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Contents

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Concentration of organochlorine pesticide residues in water, sediment and fish from the Euphrates River near the center of Al-Nassiriyia city, Iraq.

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Abstract

Concentration of some organochlorine pesticides (chlorine, linden, dieldrin, dichlorovores and O,P ,DDT) residues were estimated in water, sediments and two species of fish *Cyprinus carpio* and *Liza abu* which collected from the Euphrates river during Summer 2013.

In water dichlorovores pesticides observed higher concentration (360.6) µg/l at station 2, while organochlorine revealed maximum concentration (56.05 µg/Kg) dry weight in sediments at station 2. In fish dichlorovores and O,P , DDT observed higher concentration (46.96 and 151.94) µg/Kg dry weight in *Liza abu* and *C. carpio* respectively. It concluded that all pesticides standard used in this study were existence in all studied samples but it was in acceptable range when it compared with Global range.

Key Words: Organochlorine pesticides, water, sediments, fish species, Euphrates River, Iraq.

Introduction

The analysis of environmental pollutants among of them (organochlorine pesticides) and their metabolites in deferent compartment of environment have been widely used to study the risk posed by this kind of contaminats to aquatic systems. Organochlorine pesticides (OCPs) have been of the world wide cancer due to their chronic toxicity, persistence, tendency to accumulation in biota and potential negative impact on humans and aquatic life [1]. There are persistent broad-spectrum toxicants that accumulate in food web with high risk to the ecosystem and human health [2, 3 and 4].

Input pathways of OCPs into the aquatic systems includes run off from non point sources, discharge of domestic sewage and industrial waste water. OCPs have a strong

affinity for suspended particulate matter and one of their main sinks is thought to the river and lake sediment (5). Therefore, the determination of OCPs residues in water and sediments samples can provide valuables records of aquatic contamination (1 and 6). A potential pathway for adverse effects of pesticides is through hydrologic systems, which supply water for both human and natural ecosystems. Water is one of the primary ways pesticides are transport from an application area to other location in the environment [7].

Sediments represent the source of organochlorine components both for the water and living organisms through their redistribution in the aquatic system, thus sediments can represent long term pollution [8]. The sediment stands for the habitat of the benthic fauna, a source and mechanism for removal of some specific contaminations from and to the aquatic ecosystem and transporters of contaminants in the ecosystems. The aquatic life represents as important source of food for the species living on the land and for the aquatic organisms such as fish populations, which on other side represent food for the people. Consequently, bioaccumulation and biomagnification takes place up the food chain ,hence the need for proper monitoring. However, few studies were done in the southern of Iraq, limited data are available [9]. Moreover, it was not report on OCPs residues in fish from the river in Al-Nassiriyia city. fish constitutes a major component source of most aquatic. habitats, they are important source of food and are also a key unit in many natural food webs. They also share many physiological properties with mammals and are often the primary indication of the toxfication of streams river and lakes, therefore, more studies is need to focused on ascertaining the levels of OCPs in some common species of fish in the selected river in Al-Nassiriyia city, where fishing is the predominant occupation of the people and the potential health risk posed to consumer from the exposed to these compounds through the ingestion of fish grown in these rivers. Most of Fish markets of Al-Nassiriyia city were captured from the river under study.

Material and Methods

Sampling area:

The Euphrates River form the main river in south west Asia with an average length of about 2800 km .It extend inside Iraq, about 35% from the total length of the river. Which irrigate vast areas of sediment land about 765381 km2. Its Discharge rate reaches up to 18 $m^2.min^{-1}$. The running water of Euphrates is warm and fresh and its salinity increase as river passing south.

The Euphrates River in the city of Al-Nassiriyia by the lack of reservoirs and dams and ports. There

are irrigation systems originated from the river including 15 small branch rivers on the right side and (3) other small branch river on the left side. On the right side of river thermal a power station at the beginning of the entrance of the river to the city which uses a large quantities of river water for cooling purpose . As well as the sewage water, water drainage disposal directly to the river, with inefficiency treatment a number of village are exist over both banks of the river, characterized by the presence of farm land, orchards and field crops and livelihood of most people are agriculture as well as fishing.

The study area extend about 15 km, three stations were chosen in the study area to execute this study as fallowing:

Station 1: this station is in north before the river entering to the city.

Station 2: it is near the electric power station (EPS) of the city.

Station 3: it is in southern part of the river near the sewage treatment unit of the city.

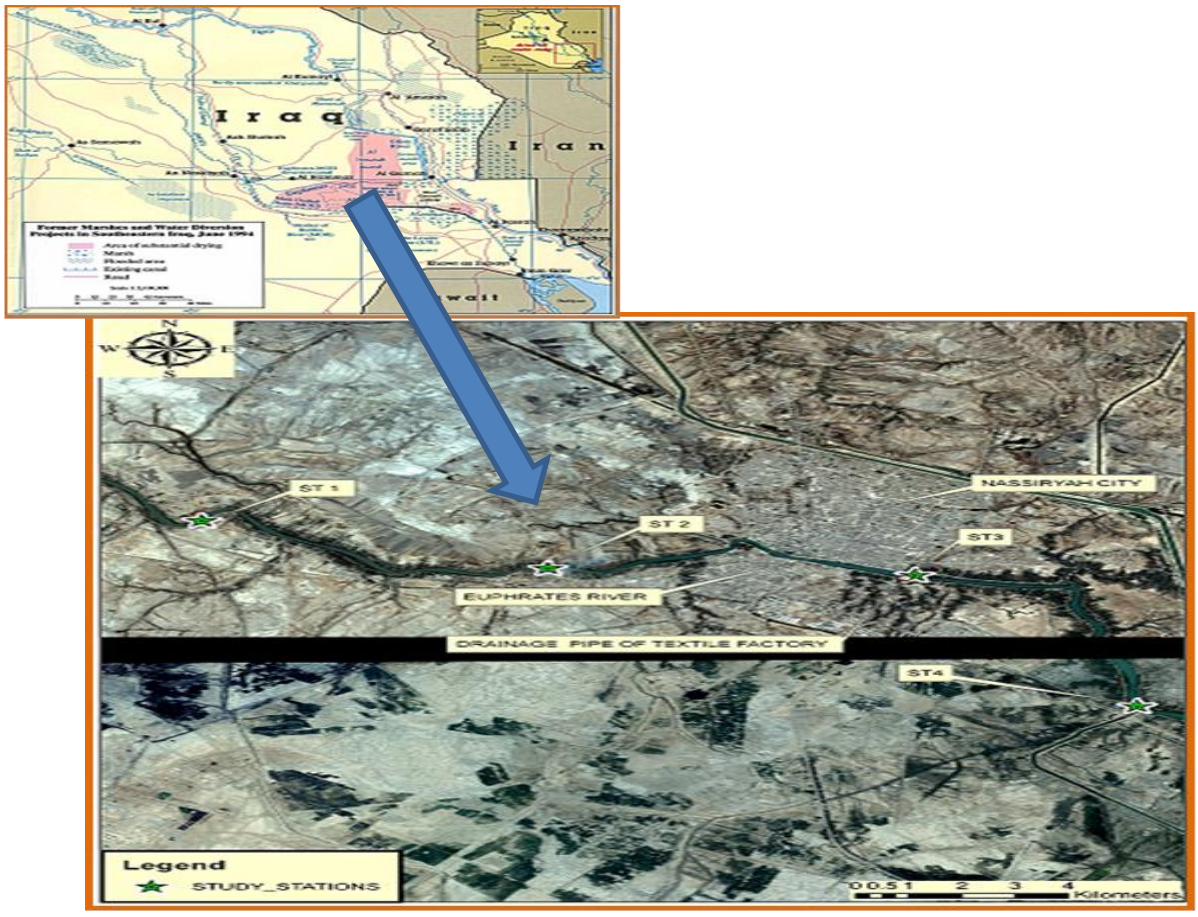

Fig.1: Map shown the study area and study stations.

Sample collection:

Three Stations were selected at the study area (Fig. 1). Samples of surface waters, sediments and fish were collected during summer 2013. Water samples were collected in 1L precleaned glass bottles from the each stations and kept at 4 °C, while sediments sample were collected with Van ven grab Sampler. Fish were collected by using 25*25 mm mesh size gill nets. All samples were reserved in ice box until reaching to the lab.

The extraction of water, sediments and fish samples were done according to [10]. The pesticides residue were analyzed by gas chromatography (GC).

Results and Discussion:

The concentration range mean values and standards deviation of organochloride pesticides in the water and sediments samples from Euphrates River are shown in table 1 and 2 respectively. The results of the study showed that analyzed five organochlorine pesticides and their residues were detected in selected stations from the study area. The compounds detected were chlordine, O, P, DDT, Dieldrine, Lindane and dichlorovors. This mean that the pollution of OCP_S in Euphrates River is ubiquitous.

According to Turkish official guideline [11], the concentration of each pesticide should be less than 0.1 µg/L. The highest level of OCP_S were detected in water samples from Station 1 which follows Station 2.

The highest chlordine and lindane were obtained from samples of Euphrates River Station. The highest concentration might not be unconnected with extensive use lindane, which is marketed and used by farmers for agriculture purposes for crap protection and the use by some fisher men in that locally. Euphrates River also contained the highest concentration of some organochlorine. This could be to run-offs from farms (agricultural practices) in the locality, as the farmers use dieldrine (where dieldrine is the major components) for crop protection as there quite a number of privately owned farms, amongst others under the supervision of the state ministry of agriculture not too far from the river.

The concentration of different organochlorine residues in sediment is presented in table (2).concentration of OCP_S in sediment Sample ranged from (13.37-56.05) µg/Kg for dichlorine (0.32-1.69)µg/Kg for dieldrine, (1.18-3.87)µg/Kg for O, P, DDT, (5.31-52.80) µg/Kg for lindane and (71.85-113.53)µg/Kg for dichlorovores. According to the concentrations and detection frequencies dieldrine and dichlordine were the most dominant compounds among the OCP_S similar results for OCP_S levels in aquatic ecosystem have been reported in recent investigations [12, 13, 14, 15 and 9].

In this study, the concentrations of OCP_S in water sample from the study area was lower than that of sediment samples. Because of hydrophobic characteristics of the organochlorine compounds, it is expected that any organochlorine pesticides present in the study area preferably bind to the particulate phase in aquatic system and then accumulated to the sediment via sedimentation process. They have an affinity for particulate matter and one of their main Sinks is thought to be river sediment [16, 17 and 4].

Table (2): Concentration (mean±SD) (µg/Kg) dry weight of Pesticides in the sediment from three station of Euphrates River during summer 2013.

pesticides	St.1 ± SD	St.2 ± SD	St3 ± SD	Region mean ± SD
Chlordine	13.37 ± 1.12	56.05 ± 6.21	16.52 ± 3.01	28.64 ± 3.44
O,P,DDT	1.18 ± 0.20	3.87 ± 0.5	3.86 ± 0.09	2.97 ± 0.26
Dieldrine	0.32 ± 0.06	1.69 ± 0.21	0.63 ± 0.10	0.88 ± 0.12
Lindane	5.31 ± 0.7	52.80 ± 6.08	7.97 ± 1.16	22.02 ± 2.64
Dichlorovores	110.21± 20.06	71.85 ± 5.87	113.53 ± 19.1	98.53 ± 15.01

In fish species (*Cyprinus carpio* and *Liza abu*) the maximum concentrations of pesticides residue O, P, DDT in *Cyprinus carpio* (table 3). The levels of OCP_S residues in fish muscle were higher than that obtained in the water samples from the same river, this could be attributed to the pesticides being lipophilic, they residue and accumulate in fatty tissues pesticides enter fishes not only by ingestion but also through dermal absorption and respiration. When these chemicals are taken in by the fish, they bioaccumulated, bio magnify and remain in the fish till they are caught and consumed by man or eaten by bigger fishes which are eventually eaten by human [18, 19 and 20].

These result demonstrate an accumulation of pesticides residues through food chain (from soil- water – sediments – microbes carp fish - human) which is a serious matter of concern. This Agree with the study reported by [18, 21, 22, 23, 24, 25 and 26].

Table (3): Concentration of Pesticides in Muscle fish species from three station of Euphrates River.

pesticides	Range and mean concentration of pesticides in fish species (µg/Kg) muscle +SD	
	Cyprinus carpio	*Liza abu*
Chlordine	(2.01-60.01) 15.94 ± 5.16	(3.60-60.50) 28.07 ± 8.04
O,P,DDT	(74.10-226.71) 151.94 ± 57.73	(ND – 0.60) 0.5 ± 0.01
Dieldrine	(ND – 0.017) 0.009 ± 0.0008	(ND – 0.21) 0.054 ± 0.002
Lindane	(2.00-11.01) 5.43 ± 1.12	(0.10-20.01) 5.57 ± 1.14
Dichlorovores	(0.01-5.01) 1.54 ± 0.53	(25.13-103.10) 46.96 ± 15.94
Mean ±SD	29.14 10.75	13.52 4.19

Conclusions:

This Study shows some degree of contamination of fish in Euphrates Rivers. Levels of most of the OCP_S in water and fish is on the increase, the continuous use of the contaminated water for drinking and other domestic purposes, over a long period of time, and use of pesticides for fishing by farmers in these area will definitely lead to dangerous high concentration of the not easily metabolized chemical in the body. There is serious need for the monitoring of these pesticides residues in sediment, water, food and environment, as this will go a long way towards preventing various environmental and public health hazard, as most of the river foods in the markets in the southern part of Iraq in Al- Nassiriyia city come from the rivers.

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تركيز المبيدات الكلورينيه في الماء، الرواسب ونوعين من الاسماك من نهر الفرات قرب مدينة الناصريه_ العراق.

باسم يوسف الخفاجي افراح عبد مكطوف رشا صالح نهير

قسم علوم الحياة _ كلية العلوم_ جامعة ذي قار.

المستخلص:

قدرت تراكيز المبيدات الكلورينيه العضوية (الكلورين، لندين، داي الدرين، دايكلوروفورس، د ي دي تي) في الماء، الرواسب ونوعين من الأسماك الكارب الاعتيادي والخشني جمعت من نهر الفرات خلال صيف 2013.

في الماء سجل أعلى تركيز لمبيد داي كلوروفورس (360,6) مايكروغرام/لتر في المحطة الثانيه، بينما في الرواسب كان أعلى تركيز (56,05) مايكروغرام/كيلوغرام وزن جاف فد سجل لمبيد داي كلوروفورس في المحطة الثانية. أما في الأسماك فقد سجلا كلا من داي كلوروفورس و د يدي تي أعلى التراكيز (46,96 و 151,94) مايكروغرام/كيلوغرام وزن جاف في سمكة الخشني والكارب الاعتيادي على التوالي.

استنتج من الدراسة ان جميع المبيدات قيد الدراسة كانت متواجدة في محطات الدراسة من خلال تواجدها في العينات المدروسة ألا إن تراكيزها كانت ضمن المدى المقبول عند مقارنتها بالمدى العالمي.

الكلمات الدالة: المبيدات الكلورينيه، المبيدات، الماء، الرواسب، الأسماك ،نهر الفرات، العراق.

Comparative ecological study of pathogens structure between wild and cultured common carp *Cyprinus carpio L.* in Basrah.

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Methaq. A. Abood[(1)], Rehab, S. Kzaal[(1)] & Yousra, J. Aliwy[(1)].

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Abstract:

Monthly samples of water and fish were collected from Qurna, Dayer and Abu Al-Khaseeb localities from the fish cages and from Shatt Al-Arab River outside them on the period from December 2012 to June 2013. The study aimed to investigate the influence of some environmental factors on parasites structure and its prevalence in *Cyprinus carpio*. The results revealed that *Cyprinus carpio* was infected with three species of parasites belong to the kingdom protista they are : *Myxobolus pfeifferi* (phylum Cnidaria), *Ichthyophthirius multifiliis* (phylum Ciliophora), and *Trichodina domerguei* (phylum Ciliophora), and four species of parasites belong to the kingdom Animalia they are: *Contracaecum* sp. (phylum Nematoda), *Neoechinorhynchus iraqensis* (phylum Acanthocephala), *Lernaea cyprinacea* (subphylum Crustacea), *Ergasilus ogawai* (subphylum Crustacea), and two species of fungi they are*: Saprolegnia sp., Ichthyophonus hoferi* in addition to the infection with fin rot disease. According to locality of infection, in the cages at both Qurna and Dayer, all of the infected fishes were infected with ectoparasites only while at Abu Al-Khaseeb, both ectoparasites and endoparasites were isolated. The statistical analyses showed the influence of environmental conditions upon infection of fish with parasites. The test of variance showed significant variations in percentage of infection ($P< 0.05$) between fish inside cages and outside them (at Shatt Al-Arab River environment), and between the localities ($P< 0.05$). Also, there were highly significant variations between the months ($P< 0.01$).

Key words: fish cages - parasites – prevalence of infection - environmental factors.

Introduction:

Fish farming in various parts of the world has increased many folds in the last decade. So, fish culture has now become commercially an important industry worldwide for supplying animal protein. Many commercial species, including bluegill, hybrid striped bass, carp, channel catfish, salmon, tilapia and trout have been cultured in cages (Beveridge, 1987). In Iraq, the fish *Cyprinus carpio* L. considered one of the economically fish because of its highly resistance to various

environmental conditions and its growth speed. It had been imported from Holland in 1955 and from Indonesia in 1956 and brought up in Za' faraniyah Fish Pond south of Baghdad (Al-Hamid, 1960). And the production of fish in cages has been practiced in 2008. One of the major issues in fish production through the aquaculture is loss associated with diseases. Improper and faulty management practices followed in fish culture system are often stressful to fish. Under stress condition, fish suppresses the immune responses and alternatively pathogen attack take place subsequently suffer from disease (Guquloth et al., 2013).

Parasitic infections often give an indication of the quality of water since parasites generally increase in abundance and diversity in more polluted waters (El-Naggar, 2012; Guquloth et al., 2013). So, the goal of ecologists is not only to document the distribution of parasites, but also to determine methods by which parasites can disperse to new areas. Through the determination of the groups of parasites that can establish themselves in a new environment, it is possible to determine which strategies of reproduction are favoured. Improved understanding of these mechanisms of dispersion can increase the chances of limiting the dispersion of certain parasites (Takemoto et al., 2009).

The present study is the first one in Basrah which deal with pathogens of fish's cages due to parasite infections. The objective of it was to demonstrate the affect of those environmental circumferences upon the prevalence of infections and their qualities for *Cyprinus carpio* raised in cages and that lived in wild.

Material and methods:

Sampling:

The present study was conducted on three fish cages located a long Shatt Al-Arab River at Al Qurnah, Al Dayr and Abu Al-Khaseeb (Saraifa, Dayr, Mheijran) villages during the period extended from December 2012 to June 2013 as shown below in figure 1. Monthly samples of water and vital fish were collected from the cages and from Shatt Al-Arab River outside them. A total of 50, 46 and 53 fish that specimens have been collected from the cages of Qurnah, Al- Dayr and Abu Al-Khaseeb respectively while 58, 77 and 69 fish specimens have been collected from the river of Qurnah, Al- Dayr and Abu Al-Khaseeb respectively. Fish samples were captured by both cast and gill nets and later examined in the laboratory within forty eight hours to avoid lose any parasite. Small fish were killed by damaging of spinal pith (pithing) while the large ones were killed by blow on their head.

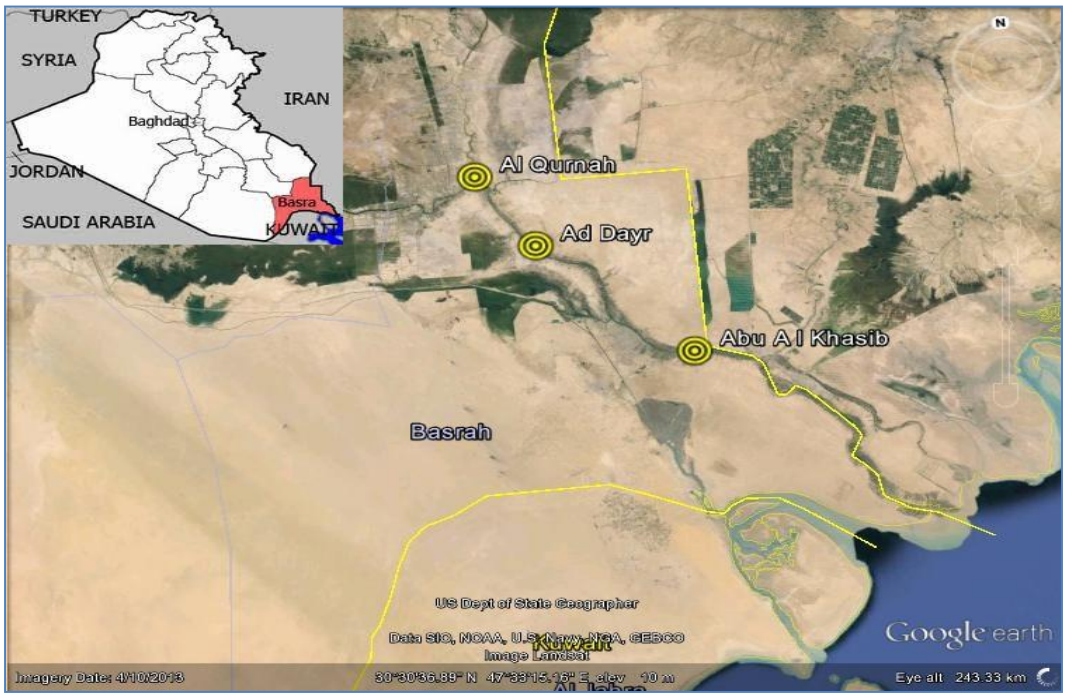

Figure 1: map illustrated the three localities of the studied fish cages at Basrah governorate.

Analytical methods:

Water temperature (W.T.), pH and electrical conductivity (EC) were measured in field with WTW multimeter. The analyses of Chlorophyll a (Ch.a), nitrite (NO_2^-), nitrate (NO_3^-), orthophosphate (PO_4^{-3}) were conducted by colorimetric methods according to APHA (2005). Total Suspended Solids (TSS) was determined gravimetrically according to APHA (2005).

Fish examination, isolation of parasites and slide preparation:

In the laboratory fish were examined for infestation with external parasites by Japanese Meiji dissecting microscope at magnification of 7-45 times, smears were taken from skin, fins and eyes with aid of spatula and fine needle.

Gills were removed by cutting gill arch and transported to petri dish with some tap water in order to examine them under dissecting microscope then slides made from them for later identification with compound microscope at magnification of 64-1600 times. Fish were dissected for detecting internal parasites in digestive tract and other viscera according to Amlacher (1970). Each fish was opened and its internal organs were inserted in petri dishes then isolated alone in petri dishes containing tap water in order to taken smears from them. The entire digestive system was removed and placed in a Petri-dish and opened with a fine needle for isolating internal parasites if present.

After isolating of parasites, different approaches were used for fixation and staining them on slides depending on their groups to whom they belong according to Robert (1982), Kudo (1971), Garcia & Ash (1979), Fernando et al. (1972) for fungi, protozoan, helminthes and crustacean respectively.

Methods of identification and analyses of parasites:

parasites were identified according to Kudo (1971), Kabata (1979), Khamees (1983), Al-Daraji (1986), Mhaisen *et al.* (1988), Mohamad (1989), Khamees (1996), Moravec *et al.* (1999), Moravec *et al.*, (2003), Shwani (2009).Then Jaccard similarity index and the prevalence of infection were calculated monthly. Jaccard similarity index was calculated according to Jaccard (1921) and the prevalence of infection was calculated according to Margolis et al. (1982).

Statistical analyses:

For statistical analyses of the present study, Analysis of variance (ANOVA) was applies to find spatial and temporal variations for environmental factors and the prevalence of infections. T-test of variance was applied to find spatial variations in prevalence of infection between cages and river. Also, correlation coefficient was applied to find the correlation between the prevalence of pathogens and environmental factors.

Results and discussion:

Environmental analyses:

The results of ten parameters were illustrated below in table1. pH values were alkaline along the study period. According to Svobodova et al. (1993), the optimal pH range for fish is from 6.5 to 8.5 and pH values above 10.8 and below 5.0 may be rapidly fatal to cyprinids (especially carp and tench). Lower values of water temperature were registered in Winter months while higher values were registered in Spring and Summer months. Values of

chlorophyll a (Ch.a) according to Shmitt (1998) ranged from oligotrophic state (1-4 µg/l) to polytrophic state (50-100 µg/l). Values of total suspended solids (TSS) did not reach 200 mg/l which clogging fish gills (Abawi and Hassan, 1990) except at outside the cages in Al- Dayr. Electrical conductivity (EC), according to Ayers and Westcot (1985), ranged from slightly saline water (0.7-3 ms/cm) to highly saline (> 6 ms/cm and < 14 ms/cm). Values of nitrite (< 0.1 mg/l) and nitrate (< 1 mg/l) were classified according to Barndt and Bohn (1992) as nutrient poor.While values of orthophosphate were ranged between nutrient poor (< 0.015 mg/l) to nutrient rich (> 1.5 mg/l). Svobodova et al. (1993) noted that the COD maximum level for cyprinid culture is 20–30 mg/l and the present values ranged from below this level to higher than it. Svobodova et al. (1993) noted that the BOD_5 for cyprinids is 8 to 15 mg/l and the present values out of the latter range. The statistical analysis of variance (ANOVA) showed significant spatial variations only for electrical conductivity ($p < 0.001$) and pH ($P < 0.01$). Also, it showed significant temporal variations among the study months for pH ($p < 0.05$), water temperature ($p < 0.001$), total suspended solids ($p < 0.001$), nitrate ($p < 0.001$), nitrite ($p < 0.001$), total phosphate ($p < 0.05$), orthophosphate ($p < 0.001$), and biological oxygen demand ($p < 0.001$).

Table 1: the summery results of environmental analyses of the present study.

Area / Results		Al Qurnah		Al Dayr		Abu Al-Khaseeb	
		Cages	River	Cages	River	Cages	River
pH	(min-max) ± sd	(8.02 – 8.34) ± 0.11	(8.11 – 8.3) ± 0.07	(8.2 – 8.55) ± 0.13	(8.10 – 8.8) ± 0.22	(7.8 – 8.2) ± 0.21	(7.8 – 8.35) ± 0.26
W.T. (C°)	(min-max) ± sd	(18.9 – 25.9) ± 2.54	(17.7 – 26) ± 2.86	(18.3 – 27.5) ± 3.75	(18.4 – 27.5) ± 3.73	(18.28 – 23.1) ± 2.50	(18.1 – 23.2) ± 2.29
Ch.a (µg/l)	(min-max) ± sd	(0 – 7.42) ± 3.20	(0 – 10.21) ± 3.60	(0 – 39.52) ± 15.60	(0 – 8.96) ± 3.12	(0 – 14.85) ± 6.02	(0 – 57.77) ± 14.92
TSS (mg/l)	(min-max) ± sd	(42 – 154) ± 63.54	(8 – 178) ± 60.73	(20 – 56) ± 19.28	(4 – 252) ± 96.57	(42 – 86) ± 24.84	(20 – 70) ± 19.38
EC (ms/cm)	(min-max) ± sd	(1.23 – 2.5) ± 0.45	(1.20 – 2.94) ± 0.51	(1.09 – 2.83) ± 0.62	(1.09 – 2.4) ± 0.49	(2.74 – 8.15) ± 2.37	(2.73 – 8.12) ± 2.00
NO_3^- (µg/l)	(min-max) ± sd	(0.46 –15.88) ± 7.68	(5.90– 24.47) ± 8.33	(1.40 – 17.97) ± 8.18	(0.90 – 17.91) ± 5.48	(1.19 – 18.18) ± 8.91	(2.00 – 17.71) ± 6.21
NO_2^- (µg/l)	(min-max) ± sd	(3.23 – 188.72) ± 80.99	(0 – 183.56) ± 56.30	(0 – 6.39) ± 3.06	(0 – 184.40) ± 56.72	(1.90 – 197.96) ± 84.39	(0.53 – 311.93) ± 109.63
PO_4^{3-}(mg/l)	(min-max) ± sd	(0.01 – 1.85 ± 0.77	(0.05 – 2.09) ± 0.80	(0.03 – 0.95) ± 0.41	(0.023 – 1.65) ± 0.57	(0.04 – 2.73) ± 1.06	(0.01 – 3.51) ± 0.99
BOD_5^- (mg/l)	(min-max) ± sd	(3 – 13) ± 4.32	(2.9 – 24) ± 7.30	(4 – 15.4) ± 5.21	(3.4 – 17.4) ± 5.68	(3 – 14.2) ± 7.48	(2.2 – 11.4) ± 5.18
COD $^-$(mg/l)	(min-max) ± sd	(12 – 276) ± 132.02	(61 – 320) ± 129.08	(148 – 402) ± 129.63	(97 – 400) ± 114.23	(3.4 – 552) ± 310.68	(3.4 – 194) ± 82.70

The parasites and its prevalence of infection:

The present results of the identified parasites, from inside fish cages and that from river, and their prevalence and the site of infection of each parasite were illustrated in table 2. They revealed that *Cyprinus carpio* was infected with three species of parasites belong to the kingdom protista they are: *Myxobolus pfeifferi* (phylum Cnidaria), *Ichthyophthirius multifiliis* (phylum Ciliophora), *Trichodina domerguei* (phylum Ciliophora), and four species of parasites belong to the kingdom Animalia they are: *Contracaecum* sp. (phylum Nematoda), *Neoechinorhynchus iraqensis* (phylum Acanthocephala), *Lernaea cyprinacea* (subphylum Crustacea), *Ergasilus ogawai* (subphylum Crustacea), and two species of fungi they are: *Saprolegnia sp.*, *Ichthyophonus hoferi* in addition to the infection with fin rot disease.

According to the site of infection, these parasites were classified into ectoparasites and endoparasites. Ectoparasites were isolated from fins, gills, skin and the body surface while the endoparasites were isolated from digestive tract, liver and heart.

Inside cages at both Al Qurnah and Al Dayr, all of the infected fishes have been infected with ectoparasites only while at Abu Al-Khaseeb, both ectoparasites and the endoparasite, *Ichthyophonus Hoferi*, were isolated from the infected fishes. These findings were as a result to transmission of ectoparasites by contact between fishes due to high numeric density inside the cages (Awal *et al.*, 2001). According to Pearse (1989), *Ichthyophonus. Hoferi* is an obligate internal parasite which may affect freshwater species, but usually only those on farms which have been fed diets contaminated with it.

For the study of similarity in the identified parasites inside cages and in river environment, Jaccard Simillarity Index was applied. Results of Jaccard similarity index, as shown in figure 2, ranged from 0% at Al Qurnah in April and May, at Al Dayr in February and at Abu Al-Khaseeb in May to 50 % at Abu Al-Khaseeb in February. Because, there is no contact between fish inside the cages and outside them for facilitated the transmission of infections with parasites. Also, carp fish, in side cages, were fed with a commercial food of a good quality. In addition to use drugs in medical treatments for carp fish inside cages such as oxytetracyclin and potassium permanganate.

Table 2: the identified parasites and their prevalence in infected carp fish.

Month	Area	cage	Position of infection	River locality	Site of infection
Dec-12	Al Qurnah	Fin rot Saprolegnia sp. I. multifiliis M. Pfeifferi	Fins Body surface Body surface gills	N. iraqensis Contracaecum sp Saprolegnia sp	Digestive tract Digestive tract Body surface
Dec-12	Al Dayr	Fin rot Saprolegnia sp. T. Domerguei I. multifiliis	Fins Body surface Body surface Body surface	L. cyprinacea Contracaecum sp Saprolegnia sp M. Pfeifferi	Skin Digestive tract Body surface gills
Dec-12	Abu Al-Khaseeb	I. hoferi Fin rot Saprolegnia sp.	Liver Fins Body surface	Fin rot Contracaecum sp T. domerguei	Fins Digestive tract Body surface
Jan-13	Al Qurnah	Fin rot Saprolegnia sp. I. multifiliis	Fins Body surface Body surface	E. ogawai Contracaecum sp Saprolegnia sp	Gills Digestive tract Body surface
Jan-13	Al Dayr	Fin rot Saprolegnia sp. M. pfeifferi	Fins Body surface gills	L. cyprinacea Contracaecum sp Saprolegnia sp. I. multifiliis	Skin Digestive tract Body surface body surface
Jan-13	Abu Al-Khaseeb	I. hoferi Fin rot Saprolegnia sp.	Liver Fins Body surface	E. ogawai N. iraqensis Contracaecum sp	Gills Digestive tract Digestive tract
Feb-13	Al Qurnah	Fin rot Saprolegnia sp. I. multifiliis	Fins Body surface body surface	N. iraqensis Contracaecum sp Saprolegnia sp	Digestive tract Digestive tract Body surface
Feb-13	Al Dayr	Fin rot Saprolegnia sp. M. pfeifferi	Fins Body surface gills	N. iraqensis Contracaecum sp I. multifiliis	Digestive tract Digestive tract Body surface
Feb-13	Abu Al-Khaseeb	I. hoferi Fin rot Saprolegnia sp.	Heart Fins Body surface	Fin rot Contracaecum sp Saprolegnia sp.	Fins Digestive tract Body surface
Mar-13	Al Qurnah	Fin rot Saprolegnia sp. I. multifiliis	Fins Body surface Body surface	N. iraqensis Contracaecum sp I. multifiliis	Digestive tract Digestive tract Body surface
Mar-13	Al Dayr	Fin rot Saprolegnia sp. T. domerguei I. multifiliis	Fins Body surface Body surface Body surface	L. cyprinacea Contracaecum sp T. domerguei	Skin Digestive tract Body surface
Mar-13	Abu Al-Khaseeb	I. hoferi Fin rot Saprolegnia sp.	Liver Fins Body surface	E. ogawai Contracaecum sp M. pfeifferi	Gills Digestive tract gills
Apr-13	Al Qurnah	Fin rot Saprolegnia sp. I. multifiliis L. cyprinacea	Fins Body surface Body surface skin	E. ogawai Contracaecum sp M. pfeifferi	Gills Digestive tract gills
Apr-13	Al Dayr	Fin rot Saprolegnia sp. T. domerguei	Fins Body surface Body surface	N. iraqensis Contracaecum sp T. domerguei M. pfeifferi	Digestive tract Digestive tract Body surface gills

Apr-13	**Abu Al-Khaseeb**	**I. hoferi Fin rot Saprolegnia sp. T. domerguei**	**Heart Fins Body surface Body surface**	**Fin rot L. cyprinacea E. ogawai T. domerguei**	**Fins Skin Gills Body surface**
May-13	**Al Qurnah**	**Fin rot Saprolegnia sp. I. multifiliis**	**Fins Body surface Body surface**	**Fin rot N. iraqensis Contracaecum sp**	**Fins Digestive tract Digestive tract**
May-13	**Al Dayr**	**Fin rot Saprolegnia sp. T. domerguei I. multifiliis**	**Fins Body surface Body surface Body surface**	**Fin rot L. cyprinacea E. ogawai Contracaecum sp T. domerguei Saprolegnia sp.**	**Fins Skin Gills Digestive tract Body surface Body surface**
May-13	**Abu Al-Khaseeb**	**I. hoferi Fin rot Saprolegnia sp.**	**Liver Fins Body surface**	**E. ogawai N. iraqensis Saprolegnia sp.**	**Gills Digestive tract body surface**
Jun-13	**Al Qurnah**	**Fin rot Saprolegnia sp. T. domerguei**	**Fins Body surface Body surface**	**L. cyprinacea T. domerguei I. multifiliis**	**Skin Body surface Body surface**
Jun-13	**Al Dayr**	**Fin rot Saprolegnia sp. L. cyprinacea**	**Fins Body surface skin**	**Fin rot L. cyprinacea N. Iraqensis I. multifiliis**	**Fins Skin Digestive tract Body surface**
Jun-13	**Abu Al-Khaseeb**	**I. hoferi Fin rot Saprolegnia sp. L. cyprinacea**	**Liver Fins Body surface skin**	**I. multifiliis L. cyprinacea N. Iraqensis Saprolegnia sp. M. pfeifferi**	**Skin Digestive tract Body surface gills**

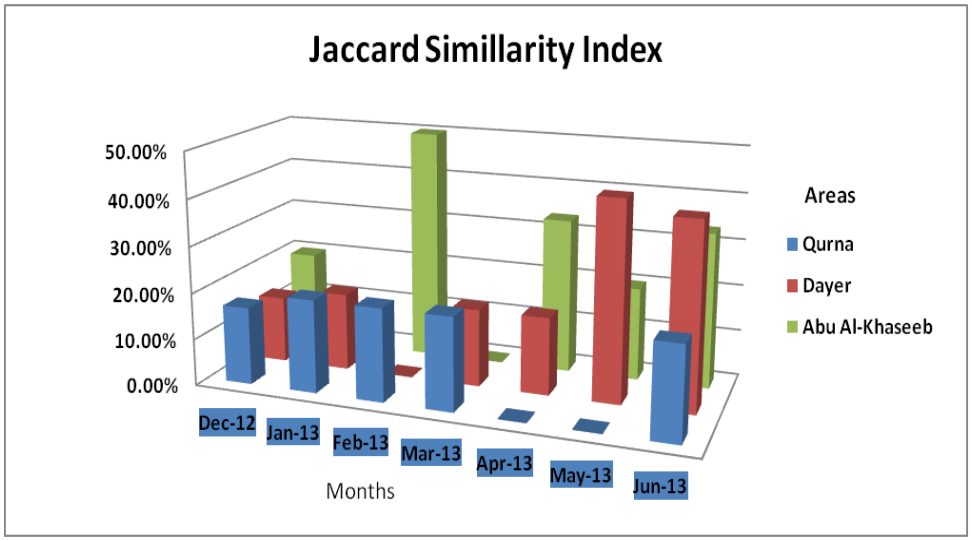

Figure 2: Values of Jaccard similarity index based on the monthly variation for the prevalence of pathogens.

As shown in table 3, the prevalence of infections inside cages were higher than in the river, with the exception of Abu Al-Khaseeb in March and Al-Dayer in May whose prevalence of infections were 45% in both localities. Whereas, in February at Al-Dayer, the prevalence of infection in the cages was 32% lower than 35 % outside them.

Table 3: The monthly data of prevalence of infection for carp.

locality	Months	Cage	River
Al Qurnah	Dec-12	40%	30%
Al Dayr	Dec-12	35%	32%
Abu Al-Khaseeb	Dec-12	50%	36%
Al Qurnah	Jan-13	38%	25%
Al Dayr	Jan-13	36%	27%
Abu Al-Khaseeb	Jan-13	43%	32%
Al Qurnah	Feb-13	41%	27%
Al Dayr	Feb-13	32%	35%
Abu Al-Khaseeb	Feb-13	40%	37%
Al Qurnah	Mar-13	45%	32%
Al Dayr	Mar-13	40%	37%
Abu Al-Khaseeb	Mar-13	45%	45%
Al Qurnah	Apr-13	50%	40%
Al Dayr	Apr-13	46%	43%
Abu Al-Khaseeb	Apr-13	56%	52%
Al Qurnah	May-13	57%	42%
Al Dayr	May-13	45%	45%
Abu Al-Khaseeb	May-13	60%	56%
Al Qurnah	Jun-13	63%	45%
Al Dayr	Jun-13	50%	47%
Abu Al-Khaseeb	Jun-13	77%	58%

The affect of environmental circumferences on prevalence of infection:

The parasites community of fish shows considerable variation with the environmental conditions in which fish's live (Hossain et al., 2008). In an unpolluted environment with only the normal fluctuations in ambient conditions, there will be a natural balance between host fish, pathogens and environmental factors, leading to sporadic outbreaks of the disease. However, a reduction in the quality of environmental factors will lead to a marked increase in the frequency and severity of diseases, mainly by reducing the resistance of the host organisms to the diseases. Also, an increase in the population density of the host fish inside fish farm will increase the risk of disease outbreaks (Svobodova, 1993; Awal *et al*., 2001).

In the present study, the affect of environmental circumferences on both the type of infection and its prevalence have been demonstrated statistically. Some of the identified parasites appeared a correlation with some of the environmental analyses. An ectoparasite copepod *L. cyprinacea*, which isolated and identified from *Cyprinus carpio* skin, showed highly significant correlation (r = 0.585) between its prevalence and water temperature. It identified in infected fish in March at Al Dayr inside and outside cages and in April at Al Qurnah inside cages while at Abu Al-Khaseeb outside them. In May at Al Dayr outside cages, in June at Al Dayr and Abu Al-Khaseeb inside and outside cages while at Al Qurnah outside them. A similar result was investigated by Yassin (2010) who isolated and identified the same parasite from *Liza abu* and *C. carpio* in Al-Shenafya River and he demonstrated that the percentage of infection with this parasite was increased during Summer months due to elevated of water temperature.

Myxobolus pfeifferi, which isolated and identified from gills, is an unicellular protozoan belong to myxozoan parasites but recent evidence clearly indicates that myxozoans are true metazoans (Takemoto et al., 2009). The genus *Myxobolus* are regarded as host specific parasites for the carp, *Cyprinus carpio*, by many authors in China, Aumer basin, Russia, Japan (Molnár, 2009). In the present study, the recorded infections were in December at Al Qurnah inside cages and at Al Dayr outside cages. In January at Al Dayr inside cages, in February in Al Dayr inside cages. In March at Abu Al-Khaseeb outside cages. In April at Al Qurnah and Al Dayr outside cages. In June at Abu Al-Khaseeb

outside cages. The statistical analysis showed significant positive correlation (r = 0.541) between its prevalence and chemical oxygen demand. Water pollution reduces a fish's immno-ability allowing attacking microorganisms (Pearce, 1989). Increased organic matters that are often resulting from added access diet which consider good substrate for the parasites. An increased in organic matters leads to organic pollution and their decomposition affect fish gills making them more sensitive to pathogens and parasites (Raskovic et al., 2010).

Trichodina domerguei belong to the Trichodinid parasites showed a weak and negative significant correlation (r = - 0.357) with orthophosphate .Trichodinids are a widely dispersed group of ectoparasites in freshwater, marine and euryhaline environments about 70 species were identified in marine fishes and more than 112 from freshwater fishes worldwide (Özer, 2003). In the present study, the recorded infections with *Trichodina domerguei* were in March at Al Dayr inside and outside cages, in April at Al Dayr and Abu Al-Khaseeb inside and outside the cages, in May at Al Dayr inside and outside cages and in June at Al Qurnah inside and outside the cages. Ath an assopou lou et al. (2009) demonstrated in their overview study that trichodinid parasites have a direct life cycle which is difficult to treat. They can cause high mortality in fish cages, especially in areas with deterioration of the water quality and high temperatures.

Saprolegnia a fungus belong to the group of fungi called Oomycetes. This genus is not species specific and it is capable of attacking any tissue in a wide range of fish species (Pearce, 1989). *Saprolegnia* species are opportunistic facultative parasite either ecrophs or saprotrophs. It causes substantial mortality among freshwater fish and mostly associated with environmental stresses such as overcrowding, rough handling, transport, low dissolved oxygen, temperature fluctuation, osmotic shock and water pollution (Zaki et al., 2008). In the present study, the infection was registered at all studied areas. Inside cages, it registered in all months while outside cages, it registered in most of them. According to the statistical analysis, its prevalence showed a weakly significant negative correlation (r = - 0.321) with nitrate and a highly significant negative correlation (r = - 0.592) with chlorophyll a.

Ergasilus ogawai a copepod which, in the present study, isolated and identified from gills. Adult *Ergasilus* parasites are usually found on gill filaments but

can attach to gill rakers or some other external location as well (Hoffmann 1998). They will rarely attach to any other surface than the gill filaments swimming. They like to feed on surrounding tissue and mucous secreted by fish and can cause enough damage (cause harm to their fish host by damaging the gills and decrease the amount of oxygen that the fish is able to obtain from the gills) to allow a secondary infection of bacteria or virus (Lasee 1995). *Ergasilus ogawai* showed a negative highly significant correlation ($r = - 0.513$) with pH and this result lead us to conclusion that the infection with *Ergasilus ogawai* was due to the prevalence of spatial variations ($p < 0.01$) and temporal variations ($p < 0.05$) in pH values. In the present study, the recorded infections with *Ergasilus ogawai* were outside cages, in January at Al Qurnah and Abu Al-Khaseeb, in March at Abu Al-Khaseeb, in April at Al Qurnah and Abu Al-Khaseeb, in May at Al Dayr and Abu Al-Khaseeb.

The prevalence of infection with parasites, according to T-test of variance showed significant variations ($p < 0.05$) between environment inside cages and river environment outside the cages. These results due to highly numeric density of fish inside cages.

The statistical analysis of variance (ANOVA) showed a highly significant variations ($p < 0.01$) in prevalence of infection among different months where high prevalence of infections has been recorded in Summer months (June and May) followed by Spring months (April and March) then by Winter months (December, February and January) and the statistical analysis of correlation for prevalence of infection showed a highly positive significant correlation ($r = 0.661$) with water temperature due to the impact of water temperature upon fish immunity towards parasitic diseases (Guquloth et al., 2013). Also, the statistical analysis of correlation showed an influence of other environmental factors on prevalence of infection. Where it showed a positive significant correlation ($r = 0.406$) with nitrate. While it showed a negative significant correlation with biological oxygen demand ($r = - 0.473$) and orthophosphate ($r = - 0.427$).

Also, there was significant variations ($p < 0.05$) in prevalence of infection among the studied areas where the highest percentage was recorded in Abu Al-Khaseeb and the least one was recorded in Al Dayr which significantly different from Abu Al-Khaseeb. These spatial variations belong to the variance in environmental circumferences at each locality.

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دراسة بيئية مقارنة لتركيب الممرضات بين أسماك الكارب الأعتيادي المستزرعة والبرية في البصرة.

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المستخلص: جمعت عينات شهرية للمياه والأسماك من مناطق القرنة والدير وأبو الخصيب من داخل أقفاص الأسماك ومن مياه نهر شط العرب خارج هذه الأقفاص للفترة الممتدة من شهر كانون الأول 2012 الى شهر حزيران 2013. كان هدف الدراسة هو توضيح تأثير بعض العوامل البيئية على تركيب الطفيليات وتواجدها في أسماك الكارب الأعتيادي. وقد أوضحت النتائج أصابة أسماك الكارب الأعتيادي بثلاثة أنواع من الطفيليات تعود الى مملكة الأبتدائيات هي: *Myxobolus pfeifferi* (phylum Cnidaria), *Ichthyophthirius multifiliis* (phylum Ciliophora), *Trichodina domerguei* (phylum Ciliophora) وأربعة أنواع تعود الى المملكة الحيوانية هي: *Contracaecum* sp. (phylum Nematoda), *Neoechinorhynchus iraqensis* (phylum Acanthocephala), *Lernaea cyprinacea* (subphylum Crustacea), *Ergasilus ogawai* (subphylum Crustacea) ونوعان من الفطريات هما : *Saprolegnia* sp. و*Ichthyophonus hoferi* . أضافة الى مرض تآكل زعانف. وتبعا" لموقع الأصابة، فأن جميع الأسماك المصابة داخل أقفاص كلا" من القرنة والدير كانت بطفيليات خارجية فقط بينما عزلت في أبو الخصيب كلا"من الطفيليات الخارجية والداخلية وقد أظهر التحليل الأحصائي تأثير الظروف البيئية على أصابة الأسماك بالطفيليات. وأظهر أختبار التباين وجود تغايرات معنوية في نسبة الأصابة بالطفيليات ($P< 0.05$) بين الأسماك داخل وخارج الأقفاص (في بيئة مياه شط العرب) . وبين المواقع ($P< 0.05$). و هناك تغايرات عالية المعنوية بين الأشهر ($P< 0.05$) أيضا".

الكلمات المفتاحية: أقفاص الأسماك – الطفيليات – تواجد الأصابة – العوامل البيئية.

Laboratory culturing of *Brachionus calyciflorus and Brachionus plicatilis* Rotifers collected from Shatt al- Arab River in Basra-Iraq

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Abstract

The study relied to Laboratory culturing of ***Brachionus calyciflorus & Brachionus plicatilis*** collected from Shatt Al- Arab River (Sindbad and Garmat Ali) in Basra province, where they were cultured in the laboratory control of the Marine Sciences Center - University of Basra, using the four plastic basins volumes (40 cm length of 30 cm width, 20 cm height) used baker´s yeast *Saccharomyces cerevisiae* as a food source as well as animal manure booster diet for the growth of phytoplankton and a mixture of them were selected 50 individual / ml as the number in the first study for seven days culturing period. The results demonstrated that the average density and the doubling rate was the highest growth rate of ***B. plicatilis*** type because of its ability to live in laboratory conditions and the type of feed used in the study.

Key Words: Cultured, *Brachionus* sp, Basra-Iraq

Introduction

The phylum Rotifera is a relatively small group of microscopic aquatic or semi-aquatic invertebrates, encompassing about 2,000 species of unsegmented, bilaterally symmetrical pseudocoelomates , monogonont rotifers of the genus *Brachionus* have been among those planktonic organisms used with success for the rearing of numerous freshwater (Shiri Harzevili *et al*., 2003) and marine fish (Lubzens *et al*., 1989). The species under study, the monogonont rotifer *Brachionus* sp, is a zooplanktonic invertebrate, where environmental factors restrict population growth to short periods lasting days or months. Their high reproductive rates facilitate colonization of vacant niches with extreme rapidity, converting primary production (algal and bacterial) into a form usable for secondary consumers with remarkable efficiency (Nogrady *et al*., 1993). More than 60 marine fish species and 18 crustacean species cultures

require adequate and reliable production of high quality, nutritious rotifers. The quality of rotifer cultures is evaluated not only by reproduction rate and density, but also nutrients essential and associated microbiota for the larval predators (Dhert 1996). During that time, *Brachionus* mass culturing was significantly improved (Park *et al*., 2001) as a result of continuous research on rotifer culture conditions. (Suantika *et al*., 2001). Nowadays, hatcheries produce *Brachionus* rotifers at maximum possible reproduction rates and population densities, in order to meet the growing needs of the aquaculture industry (Lubzens *et al*., 2001). In spite of an apparent peak in terms of efficiency, efforts to achieve ultrahigh density production are being tested (Yoshimura *et al*., 2003). It should be pointed out that recent results have demonstrated that the most commonly cultured rotifer strain, *Brachionus plicatilis,* and *Brachionus calyciflorus* are actually a species complex (Papakostas *et al.* 2005; Dooms *et al.* 2007). The increase in marine fish larvae rearing around the world has been due partly to the availability of rotifers (*Brachionus* spp) as live feeds for first-feeding fish larvae (Yoshimura *et al.* 1996). Which had conceder essential food source for raising marine fish larvae in marine fish hatcheries. *Brachionus* sp. rotifers are widely used in large numbers for larval rearing in fish industry Cheng *et al*., 2004). *Brachionus* feeds on microalgae, protozoa, bacteria and dead organic materials (Rezeq and James, 1987) in addition to artificial feeds. Diet is regarded as the most important criterion that could affect growth as well as nutritive quality of rotifers Akter,(2013) .Edmondson (1959) has been focusing on the types of the genus *Brachionus* in its use as a source of culturing and feeding the larvae of fish and shrimp without other rotifer since he has this sex characteristics make it better culturing when creating the conditions for laboratory and basins appropriate where small size (60-400 microns) appropriate to the size of the mouth opening to fish larvae and shrimp as well as the possibility of raising the object and fed on algae and yeast in addition to its high capacity valuable breeding under laboratory conditions a proliferation asexual as he can propagation , some of which in freshwater environments and others in salt water. The study carried out by (James and Abu-Razeq, 1986) ability to rotifers *B. calyciflorus* and *B. plicatilis* to growth in stander temperatures ranging from 15-32ºC and pH suitable for culturing is between 6.5-8 As for the dissolved oxygen rotifer have the ability to live in an environment that reaches the

concentration of oxygen dissolved in it to less than 1 mg / L. This study aims to select two types of rotifer affiliated to the genus *Brachionus* which *B. calyciflorus* and *B. plicatilis* and content in the water in the province of Basra to be cultivated in laboratory and relying on natural and artificial nutrition.

Materials and methods

Laboratory culture: Prepared control laboratory in the Marine Science Center - Marine Biology Department for thermal conditions controlled by the extent of the range of 21-22 ºC with an area of 4 meters and was equipped with four plastic basins of dimensions fixed (40 cm length , 30 cm width and 20 cm height) was secured from the oxygen needed by a ventilator electric-type RS electrical 5010) a Chinese-made in addition to artificial light source (Florescence) basins surrounding culture from all sides need to secure the object from the light.

Nutrition: We fed the object on three types of food, including animal manure , yeast plus a mixture of animal manure and baker´s yeast *Saccharomyces cerevisiae* were weight is 250 mg \ 50 individual and adjust the ratio depend on the numerical increase daily either weight animal manure are 5.01 gm or weight yeast and compost it 255.01 gm.

Collection of samples: samples were collected from water belonging to Shatt al-Arab River by net cone length of 1 m diameter, aperture 40 cm and mesh size 50 micron tied a rope to pull it where it thrown the net and then with drawn to a distance of 3 meters after which it is removed from the water and pour samples in plastic bottles well suited for this purpose

Purification of samples : The sample was purified immediately after it reaches the lab for *B. calyciflorus* and *B. plicatilis* Figure (1 , 2) after diagnosis phenotypic using an optical microscope depending on (Fernando, 2002 , Hammadi,2010.) where isolated species by nets , especially those with different sizes (43 and 90 microns) and anatomical microscope provider a light source for the purpose of gathering the object near him where they are dragging the object using a glass pipette as well as a process of sifting through the use of the net with the size of 90 microns to obscure objects bigger than rotifer then

taken into the sample container on rotifer and objects smaller by volume and pass through the net with the size of 43 microns and gathering rotifer and objects of similar size at the top of the net and then put the net in water free from chloride then put part of the sample in a petri dish and examined under an anatomical microscope by shedding light on one aspect of the petri dish where the rotifer gather near a source of light when it can pull rotifer by an glass pipette and placed in a glass beaker 100 ml and returned a series of dilution to reach to the purity (Ghazi., 2005)

Figure (1) ***B.calyciflorus***

Figure (2) ***B.plicatilis***

Measuring the dimensions of rotifers: Rotifers measured by using the compound microscope lens containing an accurate scale staging ocular micrometer and strongly 10x where measured the length of the front of the head to the end of the body and measured the width of the through wider area of the body and the number of individuals / ml (John and Frank, 1984).

Counting of rotifers: 1 ml of sample taken from cultured rotifer and placed in a slide count after installed by formalin where they are counting directly under a compound microscope and conducted the counting process using glass pipette and preferably repeat the process three times and

Brachionus culture : After the isolating and purifying rotifer added 50 individual / ml as the number of first to ponds present for this purpose and capacity 5 liter where the laboratory conditions appropriate for the reclamation process shall include (salinity 1.73 g / l, dissolved oxygen 7.3 mg / L, pH 7.5 and the water temperature 22ºC) begins the process of feeding rotifers dissolving 250g of Baker´s yeast in warm water and filtered by a barrier lumbar while animal manure 5.01 g are sterilized by oven degree 60 ºC for 24 hours covered with gauze topic in the basin and feeding for seven days at the rate of once per day.

N1=Final number

T=Time

log2=In2

Results

The present study showed that cultured rotifer *Brachionus calyciflorus* and *Brachionus plicatilis* according to the environmental factors involved in the experiment had a big role in the process of culturing and as shown in Table (1)

is calculated numerical density through density rotifer individual / ml = Average number of X amount of dilution. Calculating Growth rate and doubling time to rotifers according to (James and Dias, 1984; Scott and Baynes, 1978).

Where:

K=InN1-InN0/T

D=Log2/K

K=Growth rate

D=Doubling time (day)

N0=Initial number

Table (1): The Basic Environmental factors in the culture.

Basic environmental factors	Recorder value
Temperature	21- 22 ºC
Dissolved Oxygen	6.5 - 7.3 mg/L
Salinity	7.1 - 8.73 gm/L
pH	6.5 - 7.5
NH3	<0.1

.

In table (2) the initial and final number of rotifer *B. calyciflorus* & ***B***. *plicatilis* cultured within seven days and feed on Baker´s yeast *Saccharomyces cerevisiae* and animal manure and mixed feed. the results showed adopted in the statistical analysis of the existence of significant differences (P <0.01) in cultured rotifers intensity depending on the type of feed used after reaching its highest density of species rotifers when fed on Baker ´s yeast 333 individual / ml. Also the feeding on animal manure reaching density 483 individual / ml. While the density of rotifers feed on mixture of animal manure and yeast reached 128 individual / ml.

Table (2): Cultured rotifers intensity depending on the three type of feed through seven days.

Rotifers	Initial No ind/ ml	Final No Manure feed ind/ ml	K	D	Final No Yeast feed ind/ ml	K	D	Final No Mixed feed ind/ ml	K	D
B.calyciflorus	50	227±10	0.21	3.3	114±10	0.11	6.3	97±10	0.09	7.7
B. plicatilis	50	483±10	0.32	2.1	333±10	0.27	2.5	128±10	0.13	6.8

Discussion

Secured environmental conditions necessary for the cultivation of *B. calyciflorus and **B**. plicatilis* in laboratory thermal control and pre- initializer small-scale basins inside the lab as well depending on the number of user object study. We are dealt with a lot of research and studies conducted in the field of aquaculture rotifer for the purpose of feeding fish larvae have focused mostly on rotifer ***B***. *plicatilis* (Khathem, *et al*., 2013) she is took the same species in her study and the same laboratory condition but there is difference in the number of user species just 10 individual and the type of nutrition. The rotifer *B. plicatilis* was cultured under controlled laboratory conditions, with temperature was 22 ºC. The rotifers feeding on two type of food, the first was Baker´s yeast and second the animal manure. Generally, the animal manure was used well than baker´s yeast. The density of rotifers culture at 22 ºC which fed on animal manure was 145 ind /ml, while growth rate was 2.67 and doubling time was 0.25 day. The density, growth rate and doubling time of rotifers culture at 22 ºC which fed on yeast were 75 ind/ml, 2.01 and 0.34 day respectively. The importance of her study to determine the ability to depending on animal manure as cheap resource and available to improve rotifer growth compared with baker´s yeast. Additional, to suitable period determined to culture of rotifer for supply it to larvae of fish and crustacean. Studies have shown that rotifer *B. calyciflorus* is most common in fresh water was chosen because of the easy isolated and cultured at high densities under laboratory conditions as well as the possibility of its presence in the brackish water environments (Strojsova *et al*, 2005). The decrease in the doubling time and increase in the growth rate when feeding rotifer on animal manure as possible be recurs that to fact when rotifer gets the basic needs of the elements and nutrients that directly affects active growth and enable the animal to do biological activities (Venetia *et al*

., 2007) this study is agree with Weber and Juanico (2004).Where the manure cheap price and contains a high amount of essential nutrients and nutrients that can benefit from valuable field of aquaculture. While rotifers fed on baker´s yeast was recorded high doubling time and less growth rate and this happen due to the problems resulting from the use of baker´s yeast in nutrition, including the lack of nutritional value.

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الأستزراع المختبري للدولابي *Brachionus calyciflorus & Brachionus plicatilis* والمعزول من شط العرب في البصرة – العراق

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المستخلص:

أعتمدت الدراسة على الأستزراع المختبري للدولابين *Brachionus calyciflorus* و *Brachionus plicatilis* والمعزولين من شط العرب في محافظة البصرة والتي تم أستزراعهما في مختبر السيطرة التابع لمركز علوم البحار- جامعة البصرة حيث أستخدم لهذا الغرض اربعة احواض بلاستيكية ذات أبعاد (40 سم طولاً،30سم عرضاً و20سم ارتفاعاً) واستخدمت الخميرة الصناعية *Saccharomyces cerevisiae* ،فضلات الحيوانات (الروث) ومزيجهما كمصدر غذائي . اختير 50 فرداً لكل مل في البداية خلال فترة الأستزراع والمتضمنة سبعة أيام . اوضحت نتائج الدراسة أن معدل الكثافة ،مستوى التضاعف و مستوى النمو سجل اعلى قيمة للدولابي *Brachionus plicatilis* وذلك لقابليته العالية للعيش في مختبر السيطرة وملائمة نوع الغذاء المستخدم في الدراسة.

Study of physico-chemical and bacteriological properties of bottled water in Iraq

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Abstract

Bottled drinking Water" means water that is intended for human consumption and that is sealed in bottles or other containers with no added ingredients except that it may optionally contain safe and suitable antimicrobial agents. The bottles water were collected from some Iraqi governorates (Basrah, Karbala, Najaf, Baghdad and Arbeel). Water quality was assessed by examining various physico-chemical and biological parameters such as pH, EC, TDS, Total hardness, Total alkalinity, Chloride, Sodium, Potassium, sulphate, NO_2, NO_3 total coliform count at 44c° and fecal coliform count total plate count at 22◦C, 37C°.The results of the bacterial analysis showed that there are variation in bacterial counts so its un fit for human consumption. While, the pH (7.07-8.50) and EC (20-366µS/cm), TH (9.00-1207mg/l). B(0.11-7.91 mg/l), Na(10-273mg/l), K(2.86-62.89mg/l), Mg(0.48-288 mg/l), Ca(2.0-40 mg/l), Cl(27-511 mg/l) and SO4(1.30-190.7),NO_2(1.00-0.12),NO_3(1.00-0.06).

KEY WORD: Iraq, bottled water physico-chemical, biological parameters

Introduction

Bottled water consumption has been steadily growing in the world for the past 30 years. It is the most dynamic sector of all the food and beverage industry. Consumption in the world increases by an average of 12% each year in spite of its high price compared to tap water (Abd El-Salam, *et al*., 2008).

The quality of water is determined largely by bacteriological analysis, in bottled water the bottling process may be a source of additional contamination. In addition, the common sources of contamination of bottled water are equipment, bottles and cups, exposure to air and contact with humans during the bottling process. (Osman *et al*., 2009).

Epidemiological studies have reported the occurrence of disease including problems with reproduction, cancer, congenital malformation of the central nervous system, cardiovascular disease and even death due to exposure to trace elements and mineral contents of water such as Calcium (Ca), Magnesium (Mg), Sodium (Na), and Potassium (K).(Abed & Al-Wakeel, 2007).

So, the objective of this study is to assess the microbiological and chemical parameter of the bottled

water retailed in local markets and study if their suitability for human consumption.

Materials& Methods

Water Samples

A total of 28 different bottles were collected from local markets in Basrah, Karbala, Najaf, Baghdad and Arbeel governorates during the period from 2011-2012. The bottles are including local and imported products.

Bacteriological Analysis:

A duplicate of 100 ml from each sample were filtered by membrane filtration

Technique using 47 mm cellulose acetate filters with a nominal pore size of 0.45µm (Sartorius, Germany) and analyzed for total coliforms and fecal coliforms and plate count. The membrane filters were placed on the surface of M- endo agar contained in Petri dishes and incubated at 37 ± 1°C for 24 h. The coliform colonies will appear as pink to dark red spots with metallic (golden) sheen, which may vary in size from pinhead to complete colony coverage. While for fecal coliforms the membrane filters were placed on the surface of M-FC agar without rosolic acid contained in Petri dishes and incubated at 44.5°C for 18 h in water bath. The colonies will appear as blue or light blue. In addition to that total plate count at nutrient agar have done at 22° c for 18-24h.

Physicochemical analysis:

HCO_3, Cl and SO_4) were analyzed in the laboratory using standard procedures according to APHA (2005). Sodium and potassium were determined by flame photometer (Jenway pep7). Calcium and Magnesium were titrated with 0.01N Na_2EDTA. Chloride was determined volumetrically by titration with 0.01 N $AgNO_3$. Sulfate was determined by spectrophotometer (Cecil, UK) using turbidity method and bicarbonates were determined volumetrically by titration with 0.01N H_2SO_4. Nitrite (NO_2^{1-}) determined by colorimetric method. Cadmium reduction method was used to determining nitrate (NO_3^{1-}).

Results &Discussion

The results of the bacterial analysis for the commercially available bottled mineral water were tabulated in table (1), these results showed that there are variation in bacterial counts among the tested brands of bottled mineral water. The most contaminated brands was Alrawabee (UC for four bacterial tests) while only one brand (Life) which had no bacterial growth (nil for four bacterial tests). There was a wide variation in the levels of bacterial indicators of contamination recorded in different categories of water. Mean total and fecal coliform bacteria count in the tested brands ranged from (1-UC) cu/100ml, these results were in agreement with the findings of Oyelude and Ahenkorah (2012) who stated that improper handling might

The pH ,

be a reason why coliform bacteria were detected in some bottled water.
WHO (2011) recommended that fecal coliform bacteria must not be detectable in a 100-ml sample of drinking water, out of 28 tested brands,14 brands were contaminated with total coliforms (50%), while 26 brands (92.85%) of tested brands were contaminated with fecal coliforms, these findings were in agreement with what founded by Islam *et al* (2010) who indicated that 50% of mineral water tested by them were exceeded the drinking water guideline value of WHO, also our findings were in agreement with Razuki & Al-Rawi (2010) who attributed the presence of coliform bacteria in bottled water to some reasons such as the difference in the quality of water used for production and amount of pollutants and the quality purges in the systems of bottled water as a result of not controlling ozone doses wavelength rays UV necessary to ensure the cleansing process successful as well as reasons not to apply health conditions that must be met in the coefficient of water filling contained in the terms of specification Iraqi No.356 of 2000 and the rules of health in manufacturing plants and food preparation.

Total plate counts at 22° C and 37◦ C were varied from nil to UC ,our results showed that there is no correlation between the two tests , this is in disagreement with Osman *et.al.*, (2009) who found that the average counts of total bacteria were at 22° C was higher than those at 37◦ .

Table (1) The bacterial analysis for the bottled water

Sample	T.C.	F.C.	T.P.C.22˚C	T.P.C
DORalynabee / Iraq	1	Uc	100	Nil
Auyoun / Iraq	Nil	Uc	45	66
Pearl / Iraq	1	Uc	Uc	Uc
Al-Waha / Iraq	10	Uc	Uc	Uc
Al-Khaleej / Iraq	5	Uc	Uc	Uc
Refresh / Kuwait	1	Uc	5	Uc
Al-Badeea / Iraq	Nil	Uc	55	Uc
Life / Iraqi	Nil	Nil	Nil	Nil
Aquafina /Kuwait	Nil	1	Nil	Nil
Lolav /Turkey	2	5	Nil	Uc
Al-Janaen / Iraq	Uc	36	Nil	Uc
Al-Tour / Iraq	9	Uc	14	31
Al-Dafiq / Iraq	Nil	27	Nil	Uc
Al-Buraq / Iraq	Nil	1	9	33
Mazaya /Iraq	Nil	6	7	18
Yahya / Iraq	Nil	6	2	19
Babeet / Iraq	Uc	24	Uc	33
Al-Mudheef /Iraq	Nil	8	1	12
Al-Naqawah / Iraq	2	2	1	18
Aquagulf / Kuwait	1	Uc	Uc	Uc
Salsal / Iraq	1	Uc	Nil	Uc
Mazee / Iraq	Nil	10	1	2
Al-Rawabee / Iraq	Uc	Uc	Uc	Uc
Al-Raad / Iraq	Nil	7	9	54
Al-Aaelah / Iraq	Nil	Nil	1	57
Karwan / Iraq	Nil	4	3	62
Al-Radhadh /Iraq	Nil	3	Nil	Uc
Al-Khazer /Iraq	173	43	Uc	Uc

*T.C.: total coliform * F.C.: fecal coliform

+ Nil: No growth ++UC: Uncountable

*T.P.C.22˚C: total plate count at 22˚C * T.P.C 37˚C: total plate count at 37˚C

Figures 1, 2 and 3 shows the pH, EC, and TDS. The pH values range between 7.07 and 8.50 and the average value was 7.93 the higher frequency acquire in value from 8 to 8.5. The results are within the acceptable limits of DW Iraqi standard (6.5 – 8.5).

The EC values range between 20 and 366 (± 104.07) µS/cm and the average is 159.08 mg/L the higher frequency acquire in value 200) µS/cm. The EC of samples are within the acceptable limits of WHO (2011) and the European standards recommended value of EC is 250 µS/cm. The TDS values range between 12.80 and 234.24mg/L and the average is 101.65 mg/L the higher frequency acquire in value100 mg/l. EC were correlated with TDS values (Barbooti *et al*. 2010).

Figures 4, 5, 6 and 7 shows the frequency concentration values of the major anions: SO_4, Cl, HCO_3 and NO_2. The sulphate concentration values range between 0 and 191 mg/L and the average is 28.89 mg/L. within the acceptable limits of DW Iraqi standard (2000). The higher frequency acquire in value 0-50 mg/L. The chloride concentration values range between 0 and 511 mg/L. A few samples is higher than the maximum limit of standard. Most of the samples were within the value 100 mg/L. The concentration of bicarbonate values range between 0 and 996 mg/L and the average is 178 mg/L. The highest frequency of the nitrite concentration was within acceptable limits of standard (0.02-0.03 mg/L).

Figures 8, 9 and 10 shows the frequency concentration values of the major cations Ca, Mg and hardness. The Ca and Mg concentration values ranged from 0 to 40 mg/L and the average is 12.44 for Ca that value within the acceptable limits of DW Iraqi standard(50 mg/L) and from 0 to 288 mg/L ,the average is 64.24 mg/L for Mg that values higher than the maximum limit of stander. The hardness ranged from 0 to 1207 mg/L (the high concentration have a few frequency) the average 259.66 mg/L. The highest frequency of calcium appeared at concentration 0-15, while the frequency of magnesium from 0 to 50 of the magnesium concentration and high frequency of hardness from 0-100 mg/L. There is a highly significant correlation between turbidity and magnesium (0.998), while there were not any correlation with calcium, this is reverse Barbooti *et al*. (2010) who found a high correlation between calcium and turbidity in drinking water. Moyel *et al*. (2013) Found that reverse water RO water which used for drinking in Basrah city is not suitable for health, due to the deficiency of Calcium and Magnesium and Ions, such ions are demanded for human health.

The highest frequency of concentration of sodium is within the limits of the acceptable standard of Iraqi DW (0-50) figure (11).

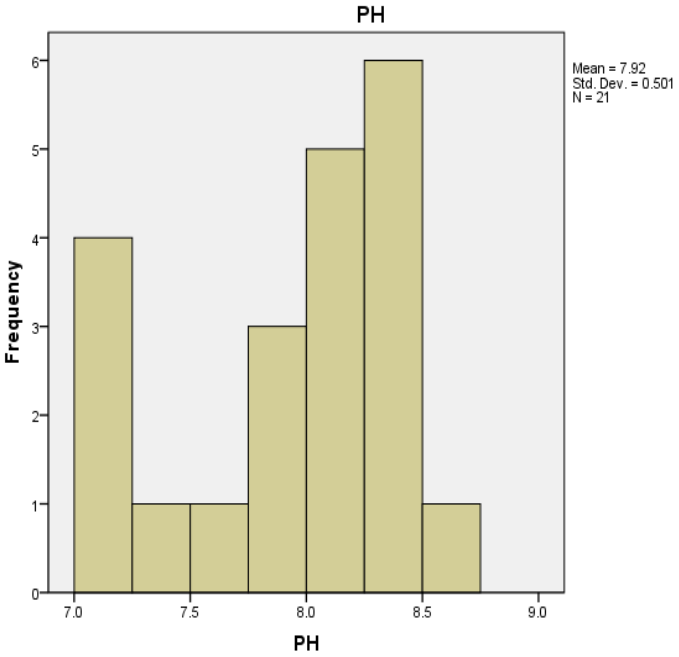

Fig.1: the frequency of pH value

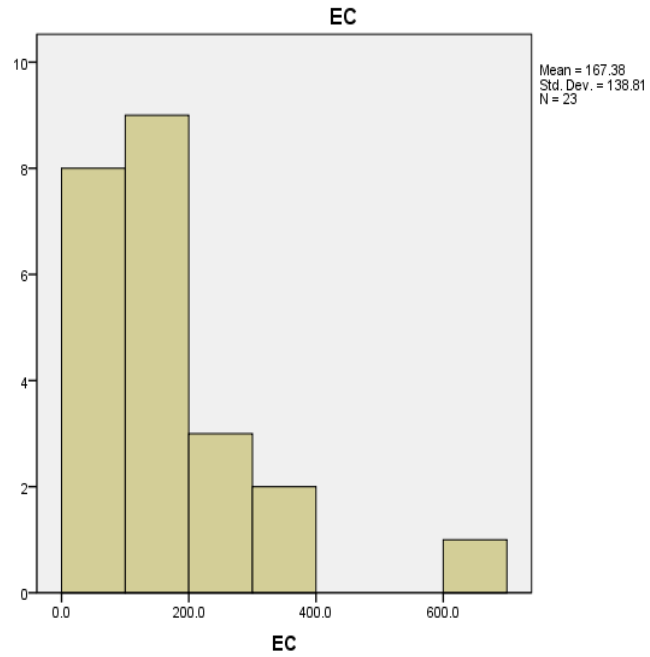

Fig.2the frequency of EC

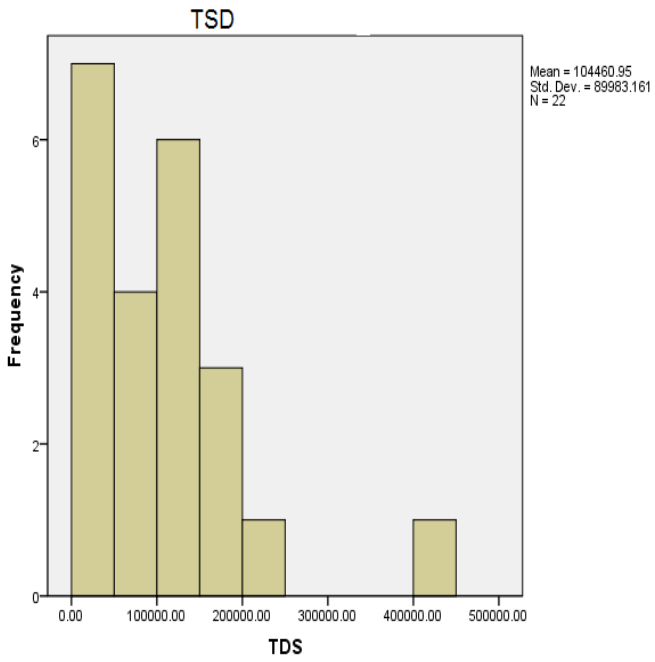

Fig.3: the frequency of TDS concentration

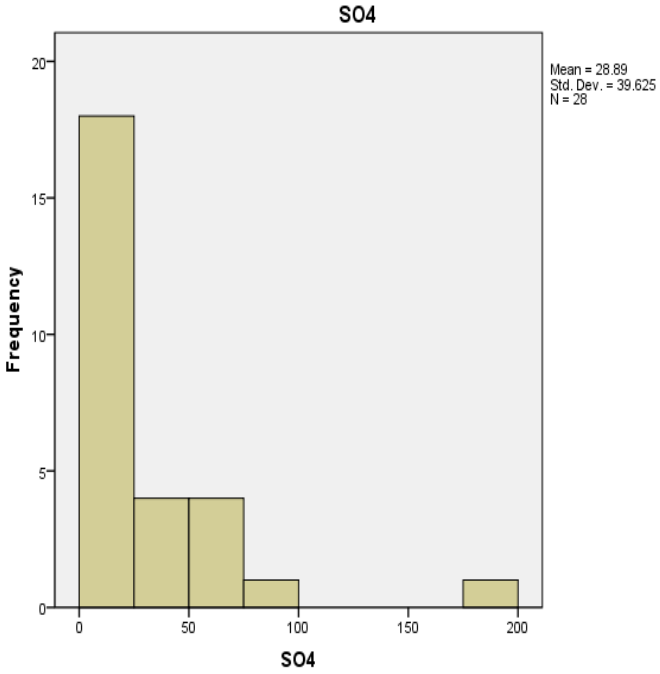

Fig.4: the frequency of SO4 concentration

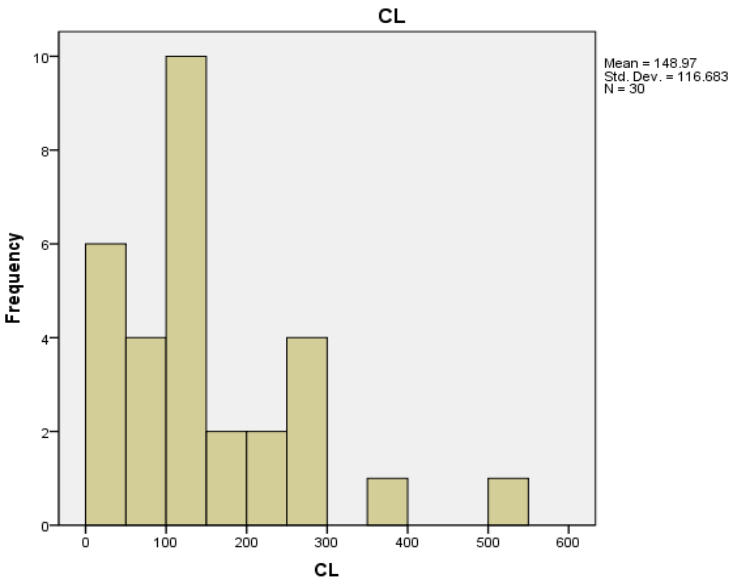

Fig.5: the frequency of Cl concentration.

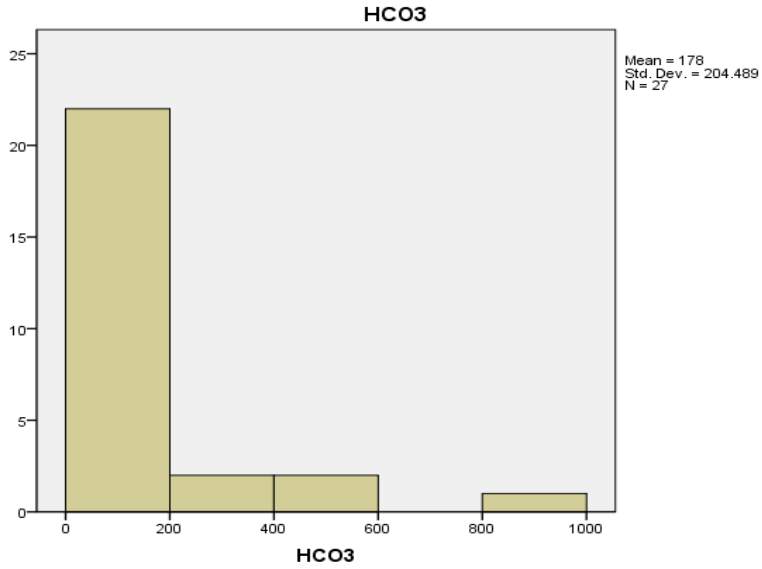

Fig.6: the frequency of HCO_3 concentration.

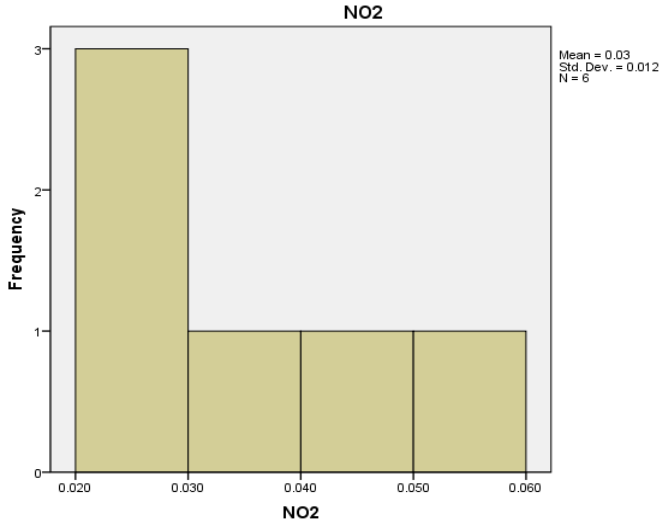

Fig.7 the frequency of NO_2 concentration.

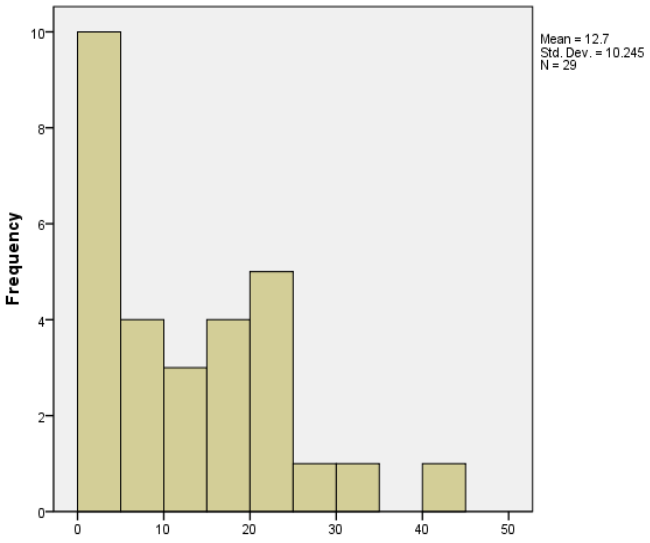

Fig.8: the frequency of Ca concentration.

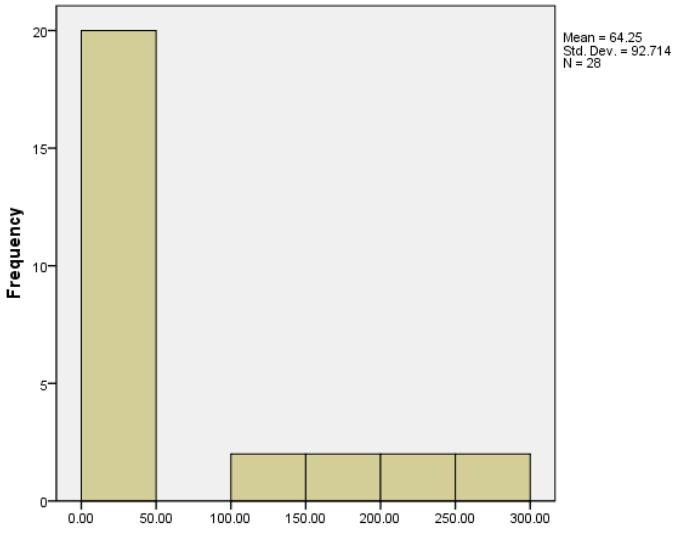

Fig.9: frequency of Mg concentration.

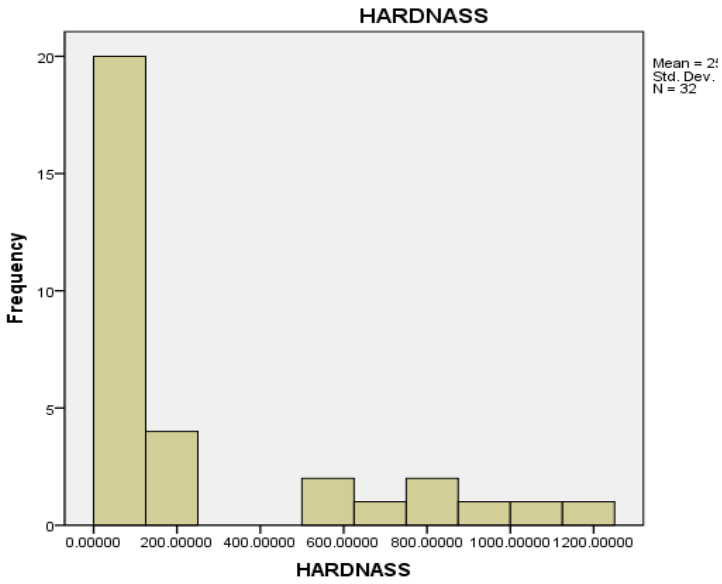

Fig.10: the frequency of Hardness.

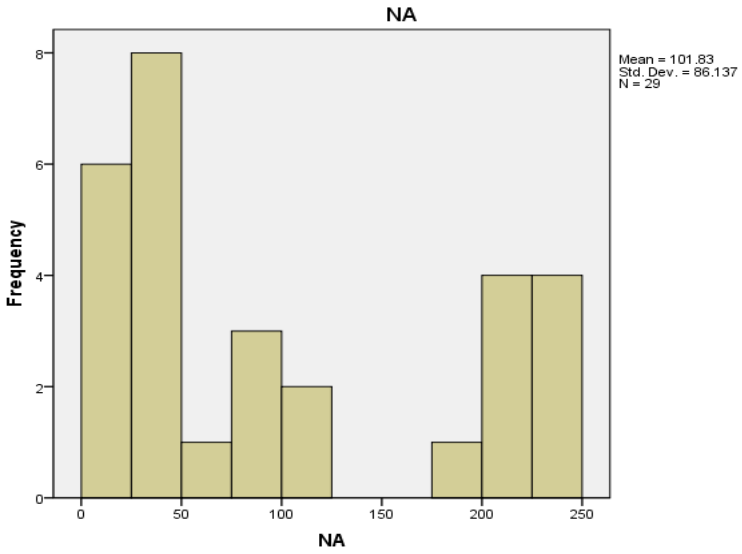

Fig.11: frequency Na concentration

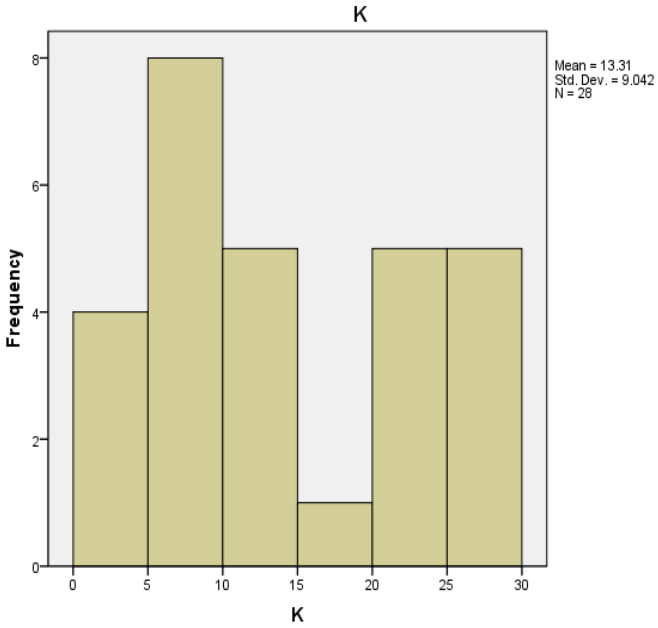

Fig.11: the frequency K concentration

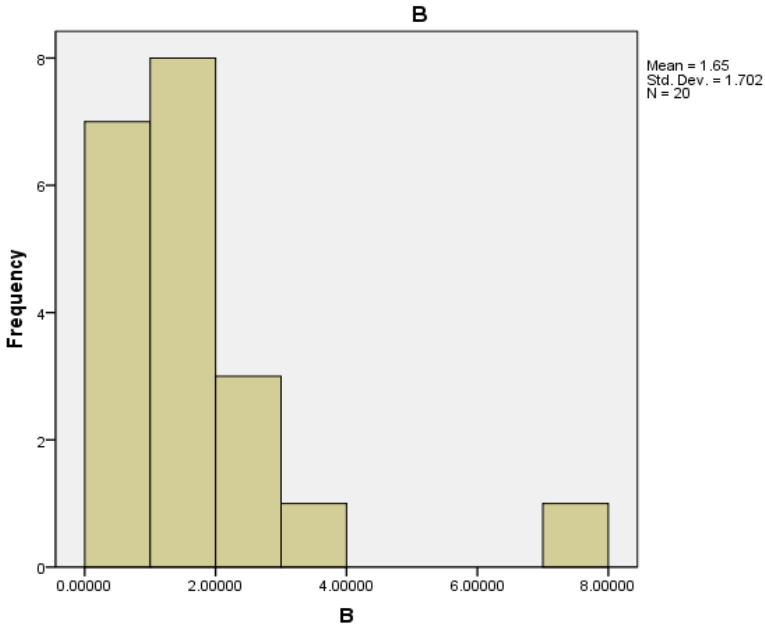

Fig.12: the frequency B concentration

The highest frequency of concentration of sodium are from 5-10 mg/L.

Figure (12) showed the frequency of concentration of boron in the samples. The higher frequency appeared in concentration 1-2 mg/L. A few samples high concentration ranged from 2-8 mg/L. Most of sources of drinking bottled water were ground water. In ground water boron concentrations can be as high as 10 mg/L in areas to the west of Euphrates River (Al-Dabbas, 2006).

From the results of water samples selected that most of the samples are not in conformity with the standard specifications for the Iraqi drinking water, for both presence of bacterial or concentrations of some ions, as well as turbidity or boron addition to the low concentrations of elements also are not conforming to specifications showing that some of the samples where the concentration of elements up to zero (SO_4,HCO_3,Cl,Ca,Mg,Na,and K) so the quality of the bottled water must be over control. That bottled water is in direct contact with people's lives, especially children, to the confidence of the people because they are subject to the supervision and quality control.

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دراسة الخصائص الفيزيائية والكيميائية والبكتريولوجية للمياه المعبأة في العراق

وصال فخري حسن ، ايمان عبد الله الامارة ، ايناس قاسم محمد ، اسعد محمد رضا ، ر نا طارق شبلي

قسم الكيمياء البيئية البحرية – مركز علوم البحار – جامعة البصرة

المستخلص

مياه الشرب المعبأة هي تلك المياه التي عادة ما تخلو من اي مضافات عدا تلك التي تكون غير مضرة بصحة الانسان. جمعت عينات مياه الشرب المعبأة المطروحة في الاسواق من بعض محافظات العراق (البصرة، كربلاء، النجف، بغداد واربيل). حددت المواصفات الفيزيائية والكيميائية للمياه من خلال قياس درجة الحامضية، التوصيلية، الاملاح المذابة الكلية، القاعدية الكلية، الكلوريد، الصوديوم والبوتاسيوم والكبريتات والبورون النترات و النتريت ودرست ايضا اعداد البكتريا الكلية، بكتريا القولون الكلية وبكتريا القولون البرازية.

اظهرت نتائج التحليل البكترولوجي بوجود تغاير في الاعداد وان المياه غير صالحة للشرب في حين اظهرت نتائج التحاليل الفيزيائية والكيميائية بأن قيمة الحامضية تراوحت بين (7.07–8.50) ، التوصيلية (20–366) مايكروسيمينز\سم، العكارة الكلية (9–1270) ملغم\التر ،العسرة الكلية (9–1207) ملغم\التر ،البورون (0.11–7.91) ملغم\ لتر ،الصوديوم (10–273) ملغم \التر، البوتاسيوم (2.86–62.89) ،مغنيسيوم (0.48–288) ملغم\التر ،كالسيوم (2.0–40) ملغم\التر ، الكلوريد(27–511) ملغم\التر والكبريتات (1.3–190.7) ،النتريت(0.06–1.00)والنترات(0.12–1,00).

الكلمات المفتاحية : العراق ، الصفات الفيزيو– كيميائية للمياه المعبأة ، الصفات البكترولوجية.

Watersheds Mapping Using ArcGIS

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Abstract

Water resources have become significant element of national concern, notably in arid and semi-arid regions where they constitute serious geo-environmental issues. A watershed is a geographic area where all rainwater and any other type of precipitation drain into lakes, rivers, or other bodies of water. A watershed or running water infiltration area is the most important unit for management of wetlands and water resources. When creating watersheds, GIS assumes that water will simply flow downhill. Watersheds are physically delineated by the area upstream from an outlet point and are usually separated by ridgelines. Before watersheds can be managed, it is necessary to delineate their boundaries and this was done in ArcGIS using the hydrologic analysis tools.

Keywords: Watershed, GIS, Water resources.

Introduction

A watershed is a land area that drains off to a natural body of water or surface water. Any rain that falls on this land area runs off or drains into that body of water. A healthy watershed both stores and filters water before it reaches streams, rivers or lakes. As water percolates into the soil, the soil acts as a filter and removes impurities. Watersheds are the most suitable units to conserve water resources and ecosystems and to plan the sustainable usage of them [6], [7]. Watershed is a natural laboratory of hydrology. It is a natural convergent mechanism which consists of a network, branch of streamlets converging into a major stream. Studies of morphometry and hydrologic analysis on different watersheds have been carried out in many parts of the world. Relief and climate is the key determinants of running water ecosystems functioning at the basin scale [5], [3], and [9]. Watersheds are physically delineated by the area upstream from an outlet point and are usually separated by ridgelines. Before watersheds can be managed, it is necessary to delineate their boundaries and this is done in Arc Map using the hydrologic analysis tools [10], [11]. These tools are available in ArcGIS after one has enabled the Spatial Analyst extension. The Hydrology toolbox

can be found in Arc Toolbox under Spatial Analysis [1], [8].

Materials and Methods

A geographic information system (GIS) is a tool that integrates hardware, software, and data for capturing, managing, analyzing, and displaying all forms of geographically referenced information. This tool is really useful to understand and estimate events and situations related to the use of natural resources, and climate change activities in a given area [10]. Starting from the raw digital elevation data, a geo-processing analysis was performed to recondition the digital elevation model and generate data on flow direction, flow accumulation, stream segments, and watershed delineation. Shuttle Radar Topography Mission Digital Elevation Models are an emerging source of high-resolution topography data obtained using radar interferometry onboard the Endeavor Shuttle [4]. The sampling technique consisted of two radar instrument pairs separated by a 60-m mast. Processing of the *C*-band data provides a nominal 30-m product over 80% of the Earth's landmass [2]. In this study, a DEM Shown in figure (1) was used.

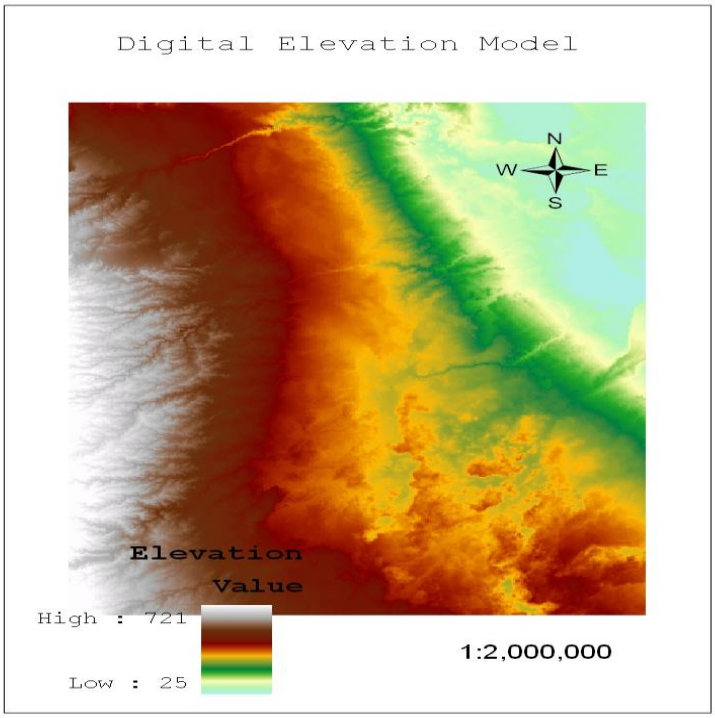

Figure (1): Digital elevation model of study region.

The elevations of the study region were:
Minimum elevation = 25 meters.
Maximum elevation = 721 meters.
The coordinates of the study area in degrees decimal are:
Upper left corner
Latitude = 32.923
Longitude = 40.866
Lower right corner
Latitude = 32.139
Longitude = 41.811
Pixel size = 90 meters.

The histogram of the study region is shown below in figure (2). The study region lies in the western desert (Iraq). Figure (3) shows a Landsat image of the study area west of Iraq.

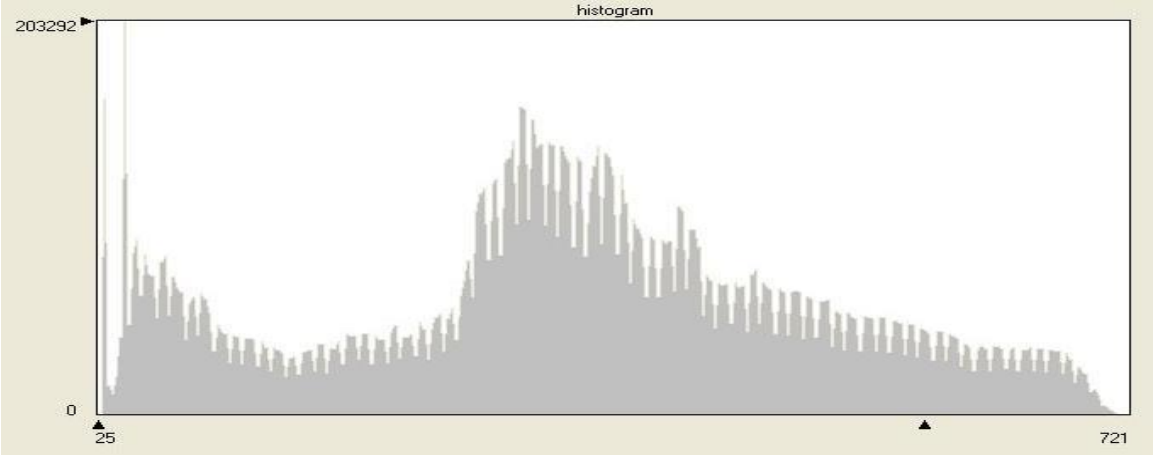

Figure (2): The histogram of elevation data.

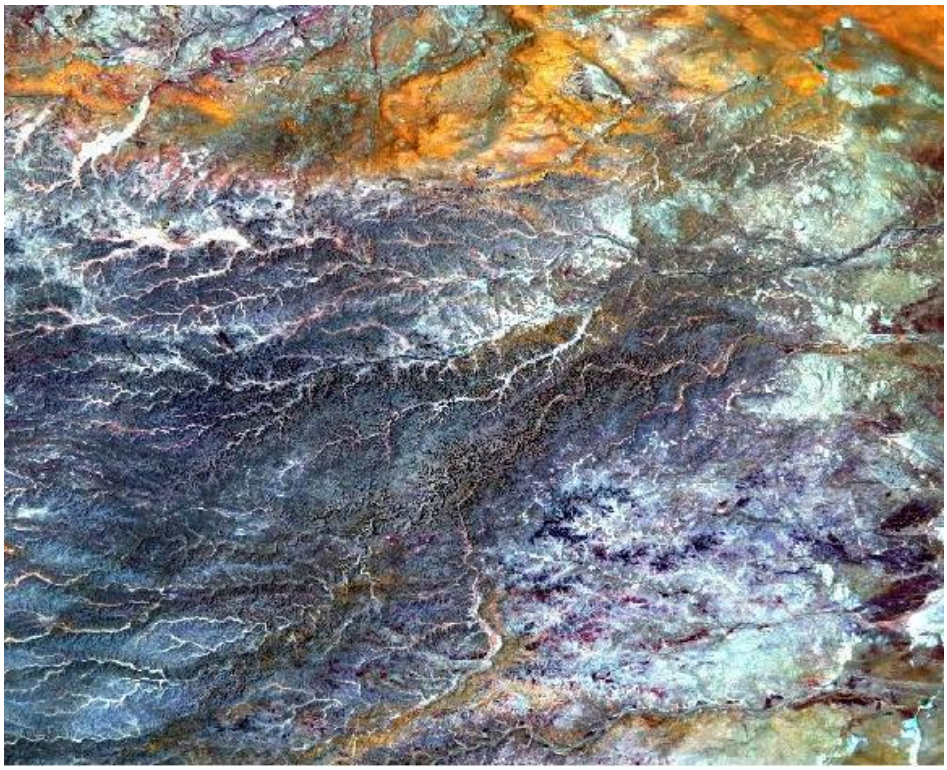

Figure (3): Landsat satellite image of the study area.

Results and discussion

Flow direction

This function computes the flow direction for a given grid. Figure (4) shows the resulting flow direction map. Flow direction is calculated as the direction of steepest downward descent. Flow direction is calculated for each cell, resulting in a new grid theme. Figure (5) shows the codes of the directions.

To calculate a drainage network or watersheds, a grid must exist that is coded for the direction in which each cell in a surface drains. Flow direction is important in hydrologic modeling because in order to determine where a landscape drains, it is necessary to determine the direction of flow for each cell in the landscape. For every cell in the surface grid, the ArcGIS grid processor finds the direction of steepest downward

descent. Flow direction is a local function. For every 3-x-3 cell neighborhood, the grid processor stops at the center cell and determines which neighboring cell is lowest.

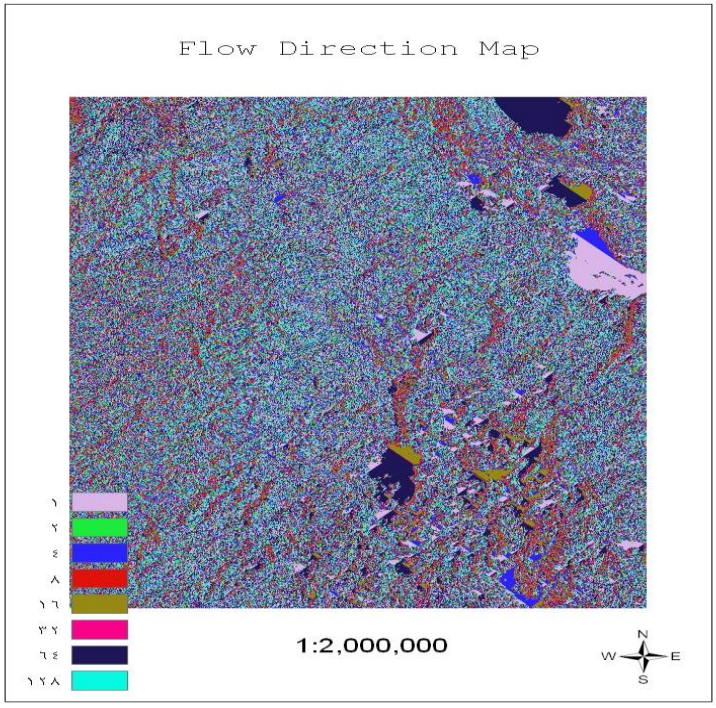

Figure (4): Flow direction map.

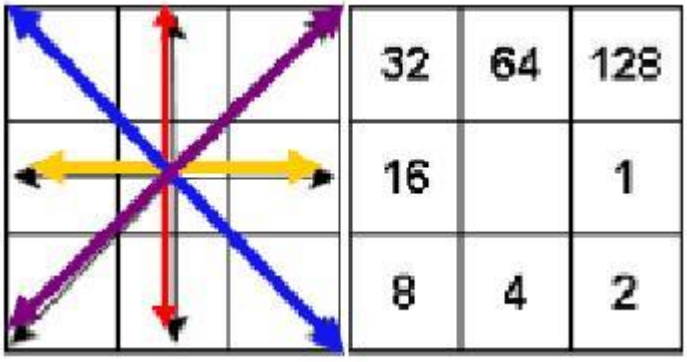

Figure (5): Codes of the different directions.

Flow Accumulation

This function computes the flow accumulation grid that contains the accumulated number of cells upstream of a cell, for each cell in the input grid. Figure (6) shows the resulting flow accumulation,

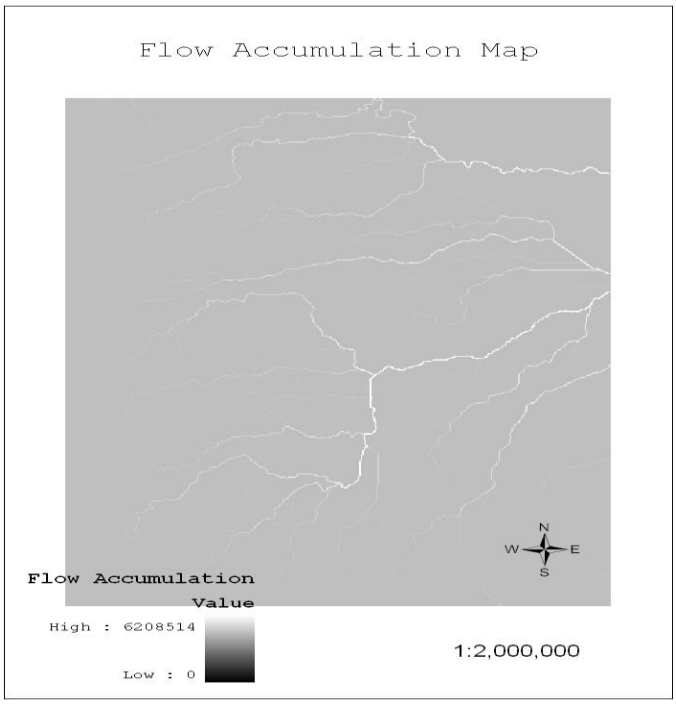

Figure (6) Resulting Flow Accumulation.

Flow accumulation is used to generate a drainage network, based on the direction of flow of each cell. By selecting cells with the greatest accumulated flow, we are able to create a network of high-flow cells. These high-flow cells should lie on stream channels and at valley bottoms. Once flow accumulation is calculated, it is customary to identify those cells with high flow.

Watershed Delineation

The last step was to delineate the watershed; the result is shown in figure (7).

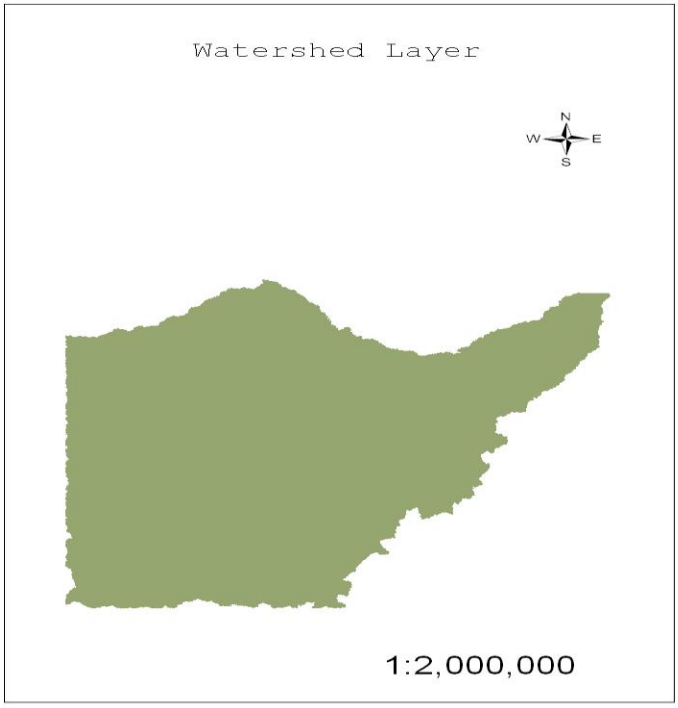

Figure (7): Watershed region.

Conclusions

Climate change is expected to increase the severity, duration and frequency of droughts. Overcoming periods of low rainfall and drought will thus become increasingly difficult. Increasing droughts are a direct threat to water and food availability for millions of people, particularly in semi-arid regions. Increased water security can be realized when water from periods of relative excess can be stored to improve water availability in dry periods. Local water storage can be an important strategy in semi-arid and arid regions with no (or little) groundwater available. In general, such local storage is sought in small surface reservoirs.

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أنتاج خرائط المستجمعات المائية باستخدام نظم المعلومات الجغرافية

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المستخلص

أصبحت الموارد المائية عنصرا مهما و ذو اهتمام دولي، خصوصا في المناطق الجافة وشبه الجافة، حيث أنها تعد موضوع بيئي خطير. يعد المستجمع المائي منطقة جغرافية تؤدي إلى تصريف مياه الأمطار أو أي نوع أخر من التساقط المطري إلى البحيرات ، الأنهار ، أو الأنواع الأخرى من الأجسام المائية. يعد المستجمع المائي أو منطقة ترشح الماء الجاري أهم وحدة في إدارة الأراضي الرطبة والموارد المائية. تفترض نظم المعلومات الجغرافية عند تحديد المستجمعات المائية بأن الماء ينساق بسهولة أسفل المرتفع. يتم تحديد المستجمعات المائية فيزيائيا بواسطة المساحة أعلى المجرى عن نقطة تصريف وتكون مفصولة بواسطة مناطق مرتفعة. قبل أن يتم إدارة المستجمعات المائية ، فانه من الضروري أن نجد حدودها ،وقد تم ذلك باستخدام برنامج نظم المعلومات الجغرافية وأدوات التحليل الهيدرولوجية .

كلمات مفتاحيه: مستجمع مائي، نظم المعلومات الجغرافية، الموارد المائية.

Investigation of Dissolved and particulate form of Copper and Zinc concentrations in Tigris River at Baghdad City

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Abstract

Four experimental stations were chosen along the Tigris River when it passes through Baghdad city. The samples were collected bimonthly from November 2010 to September 2011. In the present study showed that the general annual average of Copper and Zinc in filtered water was 6.25µg/L, and 23.8µg/L respectively, in particulate form Cu was 140.3, while Zn was 347.8. It was clear from the results showed that the particulate phase contained higher concentrations of Copper and Zinc in the water**.**

Introduction

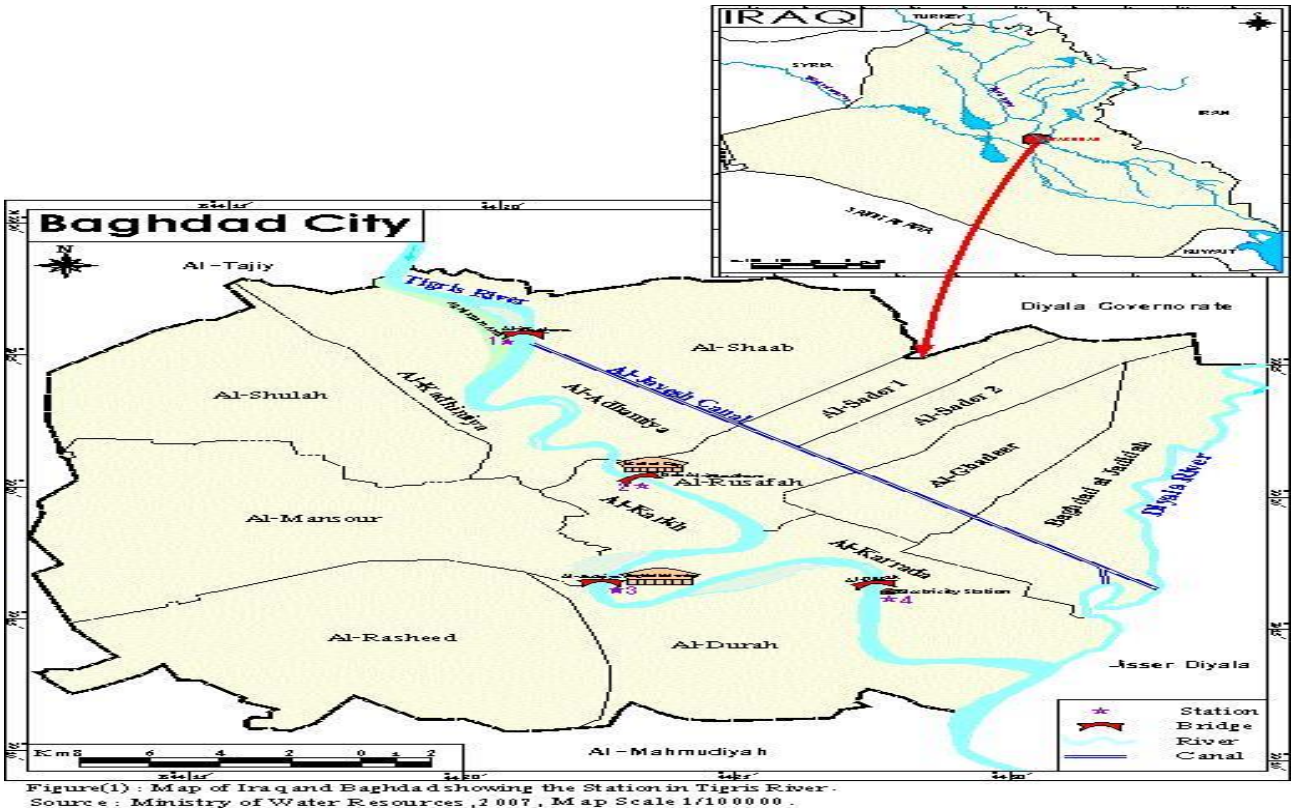
Interest in trace elements in water has grown markedly over the decades or so, mainly through increasing concern about the many undesirable effect known or suspected to be caused by certain elements. Dissolved metals are those metals in an acidified sample that pass through a 0.45-µm membrane filter (Clark, 1998). The behavior of metals in natural waters is a function of the substrate sediment composition, the suspended sediment composition, and the water chemistry (Osmond *et al.*, 1995). During their transport, the trace metals undergo numerous changes in their speciation due to dissolution, precipitation, sorption and complication phenomena (Dassenakis *et al.*, 1997; Akcay *et al.*, 2003) which affect their behavior and bioavailability (Nicolau *et al.*, 2006)

The particulate phase is the suspended matter that cannot pass through 0.45 µm ore diameter filter, the accumulation of Copper and Zinc as a particulate form consists of silt, clay, fine particles of organic and

inorganic compounds, also plankton, and other microscopic organisms (WHO, 1992). At filtration processes, species passing through a filter with a pore diameter of (0.45 μm) are commonly denoted as dissolved, while those retain as particulate. The former includes free ions of elements or organic and inorganic chemical compound the latter divided into biotic (zooplankton, phytoplankton, bacteria, fungi etc.) and abiotic includes clays, silts, feldspars, quartz, etc. (Riley and Chester, 1981). Morris (1978) has reported that the degree of accumulation of heavy metals in the surface water divided or portioning finally into suspended matter, bed sediments or living organisms. The present study aimed to investigate dissolved and particulate forms of Copper and Zinc concentrations in water and their related with some physical and chemical characters of the Tigris River.

Materials and methods

Four stations were chosen to collect water samples to study the status of the Tigris River from north to south of Baghdad city, the locations of these stations were ((Figure 1) : Station one (S1): located at the Al - Tajiyarea near Al-Muthanna Bridge, this area iss an agricultural area consists of groves of orange and other citrus trees . Station two (S2): located at Al- Kharkh area under 17th July Bridge. Station three (S3): Located at Al-Jadriyah area near Al -Jadriyah Bridge. Station four (S4): located at Al- Rasheed area which near AL-Zafarania city southern Baghdad city, there are forms, groves and homes for farmers beside the river . The vertical distance between Station 1 and Station 2 was 10.5Km, while the distance between Station 2 and Station 3 was 8.6Km, and the distance between Station 3 and Station 4 was 7.5Km.Sampling was collected bimonthly from November 2010 to October2011. Heavy metals were extracted from water sample (dissolved form) according to Riley and Taylor (1968) whereas the extraction of particulate heavy metals from suspended matter according to Sturgeon *et al*. (1982). Dissolved and particulate form measured by using an atomic absorption spectrophotometer.



Figure(1) : Map of Iraq and Baghdad showing the Station in Tigris River.
Source : Ministry of Water Resources ,2007, Map Scale 1/100000.

Figure 1: Map of Iraq and Baghdad showing the station in Tifris River

Results and Discussion

1- Dissolve Phase of Copper and Zinc in Water

The obtained results showed that the highest value of Zn was 34.2 µg/L in summer at station 4, while the lowest value was 15.5 µg/L in winter at station3. Whereas Cu values varied from 1.53 µg/L in autumn at station 2 to 10.55 µg/L in spring at station 2 (Figure 2; 3).

The statistical analysis indicated that there were no significant differences among stations ($p \geq 0.05$) of dissolved Zn. Also no significant differences among stations ($p \geq 0.05$) of dissolved Cu (Table 1; 2).

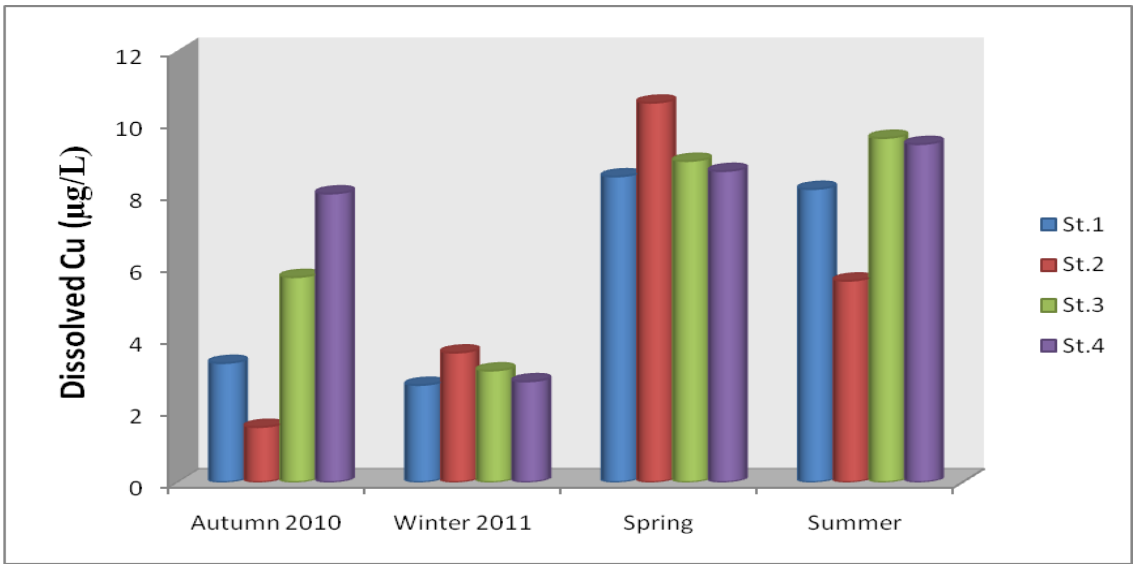


Figure (2): Seasonal variation of dissolved Copper in Tigris River during 2010 to 2011.

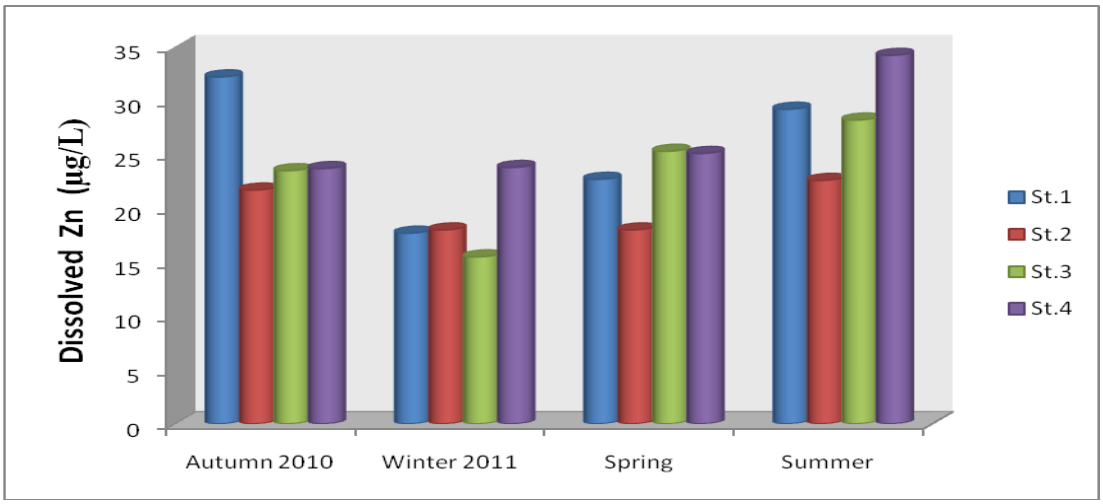


Figure (3): Seasonal variation of dissolved Zinc in Tigris River during 2010 to 2011.

Table (1): Copper concentrations at Tigris River along Baghdad city during 2010 to 2011.

Stations	1	2	3	4
Cu Dissolved µg/l	5.74±1.59 1.22-12.1 a	5.56± 1.73 0.38-11.50 A	6.61±1.099 3.60-12.10 a	6.61±1.42 2.80-11.5 A
Cu Particulate µg/g	175.11±37.0 58.2-292.3	128.76 ±20.9 58.4-199.6	129.3±28.7 40.8-191.1	125.6±25.5 38.8-205.7

	a	B	b	B

Table (2): Zinc concentration in Tigris River along Baghdad city during 2010 to 2011.

Stations	1	2	3	4
Zn Dissolved µg/L	26.13±4.55 17.3- 47.1 a	20.0±1.42 15.7- 25.25 A	23.68±2.73 15.5-32.2 a	27.8±4.45 16.1-45.3 A
Zn Particulate µg/g	314.10± 36.01 171.7 - 35.5 b	32.73±27.10 219.20-400.00 B	337.91± 70.11 180.00 -575.00 b	427.40± 92.29 120.00-681.25 A

There were some variations among the different localities in the values of both Zn and Cu which may be due to the different input of the agricultural and industrial discharge along the river as well as the different population densities. There was clear seasonal variation in the concentrations of the studied metals concentration. The higher values that were determined during summer and the lowest values during winter and spring, which may be due to the dilution factor followed the rain fall (Rzóska, 1980).

In filtered water Table (3) comparison the present study with many other recent studies, the concentrations of copper values were lower than Al-Lami and Al-Jaberi (2002) at Tigris River and Kassim *et al*. (1997) at Euphrates River, whereas higher than Al-Taee (1999) at Shatt Al-Hilla . Also Cu values were lower than Varol *et al*. (2010) in the Tigris River in Turkey.

Zinc concentrations were lower than Al-Lami and Al-Jaberi (2002) on the Tigris River, but higher than Kassim *et al*. (1997) at Euphrates River , Al-Taee (1999) at Shatt Al-Hilla , Abaychi and DouAbul (1985) at Shatt Al-Arab and Fahad (2006) at Al-Gharraf , Sector of Tigris River, whereas the results were nearest the results of Varol *et al*. (2010) on Tigris River in Turkey.

Gümgüm *et al.* (2001) mentioned that the average contents of Cu and Zn in the Tigris River water in Turkey were found as 30 and 140 µg/L.

Generally, studied metals concentration values were within the middle values when it was compared with other rivers Table (3). And below Iraqi and WHO standards Table (4) which may indicate a good status of the river water.

Table (3): Comparison between concentrations of dissolved Copper and Zinc in filtered water of Tigris River with other rivers by µg/L unit.

Rivers	Heavy metals conc. µg/L		References
	Cu	Zn	
Tigris	0.82-14	20.2 -260	(Al-Lami and Al-Jaberi, 2002)
Euphrates	1.6- 13.1	2.6- 55.6	(Kassim,*et al*.,1997)
Shatt Al-Hilla	0.99- 9.1	0.36-29.08	(Al-Taee, 1999)
Shatt Al-Arab	--	1.8	(Abaychi and DouAbul,1985)
Al-Gharraf. sector at Tigris River	--	17.18	(Fahad , 2006)
Tigris (Turkey)	2.7 - 6.4	1.6 -74.3	(Varol *et al*.,2010)
Tigris	1.53 - 10.55	15.5-34.2	Present study

The solubility of heavy metals in surface water is predominately controlled by the water pH. A lower pH increases a competition between metal and hydrogen ions for binding sites. A decrease in pH may also dissolve metal-carbonate complexes, releasing free metal ions into the water column (Osmond, *et al.*, 1995). Statistical analysis showed that Significant correlation between pH and Copper (r= 0.436). Also Significant correlation between pH and Zinc (r= 0.436) (Table 5). The study results findings revealed that distribution patterns of Cu and Zn in Tigris River increased in the summer, which may be attributed to the release of heavy metals from sediments to the overlying water under the effect of both high temperature and fermentation process resulted from decomposition of organic matter (Elder, 1989). In addition to that, the values of Cu and Zn showed an obvious decrease in the water during cold period winter and autumn due to precipitation of heavy metals

from the water column to the sediments under weak alkaline of pH values, as well as to adsorption of heavy metals onto organic matter and their settlement downward.

Table (4): Comparison between concentrations of Copper and Zinc in Tigris River water with world and Iraqi standards of µg/L unit.

present study, (Mean of Dissolved Metal)		Iraqi standards for water quality of river and branch No. 25 in 1967	WHO stander for raw water quality	Jaban stander for raw water quality	United State stander for raw water quality
Cu	6.25	50	2000	1000	1300
Zn	23.8	2000	3000	1000	5000

Statistical analysis showed that significant correlation between dissolved Cu and water temperature (r=0. 476), but no correlation between dissolved Zn with water temperature (r= -0.25) (Table 5).

Also temperature exerts an important effect on metal speciation, because most chemical reaction is highly sensitive to temperature changes (Elder, 1989).

Soluble metals concentrations are often highest during summer with low flows, decrease in the dilution is the last and highest evaporation rates (Grimshaw *et al*., 1976). This was assured by the statistical analysis results. An inverse correlation between dissolved Cu with the water flow (r= -0.478) and no correlation for Zn (Table 5). Temperature could be the reason in the increasing of Copper and Zinc solubility that may be liberated from sediments or increasing the activities of organisms especially decomposers to liberate different metals to the aquatic environment. The same was found in this study as expressed by the direct correlation between water temperature and dissolved Cu (r=0.449) and no correlation for Zn (Table 5). Heavy metals are more toxic in soft water than in hard water because calcium is believed to protect against the uptake of metals across the cell membrane (Landis and Yu, 2003). May be we are lucky that the Tigris River water is hard water with high concentration of calcium. Statistical analysis showed that a direct correlation

between total hardness and dissolved Zn (r=0.525) and no correlation with Cu (r=0.009) (Table 5).

Table (5): The Correlation between dissolved and particulate phase of copper and zinc with water parameters.

	Air Tem.	Water Temp.	pH	E.C.	TDS	Sal.	DO	BOD	TH	Ca	Mg	NO_3	PO_4	TSS	Light pent.	TOM
Dis.Cu	0.395	0.476	0.436	-0.44	-0.43	-0.43	-0.24	0.28	0.09	0.231	-0.1	0.33	-0.02	0.53	-0.47	-0.21
Dis.Zn	0.488	-0.273	0.337	-0.199	-0.190	-0.190	-0.29	0.02	0.52	0.343	0.58	-0.04	-0.01	0.18	-0.07	0.28
Par.Cu	0.16	0.1	0.31	0.349	0.34	0.34	-0.18	-0.2	0.54	0.653	0.43	-0.34	0.097	0.21	0.609	0.22
Par.Zn	0.24	0.36	0.38	-0.17	-0.16	-0.16	-0.32	0.17	0.15	0.22	0.11	-0.28	0.17	0.45	0.43	0.21
Sed.Cu	-0.137	0.449	-0.59	0.612	0.622	0.622	0.08	-0.1	-0.3	-0.24	0.39	-0.115	-0.17	-0.18	0.25	0.36
Sed.Zn	0.351	0.329	-0.16	-0.343	-0.328	-0.328	-0.35	0.43	-0.1	-0.31	-0.05	-0.06	-0.47	0.008	-0.13	0.014

2-Particulate Phase of Copper and Zinc in Water

Particulate Cu concentration values presented in Figure (4) and Table (1). Particulate Cu concentration varies from 43.3 µg/g in spring at station 3 to 292.3 µg/g in Winter at station 1. Whereas the highest concentration of particulate Zn was 584.3 µg/g in summer at station 4, while the lowest concentration was 231 µg/g in winter at station 4 (Figure 5 and Table 1).

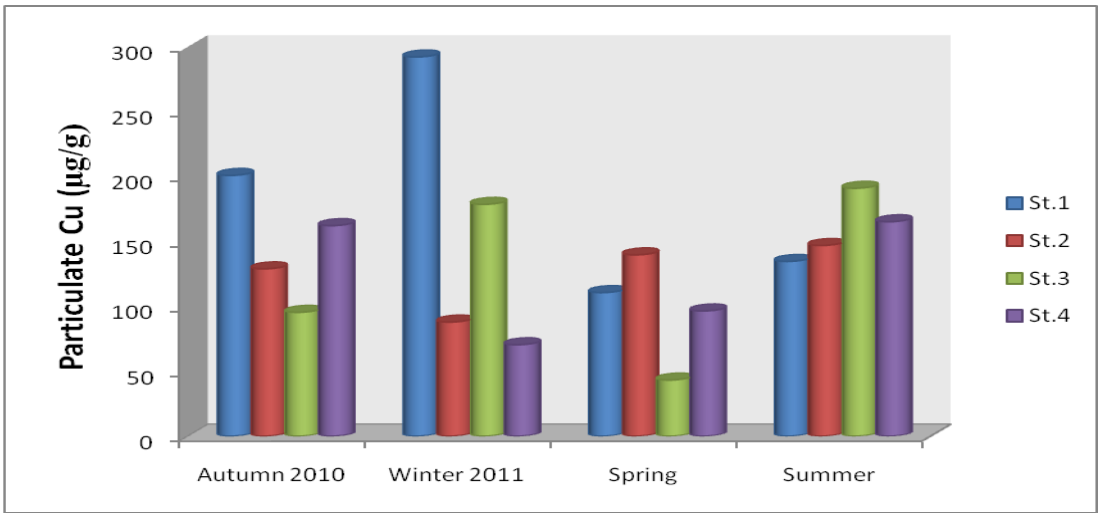


Figure (4): Seasonal Variation of Particulate Copper in Tigris River during 2010 to 2011.

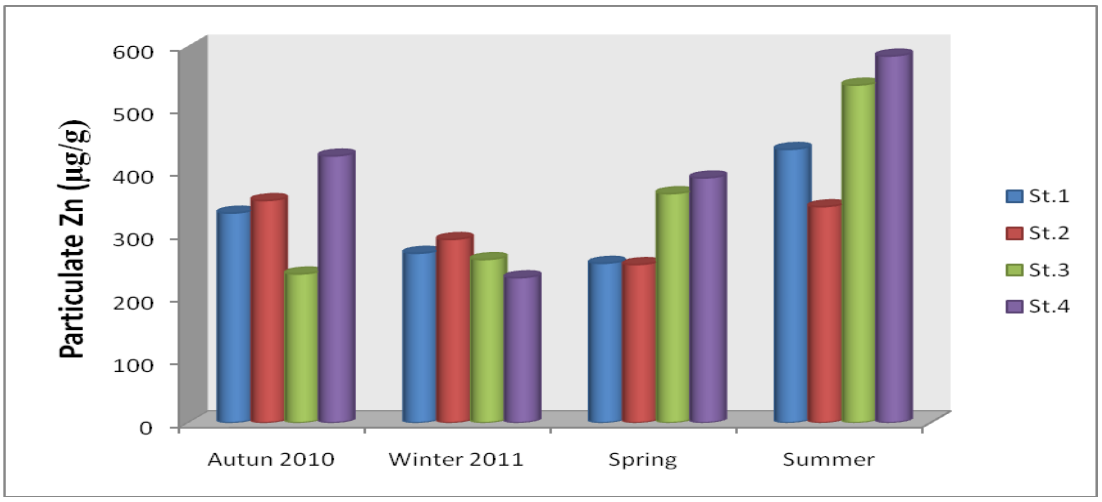


Figure (5): Seasonal variation of particulate Zinc in Tigris River during 2010 to 2011.

Statistical analysis of Particulate Cu values indicated that significant differences among stations ($p \leq 0.05$) and the highest significant differences was at station 1 (Table 1).whereas Particulate Zn values indicated significant differences among stations at ($p \leq 0.05$) and the highest significant differences at station 4 (Table 5).

Based on the obtained results, when we compare the particulate Zn and Cu concentrations with filtered water results, it was found that the particulates Zn and Cu concentrations much higher than filter water, this results it may be due to the fact that most of these particles consist of planktonic organisms which are well known in their ability of metal accumulation by a factor

(10^6) or even more. In addition to that, they have organic and inorganic materials such as eroded rocks and soil particles as atmospheric fallout which consists of autochthonous materials (Forstener, 1987). Also the nature of hydrological conditions in the bottom, and the different untreated industrial waste and waste water discharge to the river at high current, and the colloidal parts had a great ability to absorb the heavy metals like Cu and Zn, due to the particle size becomes smaller and give more than the chance to metal adsorption (Sakai *et al*., 1986)

From study results it was clear that the concentrations of particulate Cu and Zn increased in summer and decreased in spring, this variation of particulate metal concentration may be related to two factors affecting in it such as: runoff input during high discharge periods, and phytoplankton activity during low discharge periods. This shift in the source of suspended particulate matter causes an increase in the metals concentrations during the dry season, as well as to bloom of phytoplankton decrease with the increase of turbidity which was increased in the Spring due to the rain fall and erosion of soil (Salomao *et al.*, 2000), and this agrees with the present study, the correlation between Light penetration and Particulate Zn was (r=0. 439) and for Particulate Cu was (r=0. 609) (Table 5).

Metals adsorption in different media such as soil, sludge, river sediment, and ground water was investigated by several researchers. These researchers indicated that environmental factors such as pH, dissolved organic matter, metal competition, adsorption characteristics and the like might affect the metal adsorption, in general, higher pH showed higher metal adsorption (Apak, *et al.*, 1999; Simposon, *et al.*, 2004; Qian, *et al*., 2006; and Wang *et al.*, 2006). Analysis showed that a positive correlation between particulate Cu and pH (r= 0.410), also a positive correlation between particulate Zn and pH (r=0. 483) (Table 5).

Normally, more than 50% of the total concentration of a metal in water will be absorbed onto suspended particles, this process is known as sorption or adsorption and can opposite the reaction by desorption and once again became dissolved in water (UNEP, 2003).

Study results finding were lower than Sabri *et al.* (2001) which recorded that the concentration of particulate Zn ranged from 1069 µg/g to 4366 µg/g in the Tigris River at Samarra impoundment, also

Rasheed *et al*. (2001) study the distributed of heavy metals in the Tigris River, they recorded that particulate Zn ranged from 4.2 µg/g to 2017.8 µg/g , and Al-Lami and Al-Jaberi (2002) of upper and mid region of Tigris River showed that particulate Zn ranged from 631 µg/g to 3157 µg/g whereas Cu ranged from 6.51 µg/g to 64 µg/g. The concentration of particulate Cu was lower than the present study finding the high level of Zn concentration than study results finding may be due to the activity of plankton which accumulate high levels of heavy metals in their body or have organic and inorganic materials such as eroded rocks and soil particles .But agreement with Kassim *et al*. (1997) when they recorded that the range of particulate Zn was from 100 µg/g to 620 µg/g and Cu was from 30 µg/g to 230 µg/g when they study the heavy metals in the upper region of the Euphrates River.

The present study concluded that the particulate form of Copper and Zinc where higher concentration than dissolved form.

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التحري عن عنصري النحاس والزنك الذائب والدقائقي في نهر دجلة عند مدينة بغداد

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**شركة المنصور العامة، وزارة الصناعة والمعادن، بغداد العراق.

المستخلص

اختيرت أربعة مواقع لجمع العينات على طول النهر في جزئه الذي يمر بمدينة بغداد،وجمعت العينات كل شهرين، ابتداء" من شهر تشرين الثاني 2010 لغاية شهر أيلول 2011 . أظهرت الدراسة الحالية أن المعدل السنوي لتركيز النحاس الذائب 6.25 مايكروغم\لتر، اما الخارصين الذائب 23.8مايكروغم\لتر، التركيزين ضمن المواصفات العراقية لمياه الأنهار. كان معدل النحاس ألدقائقي 140.3مايكروغم\غم، و الخارصين فقد كان 347.8 مايكروغم\غم، من الواضح ان الشكل ألدقائقي الأعلى في تركيز النحاس والخارصين بالنسبة للماء.

Record of whale shark *Rhincodon typus* Smith,1828 in Shatt Al-Basrah Canal, Iraq

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Abstract

Whale Shark *Rhincodon typus* Smith,1828 was captured in Shatt Al-Basrah Canal, South Iraq during October 2010..A total of 26 morphometric characteristics of the specimen were recorded. Fish total length was 398cm,. This is the first time for this species to be recorded from Shatt Al- Basrah. It is belonging to genus *Rhincodon* and family Rhincodontidae .

Key words: Whale shark, *Rhincodon typus*, Shatt Al-Basrah, Iraq.

Introduction

The whale shark *Rhincodon typus* Smith, 1828 is generally considered to be circumglobally distributed in tropical and subtropical (Compagno 1984). There were scarce records of this species from warm temperature areas (Tyler, 1971). It's geographical distribution expands from South Africa, Mozambique and Madagascar, Red sea, Gulf of Pakistan, India, Sri lanka, Estern Australia, Moldavia, Newzeland, Indian Ocean Pacific Ocean Atlantic Ocean and Arabian Gulf (Riley *et al*. 2009). Sharks consist of 400 species belonging to 30 families, Only 30 species were considered to be dangerous for human. these include White shark, Bull shark, Tiger shark ,Oceanic shark (Hsu *et al*. 2007) *Rhincodon typus* is a filter-feeder fish characterized by a huge gill slits with a distinctive spots and stripes on the body (Norman, 1999). Whale sharks have about 3000 teeth in each jaw, but these are very small less than

(6)mm in length and used for feeding, snout extremely short(Fitzpatrick *et al*., 2006). Their maximum body fish size ranges from 12m to possibly to 21.4m (Fitzpatrick *et al*. 2006). Whale sharks such as Mega mouth shark and Sun shark are a large filter feeders with enormous blubbery head (Daley *et. al*.2007). Whale sharks feed on very small preys like krill, jellyfish, small fish, and planktons by filtering them the water using the fine mesh of their gill. The prays can be found in areas where large concentrations of food are available (Stevens, 2007). Wilson, (2008) stated that recently there is a quiet demand whale shark meat at Taiwan markets. The whale shark changed their swimming behavior during the recent 60 million years where it was diving to depths of 70m and recently it swims at the surface up to 3m for feeding (Ebert *et al*. 2004). Whale sharks were considered to be a threatened species and has been listed internationally as 'Vulnerable' on the IUCN Red List of Threatened Species (ECOCEAN,2010). it been recorded from the Arabian Gulf from Khor Al-Ummia in Iraq by several authors(Mahdi, 1971).

The present study aim to highlight on morphometric and meristic characters of single specimen of whale shark that was threatened and was recorded for the first time from Shatt Al-Basrah canal.

Collection site

Shatt Al-Basrah canal is considered to be an important water body located between the main outfall drain and Arabian Gulf through Khor Al-Zubair (fig,1.) Shatt Al-Basrah canal is of a length of 59 km and width of 3.5m. It is affected by the Tidal action. The Canal severalty No availability to vessels of the internal engine combustion and some people are living nearby it (Wahab,1986). Birds such as *Phalacrocorax pygmaeus*, *Egretta alba*, *Egretta garzetta* are inhabiting the area, as well as, number of fish, such as *Sparidentex hasta*, *Acanthopagrus arabicus*, *Liza subviridis*, *Carassius auratus* and

Carassobarbus lutus. The area characterized by a high water temperature and high salinity during study (Younis and Al-Shamary, 2011).

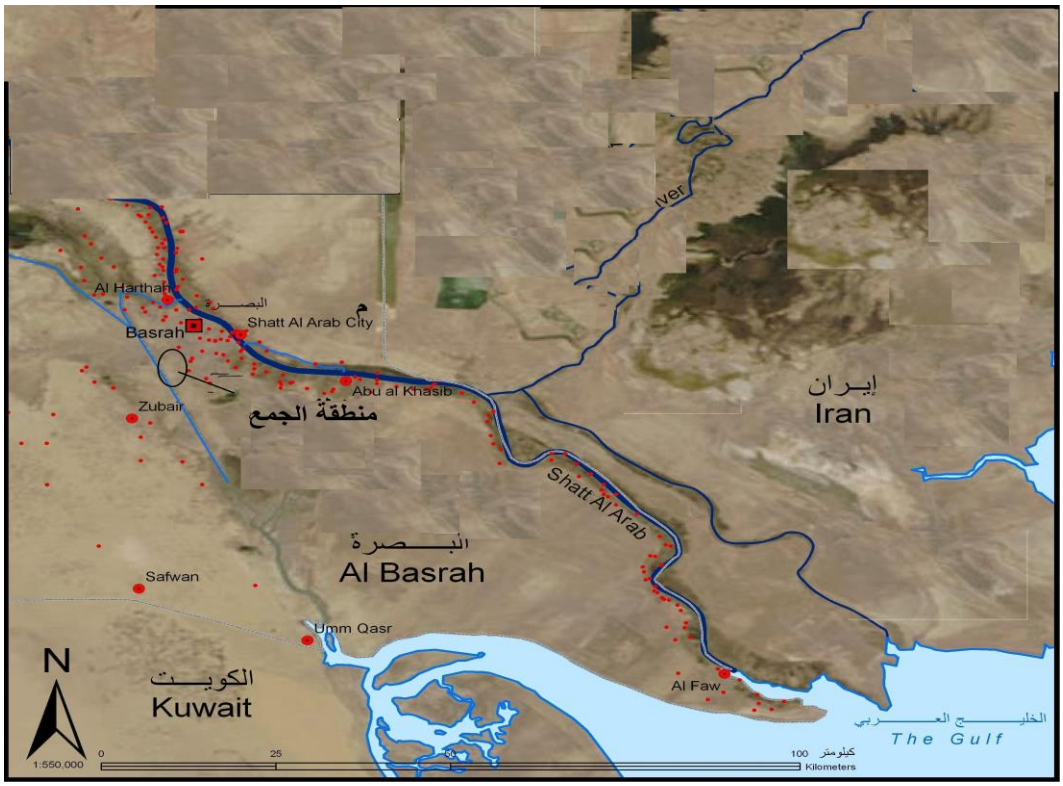

Figure 1.—Location of collection area in Shatt Al-Basrah canal, Iraq.

Methods

A whale shark was fished accidently by a fixed gill nets at Shatt Al-Basrah canal at (N:30º 29 26 E:47º 44 13) during October 2010, It was caught by a fixed gill net of a length of 30m and a 2.5X2.5cm mesh size The morphometric measurements and meristic counts followed Dulvy**,** *et*

al. (2008). The whale shark was identified according to Al-Daham (1977). Compagno, (1983). A total of 26 morphometric characteristics of the whale shark were recorded. Measurements were done a measuring tape to the nearest centimeter and caliber to the nearest millimeter. The relationships between the measured characteristics and the total length of fish were recorded .The characteristics pH, water temperature and salinity of collection area were measured YASI model 57 aperture.

RESULTS

The founded shark is belonging to:

Kingdom: Animalia

- Phylum Chordata
- Class Chondrichthyes
- Subclass Elasmobranchii
- Order: Orectolobiformes
- Family Rhincodontidae
- Genus *Rhincodon* smith
- Species:*R. typus*
- Binomial name: *Rhincodon typus* Smith,1828

The whale shark *Rhincodon typus* (fig. 2) has a total length of 398.2cm and body height of 32cm. The twenty six measured characteristics are shown in (table, 1). The shark is characterized by small eyes on the sides of the head.

Table (1) is showing the relationships between some of the studied morphometric characteristics to the total body length. Generally the fish has a small snout of a ratio of 6.7% to the total length and the ratio of pelvic fine length, pectoral fine length, anal fin length and Mouth length to the total length are 11.8%, 5.52%, 24.3% and20.3% respectively.

The mouth contains rows of small teeth. There were five slits of elasmobranches. The abdomen has gray color with white spots in some sort of a pattern on the body sides. The fish is with asymmetrical forked

anal fin, as well as, the fish has two dorsal fin.

Figure 2. A whale shark (*Rhincodon typus*) caught from Shatt Al-Basrah canal length 398.2cm, South of Iraq

Table I. morphometric characteristics (cm) and other measurements are given as percentage of total length *Rhincodon typus* in Shatt Al-Basrah canal

Morphometric characteristics	cm	Proportional measurement as expressed as percentage of TL
Head length	71.7	18
Head depth	60.3	15.15
Head width	44.2	11.1
Body width	62.8	15.7
Eye orbit	3.2	0.80
The space between sockets	32	8.04
Predorsal length	122	30.6
First dorsal fin length	29.5	7.41
The space between first and second dorsal fin	38.4	9.64
Second dorsal fin length	14.2	3.56
The space between second dorsal fin and head	233.4	58.6
The space between second dorsal fin and anal fin	165	41.45
The space between first dorsal fin and pelvic fin	38.6	9.69
The space between second dorsal fin and pelvic fin	30	7.5
The space between first dorsal fin and pectoral fin	52.3	13.1
The space between pectoral fin and pelvic fin	155	38.9
The space between pelvic fin and anal fin	183	45.9
The space between pectoral fin and anal fin	128	52.4
Pelvic fin length	22	5.52
Pectoral fin length	47.3	11.8
Anal fin length	132	33.1
Snout length	27	6.7
Mouth length	81	20.3
Gill	21.5	5.40
The space between first gill and eye	42.3	10.6
The space between first gill and mouth	33.8	8.4
Caudal fin length	63.7	15.4

Fig (3) illustrate draft some these morphometric measurement for While shark catch in shatt Al-Basrah canal and The temperature of water was 25c^{o}, salinity 38ppt and pH 8.5 in the collection area. Fig (4) shows the dorsal fin of the whale shark after has been cut and preserved in the laboratory of fish

taxonomy in the Department of Fisheries. Marine Resources, college of Agriculture, Basrah University
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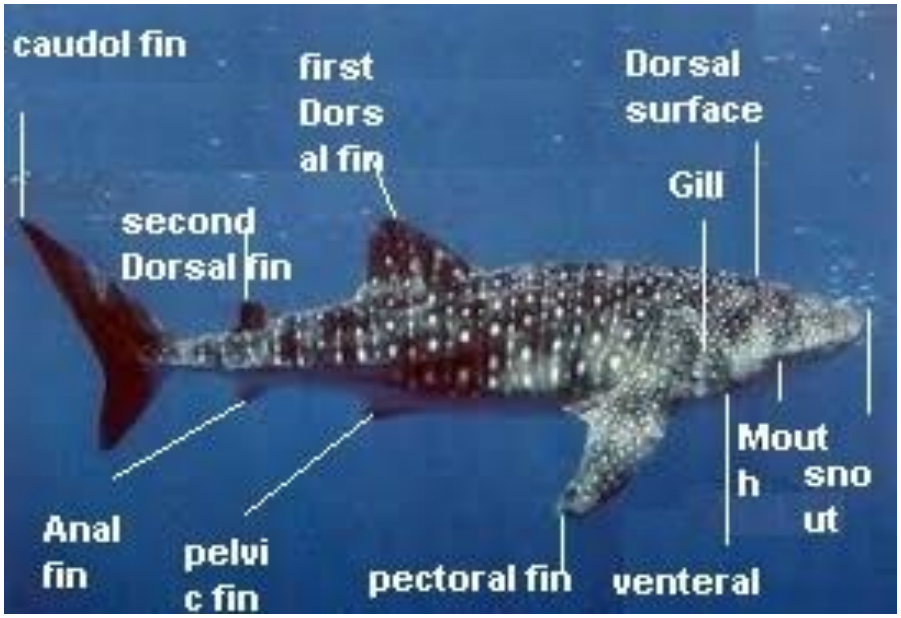

Figure 3: **showing some these morphometric measurements for whale shark *(Rhincodon typus*)**

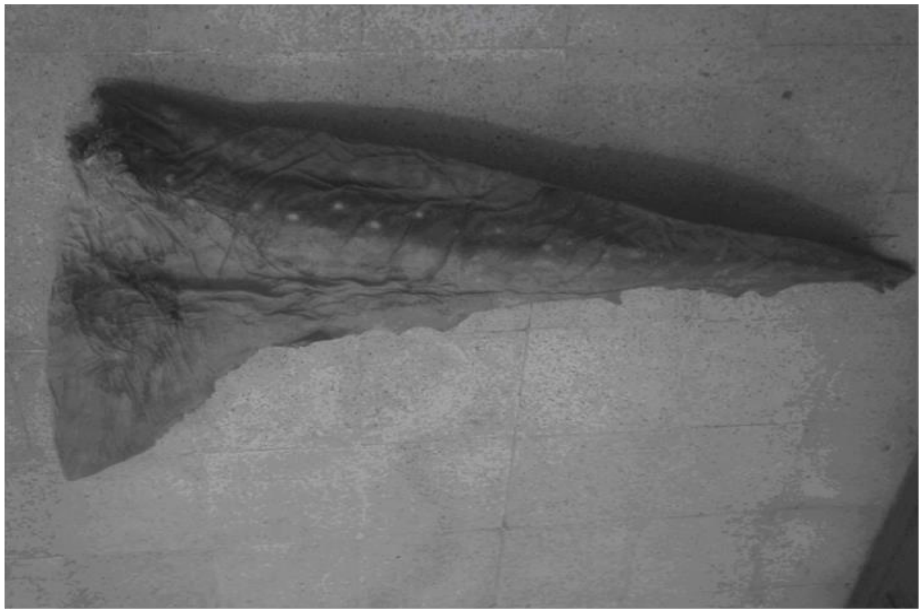

Figure 4. The dorsal fin for whale shark of length 132cm deposited in the department of fisheries and Marine Resources

DISCUSSION

Fishes are considered as one of the water bodies' components and one of the factors of ecological variation (Moyle and Marchetti, 2006). The variation in the shark occurrence variations may lead to a reversal changes in water ecological system that results in extinction of some local species (Newman *et al.* 2002). The invasion of alien species into the local habitat could be as a result of human activities beside the behavior of the species itself. Some alien fish species of some countries could find their way to neighboring countries as a result of sharing common water basins (Kemp, 1999). Gupta and Gupta, (2008) found that *Rhincodon typus* can reach the length of 15–18m with a pair of ridges in USA marine water .The whale shark has been noticed that some morphometric characteristics of the species caught in Shatt Al-Basrah were found similar to those found for while shark by Wilson *et al.* (2006) reported in Australian water and Duffy, (2002) from North East of Newzeland. In the past years the number of whale shark specimen decreased in USA and Australian sea water due to the inequitable fishing to be used for medical purposes or food.

Holmberg, *et al*. (2009) found the Whale shark's ratio in Northern Australia between first dorsal fin length to total length was 2.4% and it was close to body shark. it may be lost its way due to changes in water quality or searching for food especially this fish feed on planktons, fish and krill which is confirmed by many researchers (Tyler,1994; Colman,1997; Hyman, *et al*. 2001). The whale shark was fished in Babten region in Abu Dhabi with a length of 5m in 2009 Abd Al salam, (2009) and it also was recorded from

Salmia in Kuwait in 2008 (Al krafy,2008). However *Rhincodon typus* might entered Shatt Al-Basrah due to the changes in its behavior as a result of changes in sea temperature or the differences in salinity concentration.(Wilson, 2008) reported a of six specimen whale sharks in Australia where the water temperature was 28ċ and salinity of 40 ppt. It is believed that the whale shark especially the young ones prefers warm waters such as the ones of Arabian Gulf which is considered to be one of the warm areas (Al-Daham,1977).

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تسجيل لسمكة القرش الحوت نوع *Rhincodon typus* smith,1828 في قناة شط البصرة /جنوب العراق

أحمد جاسب الشمري

مركز علوم البحار /جامعة البصرة /العراق

المستخلص

لوحظ سمك القرش الحوت نوع *Rhinocodon typus* smith,1828 لأول مرة في العراق وفي قناة شط البصرة خلال تشرين الأول 2010 ، وتم تصنيفه حيث تم قياس 26 صفة مظهرية له، الطول الكلي للقرش 398 سم. ولأول مرة يسجل دخول هكذا قرش إلى قناة شط البصرة ويعتبر احد أنواع القروش الذي يعود إلى النوع *Rhinocodon typus* من العائلةRhincodontida

الكلمات المفتاحية: القرش الحوت، شط البصرة، العراق

MARSH BULLETIN

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Content

MARSH BLLLETIN

Aims and scope

Marsh Bulletin is a perfect Journal stated by College of Science and Marine Science center, University of Basrah concerned with all aspects of wetlands biology, ecology, hydrology, water chemistry, Geochemistry Biodiversity conservation, Agriculture and Fisheries, Pollution, Natural Resources, Social and Health issues and Tourism.

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