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Biodiversity of Mollusks in Rumaitha river-Iraq

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ABSTRACT

The chemical and physical parameters, density, spreading, biodiversity of Mollusca, and environmental features of Rumaitha district, South Iraq were investigated from July 2016 to June 2017. Mollusca and water samples were obtained from three dissimilar positions S1, S2, S3. The results were showed that water temperatures 12- 32°C. The pH was ranged 7.21-8, 12 it showed a slightly alkaline trend. The maximum value of electrical conductivity 2.6 mS, Salinity values were ranged between 0.58-1.7 ‰ that indicated the water was Oligosaline during the study period, according to the classification of Reid. Dissolved oxygen was ranged 5.3-11 mg/l. The highest value of Ca^{++} and the organic content of the bottom sediments were 214 mg/l, 21.6% respectively recorded in station S2 during the study period. Quarterly variations in bulks of Mollusca species were obtained during study period recorded Total density of 817.89 indv /m^2. In the present study, Mollusca fauna was identified 4 species belonging to 4 families of class Gastropoda and 3 species belonging to 2 families of class Pelecypoda. Gastropods Species are *Melanoides tuberculata* - Thiaridae, Melanopsis nodosa -Melanopsidae, *Neritina crepidulare* - Neritedae, and *Viviparus bengalensis* – Viviparidae. And their total density in the study period is (142, 24, 168.69, 44.45, and 106.68 indv/m^2 respectively. While the species belonging to the Class of Pelecypoda: Corbicula flumina, Corbicula fluminalis - Corbiculidae and Unio tigridis -Unionidae. And their total density in the study period are (151.13.80.01.106.68 indv/m^2 respectively. Biodiversity was low and did not exceed the diversity values of both classes. The highest value of varietal diversity of Gastropoda and was 0.43657 recorded at the station S1 during a month Apreil 2017. Sorensen Similarity was used to determine the similarity between stations taxa composition Results showed that all study stations were 100% identical for Molluscs taxa.

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INTRODUCTION

Many scientific investigations of water quality environment and biodiversity of many aquatic invertebrates, but the available information on the aquatic environment and its relationship with Mollusks in Iraqi's rivers is very rare (Ibrahim, 2005).

Water constitutes around 71% of the surface of the earth, only 3% occupy fresh water. The river is the most important freshwater system which plays important role in the most biochemical reactions in the breakdown and development of living organisms involve water. (Smitha and Shiva Shankar, 2013).

The aquatic environment plays an important role in the formation and synthesis of aquatic communities and aquatic plants (Schmid-Araya, 2000) as well as the importance of the study of water resources because of their direct and indirect relationship to human life.

Several studies have indicated that there are close relationships between the availability of mollusks in quantity and quantity with the provision of water with chemical and physical properties suitable for the growth and reproduction of molluscs where Stark *et al* (2000) pointed out that aquatic ecosystems are able to maintain their natural state, but some aquatic ecosystems are sensitive to small changes in the physical and chemical properties of the water body, which can lead to biodiversity imbalance (Ustaoglu *et al*., 2001) studied mollusks and environmental changes they noted molluscs respond directly to ecological fluctuations. This feature facilitates the studies that depend on the correlation between the ecology and organism. Ibrahim (2005) study noted that the density and spread of snails in fresh water depends on water properties, such as temperature, pH, DO, Ca^{++}, etc. the studies showed that the poisonousness of materials is affected by factors such as turbidity, pH, temperature, DO, carbon dioxide and density of water (Farid *et al*., 2008) concluded that there are many biological and environmental factors (temperature, evaporation, biodegradation, chemical oxidation, and sedimentation), may produce pronounce variations in the concentrations of hydrocarbons in the molluscs of Shatt Al–Arab river. Pinku and Rafee., (2017) were found that the incidence of snail was positively and significantly correlated with rainfall, relative humidity, and minimum temperature. Some studies have indicated that some mollusks have the ability to resist adverse environmental conditions and can live in places contaminated with toxic civil and industrial wastes. For examples (Heba *et al*,.2003) pointed out that the immune system mollusks contain innate mechanisms which are highly active against foreign substances found in the atmosphere. The explanatory analysis shows the level of contaminants, including petroleum hydrocarbons and heavy metals in mollusks Tivela ponderosa from the Gulf of Aden-Arabian Sea aiming to establish their background concentrations. And Farid (2005) searched resistance of two species of snails in Shatt Al–Arab estuary to the toxic effect of copper. The study of Aziz *et al.*, (2010) involved surroundings of biodiversity of several organisms as mollusks (snails). Assessment the concentration and distribution of some heavy metals in water such as cadmium, copper, lead, and zinc. (Choubisa and Zulfiy, 2013) revealed that stenotopic species (L. acuminata, L.luteola, A. convexiusculus, Melania scabra and Thiara lineata) were good bio-indicators for ecologically diverse freshwater habitats and are useful in their classification in the present communication.

Sunil and Kamble (2014) studied the acute effect of mercury and zinc chloride on Gastrin/CCK 8 neuropeptide in relation to the behavior of a species of freshwater snail. While the study of (Al- Shammari and Al- Janabi, 2015) was conducted on five sites of Euphrates River during the period from June 2013 until May 2014 in order to investigate certain types of organochlorinated pesticides in snails' samples (Melanoides tuberculate Muller, 1774 and Melanopsis nodosa Ferussac, 1874. (Serb and Lydeard, 2003) studied the evolution and phylogenetic utility of mitochondrial genome organization in Bivalvia (Mollusca) and they found that Mollusca is the second largest phylum of the animal kingdom, forming a major part of the world fauna. (Bernal-Hernandez *et al*., 2010) mentioned that the bivalve mollusks have characteristics such as high distribution worldwide, sedentary and filter-feeding habits; hence these organisms accumulate a large number of bacteria and chemical pollutants, which are both a source of nourishment and an immune challenge. In view of the importance of mollusks and it's widespread, many research studies examined the biodiversity of mollusks. (F.R. British Columbia, 2000). noted that, Snails, mussels, and oysters are three subsets of mollusks. Some of which live in freshwater and are an integral part of the complex network of life that supports biodiversity. They have a significant role in the food chain, functioning, decomposers and as critical links in the food web. 10 species from Gastropoda and pelecypods as well as 3species of mollusks were classified by Atte, (2008) and dominated most of the year which are: Lymenaea megasom and Melanopsis nodosa from Gastropoda and species of Corbicula fluminea from a total biodiversity value were 2.3. 1.6 and 1.9 at current study sites respectively. The yearly density of Mollusca shown declined in values which were 415.1-42.8-276.6 and 194.9ind/m2 at the same position respectively (Akbar, 2013). Study on an Ecological survey on some invertebrates of three stations (Al-Nasir, Al-Shatra, AlGharaf), in Al-Gharaf River, was conducted. Some chemical and physical factors of the study area have been measured also species diversity, evenness and richness of the invertebrates have been quantified. 58 species of invertebrates were recorded comprised of ten species of Mollusca.

The Rumaitha River is the main source of drinking water, fishing, agriculture, and other human activities, and due to the scarcity of previous studies on

the water quality and the biodiversity of aquatic mollusks in the Rumaitha River.

The present study aims to: study monthly changes in the physicochemical factors and the qualitative and quantitative of Mollusca in the Rumaitha River, additionally, assess the correlations between physicochemical and Mollusca in order to relate them with Mollusca distribution and abundance.

MATERIALS AND METHODS

Description of Study Area

The current study was elected three stations S1, S2, S3 on Rumaitha River. The River runs between the latitudes 31.65-31.47 north and between longitudes 45.03-45.28 eastward. Passing the district of Rumaitha, with a long of 43 km all inside the administrative borders of Al-Muthanna province. The water level in the river generally be under the natural ground level, the areas surrounding the river are primarily agricultural areas. The first study station S1 is located to the north of Rumatha spend at Kilometer 3 in the entering of the river to the district of Rumatha and surrounded the station farmland. The second station S2 is located on Rumaitha River about 2km north of the district center the presence of communities on both sides of the river and agricultural lands. S3 is situated at the end of the river inside the area and the advantage of the river in this region shortness beach (figure 1.)

Figure 1: Location of Rumeitha River

Sampling Procedures

Water and the bottom samples were collected of the three study stations (S1, S2, S3) beginning in July 2016 until June 2017, from the depth of 30 cm below the surface the water samples collected monthly using prewashed polyethylene bottles**.** Measuring of water temperature (°C), pH, Dissolved oxygen (D.O mg/l), Calcium (Ca mg/l) and the percentage of organic matter contents of sediments were reported by (APHA, 1999), electrical conductivity (ms/cm) were measured and in terms of the results of the electrical conductivity, salinity ($_{00}/^{0}$) was calculated (Mackereth et al., 1978). The qualitative and quantitative study of bottom Mollusks Only the living molluscs which monthly collected using Ekman Dredge with dimensions (15 × 15 cm), the similar duration of water sampling assortment relies on process from Ibrahim (2001) mollusks were considered, and preserved in 70% ethyl alcohol then classified to species level using taxonomic keys. Ahmed (1975); Robert and Michael (2003) then calculated and demonstrated by (Individual/m^2).

Data analysis

Data analyzes were accomplished using (SPSS 14.0 software) with significant level 5% were used to test the significance of differences. and to compare the means of physiochemical parameters measured, the correlation between chemical and physical parameters and density of Mollusca was done using the Pearson correlation coefficient (r). The equation [x] was used to calculate the diversity of life as follows:

$$H' = -\Sigma (ni / N) \ln (ni / N)$$

ni = number of members of each species

N = Total Number of individuals in the sample.

Sorensen Similarity (Hamayoan *et al*., 2003) was used to determine the similarity in stations taxa composition. S = 2J/ (a + b) * 100, where J=number of common species occurred in both station**.** A= number of species in (a) station. B= number of species in (b) station.

RESULTS AND DISCUSSION

Al-Rumaitha River in southern Iraq has not received adequate environmental studies, especially in the studies of mollusks compared to the Tigris and Euphrates rivers. Therefore, it is difficult to compare the results obtained in this study accurately, especially as the characteristics of the Rumaitha River and its Biodiversity Affected by seasonal and situational changes and the river's environmental state**.** Some physical and chemical properties of water and bottom models were measured in Rumaitha in the stations elected during the study period**.** The overall range in Water temperature showed clear changes in the duration of the study, with the highest temperature of 33 at station S2 in August 2017, while the lowest value of 12 recorded in January 2017 at station S1 as expected, the lowest temperatures recorded in winter, especially in January and February while the highest scores were recorded in the summer Fig2. The results of the current study revealed a significant variation ($p<0.05$) between months. Additionally, water temperatures and other parameters correlate negatively. On the other hand, there is a significant change in water temperatures during the seasons, while the maximum values of temperature were documented throughout summer and the minimum throughout winter, this fluctuation due

to the seasonal and the difference in time of sampling. These results have been agreed with a study done by Al-Fanharawi and Ibrahim, (2014). The pH values varied between the lowest values of 7.21 recorded in stations S1 and S2 in January and April 2017 and the highest values of 8.12 in September 2016 station S2. The PH was high during the period of the study and the maximum pH level was documented in the summer months while minimum during the winter months, Fig.3 the level of pH between river positions demonstrated insignificant differences ($p<0.05$), suggested that the water body was same in the level of pH. The pH level of water important due to several biological events happens only within a narrow range of pH.

The highest value of electrical conductivity hence salinity was during September 2016 at station S3 E.C was 2.6 mS /cm. Figure 4 and salinity was 1.7 $_{00}$% in September 2016 Figure5. (The conductivity unit has been called "mho" because it is the inverse of "ohm", the resistance unit. The basic unit is "mho/cm", otherwise known as 1 Siemen so we use millimhos/cm (mS/cm) as electricity unit). Lowest result salinity 0.58 $_{00}$%. was recorded at S1 in January 2017 Figure (5). Conductivity will vary with water source: groundwater, water drained from agricultural fields, municipal wastewater, rainfall. Station waters were Low salinity during the study period According to the classification of Reid, 1961. In the current study, there was a positive correlation between electrolysis and salinity ($P <0.05$) Ibrahim (2000) noted in his study of the Diwaniyah River the high values of the electrical conductivity in the direction to the south (downstream), which is the same as was observed in the current study Salinity shows the total positive and negative ion concentrations in the water sample (APHA, 1999).

The maximum dissolved oxygen value was 11 mg /L in February 2017 at stations S1, while the lowest value was 5.7 mg / L recorded at station S2 and S3 in July 2017. Figure 6. The maximum level was documented in winter and the lowermost in summer, Dissolved oxygen concentrations in water are affected by several factors, including daily and seasonal changes in temperature, the density of aquatic organisms, water quality, and presence of organic pollutants (Ibrahim, 2000). The high concentration of dissolved oxygen in the aquatic environment is evidence of its validity. In this study, dissolved oxygen didn't reach the critical limit or lack of oxygen during the study period. As expected for the quarterly changes. The other seasons, especially the summer, and this phenomenon is known scientifically due to the low gas solubility at high temperature in addition to the decomposition of organic matter by microorganisms, leading to increased consumption of oxygen, In the current Diwaniyah was close to what was found in research (Ibrahim, 2000 and Ibrahim, 2005) In general, dissolved oxygen values were consistent with the parameters of the Iraqi river and public water system of pollution No. 25 of 1965, which determined dissolved oxygen values of more than 5 mg / L. In the present study, liquefied oxygen revealed a negative correlation with water temperature of 14. The present study also revealed liquefied oxygen diminished when water temperature increases, additionally, there is a negative relationship between DO and water temperature, EC, and organic content. The increase in residues concentrations of agricultural and industrial activities added to the aquatic environment can lead to various problems such as the growth of toxic algae and the reduction of oxygen to the critical limit. This leads to the death of fish, the loss of biodiversity and the loss of caustic plant species (Iscen *et al. 2008).* The concentrations of Calcium recorded the highest value of 214 mg /l in June 2017 at station S2. The lowest value of calcium was 93 mg / l recorded at station S1 and S3 in February 2017. Figure (7**) .** In the current study, positive correlation between calcium, salinity, and negative correlation with temperature $p <0.05$). As provided for in the System for the Conservation of Rivers and Public Water from Pollution No. 25 of 1965. Added to this are the residues of agricultural activities and pesticides. The values of the organic content of the bottom sediments in the selected study stations ranged from the highest of 21.4% at station S2 in August 2016, and the lowest value of 11% at station S2 in February 2017, Figure 8**.**The level of organic contents were showed obvious change ($p<0.05$) between months which result in precipice of huge amounts of organic west of country, that crosses the river, additionally, the occurrence of waterways that poured to the river, positives and negative correlations were observed between the organic content of the bottom sediments and some parameters.

Based on chemical and physical parameters, the results gained showed to provision each other. Due to internal, farming and manufacturing wilds and the cleansed wastewater is drained into the Rumetha River, the positions on the Rumetha River were polluted in organic and inorganic compounds. Consequently, the chemical and physical parameters were documented to be high comparatively other stations. Quarterly fluctuations in densities of Mollusca species were collected during the study period recorded Total density of 817.89 in dev /m^2. In the present study, Mollusca fauna was identified 4 species belonging to 4 families of class Gastropoda and 3 species belonging to 2 families of class Pelecypoda. Species gastropods are: species

are: Of the gastropods, *Melanoides tuberculata* (MULLER)- Thiaridae, Melanopsis nodosa (FERUSSAC)-Melanopsidae, *Neritina crepidulare* - Neritedae, and Viviparus bengalensis (LAMARCK) – Viviparidae. And their total density in the study period is (142, 24, 168.69, 44.45, and 106.68 indv/m^2 respectively. While the species belonging to the Class of Bivalvia Species Were Corbicula flumina (MULLER 1774), Corbicula flumina (MULLER) – Corbiculidae and Unio tigridis (BOURGUIGNATA1852)- Unionidae. And their total density in the study period are (151.13.80.01.106.68 indv/m^2 respectively. by Sorensen Similarity (Hamayoan *et all*. 2003) was used to determine the similarity in stations taxa composition. Results showed that all study stations were 100% identical for mollusks and each separately. Snails are often affected by environmental changes. This makes them a good field for studying the interrelations between environment and snails (Ostoglo et al., 2001). Ibrahim, (2005) noted that the non-polluted areas were characterized by high diversity, as opposed to spring polluted water bodies. The availability of Ca^{++} is the main restrictive factors affecting the spreading of many freshwater aquatic organisms including mollusks (Brier, 2003).

Mollusks depend on Ca^{++} for development of their shell, consequently, the availability of on Ca^{++} for survival is very important, representative decreased growth rate, survival and reproductive production in little calcium concentration, (Zaliznіak *et al*, 2009). The monthly density of the Gastropoda samples fluctuated during the months of the study with the maximum density of 80.89 indv / m2 recorded during a month.Aprile At the station S1. mollusks have recorded a density of (26.67, 8.89 indv / m2) in December 2016 in S1 and S2 stations respectively. but not recorded in the models taken in the summer and autumn months, In stations 2 and 3 and in February at the station 2 figure (9). That perhaps due to the fact that they are separated from the direct heat of the sun and disappearance between or climbing on aquatic plants or the effect of materials used in agriculture, Choubisa and Zulfiya (2013). Recovered about fifteen snail species were from diverse habitats.and Found that Gastropoda species inhabiting different types of lentic and lotic habitats of southern India. The monthly density of the Gastropoda samples fluctuated during the months of the study with the maximum density of 80.89 indv / m2 recorded in.Aprile 2017At the station S1. mollusks have recorded a density of (26.67, 8.89 indv / m2) in December 2016 in S1 and S2 stations respectively. but not recorded in the models taken in the summer and autumn months, In stations 2 and 3 and in February 2017 at the station 2 figure (9). As for the Monthly density of Pelecypoda mollusks, the maximum density was 53.34 indv / m2 recorded in Aprile 2017 At the station S1. However, the Pelecypoda mollusks have disappeared and were not recorded in the samples taken during the months of summer, autumn, and February during the period of study in all stations except in October and November, the average monthly density was (178, 8.89 indv / m2), respectively. Figure 10., the freshwater Mollusca revealed its maximum level throughout spring, then by winter, while the Mollusca disappear in summer and autumn. The results of the analysis showed a significant relationship between the individuals and some parameters such as D.O., pH, Ca^{++} and water temperature.

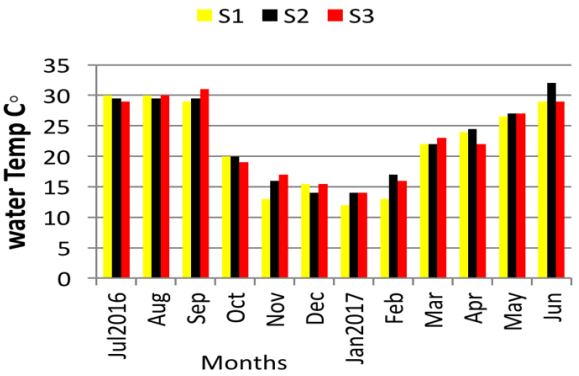

Figure 2: Months fluctuations in Water Temperature

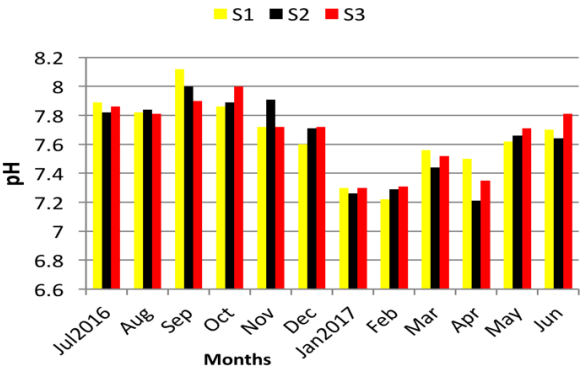

Figure 3: Months Variation in pH during study period

Biodiversity was low and did not exceed the diversity values of both classes. The highest value of varietal diversity of Gastropoda and was 0.43657 recorded at the station S1 during a month April 2017 Figure (11). But the highest value of varietal diversity of Pelecypoda was 0.36629 recorded in April 2017at the station S3. Figure (12). The density of Mollusca between positions throughout the current study showed obvious deference ($p<0.05$) between months in the density of Gastropoda and Pelecypoda of all station in the study period. Sorensen Similarity (Hamayoan *et al*. 2003) was used to determine the similarity in stations taxa composition It was observed that all stations were

100% identical by scale Sorensen Similarity. Hamayoan *et al.* (2003). table (1). It is possible to observe the decline in the biodiversity values of mollusks in the river. In addition, the low density of Mollusca recorded in the current study when compared to what Ibrahim (2002), When he studied organic pollution in the Diwaniya River. Ibrahim, (2005) was noted that the numerical abundance and diversity of some types of bottom vertebrates were affected by inappropriate physical and chemical changes and the degree of pollution, especially sensitive species**.** Finally, this study is the first of its kind in the Rumaitha River, So We propose periodic biological studies to determine the prevalence and density of different species of mollusks in water bodies in order to develop a reference study for these groups by comparing published research and standardization of species in local studies.

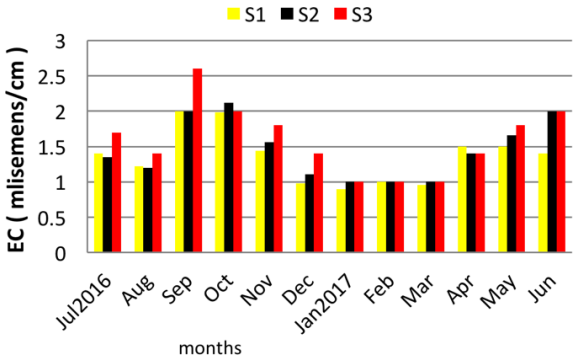

Figure 4: Months fluctuation in Electrical Conductivity

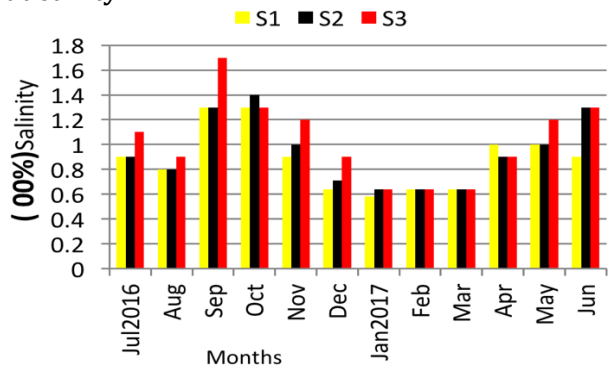

Figure 5: Months fluctuation in Salinity during study period

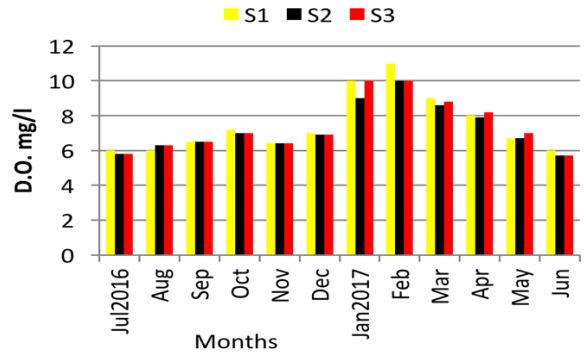

Figure 6: Months Variation in D.O during study period

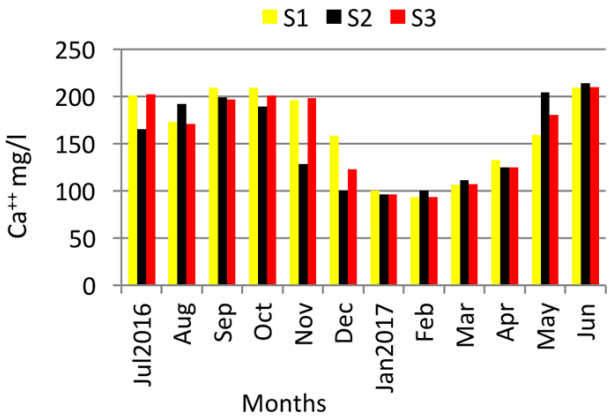

Figure 7: Months Variation in Ca during study period

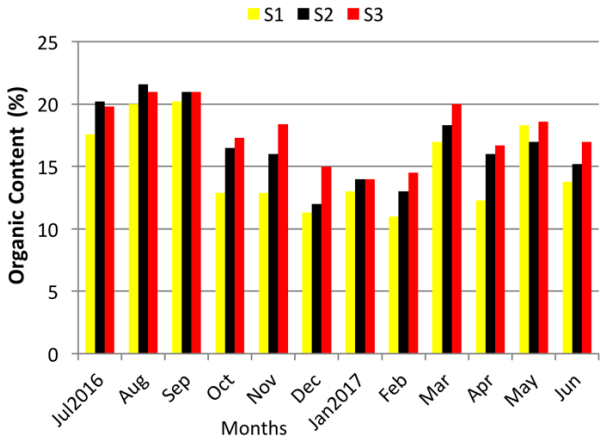

Figure 8: Months fluctuation in Organic Content (%)

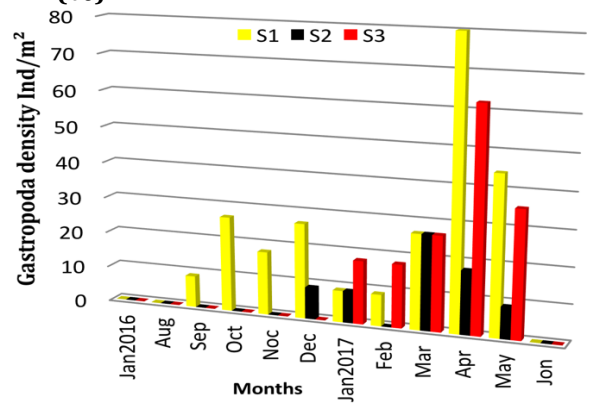

Figure 9: Months Variation in Gastropoda density ind/m²

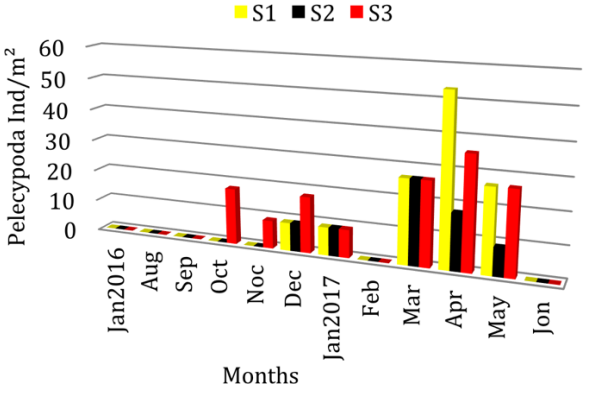

Figure 10: Months Variation in Pelecypoda density ind/m² during study period

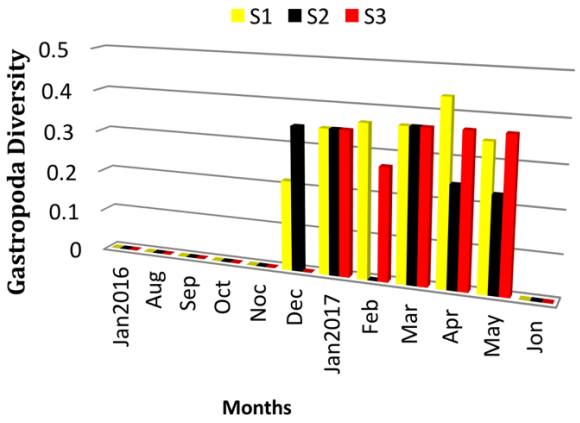

Figure 11: Months fluctuation in Gastropoda Diversity during study period

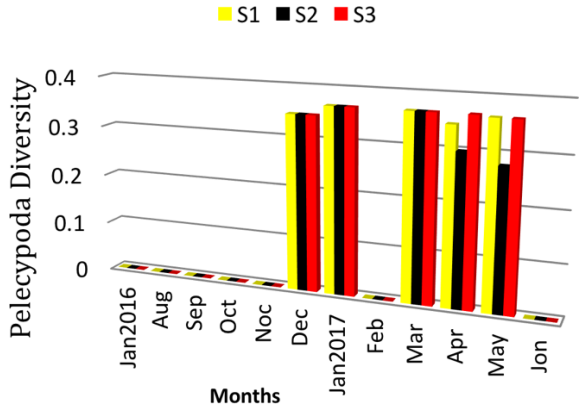

Figure 12: Months Variation in Pelecypoda Diversity during study period

Table 1: Sorensen Similarity values among the stations elected during the study period

Station	Taxa	
	Gastropoda	Pelecypods
S1, S2	100%	100%
S1, S3	100%	100%
S2, S3	100%	100%

REFERENCES

Adjustments attached to the system Water and public water conservation system from pollution. 1980. and the amendments there to. 1980. http://wiki.dorar-aliraq.net/iraqilaws/ p=3131.

Ahmed, M.M. (1975). A systematic study on Molluska From Arabian Gulf and Shatt Al- Arab, Iraq. Center for Arab Gulf Studies, Univ. Basrah., Iraq, 105p.

Al- Shammari, M.S., And Al- Janabi, A., I.H., 2015.Investigation of Some Chlorinated Organic Pesticides of Some Species of Snails in The Euphrates River Central Iraq. Journal Of The University Of Babylon / Pure Sciences Applied.3 (23). 1387-1407.

Al-Fanharawia.Ali Abdulhamza and Sahib Shanon Ibrahim. (2014). Environmental Study of the Benthic Mollusks in Euphrates River at Samawa City, Iraq. International Journal of Science and Research (IJSR). Volume 3 (7). P 1955-1960.

APHA (American Public Health Association). (1999). Standard Methods for Examination Of Water And Wastewater. 20th Ed. Washington DC, USA.

Atte, Raid Sami. 2008. Bio-Diversity of Mollusca In Four Follow Ecosystem Southern of Iraq. Basra Scientific Research Journal 34(3). P28-34.

Aziz, N. M.; Balsam A. Marina and Enaam A. Qza, 2010. The Potential of Some Snails as Bioindicator Of Trace Metals Level in East Hammar Marsh, South Of Iraq. Basrah Journal of Science, Vol. 28(2):228-242.

Bernal-Hernández YY, Medina-Díaz IM, Robledomarenco ML, Velázquez-Fernández JB, Girónpérez MI, Ortega-Cervantes L. (2010). Acetylcholinesterase and Metallothionein In Oysters (Crassostrea Corteziensis) From A Subtropical Mexican Pacific Estuary. Ecotoxicol. 19: 819-825.

Briers, R. A. (2003). Range size and environmental calcium requirements of British freshwater gastropods. Global. Ecol. Biogeogr. 12, 47-51.

Carella F, Figueras A, Novoas B, De Vico G. (2013). Cytomorphology and PCNA expression pattern in bivalves Mytilus galloprovincialis and Cerastoderma edule with haemic neoplasia. Dis. Aquatic. Org. 105: 81-87,

Choubisa, S. L. And Zulfiya Sheikh. (2013).Freshwater Snails (Mollusca: Gastropoda) As Bioindicators For Diverse Ecological Aquatic Habitats. International Journal of Vol. 2(3), Pp.22-26.

F.R. British Columbia (2000). Wildlife In British Columbia At Risk.BC Conservation Data Centre Ministry Of Environment, Lands And Parks PO.Box 9344 Stn. Prov. Govt.

Farid, W. A., Hamid T. Al-Saad, Abdul - Hussain Y. Al-Adhub. (2008). Monitoring of Hydrocarbons in Shatt Al-Arab River By Using Some Species Of Molluscs.J Marina Mesopotamica, 23(1): 305-319.

Farid, W.A.M. 2005. Short-Term Toxicity of Copper of Two Species of Snails In Shatt Al–Arab Estuary. J. Basrah Res., 31 (2): 26 – 30.

Giron, MI -Perez, 2010. Relationships Between Innate Immunity in Bivalve Molluscs And Environmental Pollution, ISJ 7: 149-156.

Hamayoan, S.B.; James, T.C. (2003). Depth distribution of microbial diversity in the mono lake a meromictic soda lake in California.Appl.and environ. Microbial, 69(2), 1030- 1042.

Heba H.M. A., Saeed, M.A., Al–Shawafi, N.A. And Al-Saad, H.T. 2003. Petroleum Hydrocarbons And Trace Metals In Mollusca (Tivela Ponderosa) From The Gulf Of Aden. J. KAU: Mar. Sci., Vol. 14, Pp. 77-86.

Ibrahim, Sahib Shannon (2000). Use Of Oligo-chaete- Annelida As Bio-Indicator Of Pollution In The Diwaniyah River. Master Thesis - Faculty Of Education - University Of Qadisiyah. Iraq, pp.1-85(in Arabic).

Ibrahim, Sahib Shanon.(2005).Biological Diversity Of Invertebrates In Al-Dagara And Al-Diwaniya Rivers/Iraq. A Dissertation Submitted to the Council of College of Education, Al-Qadisiya University In Partial Fulfillment of the Requirements for the Degree Of Doctor of Philosophy in Biology (InvertebrateIraq, pp.1-177(in Arabic).

Mackereth, F.G.H.; Heron, J. Andtalling, J.F. (1978).Water Analysis: Some Revised Methods For Limnologist. Sci. Pub. Fresh Water. Bio. Asso.(England). 36: 1-120.

Manal M. Akbar (2013) Ecological Survey Of Al-Gharaf Canal At Thi Qar Province, Iraq. Marsh Bulletin 8(1) 1-17.Iraq

Ostoglo, M.R., Balık, S. and Özbek, M. 2001. Işıklı Gölü (Çivril-Denizli)'nün Mollusca Faunası, E.U. Journal of Fisheries and Aquatic Sciences, 18(1-2): 135-139.

Plaziat, J.C. & Younis, W.R. (2005). The Modern Environments Of Molluscs In Southern Mesopotamia, Iraq: A Guide To Paleogeographical Reconstructions Of Quaternary Fluvial, Palustrine, And Marine Deposits.CG. Notebooks On Geology-A01: 1-18.

Reid, G. K. (1961). Ecological of inland waters and estuaries-Rhiem hold corp, New York, 375 pp.

Robert, L. & Michael, S. (2003). Family- Level Key To The Stream Invertebrates Of Maryland And Surrounding Areas. MDNR. Annapolis, Maryland 21401.

Schmid-Araya, J. M (2000). Invertebrate Recolonization Patterns The Hyporheic Zone Of A Graver Stream. Limnol. Oceanogr. 45 (4): 1000-1005

Serb, J. M., & Lydeard, C. 2003. Complete mtDNA Sequence Of The North American Freshwater Mussel, Lampsilis Ornata (Unionidae): An Examination Of The Evolution And Phylogenetic Utility Of Mitochondrial Genome Organization In Bivalvia (Mollusca). Molecular Biology And Evolution. 20:1854–1866.

Smitha, A. D. & Shivashankar, P. (2013). Physico Chemical Analysis Of The Freshwater At River Kapila, Nanjangudu Industrial Area, Mysore, India. Int. Res. J. Environment Sci. Vol. 2(8), 59-65.

Stark, J.R.; Hanson, P.E.; Goldstein, R.M.; Fallon, J.D.; Fong, A.L.; Lee, K.E.; Kroening, S.E.; & Andrews, W.J. (2000). Water Quality In The Upper Mississippi River Basin, Minnesota, Wisconsin, South Dakota, Iowa, And North Dakota, 1995-98. United States Geological Survey, Circular 1211, Reston, Virginia, 36pp.

Steel, R.G.D. And Torrie, J. H. 1980. Principles And Procedures Of Statistics. A Biometrical Approach. New York, USA, P: 633

Sunil Londhe And Nitin Kamble, 2014. Acute Effect Of Mercury And Zinc Chloride On Gastrin/CCK 8 Neuropeptide In Relation With Behavior Of Freshwater Snail Bellamya Bengalensis: A Microscopic Study. Int.J.Curr.Microbiol.App.Sci 3(4): 1052-1065.

Ustaoglu, M.R., Balık, S. And Ozbek, M. 2001. Işıklı Golu (Çivril-Denizli) Mollusca Fauna, E.U. Journal Of Fisheries And Aquatic Sciences, 18(1-2): 135-139

Zalizniak, L., Kefford, B. J. and Nugegoda, D. (2009). Effects of different ionic compositions on survival and growth of Physaacuta. Aquat. Ecol. 43, 145-156

Zeybek, Melek.Hassan Kalyoncu and, Ömer Osman Ertan.(2012) Species composition and Distribution of Mollusca in Relation to Water Quality. *Turkish Journal of Fisheries and Aquatic Sciences 12: 719-727.*