MARSH BULLETIN 15(1) April (2020) 19–30

MARSH BULLETIN

Study of Some Ecological Characteristics of Iraqi Marine Waters Southern Iraq

Ahmed.CH.Al-Shamary[1], Usamah, H. Yousif[2], Kadhim, H. Younis[1]

1.Marine science center/University of Basrah

2.College of Science /University of Basrah

a_kaseb@yahoo.com

Abstract

Monthly of some ecological factors from the Iraqi estuarine and marine waters were studied for the period January 2018 to December. Three stations were chosen, the first station Shatt Al-Arab estuary, the second station the intermediate part between Iraqi marine and estuarine waters while the third station the Iraqi marine waters. The ecological factors that have been estimated includes air and water temperatures, transparency, turbidity, salinity, pH, dissolved oxygen, total phosphorus, sulphate, calicium, sodium, potassium, chloride carbonate and bicarbonate. the maximum water temperature recorded value was (35.4, 33.2, 37.2ºC) during June in the three stations respectively, the highest salinity concentrations were recorded during July, reaching (47.3) ppt in the first station and in September it reached (45.7) ppt in the second station and in October it reached (43.1) ppt in third station, the highest values of transparency were recorded in the third station with a maximum value of 240cm during February. And to know the physical and chemical properties of marine water due to the lack of environmental studies

Key words: chemical, physical, characteristics, Shatt Al-Arab, Estuary

Introduction

Estuaries are areas where fresh and marine water meet and mix, therefore they represent an interaction between land and sea. They are considered to be among the most productive environments on earth due to the supplement of nutrients carried by rivers, but also rank among the environments most affected by humans through river pollution and activities (Castro and Huber, 2003). Estuaries are dynamic systems that may change their nature several times during their course because of changes in physical conditions such as slope, water discharge and geological characteristics of bottom as well as chemical properties of the river or sea(Al-Shawi,2010). Marine environments especially coastal ones, are of an economic importance for many countries in fields like navigation, fishing, tourism and power generation (EPA,2004). Aquatic environment ecology will provide an information to understand the nature of transferred and available energy (Keithan and Lowe,1985). The total length of Iraqi coast is 64Kg (Al-Yamani *et al*., 2004; Al-Nafisi, 2009). The Arabian Gulf is a shallow sea with a water surface area of 239Km^2 and mean depth of about 35m. Depths of the

Arabian Gulf increases south words to reach a maximum depth of 100m at the Strait of Hormuz (Purser and Seibeld, 1973). The water is very shallow near the delta of Shatt Al-Arab at the Northwestern end of the Gulf, Shatt Al-Arab is considered to be the main source of fresh water discharged into the Arabian Gulf (5Km^3 fresh water each year) carrying a huge quantity of soft mud and clay (Hartman, *et al.*,1971). It is previous studies Hussain, *et al.*, (1999); Mohamed, *et al.*, (2001); Al-Shawi,(2010). The aim of study to know the physical and chemical properties of marine water due to the lack of environmental studies.

study area:

The Iraqi marine waters represent the most Northwestern of the Arabian Gulf (Fig.1). The study area is located in the Iraqi marine waters, which differs from the other parts of the Arabian Gulf due to the effect of transferred sediments from the Shatt al-Arab (Hussain *et al.*, 1991). The bottom nature differs between various parts of the study area due to the effect of sediments carried by Shatt al-Arab results in the increase of clay ratio in North parts comparing to south parts. Corals were discovered in the open waters of the study area which are common in most parts of the Arabian Gulf (Jawad *et al.*, 2018). Northwest wind are dominant in the region that causes water movement in three directions where the hot surface water is pushed north words facing and mixing with Shatt Al-Arab besides Coriolis effect that pushes the whole water mass towards the west (Hussain, *et al.*,1989). Shatt Al-Arab sediments are spread on both sides of the estuary causing a shallow areas extending to the mudflats called Maraqa (a local name for shallow water) Maraqa Abdullah and on the east Sid of Maraqa Abadan (Mohammed *et al.*, 2002). Three stations were chosen in this study to represent the area.

First station:

This station represents Shatt al-Arab estuary bordered by the coordinates

(29 ° 54'15.93 "N; 48 ° 41'15.62" E), (29 ° 54'15.84 "N; 48 ° 37'24.24" E), (29 ° 50 ' 44.04 "N; 48 ° 41'15.51" E) and (29 ° 50'44.12 "N; 48 ° 37'24.38" E). This station is affected mainly by Shatt Al-Arab flow that passes through the Rooka channel (10m depth) in the middle of shallow waters on both sides of 4m. during high tide. The bottom is covered by clay sediments and water color is brown due to high turbidity (Fig.1).

Second station:

This area represents the mixing part of Shatt al-Arab and marine waters, located in the area bordered by coordinates (29°50'17.98"N; 48°43'53.28"E ،) (29°50'17.86"N; 48°49'43.87"E) ، (29°46'48.85"N;48°43'53.16"E) (29°46'48.99"N; 48°49'43.90"E) .This area is characterized by increasing depths from 10 m and the presence of some grooves in the bottom up to a depth of 20 m with a muddy to sandy bottom resulted of erosion action caused by current flow (AL- Badran, 1995).

Third station:

This station is called Khor Al-Amiya representing the marine waters specified by the coordinates (29 ° 43'33.41 "N; 48 ° 43'43.46" E), (29 ° 43'33.38 "N; 48 ° 49'34.85" E), (29 ° 40'04.13 "N; 48 ° 43'43.39 "E) and (29 ° 40'04.02" N; 48 ° 49'34.96 "E). This station has greater depths than the previous stations ranging from 10 to more than 20m. The bottom of this station is sandy to rocky with some deep grooves and depths decreases gradually toward Khor Abdulla (Mohammed, *et al.*, 2002).

<u>3-Materials and Methods:</u>

Surface water samples were collected monthly from the selected study stations through the period January to December 2018 and during ebb using water sampler. The following physical and chemical parameters were estimated.

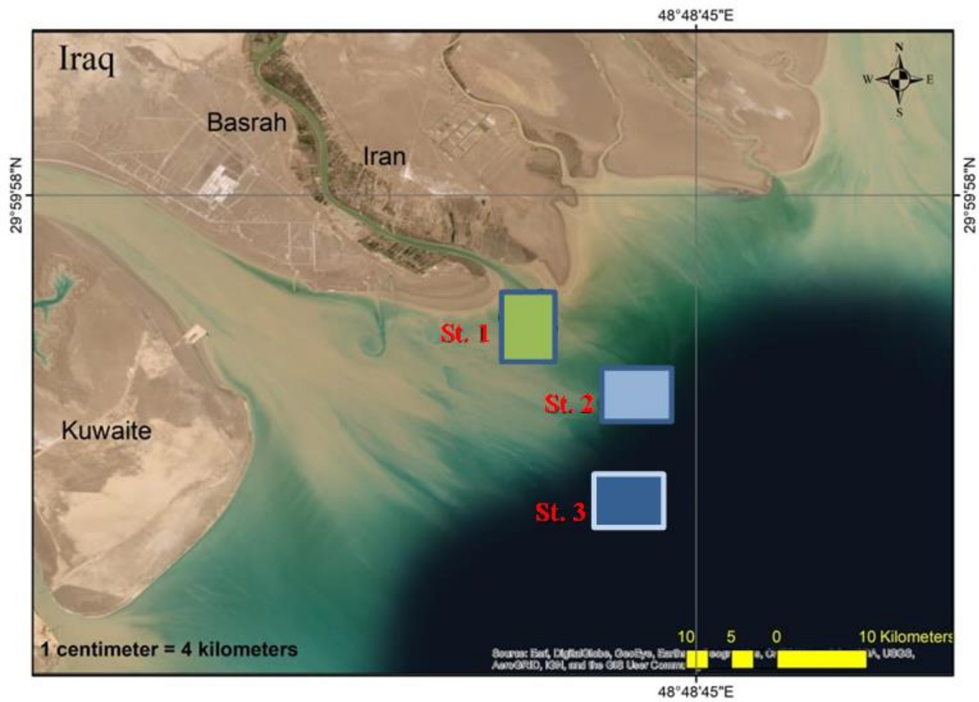

Figure (1) Northwest Arabian Gulf map showing the location of the studied stations

3-1-Physical Characteristics

Physical properties data were recorded in citu. Air and water temperatures were recorded using a simple mercury thermometer of a scale range 0-50 ° C. Transparency in cm was measured using marine Secchi disk. Kalbuneh's YSI model 57 from Kalbuneh company was used to measure salinity in ppt.

3-2-Chemical Characteristics

Tri-meter field apparatus of Kalbuneh company was used to determine pH in cite as well as turbidity (NTU) using HI-93703 HANNA turbidity meter. Dissolved oxygen, COD, Total phosphorus, Sulfate ion concentration ($SO4^{-2}$), Calcium ion concentration (Ca^{+2}), Sodium(Na)+, potassium$(K)^{-}$ in (mg / l) were measured in laboratory according to (APHA, 1999). Chloride ion (Cl^{-}) concentration was determined according to APHA, (2005) and soluble carbonate & bicarbonate ions after Page *et al*., (1982) in laboratory.

:

Results 4-

4-1-Physical characteristics:

-Air temperature:

Monthly changes in air temperature (ºC) for the three stations during the study period are shown in fig (2). The minimum values were recorded during December (16.5ºC) in the first station and during January (17.5 and17 ºC) in the second and third stations respectively. Maximum air temperature was recorded during June (38.4, 36.9 and 40 ºC) in the three stations respectively. There were significant differences (P <0.01) in air temperature values spatially and temporally during the study period.

-Water temperature:

The minimum water temperature values were recorded during January (13, 15.6, 12.4ºC) in the three stations respectively while the maximum recorded value was (35.4, 33.2, 37.2ºC) during June in the three stations respectively too (fig. 2). Statistically there was significant differences (P<0.01) between the three stations during the study period.

- Salinity (Ppt) and K+:

The results of the present study showed the monthly changes in salinity concentration among the selected study stations. The highest concentrations were recorded during July, reaching (47.3) ppt in the first station and in September it reached (45.7) ppt in the second station and in October it reached (43.1) ppt. The lowest concentrations were recorded in November

(28.1) ppt in the first station and in December (33.8) ppt, (39.7) ppt in the second and third stations respectively and the rang K+ between (28.1-472)mg/l in three stations. Figure (3). the results of the statistical test (F-test) showed no differences. Significant (P <0.01) in salinity and K+ concentration values in the three study stations.

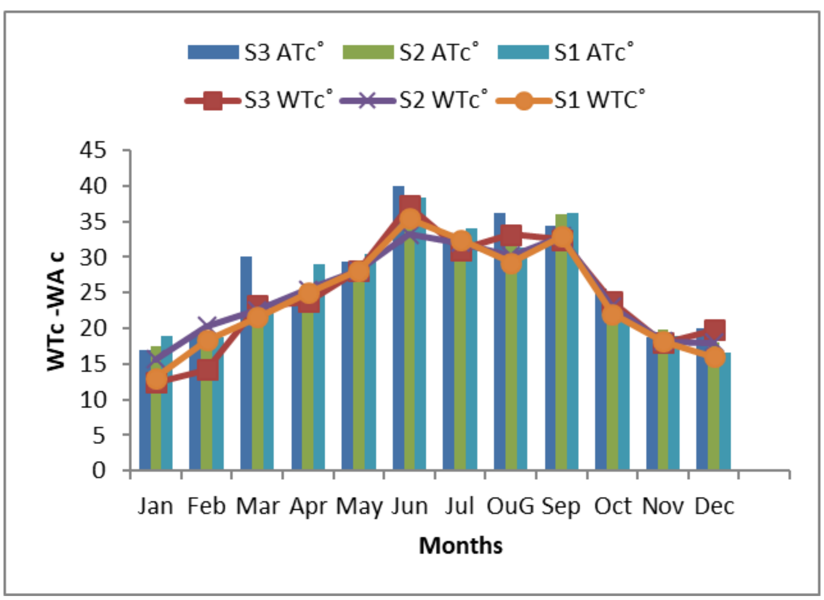

Fig. (2). Monthly changes of water and air temperature (ºC) in the three studied stations.

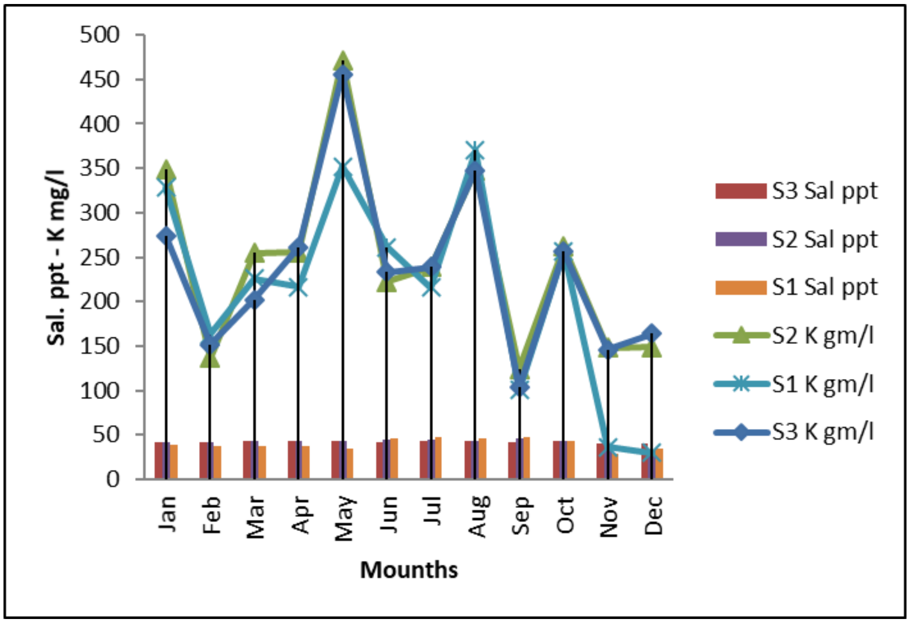

Figure 3. Monthly changes in salinity (ppt) and K^+ (mg/l) in the three studied stations during the sampling period

-Transparency (cm):

The recorded values of transparency showed wide significant (P <0.01) differences between the three stations during the study period. The highest values of transparency were recorded in the third station with a maximum value of 240cm during February. The other two stations showed lower transparency values with an of 20 cm in the second station during August and 16 cm in the first station during October.

-Turbidity (NTU):

The values of turbidity showed wide significant (P <0.01) differences between the three stations during the study period. The highest values of turbidity were recorded in the first station with a maximum turbidity of 645 NTU during October. The maximum turbidity in the second station was 600 NTU during August and 500 NTU in the third station during November. The first and third stations showed the lowest recorded turbidity (Fig. 4).

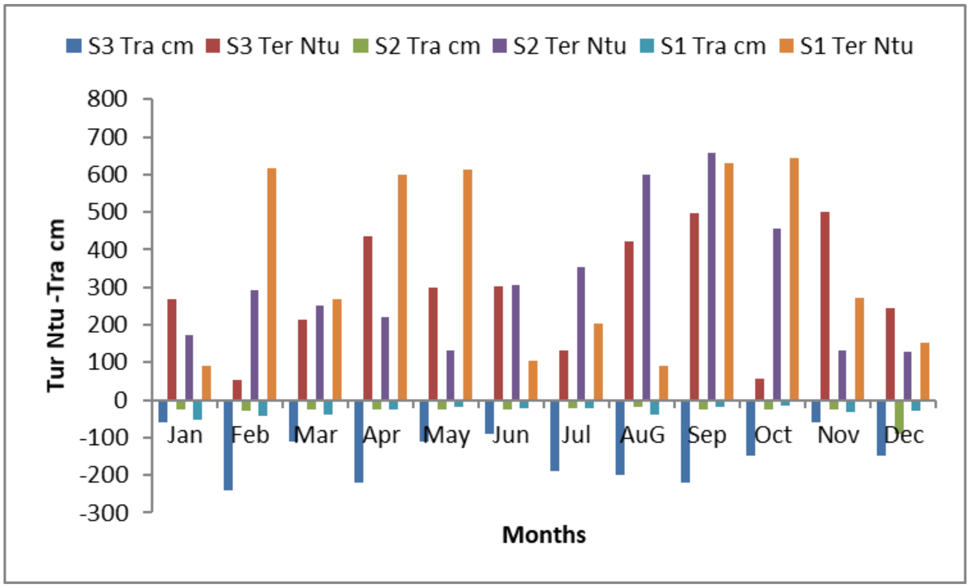

Figure 4. Monthly changes in Transparency and Turbidity values in the three study stations during the sampling period

4-2-Chemical Characteristics

-Dissolved Oxygen mg/L

Spring and early summer period showed the highest dissolved oxygen concentrations (Fig. 5) in the study area. There were no significant differences (P <0.01) between the stations but monthly variations showed a significant difference. The maximum D.O. concentrations were recorded during April (12, 12.4, 13.8 mg/l) in the three stations respectively. The minimum values detected during December (4, 4.5, 4.7 mg/L) respectively.

- Acidity (pH):

All recorded pH values in the study area were more than (7) minimum value 7.5 during March in the first station). The marine station (third station) showed a high pH values comparing with other two stations, while the first station showed the minimum values (fig. 5). There were significant differences in pH values between stations and among months (P <0.01).

The minimum calcium ion concentrations in the first and third stations were recorded during April (240 and 320mg/l) respectively while it was recorded during June (240mg/l) in the second station (Fig.6). The maximum values were recorded during October (800mg/l) for first and second stations while it was recorded during February(721mg/l) for the third station. There were significant differences (P<0.01) between stations and among months.

Sodium ion Concentration (Na)+ (mg/l) -

Sodium ion concentrations varied significantly (P <0.01) spatially and temporally during the studied area. The highest concentration was recorded at the marine station (5342 mg/l) during May (Figure 6). The minimum concentration was recorded in the first station (346 mg/l) during December.

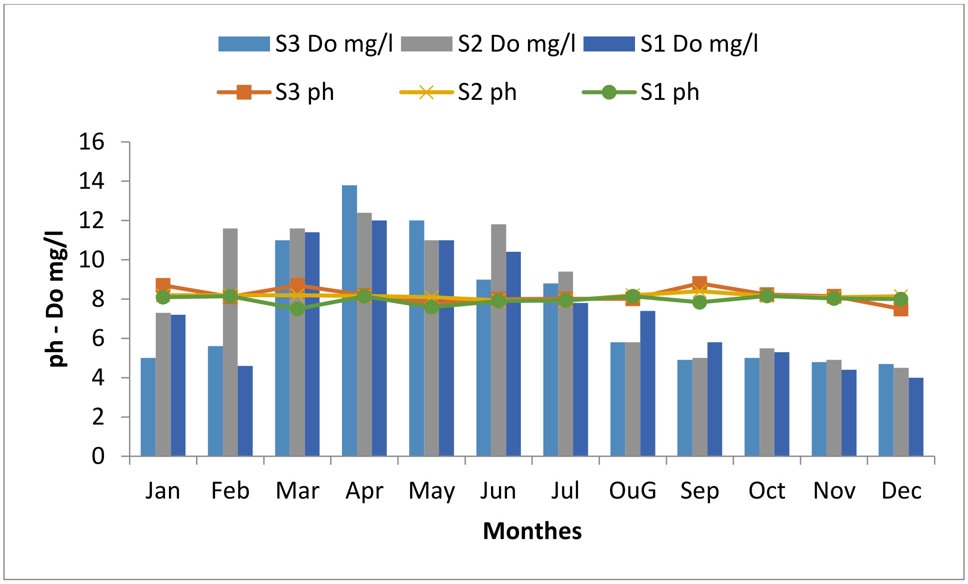

Figure 5. Monthly changes in Dissolved Oxygen ml/l and PH values in the three study stations during the sampling period

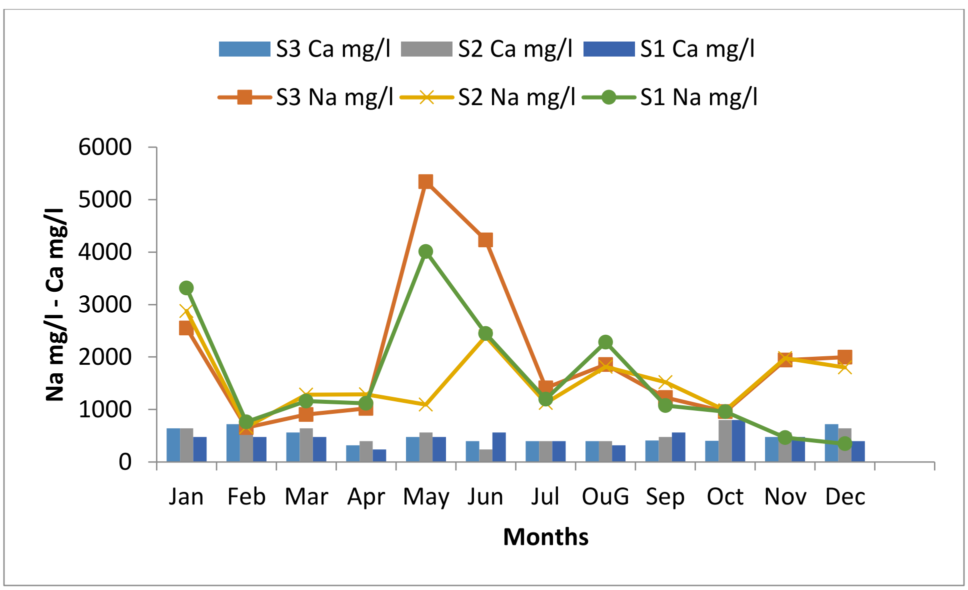

Figure 6. Monthly changes in Ca^{+2}valuesmg/l and Na^{+} in the three study stations during the sampling period

The highest concentrations of chloride ion concentrations were recorded during February and March in all stations while the lowest were recorded during May (8875, 8875, and 1065mg/l) in the three stations respectively. (fig.7).

Chemical Oxygen Demand; Cod (mg/l) -

The values of the chemical oxygen demand (COD) showed a noticeable increase during July in the three stations and reached (440, 500,410) mg /l respectively, while the lowest was during December in the first station and reached (160) mg /l, and the lowest In the other stations during April in the second and third station and reached (91, 93) mg /l respectively. the results of the test (F-test) showed significant differences (P<0.01) to the concentration of the chemical requirement of oxygen between months and study stations selected.

-Chloride ion concentration (Cl^-)(mg/l).

The highest concentrations of chloride ion concentrations were recorded during February and March in all stations while the lowest were recorded during May (8875, 8875, and 1065mg/l) in the three stations respectively Figure (7). the results of the test (F-test) showed significant differences (P<0.01) to the Chloride ion concentration between months and study stations selected.

Cl^-/Na^+Ratio:

Na+/Cl- ratio was stable throughout the study period (Fig.8) except during May in which it reached the maximum the first and the third stations (6.7 and 6.3 respectively). The lowest ratio was recorded during February (0.19) in the second station.

-Sulfate ion Concentration $(SO4)^{-2}$

The maximum recorded sulfate ion concentration was (4133mg/l) recorded during April in the third station while the minimum was (374mg/l) during December in the first station. The sulfate ion concentrations were higher in

most months in the third station comparing to the other two stations (fig.9). there were significant differences (P<0.01) in the concentrations between stations.

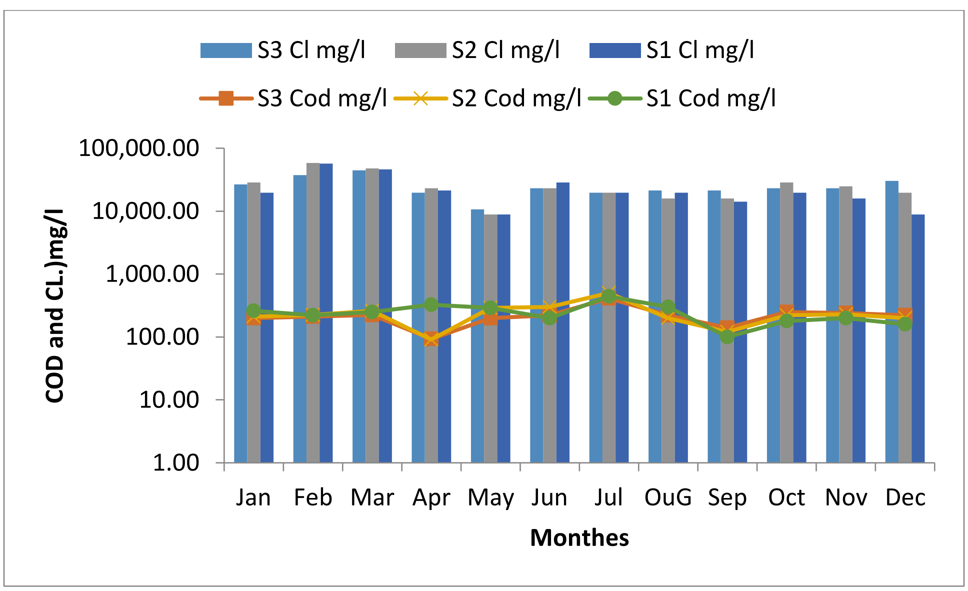

Figure. 7. Monthly changes in Cl^- values and COD values (mg/l) in the three study stations during the sampling period

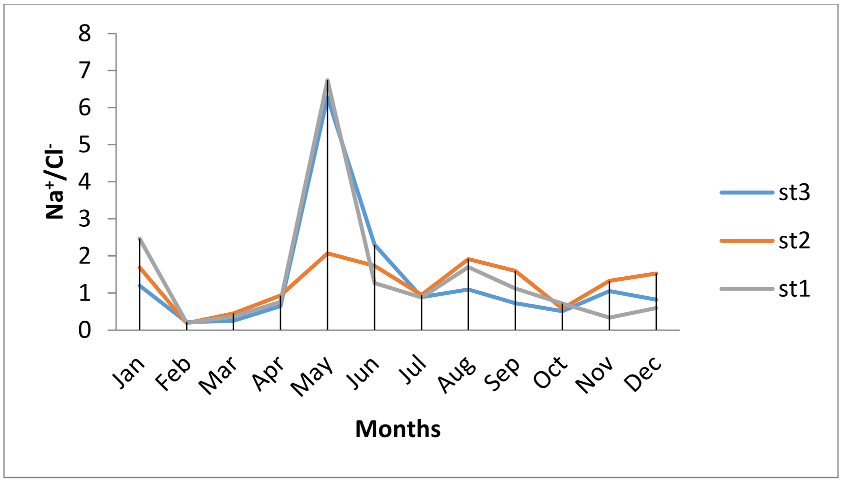

Fig. 8. the ratio of Na^+/Cl^- in the study area through the study period

The first station showed a remarkable high phosphate concentrations during February, March, May and July (Fig.9). The maximum concentration (0.59 mg/l) was recorded during February in the first station. The minimum value recorded was (0.0015 mg/l) in the third station during February. There were significant differences ($P < 0.01$) in Tp concentrations among stations.

-Sulfate ion Concentration $(SO4)^{-2}$(mg/l).

The maximum recorded sulfate ion concentration was (4133mg/l) recorded during April in the third station while the minimum was (374mg/l) during December. The sulfate ion concentrations were higher in most months in the third station comparing to the other two stations (fig.9). there were significant differences ($P<0.01$) in the concentrations between stations and months.

-Carbonate ion Concentration (CO_3^{-2}):
There was no specific pattern to describe the variations in the carbonate ions concentrations in the studied stations but it seems that there are low concentrations through October to January in all the stations (fig.10). minimum value of CO_3^{-2} was (4 mg/l) in the third station during December. The maximum value was (52.4 mg/l) recorded during February in the third station. Concentration recorded values showed significant ($P < 0.01$) differences between stations and months

-Bicarbonate ion concentration (HCO_3^-):
Bicarbonate ion concentration values had wide variations among stations except that during February, July, October November and December (Fig.10). The maximum concentration (197.6 mg/l) was recorded during July in the third station while the minimum value (24.4 mg/l) during December in the same station. The spatially and temporally differences between recorded bicarbonate ion concentration values were significant ($P < 0.01$).

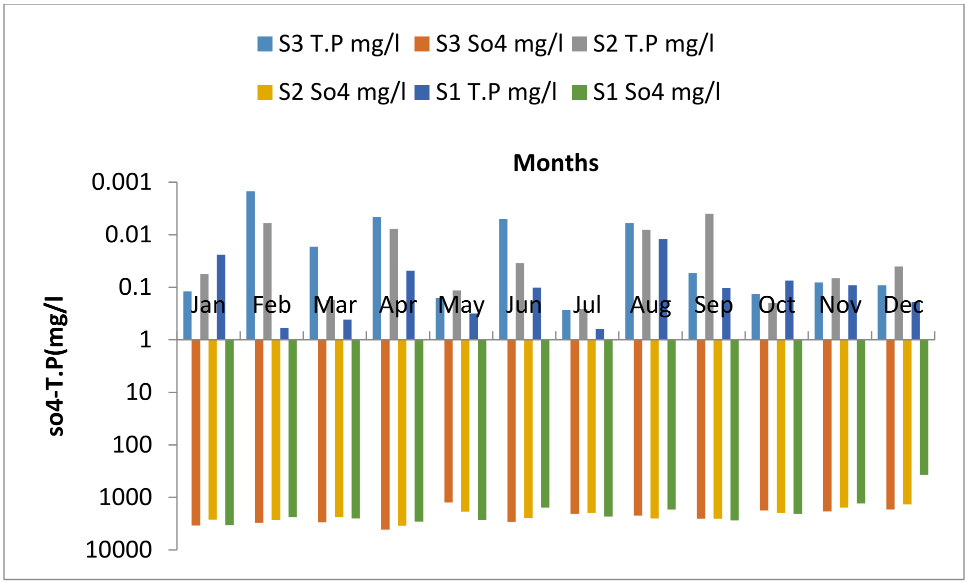

Figure 9. Monthly changes in SO_4^{-2} values and TP values in the three study stations during the sampling period

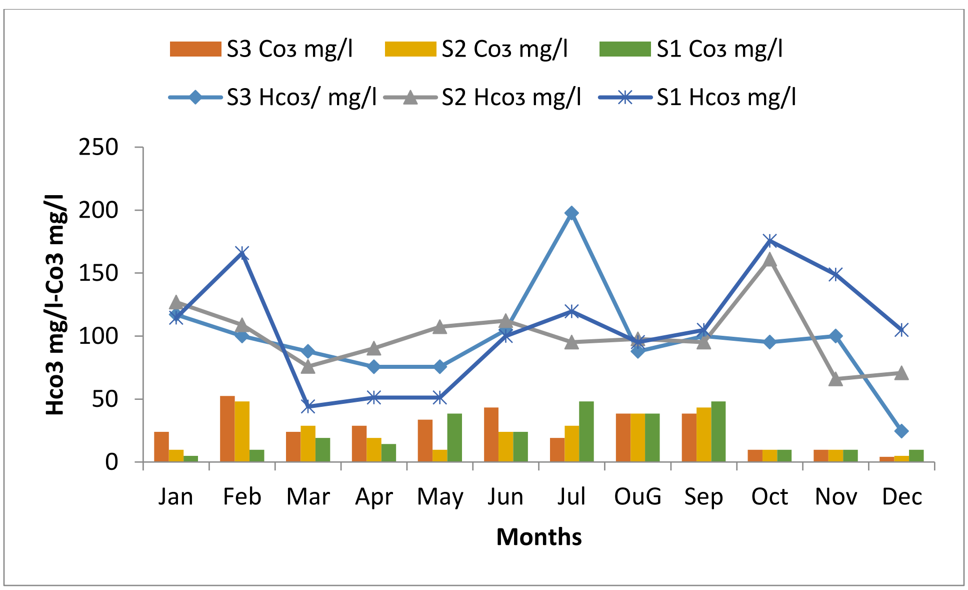

Figure 10. Monthly changes in HCO_3^{-} values and CO_3^{-2} in the three study stations during the sampling period

Disscussion

The structure of the community of any ecosystem varies according to the impact of the physical, chemical and biological factors variations (Salman, *et al*.,2003). The Iraqi marine waters are considered as a nursery and breeding ground for many marine and estuarine fish species due to its high productivity as a result of nutrient-loaded freshwater from Shatt al-Arab (Hussain and Ahmed, 1995). The temperature readings and trend agreed with the previous studies in the same area. Water temperature didn't show a time lag responding to air temperature which disagrees with that mentioned by (Preud'homme and Stefan, 1992) due to shallow waters, they found that there is a simple linear relationship between daily and weekly air and water temperature variations in U.S sea. These relationships vary from one stream to another according water depth. Time lag between air and water temperature relationship varies from hours to days depending on river depth too. Temperature is one of the highly volatile environmental factors that affect environmental factors (Mouillote, *et al*., 2005) such as Solubility of dissolved oxygen and other gases, Chemical reaction rates, toxicity. There are other effects on the activities and responses of the biota in the aquatic systems like Microbial activity and reactions, Primary production, Geographical distribution and community structure, Trophic interactions, Metabolic rate, Growth rate, Food and feeding habits, Reproduction, development rates and life histories, Eggs and fecundity, Emergence, Spawning, Movements and migrations and Tolerance to parasites and diseases (Dallas, 2009). The current results of air and water temperature showed monthly variations during the study period. Air and water temperatures of this study agreed with those of Mohamed, (2005) and Al-Yamani (2006) in the same area. Sea-level has risen during the last decades due to climate change as well as rivers discharge has declined due to human impact. These two reasons resulted in increasing salinity in most estuaries(Hussain, *et al.*,1999).

The resulting higher salinity, or saltiness of the water, could harm plants and animals, alter fish and bird habitat, and reduce the capacity of estuaries to provide such important services as seafood production and the protection of shorelines from erosion (Havens, 2018). The minimum salinity concentration in the estuary of Shatt Al-Arab was 28.1 mg/l which is considered to be of a high salinity is a result of the two mentioned reasons. this study was agreed with Ali, *et al*., (1998) in the increase in salinity in Khor Abdullah with (29) ppt during their study in Iraqi marine waters. One of the main sources of calcium carbonate in the marine environment is the boney fishes as well as the sediments production and inorganic carbon cycling (Salter, *et al*., 2019). Lobban and Harrison (1994); Doney, *et al*. (2009) and Anderson and Gledhill (2013) added other sources of calcium carbonate like coral reefs, calcifying algae, foraminifera, echinoderms, molluscs and bryozoans. and in these organisms the calcification process involves the formation of calcium carbonate deposits in shells and other skeletal parts. The death of these organisms, their calcareous skeletons sink to the bottom of the ocean and form a part of the oceanic bed (Langer 2008; Shutler, *et al*., 2013). Calcium combines with carbonate ions to form the precipitate calcium carbonate ($CaCO_3$) which change into soluble $Ca(HCO_3)^2$ depending on dissolved Carbon dioxide concentration and pH (Andersson and Gledhill 2013). Sodium and potassium are constant in the oceans with average values of 0.5567 and 0.0206 respectively were founded by Riley, and Tongudai (1967). The estimated ratios of Sodium to chloride ion concentration in the study area were very high due to the effect of Shatt Al-Arab basin which is affected by the agricultural activities and domestic sewage. The low ratio values during February, March and April is due to the low discharge of shatt Al-Arab during these months.(Al-Shawi,2010).

Phosphate is one of the important nutrients in the aquatic ecosystem and could be considered as a limiting factor in freshwater, The major source of this ion in inland waters is nonpoint variable anthropogenic activities, High concentrations of this ion combined with nitrate and suitable weather conditions might cause hypoxia, toxic algal blooms, fish deaths, loss of biodiversity and submerged aquatic plants (Adesuyi *et al*., 2015).

There are two main sources of sulphate in aquatic ecosystems. The first is from atmospheric and terrestrial processes through erosion and volcanic activities. The second source is anthropogenic from industrial activities such as mining and mineral processing, agriculture, paper and pulp, combustion of fossil fuels and refuse (Moreno-Casas, 2009). Sulphate recommended concentration limits is 250-500 mg/L for drinking water and 500-1,000 mg/L for discharge into surface water bodies.

Geurts, *et al*. (2009) noticed during their experiment that sulphate increment lead to an increase in alkalinity and sulphide concentrations, which resulted in higher decomposition and eutrophication. Sulphate pollution reduced biomass production and colonization, but macrophytes were found less vulnerable in fertilized conditions (Jeroen, *et al*., 2009). The chemical Oxygen demand COD in Iraqi marine waters was calculated as it reached the maximum of the three stations during July. Perhaps may be due to high temperatures, increasing turbidity and continuous mixing of water during sampling . in this study Agree with Abaychi *et al*.,(1988) study in Iraq marine water.

References:

-Abaychi, J. K;Darmoian, S. A. and DouAbul, A. A. (1988).The Shatt Al-Arab River: Anutrient salts and organic matter source to the Arabian Gulf. Hydrobiologia, 166 :217-224pp.

-Al-badran,B. **(1995**) Lithofacies of recent sediments of Khor Abdullah and Shatt Al-Arab delta,Northwest Arabian Gulf.Iraqi J.Sci.,**36**(4):1133-1147.

Al-Shawi,A.J.(2010) The study ecological and classification plankton in Khor Al-Zubiar with estimate total oil hydrocarbons levels phD Thesis /College of Agriculture/ basrah university .148p.(In Arabic).

-Adesuyi, A. A.; Nnodu V. C.; Njoku K. L. and Jolaoso A. (2015). Nitrate and Phosphate Pollution in Surface Water of Nwaja Creek, Port Harcourt, Niger Delta, Nigeria. Inter. J. Geo. Agri. Env. Sci. 3 (5) www.woarjournals.org/IJGAES

-Ali,T.S; Mohamed,A. and Hussain, N.A(1998) The Status of Iraqi Marine fisheries during 1990-1994.Marina Mesopotamica 13(1):129-147.

- Al-Nafisi , R. S. (2009). Positive Impact of mangrove plantation on Kuwait Costal Environment. European journal of science Research , 26 (4) : 510-521 pp.

- Andersson, A.J. and Gledhill, D. (2013). Ocean acidification and coral reefs: Effects on breakdown, dissolution, and net ecosystem calcification. Annu. Rev. Mar. Sci. 5, 321-348.

- APHA, American Public Health Association (1999). Standard method for the examination of water and waste water 20th edition, new york, USA.

- APHA: American Public Health Association (2005). "Standard methods for the examination of water and wastewater " , 21st Edition .Washington ,DC. USA

-Al-Yamani , F. Y. ; Bishop , J. M. ; Ramadan , E. , Al-Husaini , M. and Al-Ghadban , A. (2004). Oceanographic Atlas of Kuwait's waters. Kuwait Institute for Scientific Research, Safat , Kuwait.118 pp.

-Al-Yamani , F. Y. ; Subba , D. V. ; Mharzi, A. ; Ismail , W. and Al-Rifaie , K. (2006). Primary production off Kuwait Arid Zone Environment , Arabian Gulf. International Journal of oceans and oceanography , 1 (1) : 67-85 pp.

- Castro, O. and M. F. Huber (2003) Marine biology. The McGraw-Hill Companies. 462p.

-Dallas, H. (2009). The effect of water temperature on aquatic organisms: a review of knowledge and methods for assessing biotic responses to temperature. Report to The Freshwater Consulting Group Freshwater Research Unit, Department of Zoology, University of Cape Town, WRC Report No. KV 213/09.

-Doney, S., Fabry, V., Feely, R. and Kleypas, J. (2009). Ocean Acidification: The other CO2 problem Annu. Rev. Mar. Sci. 1, 69–92.

-EPA. Environmental Protection Agency (2004). Classification Framework for coast system Office of Research and Development National Health and Environmental Effect Research Laboratory , Research Triangle Park , NC 27711- EPA600 / R-04 /061.

-Hartman,M.;Lange,H;Seiboid,E. and Walger, E(1971) Oberflachen-edimente in persischen Gulf and Gulf von Oman.1.geologische hydrologist her Rahmen and erste sediment clogische Engebnisse Mngebnisse Meteor-Freshungsergeh,C(4),1-76.

-Havens, K. (2018). Climate Change: Effects on Salinity in Florida’s Estuaries and Responses of Oysters, Seagrass, and Other Animal and Plant Life. http://edis.ifas.ufl.edu.

- Hussein, N. A,; Najjar, H. H.; S, H. T .;Yousef, O. H and Sabounji, A. A. (1991) Shatt al-Arab, basic scientific studies. Publications Marine Sciences center, 391 p.(In Arabic).

-Hussain, N.A.; Ali, T.S. & Saud, K.D. **1989**. Seasonal fluctuations and composition of fish assemblage in the Shatt Al-Arab at Basrah, Iraq. J. Biol. Sci. Res., Baghdad, **20** (1): 139-150.

-Hussain,N.A ;Mohamed,A.R.M and Ali,T.S(1999)The seasonal formation of Thermocline Halocline and water masses in the Iraqi Marine waters. Marina Mesopotamia 14(2):299-312.

-Hussain, N. A. and Ahmed, S. M. (1995). Seasonal composition abundance and spatial distribution of ichthyoplankton in an estuarin sub tropical part of the Northwestern Arabian Gulf. Marine Research, 4(2): 135- 146.

Jawad,L.A;Ziyadi,M.S.F;Naslund,J;Pohl, T. and Al Mukhtar,M.A(2018) Checklist of the fishes of the newly discovered coral reef in Iraq, North-West Arabian Gulf, with 10 new records to the Arabian Gulf. aqua, International.J.of Ichthyology.24(3):89-99.

-Jeroen J.M.; Geurts A,B; , Judith M.; Sarneel, c; Bart J.C.; Willers, A; Jan G.M.; Roelofs, A ;Jos T.A.; Verhoeven, c; Leon, P.M.; Lamers,C. (2009). Interacting effects of sulphate pollution, sulphide toxicity and eutrophication on vegetation development in fens: A mesocosm experiment. Environmental Pollution 157 (2009) 2072–2081

-Keithan,E.D.and Lowe,R.L(1985) Primary productivity and Spatial structure of phytolithic growth in streams in great smoky mountains national park .Temessee,Hydrobiology,123:59-67.

-Langer, M. (2008). Assessing the contribution of foraminiferan protists to Global Ocean carbonate production J. Eukaryot. Microbiol. 55(3), 163–169 .

-Lobban, C. and Harrison, J. (1994). Seaweed ecology and physiology. Cambridge University Press.

-Mohamed,A.R.M;Ali,T.S.and Hussain,N.A(2005)ThephysicalOceanography and Fisheries of the Iraqi Marine Waters, Northwest Arabian Gulf.Utilization of marine resources.with conference 20- 22 December 2002,Karachi,Pakistan (Special Issue),47-56.

-Mohamed,A.R.M;Hussain,N.A.and Ali,T.S(2001) Estuarine Componets of the Ichthyofauna of the Arabian Gulf.Marina Mesopotamica 16(2):209-224.

-Mohamed,A.R.M.;Ali,T.S.and Hussain,N.A.(2002)Stock condition of larg-scale tonguesole,Cynoglossus arel in the Northwest Arabian Gulf.Mar.Mesopot.,17(1): 1-12p.

-Moreno-Casas, P. A.; Aral, H. and Vecchio-Sadus, A. (2009). Environmental impact and toxicology of sulphate. Environment conf. Santiago, Chile.

-Mouillote , D. ; Gaillard , S. ; Aliaume , C. ; Veriaque , M. , Belsher , T. ; Troussellier , M. and Chi , T. D. (2005). Ability of taxonomic diversity indices to discriminate coastal Lagoon environments based on macrophytes communities. Ecological Indicators , 5 (1): 1-17 pp.

- Page, A. l.; R. H. Miller and D. R. Kenney. (1982). Methods of soil analysis, part (2) 2nd.ed., Agron. 9.

-Preud'homme E. B. and H. G. Stefan (1992). Relationship Between Water Temperatures and Air temperatures for Central u.s. Streams. UNIVERSITY OF MINNESOTA. ST. ANTHONY FALLS HYDRAULIC LABORATORY Project Report No. 333.

Purser,B.H.and Seibeld,E.(1973) The principal environmental factors influencing Holocene sedimentation and diagnosis in the Arabian Gulf.(Ed.B.H purser):1-9.

-. Salter,M,; . Perry.C.T. and . Smith,A.M. (2019). Calcium carbonate production by fish in temperate marine environments. Limnol. Oceanogr.9999: 1–1

- Salman, Nader Abdul,Saad, Hamed Taleb and Hamadi, Ahmed Abdullah (2003) General Ecology / Faculty of Marine and Environmental Sciences, University of Hodeidah, Republic of Yemen. 1-252 p.(In Arabic).
- Shutler, J., Land, P.E., Brown, C.W., Findlay, H.S., Donlon, C.J., Medland, M., Snooke, R., and Blackford, J.C., (2013). Coccolithophore surface distributions in the North Atlantic and their modulation of the air-sea flux of CO2 from 10 years of satellite Earth observation data. Biogeosciences 10, 1-11.
-Riley, J.P. and M.Tongudai (1967). The major cation/chlorinity ratios in sea water. Chemical Geology, Volume 2: 263-269.

دراسة بعض الخصائص البيئية للمياه البحرية العراقية جنوب العراق

احمد جاسب الشمري[1] ،اسامة حامد يوسف [2]،كاظم حسن يونس[1]
[1]- مركز علوم البحار/جامعة البصرة
[2]- كلية العلوم/جامعة البصرة

الملخص:

اشتملت الدراسة الحالية بدراسة العوامل البيئية غير الحياتية في مصب شط العرب والمياه البحرية العراقية للفترة من كانون الثاني 2018 ولغاية كانون الاول واختيرت ثلاث محطات للدراسة الاولى مصب شط العرب والثانية مياه متوسطة بين مياه المصبات والمياه البحرية العراقية والثالثة مياه بحرية خالصة ، العوامل البيئية غير الحياتية التي تم قياسها تتضمن درجة حرارة الماء والهواء والشفافية والعكارة والملوحة والاس الهيدروجيني والمتطلب الكيميائي للأوكسجين والاوكسجين المذاب والفسفور الكلي والكبريتات والكالسيوم والصوديوم والبوتاسيوم والكلورايد والكاربونات والبيكاربونات. بلغ اعلى درجة حرارة للماء وبلغت (35.4 ، 33.2 ،37.2) م ° خلال حزيران في محطات الدراسة الثلاثة بينما بلغ تركيز الملوحة خلال تموز وبلغت (47.3) جزء بالألف في المحطة الاولى وفي ايلول وبلغت (45.7) جزء بالألف في المحطة الثانية وفي تشرين الاول وبلغت (43.1) جزء بالألف في المحطة الثالثة وبلغ اعلى قيمة لشفافية الماء في المحطة الثالثة وبلغت 240 سم خلال شباط ،وتهدف الدراسة الى معرفة الخصائص الفيزيائية والكيميائية لماء البحر نظرا" لقلة الدراسات البيئية .