Reviews of diversity, density and frequency of Macro benthos on Karun River in both cold and warm seasons, 2012 (Khuzestan Province)

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Abstract: Karun River is the longest and the most watery rivers in Iran. It is located in the main body of the Khuzestan Province. Karun River is 950 km long and its extent of the catchment area is 60,000 sq. km. This study was performed in 2012 on the Karun River in both winter and summer. Samples were taken at 11 stations with three determined replicates by using Peterson grab and with Surber cross section 225cm^2. During two seasons of sampling, the Annual density of Macrobenthos identified and counted the average of 50,308 individuals per square meter per year. Between the identified classes, the highest frequency percentage corresponds to category of Oligochaeta 56.64% and the average density of 28493 individuals per square meter; then were considered insects with frequency 11.8% and a density of 5574 individuals per square meter, Gastropod with a frequency of 02/11% and a density of 5,546 individuals per square meter bivalve with a frequency 10.39% and a density of 5226 individuals per square meter, Polychaeta with a frequency of 8.19% and a density of 4122 in individuals per square meter, crustacean frequency 2.65% and a density of 1334 individuals per square meter and leech with a frequency 0.3% and a density of 13 individuals. The Total frequency of Macro benthos is indicating Station 3 has the highest frequency 13,640 individuals per square meter and Station 5 has a minimum frequency with 293; also have had annually density of 31993 persons per square meter in summer and 18315 individuals per square meter in winter which their difference was significant. In entire period has been recorded the highest of Shannon diversity index at station 9 (1.811 ± 0.21) and the lowest at station 6 (0.427 ± 0.36) in the winter; also was Highest rate of Simpson's dominance index, at Station 6 (0.865± 0.16) and the lowest at station 9 (0.338 ± 0.14) in winter. The highest of Camargo's index has seen in the summer (0.419 ± 0.08) and the lowest in winter (0.168 ± 0.6). The highest of Berilion index has been recorded (1.622) and the lowest (0.419±0.37) in summer.
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Key words: Karun River's, macro benthos, density, diversity.

1. Introduction

Biological and ecological studies of water resources are the major topic in research and scientific investigations of ecosystems and have attracted the attention of many international organizations to it and because these regions are important reservoirs of plant and animal genes in the biosphere, they need to take international measures and serious scientific (2). Benthos is as a foundation of living organisms in aquatic ecosystems. These organisms play an important role in aquatic food chains terms of ecology, in addition to having a special place in the food chain. These organisms are biological indicators of aquatic ecosystems and are able to collect oil contamination, heavy metals, radioactive and other contaminants into the environment and cause the cleanliness and health of the aquatic environment. These organisms have always been considered as indicators of pollution because of limited movement; hence the study of the Biodiversity of Benthic Organisms is particular importance, the diversity and density of Macro benthos, can be useful in future studies on the biological monitoring of the Karun River in the desired range(1).

The major benthic invertebrates are visible by the naked eye and have a relatively long life cycle and they show different responses to environmental factors and have a high relative resistance against pollution. Benthic organisms are undoubtedly the best indicator for the detection of environmental health. Benthic organisms are an important food source for higher nutritional levels and their frequency is an indicator of environmental change and human disturbance mechanism (11).

They live on or within the sediment and are directly exposed to the accumulate pollutants in sediments And have no running out of power due to their environmental conditions and is expressed in the relationship between communities and the effects of

pollution on the macro benthos in several studies. Different factors are effective on density, distribution and diversity of benthic macro-invertebrates, some of which include such as: The structure of the substrate and the organic material on the substrate, temperature, salinity, dissolved oxygen and pH. Many scientists believe that environmental monitoring has many advantages over chemical methods which can be referred to the lower cost of accuracy and speed in the evaluation of current aquatic ecosystems. Jovic et al (2009) studied the aquatic invertebrate communities in rivers and Lipanica, who recorded 53 species. Distribution and types of benthic macro are different in the two rivers. Ayres-Peres et al (2006) studied the diversity and frequency of benthic macro fauna in environmental waters in the center of Rio Grande do sul, Brazil, and 58 families were identified in three main categories; the highest of variety and the frequency rate was recorded in the sides of the Rivers. Sadegh Saba (2011) has carried out an assessment of the diversity and distribution of Dez river of Macrobenthos in Dez Wildlife Dez Wildlife Refuge that is located within the in Khuzestan province, he has observed that The highest frequency belongs to the Oligochaeta, gastropod, insects, bivalve, crustaceans and leeches among other groups.

Nori por (2011) has been showed by determination of species diversity and distribution of the Macrobenthos of Dez River in Old Bridge up to the Bridge Hami Abad in the Dezful that the highest of frequency percentage belongs to the oligocate insects, gastropod, and leeches. Karun River is the main of water resources current in the West and South West of the country; the main of body is located in the Khuzestan province and it is the longest river and most water in Iran; because this has an important point. So that is dependent on more than 70 per cent of the 4 million people living in Ahwaz and Abadan and Khorramshahr to the Karoun and its branches. Therefore, information about the surface water of quality provides the possibility, In addition to use it's for various cases; it is causing will be adopted methods with minimal damage to water resources. Karoun is host to the largest number of aquatic birds and migratory seabirds annually; and is also valuable habitat for native birds. The river is also very rich in animal fauna includes several species of fish and other aquatic organism. Benthoses are the most important animal group that has an essential role in the provision of food for basic groups of aquatic.

The Conservation of water resources is one of the most important elements to maintain their biodiversity and biome, since it is necessary to identify Organisms River and enhances the protection of aquatic ecosystems, river assimilative capacity, so it is the appropriate approach to increase biodiversity and reduce water pollution [6]. The purposes of this study are the use of presented biological indicators and diversity, density and abundance of macro-benthos, and realize the impact of diversity and abundance on ecosystem then proceed to running Management plans and improve the environment.

2. Material and methods:

This study was conducted at 11 stations in the Karun River in the summer and winter of 2012. The studied area was selected in Khuzestan province from since the beginning Dez and Karkheh to the end of between Khuzestan and leading up to the Persian Gulf. The position of the station has characterized Figure 1. Local stations are selected on the basis of the actual situation of river and accessibility in in the region. The Sampling was carried out with three replicates in each station. Samples were taken with Surber at Station 1 and in other stations by Grab Patterson (each cross section 225cm^2).

Three replicates were used for the detection and enumeration of Macrobenthos. Formalin 5%was poured into three times Macrobenthos are fixed and are easier to be identified. Each of the three separate were washed sieve 0.5 mm and put through remaining a sieve to petri dishes and is covered with alcohol96%. The samples were stained with solution grams of Rose Bengal per liter by the method of Walton (1974). Isolation and identification of the different species are classified according to the different animal groups Identification was performed by using a stereomicroscope. The Identification key of benthic fauna is used in order to identify animal examples (15, 16). For calculating the index of diversity, dominance and evenness were used to the ecological methodology of software. It also was used software SPSS for the statistical analysis

Figur 1: Location of study stations In the Karun River (Spring 2012 – Winter2012)

3. Result:

Totally 76 species and 7 Class of macro benthic were counted during of study in two seasons of sampling. Abundance of the identified species on studing seasons is shown in Table 2. In the whole study period gathered an average of 50308 people macro benthos in the square meters Among which 25 species belong to the class Gastropoda, 17 species belonging to the class Insecta, 9 species belonging to the class Bivalvia, 10

species belonging to the category Polichaeta, 9 species belonging to the class Crustacea, 4 species belonging to the class Oligochaeta and 1 species belonging to the category Hirudinea.

An average total of Macrobenthos abundance shows on survey stations that Station 3 has the highest frequency of 13640 individuals per square meter and Station 5 has a minimum frequency with 293 individuals. Among the groups identified during study period on average, oligocheta has had maximum frequency and the minimum frequency was belonged to leech. The highest frequency percentage corresponds to the category of Oligochaeta 56.64% then was considered insects with frequency 11.8%, Gastropod with a frequency of 11.02%, bivalve with a frequency 10.39%, polychaeta with a frequency of 8.19%, crustacean frequency 2.65% and leech with a frequency 0.3%. In the two seasons of study, the most frequent of macrobenthos is related to the category of oligocheta and the minimum frequency was belonging leeches' category (table 1, figure 2).

The most frequent has been related to Tubifex tubifex species in the summer 6074 and winter titles in 27 subjects (table3, figure3).

Investigation in seasonal of variations different a category of macro benthos is also shown that the change of season has a significant effect the average density of macro benthos groups. The data also showed that the average density of groups in 11 stations are also significant differences (05/0P <).

The results show that biological indicators are calculated, bio-diversity Shannon index and Simpson dominance, and Camargo evenness and diversity Berelion for all sampling stations and seasons to evaluate biodiversity Macro benthos.

In entire period has been recording the highest of the Shannon diversity index at station 9 (1.811 ± 0.21) and the lowest at station 6 (0.427 ± 0.36) in the winter; also was Highest rate of the Simpson's dominance index, at Station 6 (0.865± 0.16) and the lowest at station 9 (0.338 ± 0.14) in winter.

The highest of Camargo's index has seen in the summer (0.419 ± 0.08) and the lowest in winter (0.168 ± 0.6). The highest of berilion index has been recorded (1.622) at station 10 and the lowest (0.419±0.37) in winter at station 6 (chart1). The results of the biological indicators show that in the summer, the Simpson dominance index and other indicators were observed an inverse linear correlation in 0.01.

In winter, between this index and density of Polychaeta, Shannon diversity index, berilion diversity, Camargo's index were observed an inverse linear correlation between in in 0.01. It is also a direct correlation between this index and the density of oligocheta in 0.05. Also it has been shown in the study of the period that in summer there is a direct correlation between the densities of insects at oligocheta in 0.01. In winter, there is a reverse linear correlation between the density of oligocheta and Polychaeta of 0.05. In winter, was observed a direct correlation between density polyethylene and crustaceans in 0.05. In winter, there was a direct correlation between the gastropod and bivalve density at 0/05.

The results of this study have shown that during the summer have been macro benthos density of 31,993 individuals per square meter and a frequency of 59/63 percent which has the highest density and abundance of macro benthos That there is a statistically significant increase Compared to winter ($p<0.05$)

Table 1: The frequency and frequency percentage of identifying Macro benthos group on the Karun River (The number on square meters)

Macrobenthos groups	frequency	frequency percentage
Oligochaeta	28493	56/64
Polychaeta	4122	8/19
Insecta	5574	11/08
Gastropoda	5546	11/02
Bivalvia	5226	10/39
Crustacea	1334	2/65
Hirudinea	13	0/03
total	50308	100

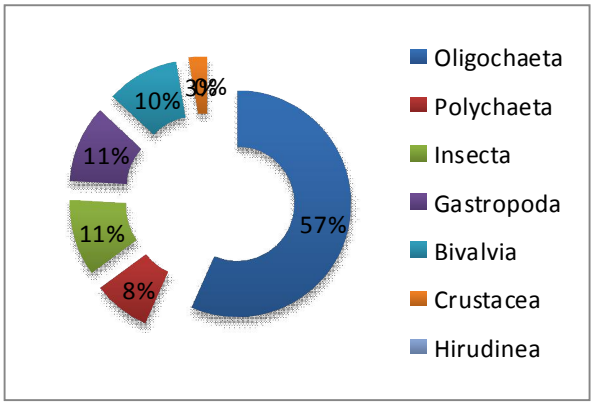

Figure 2. Frequency percentage of Macrobenthos categories of the survey course in Karun River (summer 2012and Winter (2012)

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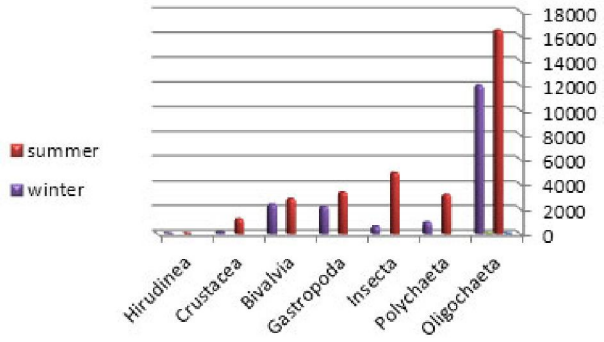

Figure 3: Average abundance of macro benthos groups on sampled seasonal (summer 91, winter 91)

In entire period has been recording the highest of the Shannon diversity index at station 9 (1.811 ± 0.21) and the lowest at station 6 (0.427 ± 0.36) in the winter; also was Highest rate of the Simpson's dominance index, at Station 6 (0.865± 0.16) and the lowest at station 9 (0.338 ± 0.14) in winter.

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In winter, there was a direct correlation between the gastropod and bivalve density at 0/05.

The results of this study have shown that during the summer have been macro benthos density of 31,993 individuals per square meter and a frequency of 59/63 percent which has the highest density and abundance of macro benthos That there is a statistically significant increase Compared to winter ($p<0.05$) the winter by the macro benthos density of 18,315 per square meter, and frequency of 41/36 percent has been allocated to it the lowest density and abundance of macro benthos; There was also a statistically significant difference between the sampling stations during the study($p<0.05$).

4. Discussion:

Based on studies that have been done on the identification, distribution and abundance of macro-benthos in Iran and elsewhere in the world is identification of the different branches and species. During Shahidi (1998 -1999) is paid to the study of benthic organisms in Afjeh River that the total balance was sampled contains 8 orders. Rahimi bashar 1995-1996 and 1998-1999 has evaluated about the potential natural production of the river's polrood; that its purpose was to determine which species of benthos, biodiversity of river bottom and determine the result of potential natural production of benthos that As a result has identified four orders of aquatic insect larvae from benthos groups.

In 2006, Ayres-Peres et al in their study have examined the diversity and abundance of benthic macro fauna in environmental waters in the central region of Brazil Rio Grandedosul. Overall, 58 families in three major categories were identified (Hirudinea, Oligochaeta, Copepoda) from invertebrates. The highest of variety and the frequency rate was recorded in the sides of the Rivers.

Insects have the highest diversity and abundance in the region among the identified species that that included 42 families, totaling 95% of the adult sampled population. Samarra Kosuke (2008) has investigated on the impact of organic pollutants on the majority of the benthic invertebrate fauna in the kermir river in Turkey, has identified 13 animal groups of Benthic macro-invertebrates showed that all, the kermir stream is affected organic pollution. The present study has shown that macro-benthos abundance in summer than in winter has been significantly increased.

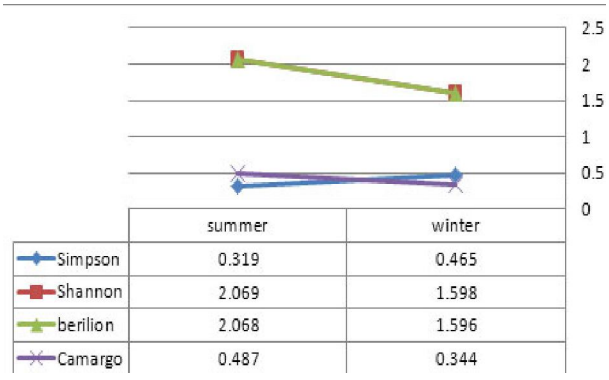

Figure 4: Comparison of biological indicators on Sampling seasons of Karun River (summer2012, winter2012)

But, according to the results of biological indicators, suggests that it is confirmed that this factor cannot be considered alone, here it was shown that the dissolved oxygen decreased with increasing temperature in the summer, However terms of the amount is the range for species has to be better conditions.

This characteristic indicates this is the case; the existing species with specific temperature of structures have certain structural and physiological capabilities of the field of water.

In this temperature range, the majority of species have the capability to reproduce and the biological activity. Because, according to the summer season for lower frequencies, it is shown that the highest diversity index that represents the proportional distribution of the species in their environment that there are various factors that demonstrate the utility of their environment; however, the factor is less than the amount of dissolved oxygen in winter, But the overall temperature factor of the animal structure is the dominant factor (18).

A macro benthos density fluctuation is in the volatility function of reproduction. Reduction in spawning or the lake of spawning can result in a reduction in food and increased energy for metabolic processes induced by environmental stresses such as fluctuations in temperature, salinity, pH, oxygen reduction, hydrogen sulfide production increase and the change of quality and quantity of food.

Oligocheta of class with a frequency 28493 individual square meter identifies the most common category in this study that the highest of them has recorded at Station 3.

Sewage discharges into the river has caused to increase the pollution in the river. Hence the Groups of resistance to infection been developed such as: Niedea and tobificidea. By pollution contamination is increased the amount of Oxygen have to be fluctuations that it will cause to eliminate sensitive and semi-sensitive groups to pollution. The groups of the most resistant to infection will be dominated. It also has been demonstrated in other studies [14, 15].

The high density of oligocheta is a good indicator to show organic pollutants. oligocheta has high resistance to various stresses and when they are abundant so they are good indicators to show pollution.

The survey Macro benthos biodiversity index, Shannon diversity index highest in summer (2.069 ± 0.21) and the lowest (1.58 ± 0.46) were recorded in the winter. The highest rate of dominance index Simpson, in winter has recorded (0.465±0.16) and the lowest in summer (0.319±0.14), respectively.

It indicates that the increasing diversity index a season of the dominance rate would be decreased and vice versa.

Gastropod class is the most diverse family with 25 categories in these stations. Because: 1. most abundant gastropod in shallow water and hot 2. Compatibility this category with plants likes Bronus [16] and 3) eating habit to scratch in the context of a course grained is provided more level of nutrition.

Increased pollution causes loss of species diversity and abundance of benthic macro-invertebrates. While in these areas, which are dominated by opportunistic species is an indicator of pollution (9).

Agricultural drainage due to Agricultural development projects in the area is entering the river. Also, the organic pollution of the input field is also entered into the region. These two sources of contamination caused by the environmental unfavorable conditions of the area are benthic.

Hence the dominance groups are resistant to infection, such as Annelid and leeches in this area. It has also been shown in other studies [8, 9].

In total, according to a survey conducted on the Karun River and macro benthos diversity and the suitable relative density of ecosystem than other similar should be done any utilization of existing capacity of further research and Evaluate all factors in the river and observing all the rules of the new species of aquatic ecosystems.

On the other hand, before any action should be controlled pollution of human origin and provide favorable conditions for aquatic life.

This makes clear the need to pay attention to the Environmental Protection Agency and the size of the organs concerned with the protection of aquatic ecosystems by taking suitable arrangements and performance management principles to preserve these rivers.

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Table 2: category of macro benthos

Class of benthos	The scientific name of the species	Stations											The total number on 11 stations
		1	2	3	4	5	6	7	8	9	10	11	
gastropods	*Theodoxus Floridatilis*	0	0	60	0	0	0	0	53	0	0	0	113
	Theodoxus Palasi	0	0	393	0	0	0	40	0	0	57	0	490
	Theodoxus sp.	0	0	0	0	0	0	87	0	0	100	0	187
	Melanoides Sp3	0	0	0	0	0	0	0	0	27	0	0	27
	Melanoides sp2	0	0	0	0	0	0	23	0	0	0	0	23
	Pseudosuccinea peregrine	0	0	0	0	0	0	0	0	0	0	43	43
	Valvata piscinalis	0	0	0	0	0	0	0	0	0	13	0	13
	Hydrobia sp.	0	0	0	0	0	0	40	0	0	40	0	80
	Melanopsis buccinoidea	0	0	90	0	0	0	0	0	0	0	0	90
	Melanopsis frustulum	0	0	220	0	0	0	0	0	0	0	0	220
	Melanopsis attenuata	0	0		0	0	0	27	0	0	650	0	677
	Pyrgula Sp	0	0	110	0	0	0	0	0	0	110	0	220
	Stagnicola montanensis	0	0	0	0	0	0	0	0	0	1006	0	1006
	Physella acuta	0	0	0	0	0	0	93	0	0	0	0	93
	Neritodryas dobia	0	0	400	0	0	0	0	0	0	0	0	400
	Neritidae Sp	0	0	0	0	0	0	0	0	0	0	0	0
	Planorbis coristortus	0	0	0	0	0	0	0	0	150	0	0	150
	Zafra comistea	0	0	0	0	0	0	0	0	0	450	0	450
	Goniobasis doolyensis	0	0	0	0	0	0	0	0	0	0	57	57
	Goniobasis Sp1	0	0	0	0	0	0	0	0	0	0	60	60
	Goniobasis Sp3	0	0	0	0	0	0	40	0	0	0	0	40
	Thiaridae Sp	0	0	0	0	0	0	57	0	0	0	0	57
	Pleuroceridae SP1	0	0	100	0	0	0	0	0	0	400	0	500
	Pleuroceridae SP3	0	0	93	0	0	0	0	0	0	0	0	93
	Bithnia tentaculata	0	0	0	0	0	0	347	0	0	0	0	347
	The total number of observations on each station	0	13	1453	0	0	0	854	53	187	2826	160	5546

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gastropods	*Theodoxus Floridatilis*	0	0	60	0	0	0	0	53	0	0	0	113
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	Theodoxus sp.	0	0	0	0	0	0	87	0	0	100	0	187
	Melanoides Sp3	0	0	0	0	0	0	0	0	27	0	0	27
	Melanoides sp2	0	0	0	0	0	0	23	0	0	0	0	23
	Pseudosuccinea peregrine	0	0	0	0	0	0	0	0	0	0	43	43
	Valvata piscinalis	0	0	0	0	0	0	0	0	0	13	0	13
	Hydrobia sp.	0	0	0	0	0	0	40	0	0	40	0	80
	Melanopsis buccinoidea	0	0	90	0	0	0	0	0	0	0	0	90
	Melanopsis frustulum	0	0	220	0	0	0	0	0	0	0	0	220
	Melanopsis attenuata	0	0		0	0	0	27	0	0	650	0	677
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	Physella acuta	0	0	0	0	0	0	93	0	0	0	0	93
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	Neritidae Sp	0	0	0	0	0	0	0	0	0	0	0	0
	Planorbis coristortus	0	0	0	0	0	0	0	0	150	0	0	150
	Zafra comistea	0	0	0	0	0	0	0	0	0	450	0	450
	Goniobasis doolyensis	0	0	0	0	0	0	0	0	0	0	57	57
	Goniobasis Sp1	0	0	0	0	0	0	0	0	0	0	60	60
	Goniobasis Sp3	0	0	0	0	0	0	40	0	0	0	0	40
	Thiaridae Sp	0	0	0	0	0	0	57	0	0	0	0	57
	Pleuroceridae SP1	0	0	100	0	0	0	0	0	0	400	0	500
	Pleuroceridae SP3	0	0	93	0	0	0	0	0	0	0	0	93
	Bithnia tentaculata	0	0	0	0	0	0	347	0	0	0	0	347
	The total number of observations on each station	0	13	1453	0	0	0	854	53	187	2826	160	5546

bivalve	*Sphaerium rivicola (Lamark,1818)*	0	0	0	0	0	0	0	26	0	0	13	39
	Sphaerium SP	0	0	0	0	0	0	0	0	0	0	157	157
	Anodonta Cygnaea	0	0	0	0	0	0	0	0	0	297	0	297
	Corbicula fluminea	0	0	40	0	0	0	0	0	0		0	40
	Lotidae Sp	0	0	0	0	0	0	0	0	0	2000	43	2043
	Pinna Sp1	0	0	0	0	0	0	0	0	84	47	0	131
	Pinna Sp2	0	0	0	0	0	0	0	53	0	0	0	53
	Pinna Sp3	0	0	0	0	0	0	0	0	103	560	0	663
	Neriptron auriculata	0	0	13	0	0	0	0	0	0	0	0	13
	The total number of observations on each station	0	0	53	0	0	0	0	79	187	4694	213	5224
Crustacea	*Shrimp larva*	1	0	0	0	0	0	0	0	0	0	0	0
	Myside Sp	0	0	0	0	0	0	0	0	13	0	0	13
	Meara hemigera	0	0	0	0	0	0	0	0	0	0	0	0
	Gnatha Sp	0	0	0	13	0	0	0	0	0	0	0	13
	Petolithes SP	0	0	0	0	0	27	0	0	0	0	0	27
	Amphitrite amphitrite	0	0	0	0	0	0	0	27	0	146	13	159
	Amphitrite Sp	0	0	0	0	0	0	0	143	13	0	0	143
	Isopoda Sp	0	0	0	0	0	0	27	0	0	0	0	0
	Trilobite	0	0	0	0	0	0	0	57	0	0	0	57
	The total number of observations on each station	1	0	0	13	0	27	881	227	26	146	13	1334

Polichaeta	Cossura Sp	0	0	0	0	13	0	0	0	0	947	0	960
	Glycera capitata	0	0	0	0	0	0	80	0	300	0	0	380
	Neries diversicolor	8	0	0	0	0	0	0	0	0	0	120	128
	Nereis Sp	0	0	0	0	0	0	43	0	0	40	0	83
	Amphinmidae	69	0	0	0	0	0	0	26	0	0	0	96
	Chrysopetalidae	0	0	0	0	0	0	120	0	100	0	0	320
	Orbiniidae	0	0	0	0	0	0	0	0	0	0	80	80
	paraonidae	0	0	0	0	27	0	0	0	40	0	0	67
	Polynoidae	0	0	0	0	0	0	37	0	0	0	14	51
	Polyodontidae Augener	4	0	0	0	0	0	0	0	0	0	2054	2058
	The total number of observations on each station	81	0	0	0	40	0	280	26	440	987	2268	4122
Oligochaeta	*Tubifex tubifex*	413	1253	10114	400	227	720	3420	1867	200	27	1840	20481
	Lumbriculidae SP	0	200	500	0	0	0	0	0	0	0	0	700
	Naididae SP	0	0	0	0	0	0	706	0	0	0	0	706
	Oligochaeta	0	0	0	0	0	33	0	0	0	0	0	33
	The total number of observations on each station	413	1453	10614	400	227	1826	8626	1867	200	27	1840	28493
Hirudinea	*Erpobdella sp*	0	0	0	0	0	13	0	0	0	0	0	13
	The total number of observations on each station	0	0	0	0	0	13	0	0	0	0	0	13
	The total number of observations on each station	563	1840	13640	559	293	3706	13001	2426	1093	8680	4507	50308

Table 3: The frequency and frequency percentage of identifying Macro benthos group on the Karun River (Summer 2012 – Winter 2012)

Macrobenthos groups	summer		Winter	
	number	percentage	number	percentage
Oligochaeta	16479	51/51	12014	65/60
Polychaeta	3177	9/93	945	5/16
Insecta	4951	15/47	623	3/40
Gastropoda	3360	10/50	2186	11/93
Bivalvia	2840	8/88	2386	13/03
Crustacea	1186	3/71	148	0/81
Hirudinea	0	00/00	13	0/07
total	31993	100	18315	100

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