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THE EFFECT OF FISH CULTURE PONDS ON THE BENTHIC INVERTEBRATE COMMUNITY IN TIGRIS RIVER, IRAQ

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Abstract

The current study aimed to identify the environmental impacts of fish farming and know the extent of its impact on the water quality of the Tigris River. The study started from November 2018 to July 2019, five sites were chosen, three in the al-saouira breeding ponds, one before the ponds and the fifth after the ponds use benthic invertebrates as biological evidence In determining the water quality, where there was a clear effect of basin water discharges on the water quality and the diversity of the benthic invertebrates at the fourth site, while the fifth site showed a recovery from the arrived waste and its properties and water quality returned to the natural level and with an increase in the diversity of the benthic invertebrates.

Key words: benthic , invertebrates , fish pond , Tigris river

Introduction

The diversity and abundance of water bodies in Iraq encouraged the formation of many diverse and extensive projects for fish farming which encouraged the introduction of new species of fish with economic and productive values and in several projects . The number of fish farms is increasing in all the world to meet the global demand for fish used as a food source for humans. Of recent trends in environmental studies is giving greater importance to biological factors in describing the state of the ecosystem. Physical and chemical factors do not clearly reflect the state of the ecosystem, because of the great overlap between them. Which makes it difficult to distinguish the most influential factor in the life of beings which live in these systems. Moreover, the complexity and adversity of the ecosystem's response to these indicators. Monitoring of ecosystems requires more accurate measurements that support and describe these systems [Karr, J.R. (1996)] . Biological communities are usually stable and in constant with water properties. So it is considered a constant indicator of the state of the water . In addition, these communities respond to wide range of biological, physical and chemical factors in the environment [Karr, J.R. and Chu, E. W. (2000)]. One of the most important aquatic organisms is the benthic invertebrates, it occupies different habitats in the aquatic environment. It lives in rocky water slopes of rivers, mountain areas and coastal areas of sandy or muddy nature. It in habits hot, icy and salty ponds. Benthic invertebrates are scientifically and economically important. It occupies a privileged position in the food chain and it is considered a primary consumers and a link between primary and secondary consumers. It is a very important food material and rich in protein for other aquatic revivals, especially fish.

It also prepare food for life on land. It also has essential ecosystem services by accelerating decomposition processes. Some of them are Scavengers that feet on dead organisms and other organic matter deposited at the bottom and recycle a lot of elements.

Invertebrates release nutrients into the water through drilling, feeding activity and secretion. Bacteria, fungi, algae and aquatic plants feed on these nutrients and helps to accelerate their growth [Pelegri, S.P, Blackburn, T.H. (1996). It has a role in transporting nutrients to the upper layers of water. It also helps to purify water from suspended sediments and organic particles by filter feeding. Many invertebrates are predators. That helps to control and reduce the numbers and sizes of prey and their locations Crowl, T.A. and Covich, A.P. (1990). Therefore, the invertebrate communities reveal the extend of stability and diversity of the food web (Scourfield, D.J. and Harding J.P. (1966). Water invertebrates were used

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as bioindicators in determining water quality. The composition of the invertebrate community is influenced by the physical and chemical properties of the water bodies, including the nature of the bottom, depth, water temperature, amount of dissolved oxygen, PH , entry of heavy elements and toxic substances into the aquatic environment from agricultural, industrial and domestic sources. Nutrients have an indirect affect on them. Nutrients stimulate the growth of aquatic plants which leads to an increase in organic matter in sediments.

In Iraq, the problems of aquaculture are the lack of ventilation systems. There are neither waterfilters nor facilities to maintain the catch and move it efficiently to the market. Related industries and support and undeveloped.

In the absence of comprehensive studies on this subject, the current study targeted environmental impacts of fish farming, note that this activity is increasingly practiced. There is a great need to study the environmental implications of this. Therefore, research was required to provide more accurate information on the inter actions between the fish community and its food associated with benthic invertebrates and the importance of the benthic invertebrate to determine the state of the environment of the water bodies and their suitability.

The use of bioindicators is useful in understanding the complex overlap between an organism's response to environmental influence and its resistance to changes in its ecosystem. (Cranston *et al.,* 1999).

The current study included the following aspects:

1- Identify the community of benthic invertebrates in the basins of the breeding of AL Sauira fish hatchery and classify it to lest possible rating Level of classification and study the composition of the community and determine the totals of Classification units prevailing during the months of study and to estimate the diversity of benthic invertebrates in the basins.

Study Some of the physical, chemical and biological properties of fish farmingand see how they affect the quality of Tigris water.

Materials and Methods

Al Sauira fish hatchery is located in Iraq in Wasit

Province, Fig. 1 South of Baghdad. It is 65 Km from Baghdad, The total area of the hatching is 386 dunums and the water area is 282 dunums. It is far from Tigris River stream about 200.meters. The yield capacity of the hatchery is 50 million larvae (swimming) of carp of all kinds. (ordinary, Silver, herbal) In addition the localization and multiply of Iraqi fish (Albunni, carp, catan). Five sites have been identified to determine the diversity of benthic invertebrate sand to see the impact of hatching water on Tigris River. The sites Specified were as follows: The first site is the Tigris River before the water enters the hatchery 100 meter before the hatchery. The Second site, inside the hatchery is a fish pond with silver carp. The third site is inside the hatchery and has herbal carp. The fourth site is a. drainage canal for breeding basins to the Tigris River. The fifth site is the Tigris River, 100 meter a way from the hatchery .Physical and chemical parameter: physical and chemical factors were measured in the morning between 8.00.a.m to midday. From November, 2018 to July 2019).

Field measurement

Water temperature measured directly from the field standard mercury thermometer from 0-100 p^0(184). Water PH readings were recorded by using a method of Electronic meters by pH. Type HACH. Then measure the Electrical conductivity by using HACH. The results were expressed in the Micro Siemens/CM unit.

Laboratory Measurements

Winkler's method fallowed Azid modification described by public Health Association 185 to measure dissolved Oxygen. The Biological Oxygen Demand.

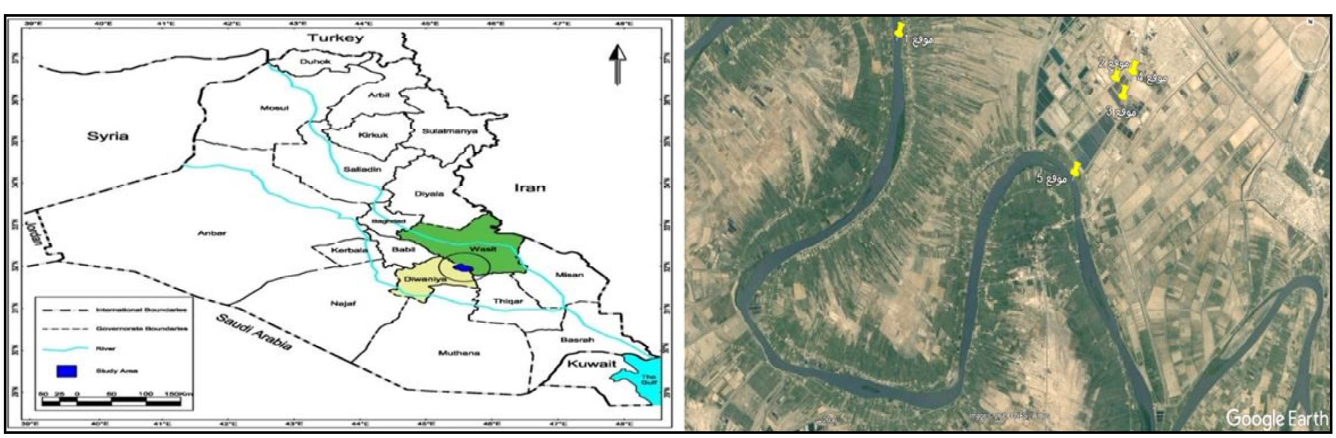

Fig. 1: Map of study areas (Used Arc-GIS Map program).

BDD_5 for study stations has been measured It adopted the method described in (Mackereth *et al.,* 1978), The total hardness Values of the study samples were determined by the method described by [Lind, O.T. (1979)], phosphates and nitrates in water were measured according to the method mentioned in (Apha, 2012).

Biological test

Sorting, Identification and classification of Benthic Invertebrates

As for the qualitative and quantitative study for benthic invertebrates, the aquatic plants collected monthly by using a band shovel with (15×15) cm dimensions. While sediment, filamentus algae and the remains of dead and conjoined plants were collected on the cliff of study site by landing Eckman Dredge with (15×15) cm, in the amount of five dredges. Note that the samples were collected 1.2 meters from the bank and 50–90 cm deep. The sample of sediments is placed in a 0.2 mm hand sieve.

The sediment and mud were washed by the water of the river. After the sieving process is completed. Macrobenthos which attached to the tongs are isolated. They kept in the polyethylene, leak proof containers. And formalin added to them by 4%. The name of the site, sample number and date of collection are marked. The sediment, plants, detritus and threaded algae were placed in plastic container with a little site water. The name of site sample number and date of collection are marked. they were transferred to the laboratory to isolate the meiobenthos and microbenthos a dissecting microscope under the power (×40 and ×10) classification was done based on keys [Edmondson, W.T. (1959), Pennak, R.W. (1978)].

Biological Diversity Indices

Species Richness Index (D): This indicator is calculated monthly according to the formula stated by (Sklar (1985).

$D = (S-1)/\log a\ N$

As: S = the number of species.

N = the total number of individuals.

Constancy Index (S): According to the presence of the repetition of each species according to the formula mentioned in (Serafim *et al.,* (2003)

$S = n / N * 100$

n = the number of samples in which the species appears

N = total number of samples

Results are expressed using a percentage according to the following method:

50% <Constant species , 5% - 50% Accessory species , 1% - 25% Accidental species

Shannon- Weaver Diversity Index (H): Values of this indicator were calculated monthly for all group samples by using the equation of Shannon and Weiner according in the (Southwood, 1978)

$H = -\sum nx / n \log nx / n$

As nx= The number of species individuals. , n= The total number of individuals.

The Species Uniformity Index (E): The species uniformity index is measured according to the formula contained in the(Floder & Sommer 1999)

$E=H/\ln S$

As: LnS=H max, H = Shannon – Weiner index value, S = Number of species in the site

Relative abundance index (Ra): This indicator is calculated based on the formula provided in Omori & Ikeda (1984).

$Ra = N / Ns \times 100$

As: N = the number of individuals returning per taxonomic unit in the sample.

Ns = the total number of neighborhoods in the sample.

The results are expressed using the percentage as follows: % 70> Dominant species, 40-70% Abundant species, 10-40% Less abundant species, <%10 rare species.

Results and Discussion

Table 1 shows the basic values of the physical and chemical factors of the five sites. Two sites on Tigris River three sites within Al Sauira fish hatchery. The results were statistically analyzed by the application of SPSS to compare the results of the sites that were studied. As it was shown that there is a clear effect of the drainages of water basins on the quality of the water and the diversity of the benthic invertebrates in the fourth site. While the fifth site showed it is recovery from the debris that arrived and return of its properties and water quality to normal and with increase in the diversity of the benthic invertebrates as shown below.

As the lowest temperature of the water was 13 degree, recorded on February in the fifth site of the Tigris River. The highest temperature of the water was 40 degree recorded on July in the fifth site of the Tigris River. This is due to the high temperature of the air and the environment surrounding the site and the times for collecting samples are close.

As the results of the current study showed that the highest pH value recorded in the second and third sites during March and April and respectively, it was (7.9, 8.1). The pH values were converged in station and other months of study. The pH values in study sites tend to be light base. The values ranged from 7.3 to 8.1, which is within the allowed values. Statistical analysis showed no moral difference ($p \leq 0.05$) for the values of PH values in sites of study.

This little range in the difference of pH values is due to the existence of carbons and Bicarbons ions in the water which leads to buffer system (Lind, 1979). The PH values in the current study are similar to the results of previous local studies as it recorded (Sabtie 2009).

The results of the current study showed that there were clear differences in electrical conductivity values. The highest conductivity values were 1288 µs/cm on the site in July. The lowest value of conductivity was 791 µs/cm in the second site in February. The statistical analysis has shown the existence of normal differences ($p \leq 0.05$) between study sites and months except in April and June, the normal differences were not recorded. High electrical conductivity values coincided with higher temperature in summer.

This is due to increase evaporation of water with few drainages access to the Tigris River at these times of the year. Then it leads to the speed and increasing deposition of mineral salts (Abowei, 2010). This result agrees with many local studies.

The results of current studies has shown the existence of normal differences ($p \leq 0.05$) in the values of dissolved Oxygen. It varied between the months and the study sites (8 form). As the highest values in the Tigris River are recorded represented by the two sites 1 and 5. Values during the months of the year ranged from 8 to 11 mg/l while it was clear the effect of the basins in the decline in the values of dissolved Oxygen in sites, 2, 3, 4, as the values of dissolved Oxygen were between 9-6. The decrease in values of dissolved Oxygen in these sites may be due to the fact that they were fish farming ponds, lack of its own ventilation system, the density of fish and other organisms. As well as the increase in organic matter from the decomposition of the organisms after their death, or the result of the addition of nutrients may lead to a decrease in the amount of Oxygen. For the difference in the nature of the current study sites it also reflected on the values of the biological oxygen demand and showed results of the effect of the fourth site by the drainages of fish farming ponds as the highest value of the biological oxygen demand reached 3.5 mg/l in July. The lowest value of the biological oxygen demand was 0.3 mg/l which was recorded in fifth site in December. So the Tigris water is fairly clean. So the mention (Odum (1970) assessments of water bodies, as the water bodies where the value of the biological oxygen demand is 2mg/l were considered clean. The value of biological oxygen demand is 5 mg/l and it is questionable of cleanliness. The high values of the biological oxygen demand in the summer are due to the occurrence of septic process by microorganisms which lead to increase consumption of oxygen. The biological oxygen demand uses to estimate the capacity of absorption of water contaminated by water bodies. And also to evaluate the self-purification of water bodies. The values of the biological oxygen demand in the current study compared to the results of previous studies. The values of total hardness varied between the sites and month of study and it seemed clear that the values of total hardness rise in the hot months. It recorded the highest value for total hardness in July at 650 and 700 mg/l which was recorded in fourth and fifth site and respectively. While the lowest values recorded in February and the convergence of the values of the total hardness as there were no normal differences between all the study sites. The total hardness ranged (318-310) mg/l. as the values of hardness converged in the study stations in November, October and March. Normal differences were not recorded between study stations. The hardness increases generally during the hot months as a result of increasing evaporation and less rain in summer. R.R. Al-Ani, *et al.,* (2019) The result approached to many of Iraqi studies. As for the values of nutrients studied, the results showed a rise in the proportions in the sites represented by fish farming basins (2.3 and 4). The current study showed that the lowest phosphate values recorded in Tigris River, first and fifth sites which reached to 0.06 mg/l during Nonmember. While the highest values recorded in the second site during May reached to 7.37 and then the fourth site with values reached to 5.8 in March.

As for nitrate values, statistical analysis showed that there are normal differences between stations and months of study and the highest values were recorded in (3, 2, 4) sites during November reached to (12, 14, 15) mg/l respectively. While the lowest value reached to 1 mg/l in May. As for the (5, 1) sites represented by Tigris River site before basins and (5) site after basins on Tigris, the values were closed during months' study to be (3-8) mg/l. The high values of nutrients of phosphate PO_4 and nitrates NO_3 in the (2, 3, 4) sites of basins may be due to the use of nutrients. That is normal, a lot of studies has indicated to it which have shown the main problems of fish farming basins was increasing Nutrients. Biomonitoring and assessment of environmental changes by using organisms has become a widely known method of water quality assessment.

So it was isolated during the current study 963506 ind/m^2 of benthic invertebrates. They were diagnosed to 57 Species as shown in table 2. It has been distributed as fallow: Cnidaria which represented with one kind and at %1 from the total number of isolated invertebrates. and four rating units belongs to nematode that were represented %3 from the total number of isolated invertebrates ,and five rating units belongs to turbellaria which represented 4% from the total number of isolated invertebrates , and 15 rating units of oligochaeta that represented %29 from the total number of isolated invertebrates . Arthropod that represented with 9 species , belongs to curestacea, (12) rating units belongs to insect at %16 and %9 respectively. 11 kinds of Mollusca at %39 from the total number of isolated invertebrates which was the highest among the invertebrates populations as shown in the Fig. 2.

The disparity in the distribution of invertebrate populations is also due to their impact on the heterogeneity between the stations study in their chemical and physical properties. Hashem Zadeh & VerKataramana / 2012). Biomonitoring in the aquatic environment has taken two important directions: first qualitative monitoring of benthic invertebrates. Second qualitative monitoring that has shown that measuring bio diversity gives good evidence to describe water quality. The results of current study has shown the fish farming basins have clear impact in distributing the benthic invertebrates.

As total density started to gradually rise as it was (73155) ind/m^2 in site 1 to be (105521) and (98184) ind/m^2 in the (2 and3) sites respectively and significantly reduced in site 4 to reach 67582 ind/m^2. The highest density recorded in (5) site to reach (119066) ind/m^2.

As this results agreed with many of studies that numbers of benthic invertebrates were increasing down the fish farming basins. The (5) site recorded the highest number of species that were 56 species. The (4) site has the lowest number of species that were 46 species as this site represented by drainage canal and that agreed with many of studies that the shortage of classification ranks in the river below the dam or reservoir has been noted by many researchers (Ward, 1976, Ward & Short, 1978 Rader & Ward, 1988). The fluctuation of water levels in reservoir may play a role in the small number of classification ranks, especially the bottoms. The subject of the research is on the slope (Riffle Fauna). As for rising water levels leads to flood areas of land. And these submerged areas may not have had enough opportunity to be occupied or colonized by the organisms while collecting samples (Hunt & Jones, 1972).

Benthic invertebrates were used as bioindicator to determine water quality. Biodiversity indicators is used to describe and study the components of any community of living in the aquatic environment, because one of it is advantages is ease, and it reveals the environmental factors that are influential, By indicators used in the current study showed a clear variation in the biodiversity indices between sites and months of study. Species richness index D recorded the highest values reached to 12.3 in (3) site in February the lowest values in (4) site reached to 9.8 in November. The results of study showed that (5) site recorded the highest values by this index during all study months, so the values were between 12.2 as the highest values in February and 10.3 as the lowest values during July.

The recording of the great values of the cold months. Abundance index is consistent with which was referred to by (Sklar, 1985) that the availability of nutrients, the start of rising temperature and abundance of plants provides an suitable environment to increasing the number of species. The abundance of species represent the

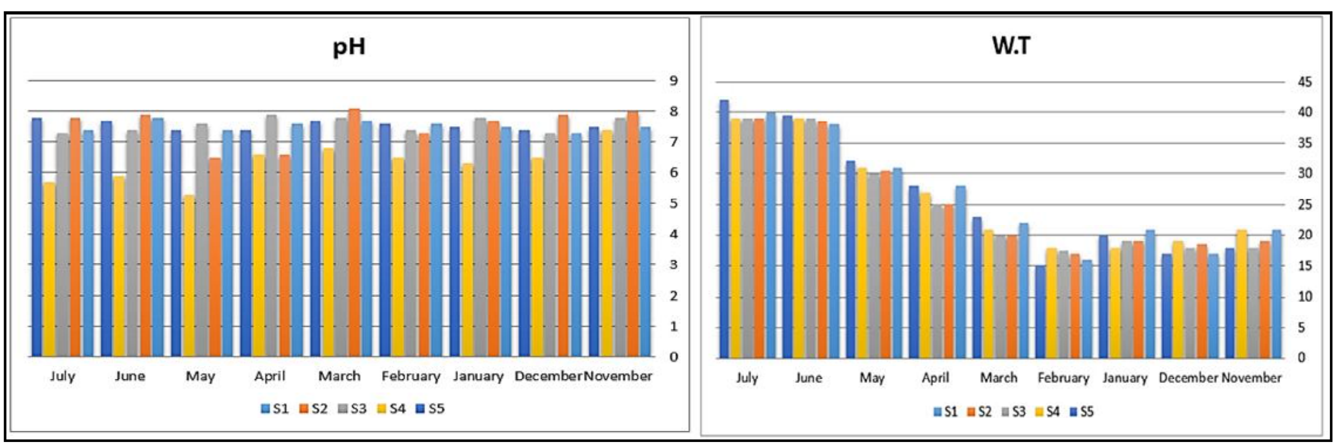

Fig. 3: Monthly variations in Water Temperatures (Cº, pH, Dissolved Oxygen (DO) (mg/l) Biological Oxygen Demand (BOD5) (mg/, Electrical Conductivity (E.C) (µs/cm, Total Hardness (mg/l) PhosphatePO4, Nitrate NO3.

number of classification units diagnosed within the water table and it refers to the diversity within the sample. It consists of classification units diagnosed to type level or it could include groups of these types (races, families, ranks). In any case, the abundance of species reflects the variety of invertebrate communities in the water (Resh *et al.,* 1995). The increase in the index of the abundance of classification units is associated with increasing health of the organisms' places in which they live. The measurement of the abundance of classification units shows the changes in the water invertebrate society. (Barbour *et al.,* 1999).

Through Shanon -Weiner diversity index , the values

Table 1: Total density of benthic invertebrates collected at the five sites during the study period.

No. species	TOTAL	Station					TAXA
		ST5	ST4	ST3	ST2	ST1	
1	532	44	111	0	111	266	Cnidarian
5	16948	4620	3354	3798	2423	2754	Platyhelimenthes (turbellaria)
4	15038	2642	1665	5910	2245	2578	Nematoda
15	133176	34659	14775	41795	21219	20729	Annelida
9	43389	16954	2552	11910	3688	8285	Arhopoda (Crustacae)
12	74182	18707	14641	14066	14374	12395	Arthopoda(Insect)
11	180243	41441	30486	28043	54126	26149	Mollusca
57	463506	119066	67582	105520	98184	73155	TOTAL
		56	46	52	42	52	species

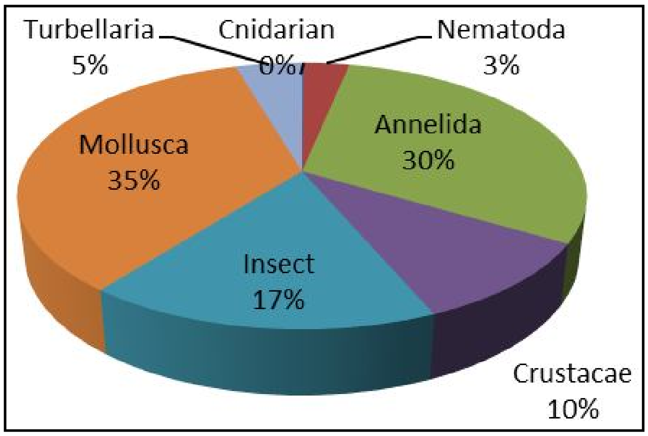

Fig. 2: Percentage of aquatic benthic invertebrates collected at the five sites during the study period.

ranged from the lowest values recorded at (4) site reached (1.91,1.98) in November and June respectively. While the highest values for this index recorded in (5) site reached to 3.5 in February and April.

According to Shanon index in the current study that Tigris River has a high diversity. Because of that biodiversity indicators refer to the number of species in the sample and the distribution of individuals between these species. (Goel, 2008) . The high values of Shanon Weiner index refer to high diversity (Burton *et al.,* 1999). The values of this index are between 5-0. According to this index, the high value from 3 refers to high diversity of healthy bio community which lives in a stable environment. While the lowest value from 1 refers to existence of environmental pressure resulted from pollution which leads to disappearance and migration of sensitive species.

High diversity values are a familiar phenomenon in many of water bodies that their environmental circumstances are more stable and then the diversity increases in the water surface (Whitton. 1978).

The change in biodiversity is considered a suitable index for changes in water proportion (Stevenson, 1984).

It was clear from the results of the current study that the highest value of Shanon index was in March, April, November and December. This may be due to increase water levels, which reduce salinity, hardness and nutrient availability. The seasonal changes in diversity values may be due to the nature of each species's life cycle. Density of some species increases in spring but others in summer.

The recorded diversity values in this study were approached With many of local studies. The results of study showed that the highest values in species uniformity index e recorded in 1, 5 sites reached 0.89 in June and July respectively. The lowest values of the index were in 4, 3, 2 sites reached 0.33 in April, March and July respectively. The lack of species uniformity index indicates the dominance of a few species with densities, which is an indicator of the existence of environmental pressure (Green, 1993) that because species uniformity index refers to the pattern and how individuals are distributed between types. The closer individuals get to each other in terms of density, the closer value is to 1. By that species recorded in the current study are homogenous in appearance in 1, 2 sites. The high values in species uniformity index are signs of no stress or environmental pressure on the species of benthic invertebrates recorded in sites. Lack of species uniformity index indicates the dominance of few species with high densities which is indication of the existence of environmental pressure.

Through the evidence used show that hydra water abundant species according to relative abundance index in (4, 2 and 1) sites and according to constancy index hydra was from constant species in Tigris river because it recorded more than %50 in constancy index. As for the group of turbellaria, most of the species recorded on relative abundance species and on constancy index, the current study they were from constant species in the sites of the current study. The distribution of the turbellaria in the sites of the current study was affected by the existence of aquatic plants ,the accumulated erosion and remnants of decaying plants and algae and may be it is because of a suitable breeding area. The turbellaria feed on the detritus and microinvertebrates (Mellanby, 1975) This also explain the decline of turbellaria in the colder months in the lake (Zbecy) This may be due to the fact that the turbellaria produce still eggs in unsuitable environmental circumstances .Temperature is one of the

Table 2: species of Benthic invertebrates, its Relative abundance (Ra Index), and the Constancy Index (S Index) at the five sites during the study period.

SPECIE	Relative abundance (Ra Index)					Constancy Index (S Index)
	ST1	ST2	ST3	ST4	ST5	
Hydra	100.00%	100.00%	-	100.00%	-	66
	PLATYHELMINTHES					
Macrostomium sp.		28.44%	20.47%	20.53%	17.31%	77
Microstomium sp.	24.19%	19.27%	19.88%	17.22%	19.23%	77
stenostomium sp.	21.77%	26.61%	19.30%	16.56%	19.71%	88
Stenostomium bryophilum	22.58%	25.69%	18.71%	15.89%	22.60%	88
other turbelaria	31.45%	-	21.64%	29.80%	21.15%	30
	NEMATODA					
seinura sp	54.31%	47.52%	14.29%	25.33%	21.85%	88
Trilobus longus	27.59%	26.73%	18.80%	41.33%	16.81%	77
Dorylainus sp.	18.10%	25.74%	18.80%	33.33%	26.05%	66
other nematoda	-	-	14.29%	25.33%	35.29%	20
	ANELIDA					
Aeolosoma variegatum Vejdovsky, 1885	5.09%	6.18%	4.09%	3.20%	2.7	100
A.hemprichi Ehrenberg,1828	5.09%	5.65%	3.72%	5.03%	2.7	100
Chaetogaster diastrophus (Gruithuisen,1828	7.03%	6.07%	10.95%	4.73%	7.4	100
Leech	-	7.33%	13.08%	10.37%	6.3	88
Stylaria s p	5.74%	8.69%	3.46%	-	4.9	88
Nais simplex Piguet,1906	4.00%	3.56%	2.55%	-	2.4	100
Dero(Aulophorus) furcatus (Müller, 1773)	5.09%	4.08%	1.12%	-	0.1	100
Ophidonais serpentina (Müller,1773)	5.09%	4.40%	1.38%	-	0.1	100
Slavina appendiculata d,Udekem,1885	5.09%	10.58%	11.80%	7.47%	1.8	88
Limnodrilus hoffmeisteri Claparede,1862	10.71%	8.48%	3.72%	13.11%	14.8	100
Tubifex tubifex (Müller, 1774)	16.45%	13.40%	24.72%	35.52%	1.3	88
Branchiura sowerbyi Beddard, 1892	10.71%	17.49%	3.72%	-	29.9	88
Eiseniella	10.71%	3.35%	15.68%	13.11%	3.8	100
Lumbriculus varigatus	7.03%	0.73%	15.68%	7.47%	9.7	88
immature annelida	2.16%	-	-	-	9.7	40
	ARTHROPODA CRUSTACAE					
Ilyocypris sp.	11.81%	72.29%	23.51%	38.26%	15.8	40
Cypridopsis vidua	12.09%	21.69%	15.11%	29.57%	7.9	30
Eucypri sp.	0.00%	6.02%	32.28%	6.96%	22.7	20
Cypris magna sp.	3.30%	-	20.34%	6.09%	13.6	20
Decapoda(Crab)	11.81%	-	1.31%	3.48%	22.7	20
Macrobrachium nipponeuse	11.26%	-	2.99%	2.61%	3.4	40
Amphipoda	2.20%	-	4.48%	10.43%	4	77
Shpaeroma annadale annandale	18.41%	-	-	2.61%	4.1	20
naplus larvae	11.81%	-	-	-	6.1	50
	INSECT					
Chrironomus sp.	21.36%	32.77%	22.47%	28.38%	23.2	100
Anisoptera	2.69%	9.74%	12.34%	5.46%	7.6	77
Zygoptera	2.51%	6.80%	3.01%	5.61%	7.7	66
Trichoptera	3.41%	6.65%	5.38%	8.80%	6.7	77
Corixidae	6.10%	-	5.22%	3.19%	7	44
Plea leachi	15.44%	-	-	-	10.3	30
Dytiscidae	3.59%	2.47%	12.82%	-	3.2	30
Hydrophilidae	4.67%	3.71%	10.60%	5.61%	3.7	30
Coleoptera larvae	3.23%	3.71%	5.06%	2.28%	3.2	30

table 1 continued ....

haliplidae	16.85%	16.85%	0.79%	-	3.7	10
Culicidae	5.87%	5.87%	17.09%	40.67%	22.2	100
Ephemeroptera .	16.85%	16.85%	5.22%	-	1.4	10
MOLLUSCA						
Physa acuta	65.51%	80.58%	67.83%	79.66%	17.3	100
Lymnea lagotis .	0.59%	0.54%	0.24%	0.29%	0.1	44
Bellamya bengalensi	2.46%	4.28%	3.01%	0.58%	1	88
Melnopsis nodosa	1.95%	4.28%	4.52%	1.60%	1.2	66
Melonoides tuberculata	2.12%	3.06%	5.55%	2.70%	1	77
Acroloxus lacustris	1.44%	3.36%	3.96%	1.68%	1	88
Pomacea canaliculata	14.19%	3.90%	2.38%	1.82%	4.2	100
Pseudontopsis euphraticus	1.70%	-	3.72%	2.84%	2.1	88
Unio tigrids	3.06%	-	2.61%	2.26%	2	100
Corbicula fluminea	4.25%	-	2.61%	3.21%	2.6	100
Corbicula fluminalis	2.72%	-	2.69%	3.21%	2.2	100

important factors affect on the number of eggs produced and the time of hatching (Heitkamp, 1977) The results of the current study are consistent with (Jaweir & AL-Seria 2014) study record neither abundant nor prevalent types of abundance in the sites of the current study.

The absence of demand species provides evidence that the turbellaria are not subject to the pressure of competition among them. As for the group of nematode, the seinura species were abundant species in (1, 2) sites, according to the relative abundance index and the other diagnosed species in the current study were less abundant species, according to index. While nematode recorded in the current study were considered constant species in stations of the current study in Tigris river and fish farming ponds. Nematoda have ability to resist drought. They are known for their ability to suspend the metabolism in a process called Cryptobosis. Their life cycle are short so they can overcome on the extreme environment circumstances (Sherman and *et al.,* 2007).

As for annelida, they ranged, according to the relative abundance index, between less in abundance and rare. There were no recorded in any abundant and prevailing species. All the diagnosed species of annelida in the current study, according to constancy index, were constant species in the sites in the current study because they recorded values more than 50%. The failure to register dominant species in the current study may be due to difference of annelida preference of the bottom nature, Some species prefer clay bottom, some prefer sandy bottom (Timm *et al.,* 2001) . Noted that species are not affected by the change of chemical factors of water But its existence is closely linked to the nature of the sediment at the bottom. Depth, PH, the rate of decline and the type of settlement plants are also factors in the existence and spread annelida (Kazanci & Girgin, 1998).

Tubificoid naidid worms are among the few of Oligochacta, the most abundant in organically contaminated water for the availability of food (organic materials). And lack of competition for it as a result of the disappearance of most of the benthic organism due to the pollution and the absence of predators (Brinkhurst and Jamiesin, 1971) and (Swayne and Wetzel, 2004) Probst referred that the abundance of oligochatea have a close relationship with the proportion of organic matter found in the sediment where these worms are found.

The group of curestacea except Llyocypris, is considered one of the dominant in 2 site and it is considered, according to constancy index, constant species The rest of the species were between less abundant and rare [Maysoon Hassan (2018)]. The curestacea species recorded in the current study were considered among them are abundant and rare. According to the index, They were considered the types as it added to the sites of the current study. Monthly variations in curestacea density and seasonally succession are associated with changes in temperature of water for their effect on the rate of the speed of growth, the time of laying eggs, the hatching and the time of reproduction.

The growth of curestacea is determined by predation, especially, from fish. The increase in the number of curestacea depends significantly on the composition and diversity of their natural environment and the high density of vegetation . According to the relative abundance index, the group of insects ranged between rare species and less abundant. While the rest types ranged between added to emergency types. Chironimdae family is very common

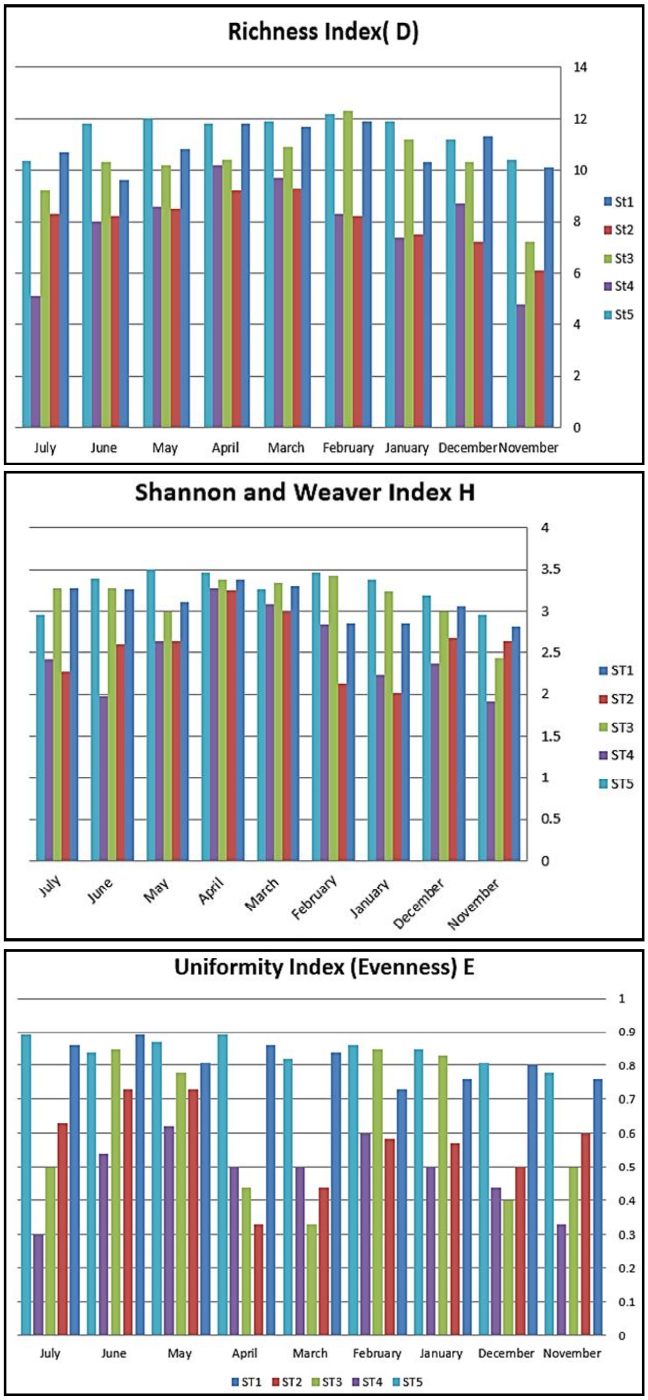

Fig. 4: Monthly variations in Richness Index (D) Shannon and Weaver Index HSpecies Uniformity Index (Evenness) E at the five sites during the study period.

in lake sediments. There detailed study on chironimdea in chain of lakes, west region of Greenland (Brodersen & Anderson, 2002).

This is due to that the larvae of Chironimadea live in still lakes where plants debris are available and which is suitable food for these larvae That leads to increasing their number (Cranston, 2001) or this is due to its small size which helps it grow between algae and plant debris which leads to increase its density (Mundie & Crabtree, 1997). It is also due to the ability of this group to be in all kinds of bottom (Tudorancea *et al.,* 1989) The current study agreed with many of local studies which referred to the abundance of the chironimd group . It also recorded many studies on the abundance of chironimd larvae in the rest of the groups in a lot of water bodies (Kerekes & Freedman, 1989).

For mullesca grouop the Physa is considered one of the dominant species in all the sites of study and it is a constant type, according to constancy index, because the type (P. acuta) belongs to physidae family which is more common and spread than abdominal pneumonia in the world (Dillon *et al.,* 2002) . This type prefers living in a sweet, clean and still environments (DE kock & Wolmarans, 200994). Its existence is related to the density of aquatic plants (Appleton, 2003). It is a fertile and breed-producing individual. The density of their reproduction is faster than the rest of the other shells (Aditya & Raut, 2002). As for the species that belong to physa, they are less abundant. According to the constancy index all the diagnosed physa in the current study are constant The result of the current study that it has been reached that physa species have specific environmental demands and the most important is the nature of the bottom where the rocks and stones represents necessary places to hold physa in these places The existence of plants is the greet importance to the physa for using as food and a place to hold physa in and source of oxygen.

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