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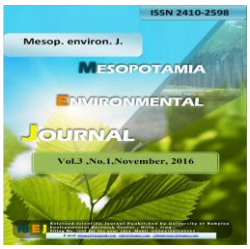

Study of Planktonic Crustaceans (Cladocera and Copepeda) community in the Hilla Rive/Iraq

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Abstract

This study focused on monthly densities of planktonic crustaceans (cladocera and copepeda) in Hilla River, as well as their relationship with some physical and chemical factors at 3 sites for the period from May 2015 to April 2016 . In present study the water temperature ranged from (12 to 32.6) ºC in summer and winter at sites 1 and 2, respectively ,the pH values were on the alkaline side with ranged from(6.55 to 8.1) in summer and spring at sites 1 and 3 respectively ,the Turbidity range from (2.70 to 31.44) NTU in summer and winter at sites 1 and 2 respectively, Electrical conductivity (EC) values changed from (500 to 1810) µS.cm-¹ in winter and summer at sites 1and 2 respectively, the dissolved oxygen(DO)values varied from (4.77 to 11.51) mg/l in summer and autumn at site 2 and 3, respectively , Biochemical Oxygen Demand (BOD5) ranged from (1.5 to 6.1) mg/l in winter and summer at site 1 and 2 respectively, Nitrate changed from(5.71 to120.11) µgm atN-NO3. L-¹ in summer and winter at site 1 and 2 respectively, Phosphate varied from(0.12 to 9.5) µgm atP-PO4. L-¹ in autumn and winter at site 3 and 2 respectively.
The total crustacean densities showed seasonally and locally significant differences between sampling periods, with higher densities 2050 Ind/m3 in spring at site 1 while lowest densities150 Ind/m3 in the winter at site 2 with recorded a positive significant relationship with water temperature ($r= 0.66$, $p<0.05$) and negative significant relationship with each of the BOD, Turbidity, Nitrate and Phosphate ($r=- 0.55$,$r= - 0.58$, $r= - 0.64$, $r= - 0.62$,$P<0.05$) respectively. In present study 25 taxa of crustacean were identified and distributed between 16 taxa belong to cladocera and 9 taxa to copepada ,the highest number of Cladoceran 1900 Ind/m3 in spring at site 1 and the lowest number 100 Ind/m3 in winter season at site 2 with recorded a positive significant relationship only with pH ($r= 0.66$, $p<0.05$) and negative correlation with each of the Turbidity, Nitrate and phosphate.($r = 0.61$, $r = - 0.59$, $r = - 0.63$, $p<0.05$). respectively, the *Chydorus sphaericus* was the most abundant cladocera species and its peak was observed in spring. The highest

number of copepod 850 Ind/m3 was recorded in summer at site 3 and the lowest number 100 Ind/m3 in winter at site 2, with a positive significant relationship with water temperature, BOD and EC ($r = 0.65$, $r = 0.66$, $r = 0.64$, $p<0.05$) respectively while recorded negative significant with DO ($r= - 0.63$,$P<0.05$) the Nauplii was found as the most abundant copepoda taxa and its peak was observed in summer season .

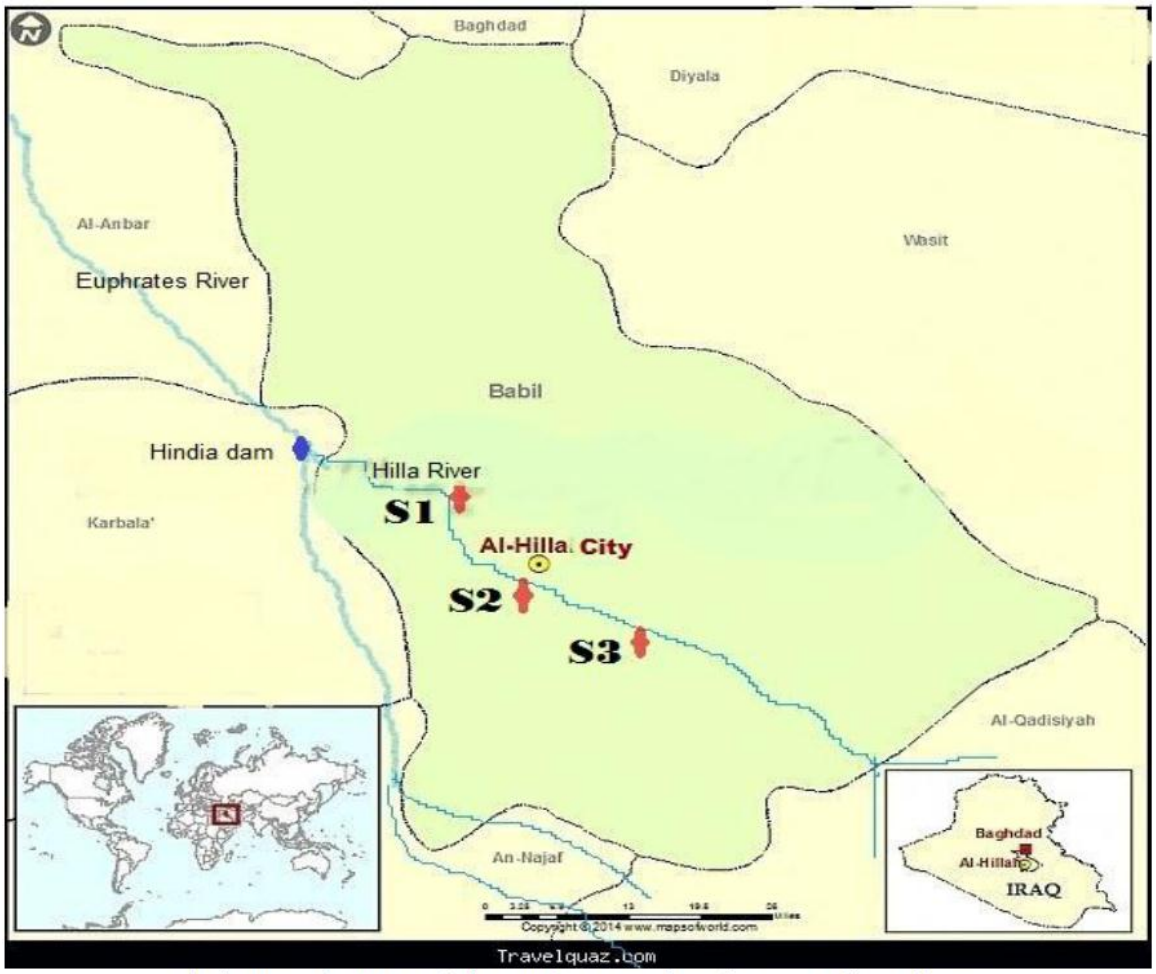
Introduction

The biotic and abiotic factors of water bodies have a significant impact on the organisms that live there, hence any change in one or more of these factors will be reflected directly in the distribution, abundance and species diversity of these organisms[1] planktonic crustaceans community one of the main biotic components in the aquatic environment, consists of a variety microscopic organisms found in all water bodies as free or parasitic organisms on juvenile and adult fish [2]They are play a vital role in any aquatic ecosystem as a primary consumer in the second level and as contributors to the next trophic level [3] the growth and distribution of crustaceans community depends on a complex set of some abiotic (e.g., temperature, salinity, stratification, pollutants) and biotic parameters (e.g., food limitation ,predation, competition)[4] They are very sensitive to environmental variation, and any change in the diversity, abundance and community composition can provide important indicators to environmental change therefore been used as good bio-indicators to assess the health and nutritional status in water bodies [5] generally the planktonic crustaceans community in fresh water consists mainly of the cladocera and copepods. The cladocera is the major group of parthenogenic organisms with short life cycle under favorable conditions of temperature and food [6]they are include filter feeding organisms that use particles organic materials suspended in the water column and also control the growth of algae by efficient grazing[7]they are considered an important food for fish zooplanktivorous.
The copepods are also form one of the most important components of the crustaceans community in the freshwater they are dependent on sexual reproduction and are divided according to their feeding into herbivorous, omnivorous and carnivorous [8] they are serve as an important link by transferring energy and organic materials between primary producers and animals of higher trophic levels [9] the larva known as a nauplius and an immature form known as a copepodit, Overall, many researches were focused on crustaceans community in terms of its environment, identified species and diversity covered most of the water ecosystems in different parts of Iraq, such as [10] who comparing the population cladocera in the Diyala, Tigris and Euphrates rivers, [11] who showed that the increase in BOD5 is responsible for cladocera absence in Diyala river at the summer season [12] mentioned that the lower Zab tributary no contributed in increase the copepod biodiversity in Tigris river [13] who studying cladocera and copepod in Euphrates river and Al-Tharthar- Euphrates canal and found that the species composition of cladocera and copepoda in the Euphrates river were no affected by the water canal [14] who observed the cladocera in the Shatt Al-arab River was reached to peak at spring season [15] showed high density cladocera in kufa river at spring[16]who shows the negative effect of thermal effluent of Al-Rasheed Power Plant on biodiversity cladocera community in Tigris River [17] who stated an environmental Study of crustaceans in Dalmage marsh Middle of Iraq and recorded the highest total density in spring season [18]who recorded a high density of cladocera and copepod in the Littoral Al- Habbaniyah Lake water at summer season.
The current study was aimed to investigate crustaceans community in the Hilla River and monitor the impact of some physical and chemical factors on the abundance of these organisms.

Materials and methods

Hilla River is one of two branches of the Euphrates River when the Indian dam in the central region of Iraq, it lies on latitudes between 32° to 33° and longitudes 44° to 45°, the length of the river is about 103 km with gradient rate is 7 cm each fall of 1 km, and discharching 250 m3/sec. the river passes through the flowing Hilla city center of Babylon province in addition to many towns and other villages than here came the importance of the river as the only source of drinking water for the inhabitants of Hilla city, moreover the use of river water for irrigation, industry and fishing.
The study samples were taken a monthly during the period from May 2015 to April 2016 at three selected sites ,the first sites north of the Hilla city and second site near the Hilla city center while another site in the southern part of the Hilla city (figer-1). The water samples were collected from the surface layer of river water and measured following physico-chemical parameters :Water temperature, pH, Turbidity,

EC,DO,BOD5,Nitrate and Phosphate in the laboratory by using the standard methods of the [19]. The crustaceans samples were collected through the filtration 60 liters of water in the conical plankton network (55 µm mesh size) and fixed with 4% formalin solution, crustaceans counted under a compound microscope using Sedgwick -Rafter room, and identified to the species based as the specialized literature as [20,21]the abundance data expressed by (Ind./m3).ANOVA test was used (P <0.05) to detect significant differences between sampling sites and months. Pearson correlation coefficient (r) was also carried out to determine the correlation between parameters(P<0.05).



(Figure -1). Map of the study area showing sampling sites

results

(Table-1**)** data represented as mean ± S.E. with minimum and maximum value of some physical and chemical parameters in the Al-Hilla river during period study.

parameters	Site 1	Site 2	Site 3
Water Temperature °C	19.7 ± 6.07 12.0 – 30.0	20.1 ± 6.76 13.0 – 32.6	19.9 ± 6.09 12.1 – 31.0
pH	7.57 ± 0.38 7.02 – 8.09	7.39 ± 0.48 6.55 – 8.00	7.47 ± 0.42 6.96 – 8.10
Turbidity NTU	7.75±0.89 2.70 - 11.70	27.22 ± 5.66 23.76 - 31.44	7.47±0.84 6.32-8.31
Electric Conductivity µS.cm-¹	195.0 ± 100.03 500 – 925	1330.8±257.67 920-1820	1000.2±109.33 860-1210
Dissolved Oxygen (DO) mg. L-¹	8.43±1.67 6.81 -11.51	6.54 ± 1.04 4.71 – 7.61	7.53 ± 1.14 5.61 – 8.5
Biochemical Oxygen Demand (BOD5) mg. L-¹	2.08±0.45 1.50-2.80	5.44 ± 0.67 4.20 - 6.10	3.93±0.29 3.60-4.40
Nitrate µgm atN-NO3. L-¹	9 .11 ± 25.37 5.71- 58.44	99.38±14.12 80.13-120.11	23.66±1.64 11.00- 32.00
Phosphate µgm atP-PO4. L-¹	4.21 ± 2 .58 0.12- 5 .50	3 .71 ± 2 .21 0 .41- 9 .50	6.70±0.50 2.43- 8.60

The water temperature values in present study ranged between 12 °C in January 2016 at site 1 and 32.6 °C in July 2015 at site 2 (Table-1) the statistical analysis was showed that no significant difference between sites at this period (P>0.05)The high water temperature value was observed in summer may be related to increased solar radiation during this season. The Hilla River water in this study have little change in pH with ranged from 6.55 in June 2015 at the site 2 to 8.10 in January 2016 at site 3 (Table-1) the statistical analysis showed significant difference between sites 2 and other sites(P <0.05).The high values of pH in the winter may be due to the increasing amount of carbon dioxide consumed in the photosynthesis of algae and aquatic plants while the lower pH in the summer may be due to increased carbon dioxide resulting from the decomposition and oxidation of organic materials[22] the low pH at site 2 may be attributed to flow acidic material in industrial and domestic waste to the River at this site. this study coincided with the results of many local studies that indicate alkalinity of Iraq's internal water bodies. The turbidity in current study ranged from lower values 2.70 NTU in July 2015 at site 1 to highest values 31.44 NTU in February 2016 at the site 2 (Table-1) statistical analysis showed is not significant difference between the sites (P> 0.05) but showed a negative significant relationship between turbidity values and water temperature (r = -0.77, P <0.05) high value of turbidity may be attributed to rainfall in this month leads to increase the level and velocity of the water, causing a stir sediments as well as the rain water bearing mud, sand and organic matter to the river from the surrounding areas [23]. this study coincided with the results of[24] at same river The Electrical conductivity(EC) values in this study ranged from 1810 µS.cm-¹ in July 2015 at site 2 to 500 µS.cm-¹ in February 2016 at site 3 (Table 1) statistical analysis showed no significant difference between the sites (P> 0.05) while showed positive significant correlation between the EC and water temperature (r = 0.77, P <0.05) the higher values of EC during the summer months may be due to the low water level as well as to increase evaporation with temperatures rise, which leads to increase of ions concentration in the water and this consistent with the results of statistical analysis that recorded positive correlation between EC and the water temperature, while the lower values during the winter months may be attributed to dilution of water body by rainwater [23] the results of the current study is similar to study[24] on the same river. The dissolved oxygen values in this study ranged from 4.77 mg / L in July 2015 at site 2 to 11.51 mg / l in October 2015 at the site 3 (Table- 1) Statistical analysis showed a significant difference between the site 2 and other sites (P <0.05) and negative significance correlation between the dissolved oxygen with each of the water temperature and EC (r=0.65,p=0.68,P <0.05) respectively, the higher dissolved oxygen values during this month may be due to low temperature that have an inverse relationship with the oxygen solubility in the water as well as to increase the photosynthetic activity, while lower values may be due to high temperature increased consumption of this gas with increase metabolism rate of organisms[25] the low content of dissolved oxygen at site 2 may be due to it contain a great amount of organic matter in sewage

and industrial waste that have a significant impact to depletion dissolved oxygen in the water [26]. this study coincided with the results of[27] at same river.

The BOD values in this study ranged between less values1.5 mg / l at site 1 in January 2016 and higher values 6.10 mg / l in July 2015 at the site 2 (Table-1) statistical analysis showed significant difference between sites ($P < 0.05$) also recording positive significant correlation between BOD and each of all the water temperature and EC ($r = 0.65$, $p = 0.68$,$P < 0.05$) respectively, as well as negative significant correlation between the BOD and the DO ($r = - 0.77$, $P < 0.05$) the high values of BOD during summer months may be due to increase rate metabolic activities of the organisms and microorganisms in water with high temperatures [26] the highest of BOD values recorded at site 2 this can be attributed to increased organic load in industrial waste and sewage, which concentrated in this site that lead to stimulate the microorganisms to increase oxygen consumption [28] nitrate were recorded in the current study ranged from the highest value 120.11 µgm N-NO3. L^{-1} in February 2016 at site 2 and lower value 5.71 µgm N-NO3. L^{-1} at site 1 in June 2015 (Table- 1).The high values of nitrate in the winter may be related to rainfall which removes nitrates in the soil and throwing them into rivers in addition to the availability of dissolved oxygen in this season which converts nitrite to nitrate [29] while lower values in summer may be attributed to increase their utilization in the photosynthesis process[27] The highest values in Site 2 can be attributed to nitrogen compounds that arrived to the river from industrial wastes, sewage and other pollutants [30] these results were agree with study[26] at same river .The Phosphate values in the current study ranged between the lower value of 0.12 µgm at-PO4. L^{-1} at site 1 in August 2015 and the highest value 9.50 µgm at-PO4. L^{-1} at site 2 in January2016 (Table-1).the statistical analysis showed a significant difference between sites ($P < 0.05$) the increase in the concentration of phosphate during the rainy season as possible return to the rain waters coming from the catchment areas, as well as to use of phosphate fertilizers [30] while low phosphate can be attributed to lock up phosphate in phytoplankton and macrophytic [27] the recorded higher values at site 2 can be attributed to municipal sewage and domestic waste which reached to the river without any treatment ,that leads to an increase in phosphate concentration this consistent with the findings [25]The occurrence of Phosphate in surface water may be due to addition of domestic sewage, detergents and agricultural fertilizers. The total crustaceans density ;at site1 ranged from highest density 2050 ind/m3 in March 2016 to 275 ind/m3 in February 2016 ; at site 2 the crustaceans varied from highest density 450 ind/m3 in March 2016 to 150 ind/m3 in February 2016 while ;at site 3 the crustaceans varied from 1750 ind/m3 in April 2016 and to 175 Ind/ m3 in January 2016 (Figure -2) .The statistical analysis showed positive significant relation between total density and water temperature ($r= 0.66$, $p<0.05$) also recorded negative significant with each of the BOD, turbidity, nitrate and phosphate ($r= - 0.55$,$r= -0.58$, $r= - 0.64$, $r= - 0.62$, $P<0.05$) respectively. The results of the current study showed variations in the total crustaceans density

at the sites, with higher values during spring season this is probably due to the rise in the water temperature as well as to increase in the populations of phytoplankton and aquatic plant at this period [3]Similar observation by [7] found the crustacean density in the Danube River was positively correlated with the rise in the water temperature also these results agree with [5] who stated that the increases and peaks in some microcrustaceans, particularly the filter feeders correlated with peaks in the abundances of phytoplankton also these results agree with[17] who stated that the abundance of crustaceans in Dalmage marsh are higher during spring season .

The lower values of total density during winter may be due higher turbidity and suspended matters in this season which have a negative impact on planktonic crustaceans [31] The lower density at sit 2 may be due to the greatest amount of industrial and domestic wastes discharged to the river causing to increases level pollution which have create significant impact on planktonic crustaceans assemblages[7]This is supported by recorded higher values of BOD and turbidity in this site, Moreover the results agrees with the results of the statistical analysis which recorded negative significant relation between total density and both of The BOD, and Turbidity.

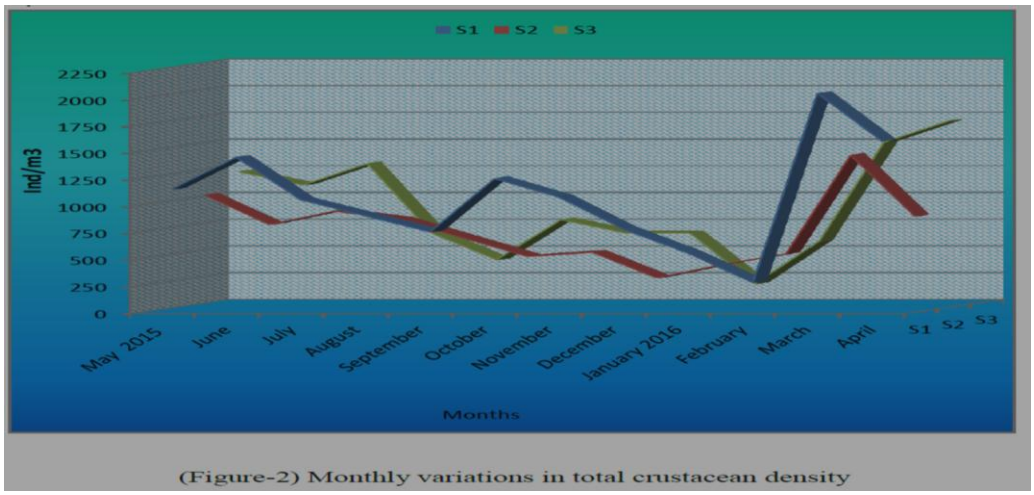
(Table-2):-Annual Density(ind./m3) ,(annual percentage) , numbers of occurrence in the Al-Hilla river during period study .

Taxa	Site 1	Site 2	Site 3
Cladocera			
Alona intermedia (Sars, 1862)	500 (3.83) 6	300(3.64) 4	450 (4.25) 5
A. rectangular (Sars, 1862)	1000 (7.67)7	500 (6.07) 4	525 (4.96) 7
Alonella excise (Fischer, 1854)	750 (5.75) 7	325 (3.95) 5	575 (5.43) 5
A. globulosa (Muller, 1785)	375 (2.87) 6	125 (1.51) 4	200 (1.89) 4
Bosmina coregoni (Baird, 1857)	175 (1.34) 4	50 (0 . 60) 2	125 (1.18)3
B. longirostris (Muller, 1785)	675 (5.18) 9	500 (6.07) 5	825 (7.80) 7
Ceriodaphnia pulchella (Sars, 1862	475 (3.64) 6	300 (3.64) 5	625 (5.91) 7
C. quadrangular (.Muller, 1785)	175 (1.34) 4	75 (0.91) 2	75 (0.70) 3
Chydorus sphaericus (Muller,1776)	750 (5.75) 8	600 (7.29) 9	875 (8.27) 9
Daphnia Pluex (Leydig, 1860)	125 (0.95) 3	25 (0.30) 1	200 (1.89) 4
D. leavis (Muller, 1785)	300(2.30)4	25 (0.30)1	75 (0.70)3
Diaphanosoma sarsi (Lievin, 1848)	375 (2.87) 3	50 (0. 60) 2	50 (0.47) 2
Leptodora Kindtii (Focke, 1844)	75 (0.57) 2	75 (0.91) 1	25 (0.23)1
Moina macrocopa (Straus, 1820	375 (2.87)6	100 (1.21) 2	75 (0.70) 3
Simocephalus. expinosus, (Koch, 1841)	425 (3.26) 7	50 (0.60)2	100 (0.94) 2
S .vetulus (. Muller,1776)	850 (6.52) 10	550 (6.68) 5	750 (7.09) 8
Total cladocera density	7400	3650	5550
Copepoda			
Calanoida			
Acanthocyclops bicuspidatus (Claus,1857)	275 (2.11) 5	150 (1.82) 2	100 (0,94) 2
Diaptomus reighardi (Marsh, 1895)	100 (0.78)2	25 (0.30) 1	50 (0.47)2
D. franciscanus(Guerne &Richard, 1889)	225 (1.72)3	50 (0.60)2	100 (0.94) 2
Cyclopoida			
Cyclops dimorphus (Keifer ,1931)	675 (5.18) 8	600 (7.29) 8	700 (6.61) 7
Mesocyclops laukatri (Claus, 1857).	1025 (7.86)10	750 (9.11) 8	1075 (10.16) 9
Eucyclops sp	600 (4.60) 8	550 (6.68) 7	575 (5.43)6
Paracyclops affinis (Sars, 1863)	550 (4.22) 8	350 (4.25) 6	550 (5.20) 8
P. fimbriatus (Fischer, 1853)	700 (5.37) 8	750 (9.11)8	500 (4.72) 8
nauplii	1475 (11.32) 12	1350(16.41)12	1375 (13.0 2 12
Total copepoda density	5625	4575	5025
Total density	13025	8225	10575

The Cladocera in present study, varied in number from 1900 ind/m3 in March to100 ind/m3 in February at site 1 and from 1275 ind/m3 in April to 25 ind/m3 in December at site 2 while from 1675 ind/m3 in April to 50 ind/m3 in January at site 3 (figure-3) The statistical analysis showed the cladocera have positive significant correlation only with pH ($r= 0.59$, $p<0.05$) and negative correlation with each of turbidity, nitrate and phosphate. ($r= 0.65$, $r=- 0.56$, $r= -0.63$, $p<0.05$) respectively. The high density of cladocera in this period may be due to the most cladocerans are herbivorous and phytoplankton feeders, for this reason the increase of phytoplankton at this period provides food source and varied micro-habitats for cladocera [32] moreover the cladocerans in habitats with vegetation can able to avoid predators more successfully than habitats without vegetation, Further the most environmental factors in this period favorable for growth cladocera such as water temperature which enhancing rapid hatching of eggs, food availability and high water transparency [33] this similar to finding by [34] that the water temperature have direct effects on

growth and reproduction of cladocera by changing metabolic rate and rapid parthenogenetic reproduction, also according to [35] the cladoceran complete development from an egg to an adult requires 20-24 days at 10°C while complete their life-cycle in 7-8 days at 20°C, the present results emphasize that species of cladocera increased in the spring more than another season and Similar results were reported in other studies as[14,15,18], The lower density in winter may be due to rainfall causes strong currents which lead to increase turbidity and depletion of phytoplankton [36**]** while The lower density in summer may be due to low PH , that acts as a limiting factor for cladocera[37] and this agrees with the findings [38]that the alkaline waters relatively high productivity and contained more phytoplankton abundance than acidic waters and for this reason the statistical analysis in current study showed the cladocera density have positively correlated with pH as well as the lack of cladocera in the summer can be attributed to the increased of copepoda which used cladocerans as good food and this is agree with the current results which recorded high densities copepoda in the summer months, in addition to the higher salinity have a negative effect on cladocera species[39] therefore the decline observed in cladocera density in summer may be associated with the higher conductivity in this season and this is consistent with the study [40] found the density of cladocerans generally reduced at higher conductivities. The higher density at site 1 It may be due to the abundance of microrganisms and phytoplankton, which act as the main food for these filter feeding organisms, in addition the increase abundance of phytoplankton lead to increase the water content of oxygen making the river as favorable environment for their growth and increase the cladocera[10] while the lower density at site 2 may be due to The absence a well-developed of phytoplankton community at this site besides this site received great mount of pollutants causing depletion of oxygen may have impact on cladoceran density [41] this consistent with the results of the study of[11]which showed that the absence of cladoceran in the Diyala River due to the temperature and the lack of dissolved oxygen and increase the BOD. In current study16 species of cladocera were recorded at 3 sites with a difference in the number of these species at each site ;in the Site1 were present 12 species: *Alona intermedia, A. rectangula, Alonella excise, Bosmina coregoni, B. longirostris, Ceriodaphnia pulchella, C. quadrangula Chydorus sphaericus , Daphnia pluex, Moina macrocopa, Leptodora Kindtii, Simocephalus vetulus* ; at site 2 were present 6 species, *A. rectangular, , B. longirostris, C. quadrangular, C. sphaericus, Moina micrura, S. vetulus* while at site 3 were present 9 species: *A. intermedia,A. rectangular, Alonella globulosa , B. longirostris, C. sphaericus, Daphnia leavis , Diaphanosoma brachyurum , S. expinosus, S. vetulus.* The difference in the number of species present at each site may be due to the direct or indirect interaction between the biotic and abiotic factors in each site, as well as a to the range tolerance of the these organisms to one or more of these factors , and this is consistent with [14] reported that the different in environmental factors, and the size of the mesh are responsible for the difference in the quantitative and qualitative distribution of cladocera from one season to another and from one place to another in the same area. The most frequent cladocerans species present at all the sites were, *A. rectangular, B. longirostris, C. sphaericus, S. vetulus* that may be attributed to have these species wide range of tolerance to the different environmental conditions . The most abundant species of cladocera was *C. sphaericus* at site1, this species peaked in March, with a density 150 ind/m3, and disappeared in the September, December, January and February months.; at site 2 this species appeared with highest density 200 ind/m3 in March and disappeared in the October, November and December months ; at site 3 this species, was observed in highest density 250 ind/m3 in April and disappeared in the August, September and January months. (figer- 4). the abundant *C. sphaericus* can be attributed to several reasons, including its physiological tolerance such as pH (3.2-10.6) or temperature [42], have ability to be very rapid colonizers of newly created habitats in temporary waters during spring , have ability to fast development in high water temperature , adapted their feeding depending on the type food present in the environment for this reason it can feed on different food resources such as phytoplankton, detritus and bacteria[43] furthermoreits evasion of predation because of its spherical carapace . these species recorded in the current study had reported prevalent in many of local and international studies. The copepoda was the second group in dominance. It ranged from 850 ind/m3 in July 2015 to 150 ind/m3 in March 2016 at site 1 and from 800 ind/m3 in July 2015 to 100 ind/m3 in February 2016 at site 2; while from 975 ind/m3 in july 2015 to 125 ind/m3 in April 2016 at site 3 (figer- 5).The statistical analysis showed the copepod density have positive significant relationship with water temperature, BOD and EC ($r = 0.65$, $r = 0.66$, $r = 0.64$, $p<0.05$) respectively while recorded negative significant with DO ($r= - 0.63$,$P<0.05$). The high copepods density in the summer may be attributed to the stable hydrological conditions in the river, such as low water levels, slow flow velocity and lack of turbidity making the river suitable environment for abundance of these organisms also the increase of water

temperature in the summer stimulate and increase the decomposition rate lead to the river becomes, rich environment with essential nutrients for the growth of phytoplankton and micro-organisms especially rotifer, which are an important food source for copepod [44] moreover the increasing salinity values in the present study may be another reason for the increased copepoda density in the summer this consistent with finding by [45] who stated that the copepoda are more abundant group during the period of increased salinity. the results of the present study are similar to many of the local studies that have pointed to an increase copepoda in the summer such as[46,12,47,48]. The highest abundance numerical copepoda in the site 3 this may be due the abundance of algae, which is the staple food of this group [48] Moreover this site have macrophytes and large vegetation, so may be that copepods used this macrophytes as refuge against from predatorsp-planktivorous fish ,this coincided with observation[47] who stated that the copepod in Diyala river have peak in summer especially in vegetated areas also this observation coincided with [49] who stated that the copepod density in the vegetated areas was higher than unvegetated areas. The lowest values was registered at the site 2 may be due to high pollution, as well as to the high level of turbidity at this site which caused the death of their young, and the inhibition of growth by determining the quantity and quality of food available [50] In present study 9 taxes of Copepoda were recorded and the sites were appeared difference in the number of these taxes at Site1 were present 7 taxes *Acanthocyclops bicuspidatus,Cyclops dimorphus, Diacyclops franciscanus, Mesocyclops laukatri Paracyclops affinis, P . fimbriatus,*and nauplii, and at Site 2 appeared 5 taxes *C. dimorphus, M. laukatri , P. affinis, P. fimbriatus* and nauplii while at Site3 were observed 8 taxes *A. bicuspidatus C. dimorphus , Diacyclops reighardi ,Eucyclops sp, M. laukatri , P. affinis, P. fimbriatus,and nauplii.* The most frequent copepod taxes present in all the sites were *C, dimorphus, M. laukatri ,P. affinis, P, fimbriatus,and nauplii* may be due to wide tolerance to variety of environmental factors according to [51] the genus *Mesocyclops* change mechanism feeding according to the growth stage (larvae, copepodit, and adult), and this is attributed to the ability to change body size as well as shape and size of the mouth apparatus. The most abundant taxa of the copepoda was nauplii at site1 appeared with highest density from 275 ind/m3 in July2015 to 25 ind/m3 in August 2015, January2016 and February 2016 months and at site 2 the nauplii observed from highestdensity 225 ind/m3 in September 2015 and January2016 months to 25 ind/m3 in February 2016 month while at site3 the nauplii varied in density from 250 ind/m3 in July 2015 to 25 ind/m3 in October2016 (figer-6). The Nuaplii formed a high percentage of copepoda density this could be due to several reasons, including wide tolerance to variety of environmental factors as well as the continuous reproduction of these organisms and passed through several phases of larval before becoming adults also it return to the different species are placed into one group for being a difficult diagnosis [18] Moreover predation intensity to adult forms allowed nauplii to predominance, on the other hand the predation of cladocera and copepodas provide the algae as food for this larvae may be one of the reasons to increase their numbers[52]the numerical predominance of young organisms especially nauplii in the copepod community in this study was also observed in many of the local and global studies in various freshwater habitats.



(Figure-2) Monthly variations in total crustacean density

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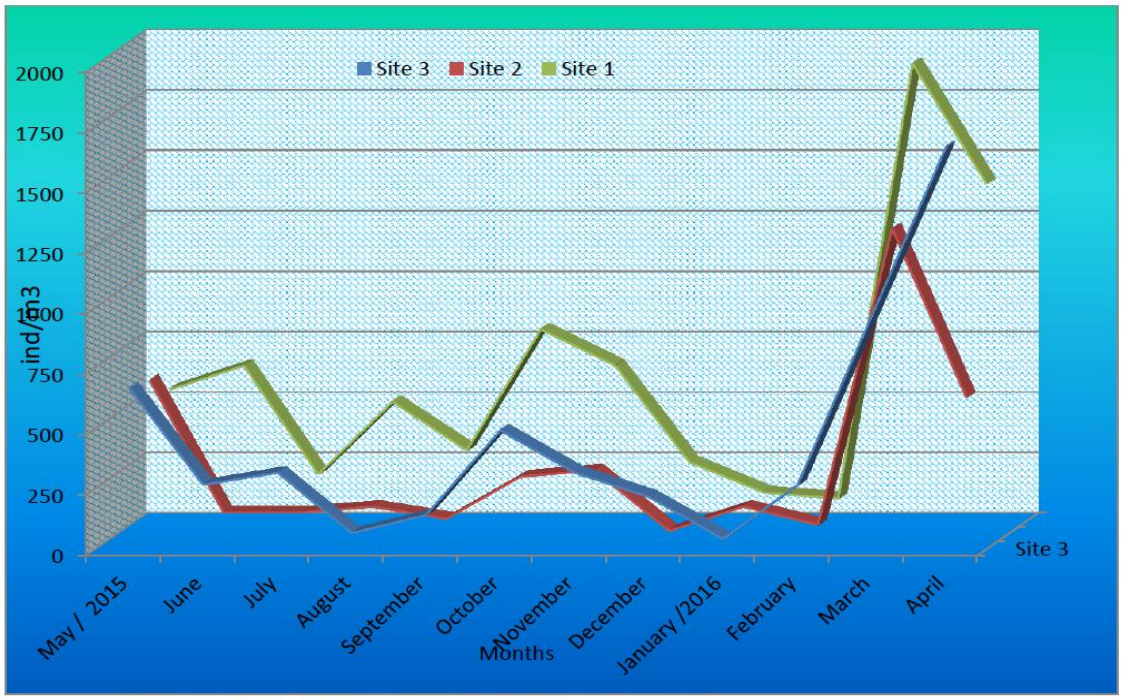
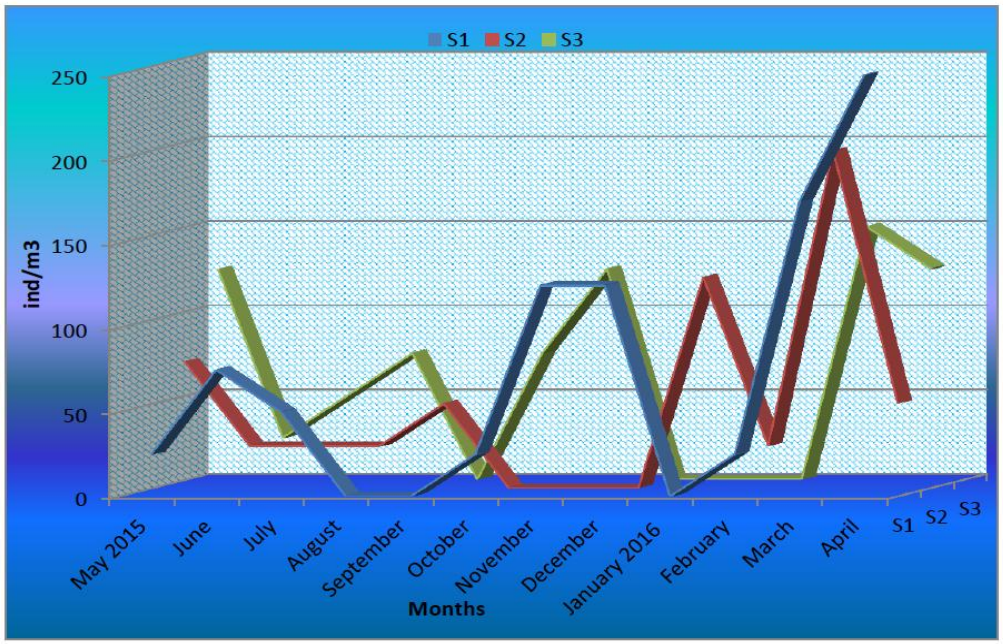
(proceeding of 1st National conference of science and Art –University of Babylon).



(Figure-3) Monthly variations in Cladocera density



(Figure- 4). Monthly variations in density of *Chydorus sphaericus*

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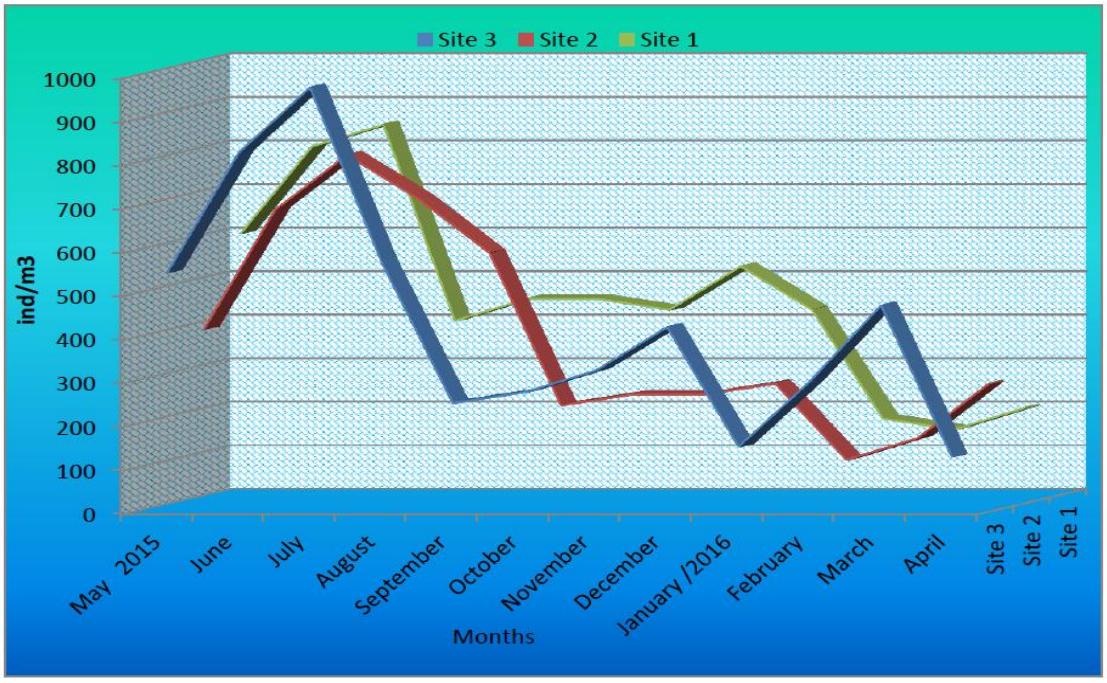
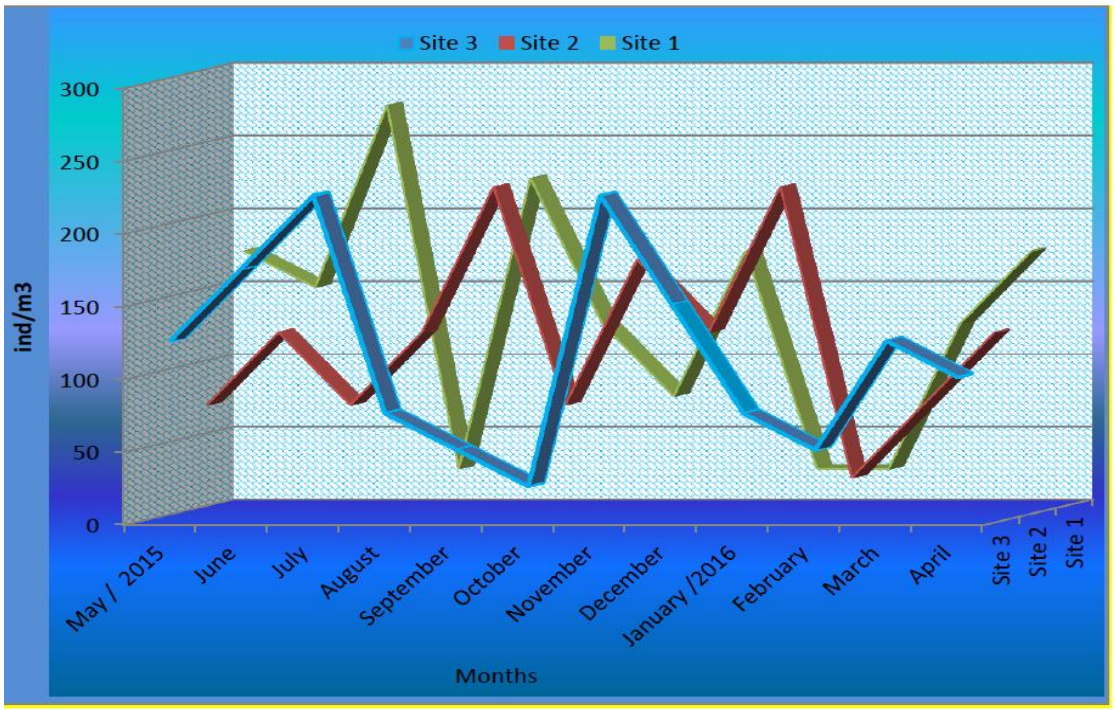


(Figure-5). Monthly variations in the density of copepod



(Figure 6). Monthly variations in the Nuaplii density

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