Conductivity is a measure of the mass of dissolved salts in a given mass of solution (19), so salty water conducts electricity more readily than pure water. Therefore, electrical conductivity is routinely used to measure salinity. The types of salts (ions) causing the conductivity usually are chlorides, sulfates, carbonates, sodium, magnesium, calcium and potassium (18).

Seasonal variations in water conductivity were observed higher in Aug. and Jun. than Dec. and March (max= 3.67 $ms.cm^{-1}$ in station 7, man= 0.99 $ms.cm^{-1}$ in station 10), this may be due to the high temperatures in summer and spring that causes evaporation of the water and so, concentrating the ions, conductivity is temperature sensitive and increases with increasing temperature (20).

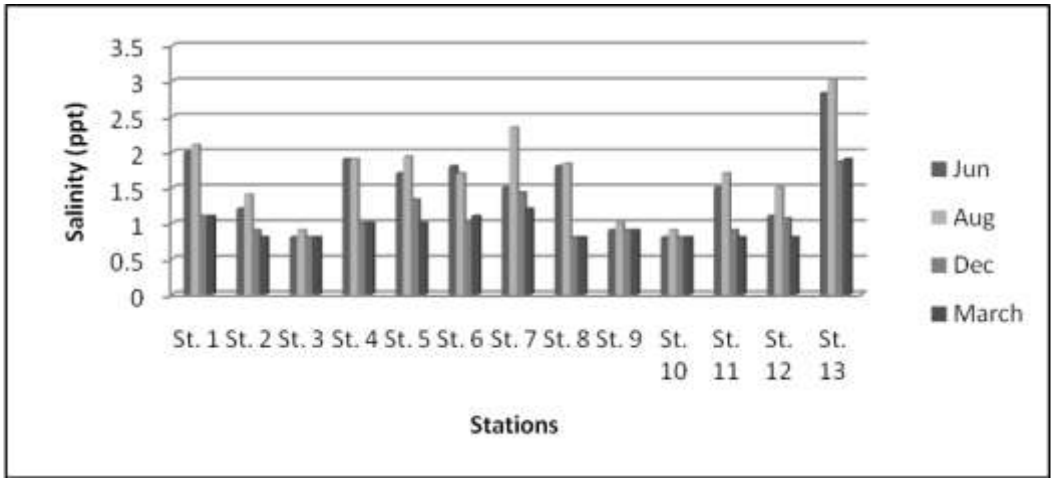

Fig. 4 the salinity concentration during period of study (ppt) in Al-Hwaizeh marsh.

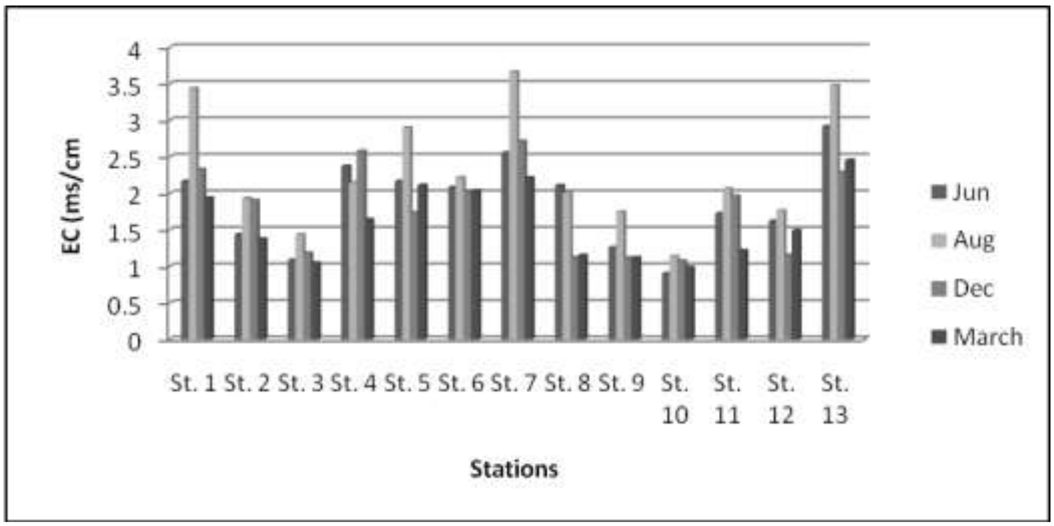

Fig. 5 the EC concentration during period of study (ms/cm) in Al-Hwaizeh marsh.

TC levels were higher in the station 13 (5.167×10^3 CFU/ ml during Dec to 13.9×10^3 CFU/ ml during March) than in the station 10 (0.031×10^3 CFU/ ml during Dec. to 0.327×10^3 CFU/ ml during Jun) (Fig. 6).

Generally we can say, the numbers of *E. coli* in stations 13, 7, and 5 were substantially higher than those found in the stations 10, 9, and 3 (Fig. 7), *E. coli* varied between 1.7×10^3 CFU/100 ml in station 13, to 0.008×10^3 CFU/100 ml in station 10.

The correlation between TC and MPN of bacteria with dissolved oxygen and pH were significant negative , they were significant positive with salinity and electrical conductivity, and they were non significant correlation with turbidity (Table: 1).

All previous study are compatible with this study by a occurrence of a highest abundance in Summer season because a warmer temperature increase a bacteria production, and a diversity of Bacteria in the wetland environment may be critical for the proper functioning and maintenances of the ecosystem (21). Also a Rhizosphere of wetland plants may serve as a reservoir responsible for the growth and spread of potential bacteria.

A changes in bacterial count related to changes in environmental conditions, so a physical and chemical factors have an effect on the composition of the decomposer community, and a pronounced seasonal shift in microbial composition could be due to response to changing composition of the decomposing plant material to a various environmental conditions (22, 23).

Untreated sewage wastes continuously enter into Iraqi rivers directly. These wastes have greatly increased in the last few years due to successive increase in human population. These wastes contain both organic pollutants, nutrient salt, and some microorganisms. The organic load greatly decreases the oxygen content of the water during decomposition causing hazardous effect to the aquatic life. The environment conditions especially high temperatures in the region are favorable for the decomposition of great amount of organic matter entering the Al-Hawizeh Marsh, nutrient salts could be considered as potential pollutants if found in concentration higher than certain levels. They cause sudden increases in the quantity of algae, and after their death they decompose consuming substantial amount of the available dissolved oxygen.

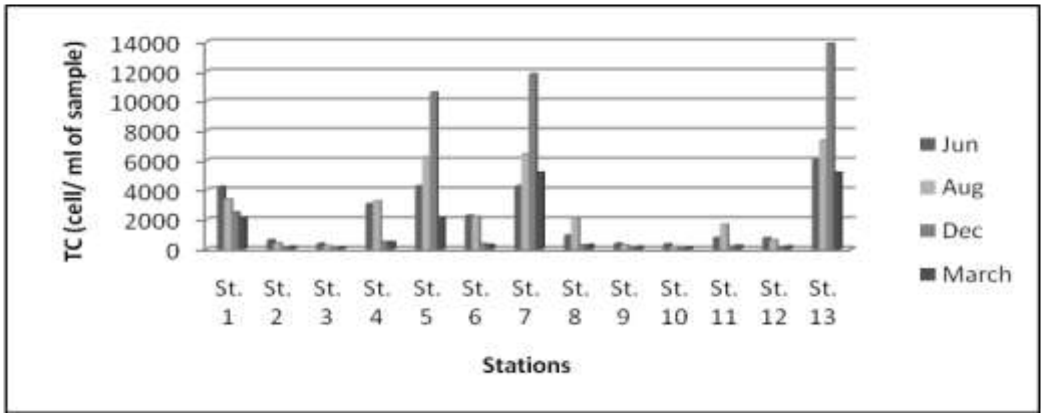

Fig. 6 Total count of bacteria during period of study (cell/ml of sample) in Al-Hwaizeh marsh.

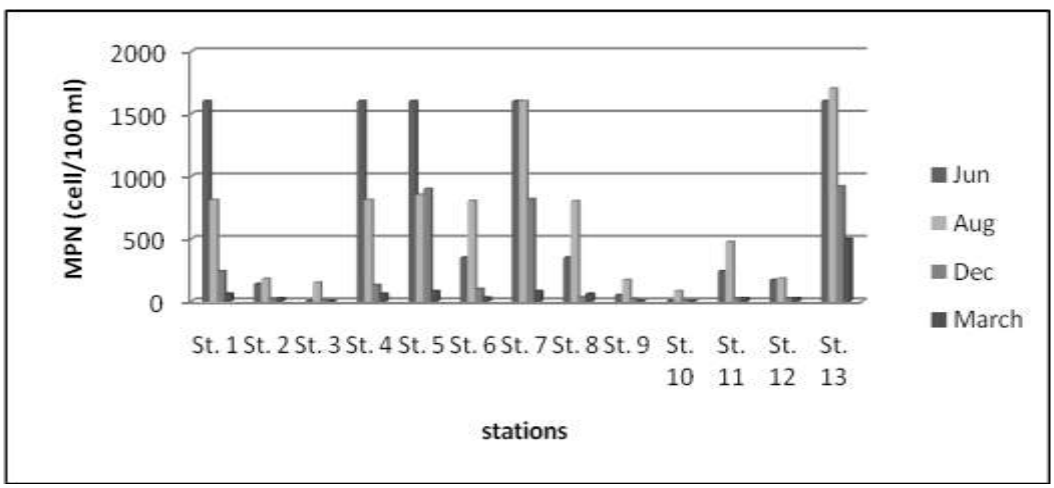

Fig. 7 Most propability number during period of study (cell/100 ml) in Al-Hwaizeh marsh.

Table 1: Correlations between bacteria cotenant and water quality

	Turb	DO	Sali	EC	pH	TC	MPN
MPN	0.086	-0.550*	0.844*	0.645*	-0.578*	0.583*	1
TC	-0.091	-0.400*	0.564*	0.553*	-0.670*	1	

* Correlation is significant at the 0.01 level.

Recommendation:

- From all of above, we advice the local governs in Basrah, ThiQar, and Omarah Cities to instilling the reveres osmosis units (R.O) for drinking water in stations 2, 3, 9, 10, 11, and 12.

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