Global Journal of Science Frontier Research: C
Biological Science
Volume 15 Issue 2 Version 1.0 Year 2015
Type : Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-4626 & Print ISSN: 0975-5896

Statistical Analysis of Some Selected Zooplakton Composition Dwelling Two Pan Marine Ecosystems with A Reference to the Abiotic Factors

By Abdullah Bedeer Hussein & Gaber Ahmed Saad
Dammam University, Saudi Arabia

Abstract- Physical and chemical factors of marine ecosystems were measured in Anfoushy and Abu Qir Bay (Mediterranean Sea) Egypt during 2009 & 2010 and Northern and Southern Khobar during 2012 & 2013 to study their effect on the distribution of the zooplankton densities. Seasonal variations of water transparency (Secchi disc reading in cm) ; water temperature (°C) ; total dissolved solids (mg/l) ; total alkalinity (mg/l) ; total hardness (mg/l) ; salinity (g/l) ; chlorides (mg/l) ; total Nitrogen (mg/l) and Tributyl tin (μgg-1) were measured. Samples of the four pan marine beaches were taken at each site, using screw top polypropylene bottles of 1000 ml. capacity. The bottles were transported filled with distilled water and washed out and refilled with sea water at each site. Closing the bottles have been done underneath the water surface so as to make sure that they were completely full. These samples were returned to the laboratory and analyzed within twenty-four hours.

Keywords: water transparency; water temperature; total dissolved solids; total alkalinity; total hardness; salinity; chlorides; total nitrogen; tributyl tin; relative densities; zooplankton.

GJSFR-C Classification : *FOR Code: 060899*

STATISTICALANALYSISOFSOMESELECTEDZOOPLAKTONCOMPOSITIONDWELLINGTWOPANMARINEECOSYSTEMSWITHAREFERENCETOTHEABIOTICFACTORS

Strictly as per the compliance and regulations of :

Open Association of Research Society, USA
Research | Diversity | Ethics

© 2015. Abdullah Bedeer Hussein & Gaber Ahmed Saad. This is a research/review paper, distributed under the terms of the Creative Commons Attribution-Noncommercial 3.0 Unported License http://creativecommons.org/licenses/by-nc/3.0/), permitting all non commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Statistical Analysis of Some Selected Zooplakton Composition Dwelling Two Pan Marine Ecosystems with A Reference to the Abiotic Factors

Abdullah Bedeer Hussein [α] & Gaber Ahmed Saad [σ]

Abstract- Physical and chemical factors of marine ecosystems were measured in Anfoushy and Abu Qir Bay (Mediterranean Sea) Egypt during 2009 & 2010 and Northern and Southern Khobar during 2012 & 2013 to study their effect on the distribution of the zooplankton densities. Seasonal variations of water transparency (Secchi disc reading in cm) ; water temperature (°C) ; total dissolved solids (mg/l) ; total alkalinity (mg/l) ; total hardness (mg/l) ; salinity (g/l) ; chlorides (mg/l) ; total Nitrogen (mg/l) and Tributyl tin (μgg-1) were measured. Samples of the four pan marine beaches were taken at each site, using screw top polypropylene bottles of 1000 ml. capacity. The bottles were transported filled with distilled water and washed out and refilled with sea water at each site. Closing the bottles have been done underneath the water surface so as to make sure that they were completely full. These samples were returned to the laboratory and analyzed within twenty-four hours. The present study provided information about the seasonal abundance of major groups of zooplankton namely, Bryozoa, Cnidaria, Rotifera, Nematoda, Annelida, Amphipoda, Copepoda, Isopoda, crustaceanlarvae, Scaphopoda, Bivalvia, molluscan-larvae, and ascidian larvae. All zooplankton studied were previously described and identified (see Saad, 2015).The seasonal fluctuations in the abiotic factors and the distribution of relative densities of zooplankton collected from Anfoushy and Abu Qir Bay (Mediterranean Sea) Egypt & Northern and SouthernKhobar of the Arabian Gulf – Saudi Arabia have been statistically analyzed. One-way analysis of variance (ANOVA) at P<0.0001, Bartlett's test for equal variances, Tukey's Multiple Comparison Test, Dunnett's Multiple Comparison Test and Newman-Keuls Multiple Comparison Test at P > 0.05 and P < 0.001 were applied. This study concluded that all abiotic facors of Mediterranean Sea, Egypt are suitable for dwelling of zooplankton than those present in the Arabian Gulf, Saudi Arabia.

The zooplankton densities in the four pan marine ecosystems all study periods were Anfoushy >Abu Qir >Northern Khobar >Southern Khobar.

Author α: Department of Biology, College of Medicine, Dammam University, Saudi Arabia, KSA, Department of Zoology, Faculty of Science, Mansoura University, Mansoura, Egypt.
Author σ: Department of Zoology, Faculty of Science, Alexandria University, Alexandria, Egypt, Department of Biology, College of Medicine, Dammam University, Saudi Arabia, KSA.
e-mail: ahussein@uod.edu.sa

Keywords: water transparency; water temperature; total dissolved solids; total alkalinity; total hardness; salinity; chlorides; total nitrogen; tributyl tin; relative densities; zooplankton.

I. Introduction

Planktonic fauna referred to as nektons arefeebly floating microscopic organisms in aquatic habitats. The majority of these groups areentirely planktonic throughout their lifetimeespecially those that belong to the annelids, rotifers, nematodes, crustaceansand echinoderms (Yakub, 2004; Ayodele and Adeniyi,2006; Okogwu and Ugwumba, 2006; Lawal-Are etal., 2010). Planktonic fauna referred to as benthos are bottom- dwellers through- out their lifetime especially those that belong to hydrozoans, anthozoans, gastropods, bivalvians and adult stage of ascidians. Meanwhile, many higher aquatic invertebrateshave developmental stages that are planktonic. Theseinclude the eggs, larvae and other developmentalstages such as shrimps, crabs,oyster, echinoderms and ascidians. Thesedevelopmental life stages are often collected whensamples of zooplankton are taken from the naturalmarine or marinewater bodies (Lawal-Are et al., 2010).

Physico-chemical parameters and quantity of nutrients in water play a significant role in the distributional patterns and species composition of plankton (Scasso, et al. 2001;FAO, 2006; Okogwu 2010). In aquatic habitats, the environmental factors include various physical properties of water such as solubility of gases and solids, the penetration of light, temperature, and density. The chemical factors such as salinity, pH, hardness, phosphates and nitrates are very important for growth and density of zooplankton and some higher consumer depend on their existence. The term “Water quality” refers for the physical, chemical and biological parameters of water and all these characteristics directly or indirectly influences the survival and production of aquaculture species (Boyd, 1998; Boyd and Tucker,1998). The Seasonal variation in the ecological parameters exerts a profound effect on

© 2015 Global Journals Inc. (US)

the distribution and population density of zooplankton (Odum, et al. 1971). A combination of light, temperature, oxygen and other abiotic variables, food resources, competition and predation affectsthe seasonal faunal composition of zooplankton. Many reviews emphasized this vital distribution of zooplankton in other ecosystems (not our study localities), Chakrabarty et al., (1959); Edmondson (1959); Nasar (1977); Rajapaska and Fernando (1982);;Dumont and Van De Velde (1977);Stich & Lampert, 1981; Sharma (1983); Sladecek (1983); Patil and Gouder (1985); Hudec (1987);Rao et. al, (1994); Primicerio & Klemetsen, 1999; Primicerio, 2000; Nogueira (2001);Nagdali &Gupta (2002); Sampaio et al. (2002); Kehayias et al., 2004; Kessler & Lampert, 2004; Arora and Mehra (2003a); Arora and Mehra (2003b); Ugale et al., (2005); Sreelatha (2007);Jyoti, et al. 2009 ; Larson, et al. 2009;Doulka & Kehayias, 2011; Ikbel, et al. 2012). Seasonal stratification is considered to be the primary factor affecting zooplankton species composition and biomass succession (Ortega-Mayagoitia et al., 2000; Ringelberg, 2010).

Studies on plankton distribution and hydrography attracted the interest of many authors (Panikkar and Rao, 1973; Nair et al 1978; Rao 1979; Qasim 1977 &1982; Dejen et al., 2004). Nektonic zooplankton are micronekton (size range, 0.02-l cm) as larvae of nematods, annelids, crustaceans, molluscs & echinoderms and macronekton (size range, 2-10 cm) like fishes (Ahmad and Ashok, 2013). Nekton are those organisms that have developed powers of locomotion so that they are not at the mercy of prevailing sea currents or wind-induced water motion. Pelagic nekton usually have stream-lined shapes that make their propulsive efforts more effective. Most nekton are specialized invertebrates evolved the ability to swim (and hunt) actively in the water column as cephalopods (squids, octopus, cuttlefish, nautilus) and arthropods (shrimp, prawns, some crabs). Mesopelagic nekton seldom exceed 10 cm, have large light-sensitive eyes, uniformly black photophores and provided with light-producing organs. Abyssal pelagic have species-specific pattern of photophores, small with flabby, soft, nearly transparent flesh supported by weak exoskeleton. Benthic invertebrate populations are important factors and frequently used to evaluate overall ecosystem health (Flint, 1979; Rosenberg & Resh. 1993; Reynoldson el al., 1995) because these communities are important to material cycling and secondary production, moreover, they are sensitive to environmental contaminants. Benthic fauna feed mostly upon detritus including sedimentary phytopJankton and zooplankton organisms. The bottom fauna, in turn, furnishes a direct food supply for some aquatic organisms including fish. Populations of the benthic organisms attain marked fluctuations at both spatial and temporal scales in relation to changes in the physical and chemical factors of water (Cyrus & Wepener, 1993; Reynoldson et aL, 1995; Dermott & Kerec, 1997; Palmer & Poff, 1997; Vivier & Cyrus, 1999; Breneman el al, 2000; Nalepa el ai, 2000; Bass & Potts, 2001; Dermott, 2001) and/or biotic interactions such as predation and competitive exclusion (Gómez-Gutiérrez, el al. 1995 & 1996 ; Guimarães,et et. 2009).Benthic meiofauna and macrofauna exhibit similar patterns across the seasons and these patterns are in part related to plankton dynamics in the overlying water column. The signature seasonal pattern is one of increased abundance and biomass (Grassle et al., 1985; Rudnick et al., 1985). It is likely that the increase in biomass and abundance in spring is primarily a response to the deposition and accumulation of organic matter from the winter-spring phytoplankton bloom (zooplankton predation during this time is largely minimal due to cold water temperatures). However, Rudnick et al. (1985) suggested that rapidly increasing sediment temperatures during this time (from 2˚C to approximately 13˚C by May) may also strongly affect benthic communities. It is also possible that the seasonal dynamics of Narragansett Bay benthic communities are affected by other factors (predation) (Frithsen, 1989), and ultimately these temporal patterns are probably affected by multiple factors working in concert.

Zooplankton play a key role in the ecosystem structure due to their quick response to abiotic conditions, especially in impacted marine or marine habitats (Levinton 1995; Neumann-Leitão et al. 1999). Little is known about the seasonal faunal composition of zooplankton in marine habitats of Abu Qir Bay, Egypt or the Arabain Gulf, Saudi Arabia. The primary aim of this study was to make a general ecological survey of the invertebrate fauna (nektonic and benthic zooplankton). The secondary aim was to investigate the differences in the invertebrates distribution along the Abu Qir Bay and Anfoushy, Egypt and the Arabain Gulf, Saudi Arabia, the effect of the chemical and physical properties of the water on the distribution of the zooplankton, the seasonal qualitative and quantitative changes in the zooplankton of each study locality, to compare zooplankton of the Abu Qir Bay and Anfoushy, Egypt with those of the Arabain Gulf, Saudi Arabia. Observations of this study were made on temporal variations in richness, community similarities, abundance, species diversity, dominance and evenness of zooplankton in the four study localities.

II. Materials and Methods

a) Physical and Chemical Factors

The following physical and chemical factors were measured in the fourpan marinesites (according to Hofmann, 1977; Abbasi, 1998; Boyd, 1998)to study their effect on the distribution of the zooplankton .

© 2015 Global Journals Inc. (US)

Seasonal variations of transparency (Secchi disc reading in cm); water temperature (°C); total dissolved solids (mg/l); total alkalinity (mg/l); total hardness (mg/l); salinity (g/l); chlorides (mg/l); total Nitrogen (mg/l) and Tributyl tin (µgg-1). Samples of the four panmarine beaches were taken at each site, using screwtop polypropylene bottles of 1000 ml. capacity. The bottles weretransported filled with distilled water and washed out and refilledwith Sea water at each site. Closing the bottles have been doneunderneath the water surface so as to make sure they were completely full.These samples were returned to the laboratory and analyzed withintwenty-four hours.

Water transparency or light penetration in water was measured with Secchi disc. It was dipped into the water on a calibrated line until it disappeared. The depth at which it disappeared and also the depth at which it reappeared when rose was recorded. The average of these two readings is called Secchi disc reading.Secchi disc reading (cm) = (A + B) / 2 where A = Depth at which Secchi disc disappears ; B = Depth at which Secchi disc reappears and 2 = standard value of equation.

Temperature (°C) of water was measured by dipping a mercury thermometer and recorded during sampling period.

Total dissolved solids (TDS), TBT and salinity were measured with WTW 320 conductivity meter. Water samples were placed into clean beakers, conductance cell of the meter was immersed into sample solution. The resistance was measured in µs/cm or mS/cm, depending upon the concentration of salts in sample, similarly the readings of salinity and total dissolved solids were noted with the conductivity meter by changing mode of measurement to salinity and TDS. The cell was rinsed in a beaker with distilled water after each reading. The calibration measurement was performed in 0.00702 NKCl solutions. This solution has a specific conductance of 100 µmhose at 25 °C.

Determination of Alkalinity has been carried out as follows: Hydrochloric acid (HCl) 0.01 N was prepared by adding 9.0 ml of 36% HCl in 1.0 liter of distilled water in volumetric flask. Two indicators, methyl orange and phenolphthalein were used. Methyl orange was prepared by dissolving of 0.5 g of Methyl orange in 50 g of d.d water. 0.5 g of phenolphthalein in 50 ml of 95% ethyl alcohol and 50 ml water. Dilute sodium hydroxide (NaOH) was added drop wise until faint color appeared. Sample (10 ml) was taken with the help of pipette in the conical flask, 4-5 drops of phenolphthalein indicator was added, if the colour developed pink, the sample was titrated with 0.01N hydrochloric acid, until the colour disappeared. The volume consumed was noted and was labeled as p- alkalinity. In same sample 2-3 drops of methyl orange indicator solution was added. The titration was continued until end point with change of colour from orange to brick red. The volume consumed was noted and amount mg/l was calculated as m-alkalinity.

Alkalinity (mg/l) = (N × M × 50,000) / V Where: N = Normality ; M = Mean ; V =Volume of sample and 50,000 = Standard value of equation.

Determination of Hardnesshas been carried out as follows: 0.372 g of ethylenediaminetetra-acetic acid disodium salt (EDTA) was dissolved in 100 ml of distilled water (0.1 N) and was used as a titrant. Buffer solution was prepared by dissolving 16.9g of ammonium chloride in 143 ml in volumetric flask. 1.179 g of magnesium carbonate, 12.6 H_2O in 50 ml d.d. water. These two reagents were mixed to make 250 ml as a final volume of buffer solution, Erichrome black-T, the indicator was used in the form of tablets. Sample (10 ml) was taken in to conical flask with the help of pipette, 0.5 mg of buffer tablet (Erichrome black-T) and 1 ml of conc. ammonium hydroxide (NH_4OH) was added as indicator and then titrated with 0.1N (EDTA) solution at the end point the colour turned from red to green then the reading was noted from burette.

Hardness (mg/l) = (N × M × 50,000) / V Where: N = Normality of titrant 0.1 N ; M = Mean of three readings ; V = Volume of sample and 50,000 = standard value of equation.

Determination of Chlorides has been carried out as follows: Silver nitrate $AgNO_3$ (E-Merck) solution of 0.1 N was used as a titrant and was prepared by dissolving 1.6987g of Ag NO_3 in 100 ml of d.d water and potassium chromate (5% K_2CrO_4 in water) was used as indicator. Sample (10 ml) was taken in conical flask and 2-3 drops of potassium chromate solution added. It was titrated with 0.1N $AgNO_3$ till the colour change from yellow to brick red, the reading was noted from burette.

Chloride (mg/l) = (N × M × 35450) / V Where: N = Normality of titrant (0.1 N) ; M = Mean of three readings ; V = Volume of sample ml and 35450 = Standard value of equation.

Determination of total Nitrogen has been carried out using Kjeldhal method. For total nitrogen determination, the solutions were prepared by diluting 50g of NaOH in 100 ml d.d. water (50% NaOH), 10g copper sulphate ($CuSO_4$) in 100ml d.d water (10% $CuSO_4$) and boric acid (H_3BO_3) solution by adding 01 ml of mixed indicator solution. In 10 ml sample, 4ml conc. H_2SO_4 and 0.4 ml $CuSO_4$ was added. The mixture was kept on flame and when it boiled, the flame was turned off to allow the sample to cool. The sample was transferred to the Kjeldhal flask and was diluted by adding the same quantity of d.d water into the flask. The sample was made alkaline by adding 2-3 drops of phenolphthalein and 50% NaOH to turn colour of the sample in to pink. Indicator H_3BO_3 25 ml was taken in 100 ml conical flask. When sample was collected in indicator solution, then was titrated with H_2SO_4 (0.01N)

© 2015 Global Journals Inc. (US)

solution, finally the color turned from green to red and reading was recorded from burret.

Total Nitrogen mg/l = (A-B × 2.80) / V Where: A= Volume of titrant consumed in sample ; B= Volume of titrant consumed in blank ; V= Volume of sample and 2.80 = Standard value of equation.

b) *Animals*

Zooplankton were collected from two pan marine ecosystems. During (2009 - 2010) planktons were collected monthly from Anfoushy and Abu Qir Bay (Mediterranean Sea) Egypt. During 2012 – 2013 planktons were collected from the Northernand SouthernKhobar, Arabian Gulf – Saudi Arabia. All planktons were transported alive in plastic aquaria containing well aerated sea water to the laboratory and placed in large glass aquaria containing well aerated sea water. Randomly selected adults of planktonic communities were dissected in sea water. Ascidian larvaehave been washed and then grown at 20°C (Hofmann,*et al.* 2008 ; Saad, 2002). Zooplankton were then described and prepared for photomacroscopy or / and SEM study.

c) *Methods of collection*

The zooplankton collection involves primarily the filtration of water by net, collecting the water in bottles/ water samplers or by pumps. The sampling success would largely depend on the selection of a suitable gear; mesh size of netting material, time of collection, water depth of the study area and sampling strategy. The gear used keeping in view the objectives of the investigation (see Sameoto, et al. 2000, Dhargalkar and Verlecar, 2004, Paturej and Gutkowska, 2014 for review). There are three main methods of zooplankton collection used, which are as follows:

d) *Bottles / water samplers*

This method was used mainly for collecting smaller forms or micro zooplankton. The water is collected at the sampling site in bottles or water samplers of 5 to 20 litre capacity. The sterile bottles should be preferred. Surface water can be collected by scooping water into the bottle of suitable size. While collecting the water samples, there should be minimum disturbance of water to prevent avoidance reaction by plankton. The water samplers with closing mechanisms are commonly used for obtaining samples from the desired depths. The micro zooplankton are then concentrated by allowing them to settle, centrifuging or fine filtration. The advantage of this method was that it is easy to operate and sampling depths are accurately known. The disadvantage is that the amount of water filtered is less. The macro zooplankton and rare forms are usually not collected by this method and so it is unsuitable for qualitative and quantitative estimations.

e) *Pumps*

The gear is normally used on board the vessel/boat. The sampling can also be carried out from a pier. In this method, the inlet pipe is lowered into the water and the outlet pipe is connected to a net of suitable mesh size. The net is particularly submerged in a tank of a known volume. This prevents damage to the organisms. The zooplankton is filtered through the net. A meter scale on the pump records the volume of water filtered. This method was used for quantitative estimation and to study the small scale distribution of plankton. The frictional resistance of the sampled water in the hose can cause turbulence; damaging the larger plankton especially the gelatinous forms, ctenophores and siphonophores etc. The advantage of the method is that the volume of the water pumped is known. Again the continuous sampling is possible. However, the sampling depth is limited to a few meters and it is difficult to obtain samples from deeper layers.

f) *Nets*

The most common method of zooplankton collection is by a net. The amount of water filtered is more and the gear is suitable both for qualitative and quantitative studies. The plankton nets used are of various sizes and types. The different nets can broadly be put into two categories, the open type used mainly for horizontal and oblique hauls and the closed nets with messengers for collecting vertical samples from desired depths. Despite minor variations, the plankton net is conical in shape and consists of ring (rigid/flexible and round/square), the filtering cone and the collecting bucket for collection of organisms. The collecting bucket should be strong and easy to remove from the net. The netting of the filtering cone is made of bolting silk, nylon or other synthetic material. The material should be durable with accurate and fixed pore size. The mesh should be square and aperture uniform. The mesh size of the netting material would influence the type of zooplankton collected by a net. The nets with finer mesh would capture smaller organisms, larval stages and eggs of planktonic forms while those with coarse netting material are used for collecting bigger plankton and larvae. Sometimes combinations of nets with mesh of different pore sizes weree used. There is a great variety of mesh available from the finest to the coarse pore sizes.

g) *Macroscopic observation*

Plaktons were prepared for both macroscopic techniques or / and scanning electron microscopy. They were fixed for 24 hr in buffered 2.5% glutaraldehyde and post fixed for 30 min. in 1% osmium tetroxide. Washing was two times in 0.1 M phosphate buffer, followed by four times in 0.4 M glycerol and two times in PPTA (15 min.). Specimens with hard exoskeleton were washed many times in distilled water and subjected to dilute

© 2015 Global Journals Inc. (US)

nitric acid for decalcification of exoskeleton or the cuticle. Specimens were fixed in neutral 10 % formalin or Bouin. Then washed in distilled water for 24 hrs, dehydration through ascending series of ethyl alcohol, alternated by another dehydration series of tertiary butyl alcohol (used as a softening agent). All zooplankton were stained with Evans stain or Nile blue or Borax carmine to observe its internal structures since they are mostly transparent. Samples were placed on glass slides with embedding mixture of PBS / glycerol / DABCO. Others were dissected with microneedles and incised longitudinally to ease its identification. Immediate viewing and photographing were performed under an Axiomicroscope (ZEISS-Axiophot). The description of almost all zooplankton was carried out on live stages under Axiomicroscope since they are minute, microscopic and transparent. Evan Blue stain was added to the live stages and described alive while movement. The photos did not clarify all described structures.

h) Scanning electron microscopy (SEM)

Samples of larvae were dried by means of the critical point method, mounted using carbon paste on an Al-stub and coated with gold up to a thickness of 400 Å in a sputter-coating unit (JFC-1100E). Observations of larvae morphology in the coded specimens were performed in a Jeol JSM-5300 scanning electron microscope operated between 15 and 20 KeV.

i) Statistical analysis

Analysis of variance (ANOVA) is a broad group of techniques for identifying and measuring different sources of variation within the data set. It consists of a set of procedures by which a variance of the random variable is broken down by certain sources of variation of its value. With the components of variance, depending on the sources, one can conclude if there is a significant difference between the values of dependent variable for different levels of the observed factor variables. In the present study, a one-way analysis of variance is used to compare each abiotic factor and each zooplankton density in the four study areas seasonally which have different levels of one variable.

If the above-mentioned assumptions for ANOVA are not met, the Turkey`s Multiple Comparison Test, Bartlett's test for equal variances and Dunnett's Multiple Comparison Test were used for determining whether three or more independent samples originate give a clear cut differences. When this test leads to significant results, at 1 North one sample differs from the others. A principal component analysis is a standard tool in modern data analysis. It is a simple, nonparametric method for extracting relevant information out of confusing data sets. Principal component analysis is concerned with the interpretation of the variance and covariance structure of the original set of variables through a small number of their linear combinations. The general objectives of principal component analysis are data reduction and interpretation. In order to reduce the number of variables. For more details about methodology of calibrations. However, One-way analysis of variance (ANOVA) at $P<0.0001$, Bartlett's test for equal variances, Tukey's Multiple Comparison Test, Dunnett's Multiple Comparison Test and Newman-Keuls Multiple Comparison Test at $P > 0.05$ and $P < 0.001$ were applied. see (Dijana, et al.2012 for review).

III. Results

In order to define particular pan marine fauna of zooplankton, it is important to analyze accurately as many physical and chemical characteristics of water as possible before preceding the biological studies. The measurements of these characteristics provide valuable information about the marine habitat. Some of the important Physicochemical factors of pan marine habitats have been analyzed:

a) Water transparency

During 2009 – 2010 (Anfoushy & Abu Qir, Egypt)and 2012-2013 (North Khobar & South Khobar, Saudi Arabia) the transparency values of marine water are given in (Tables1-4 ; Histograms 1 & 2) for pan marine habitats in different seasons of the year. Low transparency of water during 2012 was found in North Khobar during the months of February- May (17-20 cm).Tukey's Multiple Comparison Test showed the loSouthern Mean Dif between South Khobar vs Abu Qir at$P < 0.001$during 2009 & 2012. During 2010 & 2013 the loSouthern Mean Dif between North Khobar vs Abu Qir at $P < 0.01$.

The highest value of water transparency was observed during April-May in Abu Qir (173-191 cm)in 2009 and (120 cm) during October 2010.

Tukey's Multiple Comparison Test showed the highest Mean Dif between North Khobar and South Khobar -10,17 at $P > 0.05$ during 2012 andDunnett's Multiple Comparison Test showed -5,083 at $P > 0.05$ during 2013 for the same two marine localities.

Tables 1 & 2 : Seasonal variation of water transparency (Secchi disc reading in cm) inthe fourmarine localities during January to December 2009 Egypt and during January to December Saudi Arabia 2012

Months	North Khobar	South Khobar	Anfoushy	Abu Qir
January	45	53	64	91
February	40	45	50	72
March	68	70	85	148

© 2015 Global Journals Inc. (US)

April	71	64	128	191
May	36	68	180	173
June	50	62	85	107
July	30	46	67	83
August	44	53	80	91
September	64	76	100	150
October	39	47	120	128
November	70	79	60	110
December	75	91	105	160

Table 2 Analyzed				
Water transparency 1				
One-way analysis of variance				
P value	P<0.0001			
P value summary	***			
Are means signif. different? (P < 0.05)	Yes			
Number of groups	4			
F	15,76			
R squared	0,518			
Bartlett's test for equal variances				
Bartlett's statistic (corrected)	15,32			
P value	0,0016			
P value summary	**			
Do the variances differ signif. (P < 0.05)	Yes			
ANOVA Table	SS	df	MS	
Treatment (between columns)	38770	3	12920	
Residual (within columns)	36080	44	819,9	
Total	74850	47		
Tukey's Multiple Comparison Test	Mean Diff.	q	P value	95% CI of diff
North Khobar vs South Khobar	-10,17	1,23	P > 0.05	-41.41 to 21.08
North Khobar vs Anfoushy	-41	4,96	P < 0.01	-72.25 to -9.753
North Khobar vs Abu Qir	-72,67	8,791	P < 0.001	-103.9 to -41.42
South Khobar vs Anfoushy	-30,83	3,73	P > 0.05	-62.08 to 0.4134
South Khobar vs Abu Qir	-62,5	7,561	P < 0.001	-93.75 to -31.25
Anfoushy vs Abu Qir	-31,67	3,831	P < 0.05	-62.91 to -0.4199

Tables 3 & 4 : Seasonal variation of water transparency (Secchi disc reading in cm) in the four marine localities during January to December 2010 Egypt and during January to December Saudi Arabia 2013

Months	North Khobar	South Khobar	Anfoushy	Abu Qir
January	22	30	35	60
February	17	25	40	90
March	25	29	65	100
April	15	22	50	60
May	20	28	45	30
June	32	40	55	70
July	25	30	50	65
August	40	55	65	80
September	45	30	70	55
October	28	35	39	120
November	30	40	60	75
December	29	25	40	65

Global Journal of Science Frontier Research (C) Volume XV Issue II Version I Year 2015

© 2015 Global Journals Inc. (US)

Table 4 Analyzed				
Water transparency 2				
One-way analysis of variance				
P value	P<0.0001			
P value summary	***			
Are means signif. different? (P < 0.05)	Yes			
Number of groups	4			
F	24,11			
R squared	0,6218			
Bartlett's test for equal variances				
Bartlett's statistic (corrected)	14,77			
P value	0,002			
P value summary	**			
Do the variances differ signif. (P < 0.05)	Yes			
ANOVA Table	SS	df	MS	
Treatment (between columns)	15140	3	5047	
Residual (within columns)	9210	44	209,3	
Total	24350	47		
Dunnett's Multiple Comparison Test	Mean Diff.	q	P value	95% CI of diff
North Khobar vs South Khobar	-5,083	0,8606	P > 0.05	-19.46 to 9.293
North Khobar vs Anfoushy	-23,83	4,035	P < 0.01	-38.21 to -9.457
North Khobar vs Abu Qir	-45,17	7,647	P < 0.01	-59.54 to -30.79

b) Temperature

The water Temperature values are given in (Tables 5 & 8 ; Histograms 3 & 4) for pan marine habitats in different Seasons of the year. Low water Temperature of water during 2012 was found in Abu Qir during the months of December - January (8-9 °C). Dunnett's Multiple Comparison Test showed the loSouthern Mean Dif between North Khobar vs South Khobar -3 at P > 0.05 during 2012. During 2013 the loSouthern Mean Dif between North Khobar and South Khobar -4,083at P > 0.05.

The highest value of water Temperature was observed during July-October in South Khobar (38-40°C) in 2012 and (39-45°C) during July-October 2013. Dunnett's Multiple Comparison Test showed the highest Mean Dif between North Khobar and Abu Qir 9,083at P > 0.05 during 2009 & 2012 and 10,83 at P < 0.01during 2010 & 2013 for the same two marine localities.

Tables 5 & 6 : Seasonal variation of water temperature (°C) in the four marine localities during January to December 2009 Egypt and during January to December Saudi Arabia 2012

Months	North Khobar	South Khobar	Anfoushy	Abu Qir
January	13	11	12	9
February	15	19	15	12
March	20	24	19	14
April	24	27	24	20
May	29	31	26	23
June	32	35	28	27
July	34	38	31	31
August	35	40	25	28
September	30	36	22	22
October	36	38	27	12
November	30	33	14	10
December	27	29	11	8

© 2015 Global Journals Inc. (US)

Table 6 Analyzed				
Water temprature 1				
One-way analysis of variance				
P value	0,0018			
P value summary	**			
Are means signif. different? (P < 0.05)	Yes			
Number of groups	4			
F	5,901			
R squared	0,2869			
Bartlett's test for equal variances				
Bartlett's statistic (corrected)	0,6831			
P value	0,8772			
P value summary	ns			
Do the variances differ signif. (P < 0.05)	No			
ANOVA Table	SS	df	MS	
Treatment (between columns)	1086	3	362,1	
Residual (within columns)	2700	44	61,35	
Total	3786	47		
Dunnett's Multiple Comparison Test	Mean Diff.	q	P value	95% CI of diff
North Khobar vs South Khobar	-3	0,9382	P > 0.05	-10.78 to 4.783
North Khobar vs Anfoushy	5,917	1,85	P > 0.05	-1.867 to 13.70
North Khobar vs Abu Qir	9,083	2,841	P < 0.05	1.300 to 16.87

Tables 7 & 8 : Seasonal variation of water transparency (Secchi disc reading in cm) in the four marine localities during January to December 2010 Egypt and during January to December Saudi Arabia 2013

Months	North Khobar	South Khobar	Anfoushy	Abu Qir
January	17	21	13	11
February	20	26	17	13
March	25	30	20	15
April	31	34	26	22
May	33	38	25	26
June	35	40	27	29
July	40	45	30	35
August	36	41	27	30
September	32	37	24	21
October	37	39	21	14
November	33	36	17	12
December	29	30	13	10

Table 8 Analyzed				
Water temprature 2				
One-way analysis of variance				
P value	P<0.0001			
P value summary	***			
Are means signif. different? (P < 0.05)	Yes			
Number of groups	4			

© 2015 Global Journals Inc. (US)

F	12,23			
R squared	0,4548			
Bartlett's test for equal variances				
Bartlett's statistic (corrected)	1,732			
P value	0,6298			
P value summary	ns			
Do the variances differ signif. (P < 0.05)	No			
ANOVA Table	SS	df	MS	
Treatment (between columns)	1836	3	612,1	
Residual (within columns)	2201	44	50,03	
Total	4037	47		
Dunnett's Multiple Comparison Test	Mean Diff.	q	P value	95% CI of diff
North Khobar vs South Khobar	-4,083	1,414	P > 0.05	-11.11 to 2.945
North Khobar vs Anfoushy	9	3,117	P < 0.01	1.972 to 16.03
North Khobar vs Abu Qir	10,83	3,752	P < 0.01	3.805 to 17.86

c) Total Dissolved Solids (TDS)

The Total Dissolved Solids (TDS) values of marine water are given in (Tables 9 & 12 ; Histograms 5 & 6) for pan marine habitats in different seasons of the year. Low Total Dissolved Solids in water during 2012 was found in North Khobar during the months of October - December (1955-2780mg/l). Dunnett's Multiple Comparison Test showed the loSouthern Mean Dif between North Khobar vs South Khobar -4932 at P > 0.05 during 2012. During 2013 the loSouthern Mean Dif between North Khobar and South Khobar -22,17 at P > 0.05.

The highest value of Total Dissolved Solids was observed during November-December in South Khobar (5301-5593mg/l) in 2012 and (5200-6034mg/l) during May-June 2013. Dunnett's Multiple Comparison Test showed the highest Mean Dif between North Khobar vs Anfoushy 1347 at P > 0.05 during 2009 & 2012 and Mean Dif between North Khobar vs Abu Qir 2024at P < 0.01during 2010 & 2013.

Tables 9 & 10 : Seasonal variation of water total dissolved solids (TDS) (mg/l) in the four marine localities during January to December 2009 Egypt and during January to December Saudi Arabia 2012

Months	North Khobar	South Khobar	Anfoushy	Abu Qir
January	2901	4260	2034	2220
February	4410	44774	2052	2498
March	2800	4285	2990	2669
April	3570	4791	2066	2222
May	4491	5074	2032	2221
June	4906	5066	2954	2814
July	3760	4987	1873	1520
August	3100	4976	2064	2999
September	2900	4971	1773	2954
October	1955	5220	1533	1941
November	2540	5301	1188	2152
December	2780	5593	1393	2387

Table 10 Analyzed				
Total dissoved solids1				
One-way analysis of variance				
P value	0,039			
P value summary	*			

© 2015 Global Journals Inc. (US)

Are means signif. different? (P < 0.05)	Yes			
Number of groups	4			
F	3,036			
R squared	0,1715			
Bartlett's test for equal variances				
Bartlett's statistic (corrected)	130,2			
P value	P<0.0001			
P value summary	***			
Do the variances differ signif. (P < 0.05)	Yes			
ANOVA Table	SS	df	MS	
Treatment (between columns)	3,04E+08	3	1,01E+08	
Residual (within columns)	1,47E+09	44	33380000	
Total	1,77E+09	47		
Dunnett's Multiple Comparison Test	Mean Diff.	q	P value	95% CI of diff
North Khobar vs South Khobar	-4932	2,091	P > 0.05	-10670 to 809.3
North Khobar vs Anfoushy	1347	0,5709	P > 0.05	-4395 to 7088
North Khobar vs Abu Qir	959,7	0,4068	P > 0.05	-4782 to 6701

Tables 11 & 12 : Seasonal variation of water total dissolved solids (TDS) (mg/l) in the four marine localities during January to December 2010 Egypt and during January to December Saudi Arabia 2013

Months	North Khobar	South Khobar	Anfoushy	Abu Qir
January	2771	3422	3176	2398
February	3285	3865	2883	2165
March	5832	4033	3223	2054
April	4975	4914	3999	2032
May	5222	5200	3243	2487
June	6243	6034	3041	2398
July	3278	4196	3976	2534
August	4734	4165	2222	2265
September	5039	5021	3086	1554
October	3646	3270	1176	2175
November	3581	3990.0	2237	2796
December	2972	3734	2899	2431

Table 12 Analyzed				
Total dissoved solids 2				
One-way analysis of variance				
P value	P<0.0001			
P value summary	***			
Are means signif. different? (P < 0.05)	Yes			
Number of groups	4			
F	18,24			
R squared	0,5543			

© 2015 Global Journals Inc. (US)

Bartlett's test for equal variances				
Bartlett's statistic (corrected)	14,95			
P value	0,0019			
P value summary	**			
Do the variances differ signif. (P < 0.05)	Yes			
ANOVA Table	SS	df	MS	
Treatment (between columns)	37560000	3	12520000	
Residual (within columns)	30200000	44	686300	
Total	67750000	47		
Dunnett's Multiple Comparison Test	Mean Diff.	q	P value	95% CI of diff
North Khobar vs South Khobar	-22,17	0,06554	P > 0.05	-845.4 to 801.0
North Khobar vs Anfoushy	1368	4,045	P < 0.01	544.9 to 2191
North Khobar vs Abu Qir	2024	5,985	P < 0.01	1201 to 2847

d) *Total Alkalinity*

The Total Alkalinity values of marine water are given in (Tables 13 & 16 ; Histograms 7 & 8) for pan marine habitats in different seasons of the year. Low Total Alkalinity in water during 2009 was found in Abu Qir during the months of March – November (169-133mg/l). Dunnett's Multiple Comparison Test showed the loSouthern Mean Dif between North Khobar and South Khobar -225 at P > 0.05 during 2012. During 2013 the loSouthern Mean Dif between North Khobar and South Khobar -136,2 at P > 0.05.

The highest value of Total Alkalinity was observed during July in North Khobar (494mg/l) in 2012 and (579mg/l) in South Khobar during October 2013. Dunnett's Multiple Comparison Test showed the highest Mean Dif between North Khobar vs Anfoushy 185,3 at P > 0.05 during 2009 & 2012 and 69,42at P < 0.01during 2010 & 2013.

Tables 13 & 14 : Seasonal variation of water total alkalinity (mg/l) in the four marine localities during January to December 2009 Egypt and during January to December Saudi Arabia 2012

Months	North Khobar	South Khobar	Anfoushy	Abu Qir
January	310	434	312	242
February	370	420	232	267
March	429	475	165	169
April	433	387	132	155
May	354	388	152	175
June	382	462	232	201
July	494	430	183	210
August	420	442	265	197
September	340	430	186	270
October	376	455	134	171
November	383	559.0	175	133
December	332	2441	232	278

Table 14 Analyzed				
total alkalinity 1				
One-way analysis of variance				
P value	0,0035			
P value summary	**			
Are means signif. different? (P < 0.05)	Yes			
Number of groups	4			
F	5,247			
R squared	0,2635			

© 2015 Global Journals Inc. (US)

Bartlett's test for equal variances				
Bartlett's statistic (corrected)	95,87			
P value	P<0.0001			
P value summary	***			
Do the variances differ signif. (P < 0.05)	Yes			
ANOVA Table	SS	df	MS	
Treatment (between columns)	1348000	3	449200	
Residual (within columns)	3767000	44	85610	
Total	5115000	47		
Dunnett's Multiple Comparison Test	Mean Diff.	q	P value	95% CI of diff
North Khobar vs South Khobar	-225	1,884	P > 0.05	-515.7 to 65.74
North Khobar vs Anfoushy	185,3	1,551	P > 0.05	-105.5 to 476.0
North Khobar vs Abu Qir	179,6	1,503	P > 0.05	-111.2 to 470.3

Tables 15 & 16 : Seasonal variation of water total alkalinity (mg/l) in the four marine localities during January to December 2010 Egypt and during January to December Saudi Arabia 2013

Months	North Khobar	South Khobar	Anfoushy	Abu Qir
January	374	506	280	340
February	310	537	320	333
March	391	499	349	304
April	362	482	260	265
May	373	489	330	253
June	382	479	275	283
July	360	497	298	320
August	383	488	300	319
September	399	474	280	330
October	364	579	299	297
November	393	495.0	296	340
December	320	520	291	310

Table 16 Analyzed				
total Alkalinity 2				
One-way analysis of variance				
P value	P<0.0001			
P value summary	***			
Are means signif. different? (P < 0.05)	Yes			
Number of groups	4			
F	140			
R squared	0,9052			
Bartlett's test for equal variances				
Bartlett's statistic (corrected)	0,3564			
P value	0,9491			
P value summary	ns			
Do the variances differ signif. (P < 0.05)	No			

© 2015 Global Journals Inc. (US)

ANOVA Table	SS	df	MS	
Treatment (between columns)	323000	3	107700	
Residual (within columns)	33850	44	769,2	
Total	356900	47		
Dunnett's Multiple Comparison Test	Mean Diff.	q	P value	95% CI of diff
North Khobar vs South Khobar	-136,2	12,03	P < 0.01	-163.7 to -108.6
North Khobar vs Anfoushy	69,42	6,131	P < 0.01	41.86 to 96.98
North Khobar vs Abu Qir	59,75	5,277	P < 0.01	32.19 to 87.31

e) *Total Hardness*

The Total Hardness values of marine water are given in (Tables 17 & 20 ; Histograms 9 & 10) for pan marine habitats in different seasons of the year. Low Total Hardness in water during 2009 was found in Anfoushy during the months of April, June – July and September (210-220 mg/l). Dunnett's Multiple Comparison Test showed the loSouthern Mean Dif between North Khobar and South Khobar -297 at P > 0.05 during 2012. During 2013 the loSouthern Mean Dif between North Khobar and South Khobar -422,6 at P > 0.05.

The highest value of Total Hardness was observed during March-April in South Khobar (980-985mg/l) in 2012 and (940 mg/l) during May 2013. Dunnett's Multiple Comparison Test showed the highest Mean Dif between North Khobar vs Anfoushy 411,9 at P > 0.01 during 2009 & 2012 and 212,9 at P < 0.01during 2010 & 2013.

Tables 17 & 18 : Seasonal variation of total hardness (mg/l) in the four marine localities during January to December 2009 Egypt and during January to December Saudi Arabia 2012

Months	North Khobar	South Khobar	Anfoushy	Abu Qir
January	630	925	295	430
February	670	945	235	499
March	635	985	220	420
April	685	980	210	470
May	620	935	240	490
June	695	955	210	400
July	676	976	220	490
August	692	982	232	440
September	682	936	210	450
October	570	910	260	470
November	630	890.0	240	490
December	580	910	250	480

Table 18 Analyzed				
total hardness 1				
One-way analysis of variance				
P value	P<0.0001			
P value summary	***			
Are means signif. different? (P < 0.05)	Yes			
Number of groups	4			
F	940,2			
R squared	0,9846			
Bartlett's test for equal variances				
Bartlett's statistic (corrected)	3,108			
P value	0,3752			
P value summary	ns			

© 2015 Global Journals Inc. (US)

Do the variances differ signif. (P < 0.05)	No			
ANOVA Table	SS	df	MS	
Treatment (between columns)	3230000	3	1077000	
Residual (within columns)	50390	44	1145	
Total	3281000	47		
Dunnett's Multiple Comparison Test	Mean Diff.	q	P value	95% CI of diff
North Khobar vs South Khobar	-297	21,5	P < 0.01	-330.6 to -263.4
North Khobar vs Anfoushy	411,9	29,81	P < 0.01	378.3 to 445.5
North Khobar vs Abu Qir	183	13,25	P < 0.01	149.4 to 216.6

Tables 19 & 20 : Seasonal variation of total hardness (mg/l) in the four marine localities during January to December 2010 Egypt and during January to December Saudi Arabia 2013

Months	North Khobar	South Khobar	Anfoushy	Abu Qir
January	590	900	298	450
February	520	930	240	430
March	500	890	290	420
April	480	910	257	400
May	440	940	340	470
June	450	985	330	440
July	490	975	270	530
August	560	886	240	450
September	440	956	300	510
October	420	889	250	490
November	500	880	260	450
December	480	800	240	530

Table 20 Analyzed				
total hardness 2				
One-way analysis of variance				
P value	P<0.0001			
P value summary	***			
Are means signif. different? (P < 0.05)	Yes			
Number of groups	4			
F	428,1			
R squared	0,9669			
Bartlett's test for equal variances				
Bartlett's statistic (corrected)	1,748			
P value	0,6263			
P value summary	ns			
Do the variances differ signif. (P < 0.05)	No			
ANOVA Table	SS	df	MS	
Treatment (between columns)	2592000	3	864000	
Residual (within columns)	88810	44	2018	
Total	2681000	47		

© 2015 Global Journals Inc. (US)

Dunnett's Multiple Comparison Test	Mean Diff.	q	P value	95% CI of diff
North Khobar vs South Khobar	-422,6	23,04	P < 0.01	-467.2 to -377.9
North Khobar vs Anfoushy	212,9	11,61	P < 0.01	168.3 to 257.6
North Khobar vs Abu Qir	25	1,363	P > 0.05	-19.64 to 69.64

f) Salinity

The Salinity values of marine water are given in (Tables 21 & 24 ; Histograms 11 & 12) for pan marine habitats in different seasons of the year. Low Salinity in water during 2009 was found in Anfoushy during the months of January and May– October (2,1-2,7 g/l). Dunnett's Multiple Comparison Test showed the IoSouthern Mean Dif between North Khobar and South Khobar -2,758 at P > 0.01 during 2012. During 2013 the IoSouthern Mean Dif between North Khobar and South Khobar -3,575 at P > 0.05.

The highest value of Salinity was observed during almost all months in South Khobar (7,3- 7,9 g/l) in 2012 and (7.9 – 9,1 mg/l) during 2013. Dunnett's Multiple Comparison Test showed the highest Mean Dif between North Khobar vs Anfoushy 1,575 at P > 0.01 during 2009 & 2012 and 1,433 at P < 0.01during 2010 & 2013.

Tables 21 & 22 : Seasonal variation of Salinity (g/l) in the four marine localities during January to December 2009 Egypt and during January to December Saudi Arabia 2012

Months	North Khobar	South Khobar	Anfoushy	Abu Qir
January	4,1	7,9	2,1	3,9
February	4,7	7,5	3,7	3,6
March	5,1	7,4	3,9	3,6
April	5,9	7,8	3,5	3,7
May	5,5	7,5	2,4	3,2
June	5,3	6,9	3,3	3,7
July	3,7	7,3	2,9	3,8
August	4,4	7,9	2,4	3,2
September	5,8	6,8	2,8	3,1
October	4,1	6,5	2,7	3,3
November	3,7	7.90	3,8	2,8
December	3,8	7,8	3,7	2,4

Table 22 Analyzed				
Salinity1				
One-way analysis of variance				
P value	P<0.0001			
P value summary	***			
Are means signif. different? (P < 0.05)	Yes			
Number of groups	4			
F	126,5			
R squared	0,8961			
Bartlett's test for equal variances				
Bartlett's statistic (corrected)	5,12			
P value	0,1633			
P value summary	ns			
Do the variances differ signif. (P < 0.05)	No			
ANOVA Table	SS	df	MS	
Treatment (between columns)	141,8	3	47,27	
Residual (within columns)	16,44	44	0,3736	
Total	158,3	47		

© 2015 Global Journals Inc. (US)

Dunnett's Multiple Comparison Test	Mean Diff.	q	P value	95% CI of diff
North Khobar vs South Khobar	-2,758	11,05	P < 0.01	-3.366 to -2.151
North Khobar vs Anfoushy	1,575	6,312	P < 0.01	0.9676 to 2.182
North Khobar vs Abu Qir	1,317	5,277	P < 0.01	0.7093 to 1.924

Tables 23 & 24 : Seasonal variation of Salinity (g/l) in the four marine localities during January to December 2010 Egypt and during January to December Saudi Arabia 2013

Months	North Khobar	South Khobar	Anfoushy	Abu Qir
January	2,9	7,9	3,5	4,8
February	3,3	7,4	3,7	4,9
March	6,8	6,6	3,3	4,6
April	5,1	7,2	3,8	3,9
May	5,5	7,8	3,4	4,7
June	6,2	8,7	3,7	4,8
July	3,5	8,5	2,9	3,8
August	4,9	9,1	2,4	3,2
September	5,8	9,6	2,3	4,1
October	3,2	8,2	2,6	4,9
November	3,7	8.70	3,8	4,4
December	3,8	7,9	2,1	4,7

Table 24 Analyzed				
Salinity2				
One-way analysis of variance				
P value	P<0.0001			
P value summary	***			
Are means signif. different? (P < 0.05)	Yes			
Number of groups	4			
F	70,59			
R squared	0,828			
Bartlett's test for equal variances				
Bartlett's statistic (corrected)	10,36			
P value	0,0157			
P value summary	*			
Do the variances differ signif. (P < 0.05)	Yes			
ANOVA Table	SS	df	MS	
Treatment (between columns)	166,5	3	55,51	
Residual (within columns)	34,6	44	0,7863	
Total	201,1	47		
Dunnett's Multiple Comparison Test	Mean Diff.	q	P value	95% CI of diff
North Khobar vs South Khobar	-3,575	9,875	P < 0.01	-4.456 to -2.694
North Khobar vs Anfoushy	1,433	3,959	P < 0.01	0.5522 to 2.314
North Khobar vs Abu Qir	0,1583	0,4374	P > 0.05	-0.7228 to 1.039

© 2015 Global Journals Inc. (US)

g) Chlorides

The Chlorides values of marine water are given in (Tables 25 & 28 ; Histograms 13& 14) for pan marine habitats in different seasons of the year. Low Chlorides in water during 2009 was found in Abu Qir during the months of August - November (630-880 mg/l). Dunnett's Multiple Comparison Test showed the loSouthern Mean Dif between North Khobar and South Khobar -1269 at P > 0.01 during 2012. During 2013 the loSouthern Mean Dif between North Khobar and South Khobar -1379 at P > 0.05.

The highest value of Chlorides was observed during almost all months in South Khobar (2350- 2680 mg/l) in 2012 and (2310 – 2660 mg/l) during 2013. Dunnett's Multiple Comparison Test showed the highest Mean Dif between North Khobar vs Anfoushy 16,25 at P > 0.05 during 2009 & 2012 and 21,75 at P < 0.05 during 2010 & 2013.

Tables 25 & 26 : Seasonal variation of Chlorides (mg/l) in the four marine localities during January to December 2009 Egypt and during January to December Saudi Arabia 2012

Months	North Khobar	South Khobar	Anfoushy	Abu Qir
January	1390	2340	1060	1090
February	1370	2350	1180	1460
March	890	1758	1300	1510
April	1210	2250	1050	990
May	1350	2340	1057	1070
June	1360	2570	1590	1450
July	1780	2680	1460	1870
August	890	2030	1070	880
September	989	2860	780	1090
October	676	2740	890	660
November	857	2780.0	630	840
December	1060	2350	1560	1160

Table 26 Analyzed				
Chlorides1				
One-way analysis of variance				
P value	P<0.0001			
P value summary	***			
Are means signif. different? (P < 0.05)	Yes			
Number of groups	4			
F	47,24			
R squared	0,7631			
Bartlett's test for equal variances				
Bartlett's statistic (corrected)	0,1926			
P value	0,9788			
P value summary	ns			
Do the variances differ signif. (P < 0.05)	No			
ANOVA Table	SS	df	MS	
Treatment (between columns)	14460000	3	4821000	
Residual (within columns)	4491000	44	102100	
Total	18960000	47		
Dunnett's Multiple Comparison Test	Mean Diff.	q	P value	95% CI of diff
North Khobar vs South Khobar	-1269	9,728	P < 0.01	-1586 to -951.4
North Khobar vs Anfoushy	16,25	0,1246	P > 0.05	-301.2 to 333.7
North Khobar vs Abu Qir	-20,67	0,1585	P > 0.05	-338.1 to 296.8

© 2015 Global Journals Inc. (US)

Tables 27 & 28 : Seasonal variation of Chlorides (mg/l) in the four marine localities during January to December 2010 Egypt and during January to December Saudi Arabia 2013

Months	North Khobar	South Khobar	Anfoushy	Abu Qir
January	1320	2340	1020	1090
February	1310	2310	1180	1470
March	830	2770	1300	1550
April	1250	2285	1020	999
May	1370	2355	1040	1040
June	1320	2576	1580	1450
July	1710	2660	1430	1820
August	896	2020	1060	893
September	910	2870	770	1048
October	645	2786	840	650
November	880	2715.0	670	860
December	1010	2310	1280	1140

Table 28 Analyzed				
Chlorides 2				
One-way analysis of variance				
P value	P<0.0001			
P value summary	***			
Are means signif. different? (P < 0.05)	Yes			
Number of groups	4			
F	64,92			
R squared	0,8157			
Bartlett's test for equal variances				
Bartlett's statistic (corrected)	0,8398			
P value	0,8399			
P value summary	ns			
Do the variances differ signif. (P < 0.05)	No			
ANOVA Table	SS	df	MS	
Treatment (between columns)	16940000	3	5645000	
Residual (within columns)	3826000	44	86960	
Total	20760000	47		
Dunnett's Multiple Comparison Test	Mean Diff.	q	P value	95% CI of diff
North Khobar vs South Khobar	-1379	11,45	P < 0.01	-1672 to -1086
North Khobar vs Anfoushy	21,75	0,1807	P > 0.05	-271.3 to 314.8
North Khobar vs Abu Qir	-46,58	0,3869	P > 0.05	-339.6 to 246.4

h) Total Nitrogen

The Total Nitrogen values of marine water are given in (Tables 29 & 32 ; Histograms 15& 16) for pan marine habitats in different seasons of the year. Low Total Nitrogen in water during 2009 was found in Anfoushy during almost all months (1,50-1,8 mg/l). Dunnett's Multiple Comparison Test showed the loSouthern Mean Dif between North Khobar and South Khobar -2,1 at P > 0.01 during 2012. During 2013 the loSouthern Mean Dif between North Khobar and South Khobar -2,617 at P > 0.01.

The highest value of Total Nitrogen was observed during almost all months in South Khobar (3,9- 5,4 mg/l) in 2012 and (4,4 – 5,7 mg/l) during 2013. Dunnett's Multiple Comparison Test showed the highest Mean Dif between North Khobar vs Anfoushy 0,65 at P

© 2015 Global Journals Inc. (US)

> 0.05 during 2009 & 2012 and 0,8833 at P < 0.01 during 2010 & 2013.

Tables 29 & 30 : Seasonal variation of total Nitrogen (mg/l) in the four marine localities during January to December 2009 Egypt and during January to December Saudi Arabia 2012

Months	North Khobar	South Khobar	Anfoushy	Abu Qir
January	3,7	4,2	1,7	2,8
February	1,4	4,5	1,5	1,9
March	2,7	4,3	1,6	2,7
April	1,8	4,2	1,7	2,5
May	2,6	3,7	1,6	1,6
June	2,5	3,9	1,5	3,7
July	2,7	4,6	1,8	3,4
August	1,4	5,4	1,5	1,5
September	1,3	4,8	1,8	1,7
October	2,6	4,2	1,5	2,8
November	2,4	4.50	1,8	2,9
December	2,3	4,3	1,6	2,8

Table 30 Analyzed				
total Nitrogen 1				
One-way analysis of variance				
P value	P<0.0001			
P value summary	***			
Are means signif. different? (P < 0.05)	Yes			
Number of groups	4			
F	55,83			
R squared	0,792			
Bartlett's test for equal variances				
Bartlett's statistic (corrected)	25,7			
P value	P<0.0001			
P value summary	***			
Do the variances differ signif. (P < 0.05)	Yes			
ANOVA Table	SS	df	MS	
Treatment (between columns)	50,11	3	16,7	
Residual (within columns)	13,16	44	0,2991	
Total	63,27	47		
Dunnett's Multiple Comparison Test	Mean Diff.	q	P value	95% CI of diff
North Khobar vs South Khobar	-2,1	9,405	P < 0.01	-2.643 to -1.557
North Khobar vs Anfoushy	0,65	2,911	P < 0.05	0.1065 to 1.193
North Khobar vs Abu Qir	-0,2417	1,082	P > 0.05	-0.7852 to 0.3018

Tables 31& 32 : Seasonal variation of total Nitrogen (mg/l) in the four marine localities during January to December 2010 Egypt and during January to December Saudi Arabia 2013

Months	North Khobar	South Khobar	Anfoushy	Abu Qir
January	3,9	5,6	1,4	3,6
February	2,8	4,7	1,5	3,7

© 2015 Global Journals Inc. (US)

March	3,7	5,6	1,6	3,9
April	3,8	5,5	1,4	3,7
May	2,5	4,7	1,8	2,8
June	1,4	4,8	1,9	2,4
July	1,6	5,4	1,6	2,6
August	1,4	5,3	1,4	1,8
September	1,3	5,2	2,2	2,9
October	2,3	4,4	1,4	2,8
November	3,1	4.60	1,6	2,4
December	2,3	5,7	1,7	2,8

Table 32 Analyzed				
total Nitrogen 2				
One-way analysis of variance				
P value	P<0.0001			
P value summary	***			
Are means signif. different? (P < 0.05)	Yes			
Number of groups	4			
F	65,56			
R squared	0,8172			
Bartlett's test for equal variances				
Bartlett's statistic (corrected)	18,06			
P value	0,0004			
P value summary	***			
Do the variances differ signif. (P < 0.05)	Yes			
ANOVA Table	SS	df	MS	
Treatment (between columns)	79,68	3	26,56	
Residual (within columns)	17,82	44	0,4051	
Total	97,5	47		
Dunnett's Multiple Comparison Test	Mean Diff.	q	P value	95% CI of diff
North Khobar vs South Khobar	-2,617	10,07	P < 0.01	-3.249 to -1.984
North Khobar vs Anfoushy	0,8833	3,4	P < 0.01	0.2509 to 1.516
North Khobar vs Abu Qir	-0,4417	1,7	P > 0.05	-1.074 to 0.1908

i) The Tributyl tin (TBT)

The Tributyl tin TBT values of marine water are given in (Tables 33& 36 ; Histograms 17& 18) for pan marine habitats in different seasons of the year. Low Tributyl tin TBT in water during 2009 was found in North Khobar during almost March, April, June, October-November (290-380 µgg-1). Dunnett's Multiple Comparison Test showed the loSouthern Mean Dif between North Khobar and Abu Qir -191,3 at P > 0.01 during 2012. During 2013 the loSouthern Mean Dif between North Khobar and South Khobar -223,3 at P > 0.01.

The highest value of Tributyl tin TBT was observed during almost all months in Abu Qir (500-680 µgg-1) in 2012 and (550 – 670 mg/l) during 2013. Dunnett's Multiple Comparison Test showed the highest Mean Dif between North Khobar vs South Khobar -87,5 at P > 0.01 during 2012 and -101,7 at P < 0.01 during 2013.

© 2015 Global Journals Inc. (US)

Tables 33 & 34 : Seasonal variation of Tributyl tin TBT (μgg-1) in the four marine localities during January to December 2009 Egypt and during January to December Saudi Arabia 2012

Months	North Khobar	South Khobar	Anfoushy	Abu Qir
January	430	520	510	610
February	390	490	500	520
March	320	440	490	490
April	380	505	520	570
May	410	480	490	680
June	380	490	520	500
July	410	430	450	530
August	405	550	590	650
September	380	410	480	510
October	320	430	450	530
November	290	380	400	680
December	460	500	510	600

Table 34 Analyzed				
Tributyl tin 1				
One-way analysis of variance				
P value	P<0.0001			
P value summary	***			
Are means signif. different? (P < 0.05)	Yes			
Number of groups	4			
F	24,77			
R squared	0,6281			
Bartlett's test for equal variances				
Bartlett's statistic (corrected)	2,334			
P value	0,506			
P value summary	ns			
Do the variances differ signif. (P < 0.05)	No			
ANOVA Table	SS	df	MS	
Treatment (between columns)	223000	3	74340	
Residual (within columns)	132100	44	3001	
Total	355100	47		
Dunnett's Multiple Comparison Test	Mean Diff.	q	P value	95% CI of diff
North Khobar vs South Khobar	-87,5	3,912	P < 0.01	-141.9 to -33.06
North Khobar vs Anfoushy	-111,3	4,974	P < 0.01	-165.7 to -56.81
North Khobar vs Abu Qir	-191,3	8,551	P < 0.01	-245.7 to -136.8

Tables 35 & 36 : Seasonal variation of Tributyl tin TBT (μgg-1) in the four marine localities during January to December 2010 Egypt and during January to December Saudi Arabia 2013

Months	North Khobar	South Khobar	Anfoushy	Abu Qir
January	410	560	530	660
February	340	480	510	500
March	370	450	500	470

© 2015 Global Journals Inc. (US)

April	330	520	510	590
May	460	470	500	660
June	340	480	530	590
July	420	460	470	580
August	450	560	520	670
September	330	420	450	550
October	310	420	440	590
November	300	390	410	670
December	440	510	550	650

Table 36 Analyzed				
Tributyl tin 2				
One-way analysis of variance				
P value	P<0.0001			
P value summary	***			
Are means signif. different? (P < 0.05)	Yes			
Number of groups	4			
F	32,08			
R squared	0,6863			
Bartlett's test for equal variances				
Bartlett's statistic (corrected)	2,288			
P value	0,5148			
P value summary	ns			
Do the variances differ signif. (P < 0.05)	No			
ANOVA Table	SS	df	MS	
Treatment (between columns)	301000	3	100300	
Residual (within columns)	137600	44	3127	
Total	438600	47		
Dunnett's Multiple Comparison Test	Mean Diff.	q	P value	95% CI of diff
North Khobar vs South Khobar	-101,7	4,453	P < 0.01	-157.2 to -46.10
North Khobar vs Anfoushy	-118,3	5,183	P < 0.01	-173.9 to -62.76
North Khobar vs Abu Qir	-223,3	9,782	P < 0.01	-278.9 to -167.8

Qualitative analysis of zooplankton in Anfoushy and Abu Qir Bay (Mediterranean Sea) Egypt &Northern and Southern estruarine water of the Arabian Gulf – Saudi Arabia.

In a previous study, the second author of this work (Saad, 2015) collected zooplankton from four marine ecosystems namely the North Sea (Helgoland - Germany), Banyuls-sur-Mer (Mediterranean sea - France), Abu Qir Bay (Mediterranean Sea - Egypt) and the northern estruarine harbour of the Arabian Gulf (Saudi Arabia). Collection tools used involved primarily the filtration of water by net, collecting the water in bottles / water samplers or by pumps. Collected zooplaktons were prepared for both macroscopic or / and scanning electron microscopy.All zooplankton were stained with Evans stain or Nile blue or Borax carmine to observe their internal structures since they are mostly transparent. Others were dissected with micro-needles and incised to ease their identification. Marine Species Identification Portal has been applied:

http://species-identification.org/index.php//.Six species of Bryozoa were identified namely *Bugula neritina* (Linnaeus, 1758) and its barrel shaped larva, *Electra crustulenta* (Pallas, 1766) , *Bowerbankia gracilis* (Leidy, 1855) and its coronated larva, *Hippaliosina depressa* (Busk, 1854), *Nolella dilatata* (Marcus, 1940) and *Reptadeonella violacea* (Johnston, 1847). Two hydrozoan cnidarians were identified namely *Obelia geniculata* (Linnaeus, 1758) and *Pennaria disticha* (Goldfuss,1820). Planula larva of Hydrozoa and the

Global Journal of Science Frontier Research (C) Volume XV Issue II Version I Year 2015

© 2015 Global Journals Inc. (US)

anthozoan *Actinodendron* sp. were collected from the Mediterranean sea. Two rotifers were identified namely *Paraseison annulatus* (Claus, 1876) and *Seison nebaliae* (Grube, 1861). The nematode *Anisakis simplex* and its third stage larva were extracted from the branchial chambers of ascidians whereas free nematode toothless larval stage has been collected from nekton.

Four polychaetes were identified namely *Harmothoe* sp.,(scale worm), *Pomatocerous triqueter* (Linnaeus, 1758), *Nemidia lawrencii* (McIntosh, 1874) with synoneme *Nemidia torelli* and *Notomastus latericeus* (Sars, 1851). The copepod *Megacyclops viridis* (Jurine, 1820) and the gammarid *Gammaropsis* sp. with Naupli, zoaea and megalopods were found in the nekton. The the isopod *Caecocassidias patagonica* (Kussakin, 1967) has been collected from the benthos. The scaphopod *Dentalium vulgare* (da Costa, 1778) and the bivalve *Microgloma turnerae* (Sanders & Allen,1973) were found in the benthos. Veliger and glochidia larvae were collected from the nekton. Two species of brittle star namely *Amphiura* sp and *Ophiomastix annulosa* were collected from the benthos. Nine ascidian larvae were identified namely larvae of *Styela plicata* (Lesuaer, 1823), *Phallusia mammilata* (Cüvier 1815), *Corella parallelogramma* (Müller,1776), *Diplosoma migrans* (Menker und Ax. 1970), *Halocynthia roretzi* (Drasche), *Microcosmus claudicans* (Savigny,1816), *Molgula manhattensis*(Dekay, 1843), *Ascidiella aspersa*(Müller, 1776), and *Cnemidocarpa mollis* (Stimpson,1852).The abundance and distribution of all plankton studied varied considerably according to seasons and habitats.The findings of this work, the density of each genus or / and species in Anfoushy and Abu Qir Bay(Mediterranean Sea – Egypt) and the Northern and Southern Khobar estruarine beaches of the Arabian Gulf (Saudi Arabia), and the presence or absence of a certain zooplankton in the different seasons of the year (faunal composition) will be statistically analyzed in this study. This study also tried to analyze the abiotic factors of the four marine habitats studied and correlated them to zooplankton faunal compositions.

The present study provides information about the seasonal abundance of major groups of zooplankton namely, Bryozoa,Cnidaria, Rotifera, Nematoda, Annelida, Amphipoda, Copepoda, Isopoda, crustacean larvae, Scaphopoda, Bivalvia, molluscan larvae, andascidian larvae. The relative densities of different genera have been commented.

Table 37 & 38 showed monthly densities distribution of zooplankton (per sixty litre samples) collected from Anfoushy and Abu Qir Bay (Mediterranean Sea) Egypt during 2009 and 2010 &Northern and Southern estruarine water of the Arabian Gulf – Saudi Arabia during 2012 and 2013. To survive in a habitat successfully, zooplankton have to had an opportunity in the past to be dispersed into the area; it must successfully compete within already existing communities; and survive in or adapt to changing physical and chemical condition.

j) Bryozoa

During 2009, *Bugula neritina* and *Nolella dilatata* were not found during winter and spring in Anfoushy,sparse in summer season and fall , not found in Abu Qirduring winter, highly abundantin summer season in Abu Qir,totally not found in Northern and Southern Khobar. *Electra crustulenta* was many during winter and spring in Anfoushy, maximal density was found in Abu Qir. Density of *Bowerbankia gracilis* was highly intensively dense in Anfoushy. Equal densities of *Hippaliosina depressa* were found in Anfoushy and Abu Qir. *Reptadeonella violacea* dominated Anfoushy in summer season. The general densities of Bryozoa declined in 2010 in both Anfoushy and Abu Qir (see Tables 37 & 38). These sea mats generally were collected during all seasons of the year from Anfoushy and Abu Qir Bay (Mediterranean Sea) Egypt during 2009 & 2010.Sparse or many zooecia were collected from Northern Khobar. This study did not found any sea mats in SouthernKhobar. Sea mats were highly abundant and dense in summer season andAbu Qir Bay, Anfoushy contained the maximal density of sea mats. Newman-Keuls Multiple Comparison Test showed considerable difference in faunal composition of sea mats in Anfoushy vs Abu Qir, Mean Diff. -3,75 at $P > 0.05$, (see tables 39-40 & Histograms 19-20).

Table 39 : Clarifying Bryozoa Densities in the Four Study Marine Localities During 2009 & 2012

Table Analyzed Table 39			
Bryozoa density 1 during 2009 & 2012			
One-way analysis of variance			
P value	0,0001		
P value summary	***		
Are means signif. different? (P < 0.05)	Yes		
Number of groups	4		

© 2015 Global Journals Inc. (US)

F	11,69		
R squared	0,6369		
Bartlett's test for equal variances			
Bartlett's statistic (corrected)			
P value			
P value summary	ns		
Do the variances differ signif. (P < 0.05)	No		
ANOVA Table	SS	df	MS
Treatment (between columns)	1122	3	374
Residual (within columns)	639,6	20	31,98
Total	1761	23	
Newman-Keuls Multiple Comparison Test	Mean Diff.	q	P value
South Khobar vs Abu Qir	-16,25	7,039	P < 0.001
South Khobar vs Anfoushy	-12,5	5,414	P < 0.01
South Khobar vs Northern Khobar	-2,083	0,9024	P > 0.05
Northern Khobar vs Abu Qir	-14,17	6,136	P < 0.001
Northern Khobar vs Anfoushy	-10,42	4,512	P < 0.01
Anfoushy vs Abu Qir	-3,75	1,624	P > 0.05

Table 40 : clarifying Bryozoa densities in the four study marine localities during 2010 & 2013

Table Analyzed Table 40			
Bryozoa density 2 during 2010 & 2013			
One-way analysis of variance			
P value	P<0.0001		
P value summary	***		
Are means signif. different? (P < 0.05)	Yes		
Number of groups	4		
F	16,83		
R squared	0,7162		
Bartlett's test for equal variances			
Bartlett's statistic (corrected)			
P value			
P value summary	ns		
Do the variances differ signif. (P < 0.05)	No		
ANOVA Table	SS	df	MS
Treatment (between columns)	639,6	3	213,2
Residual (within columns)	253,4	20	12,67
Total	893	23	
Newman-Keuls Multiple Comparison Test	Mean	q	P value

© 2015 Global Journals Inc. (US)

	Diff.		
Southern Khobar vs Abu Qir	-12,5	8,602	P < 0.001
Southern Khobar vs Anfoushy	-9,167	6,308	P < 0.001
Southern Khobar vs Northern Khobar	-1,708	1,176	P > 0.05
Northern Khobar vs Abu Qir	-10,79	7,427	P < 0.001
Northern Khobar vs Anfoushy	-7,458	5,133	P < 0.01
Anfoushy vs Abu Qir	-3,333	2,294	P > 0.05

k) Cnidaria

During 2009 and 2012, in summer seasonequal distribution densities of *Obelia geniculata*in Anfoushy and Abu Qir, many polyps were collected from Northern Khobar and sparse from Southern Khobar.*Pennaria disticha* and *Actinodendron* sp.were highly dense in Anfoushy and dense in Abu Qir, many in Northern Khobar and sparse in SouthernKhobar. Cnidarian polyps have been collected from the four marine localities studied. Planula larvae were collected only from Anfoushy and Abu Qir Bay (Mediterranean Sea) Egypt during 2009 & 2010.The general densities of Cnidaria declined in 2010 in both Anfoushy and Abu Qir (see Tables 37 & 38). The minimal distribution of polyps were found in Arabian Gulf. Maximal density of polyps were collected during the summer season from Anfoushy. Cnidarian density in Abu Qir Bay was highly dense. Newman-Keuls Multiple Comparison Test showed Mean Diff. -3,333 at P > 0.05 between Abu Qir vs Anfoushy during 2009 and -5,833 at P < 0.01 during 2010. There were signif. means different at P < 0.05 between Mediterranean Sea and Arabian Gulf faunal composition of Cnidaria (see tables 41-42 and Histograms 21-22)

Table 41 : Clarifying Cnidaria Densities in the Four Study Marine Localities during 2009 & 2012

Table Analyzed Table 41			
Cnidaria density 1 during 2009 & 2012			
One-way analysis of variance			
P value	0,0001		
P value summary	***		
Are means signif. different? (P < 0.05)	Yes		
Number of groups	4		
F	27,94		
R squared	0,9129		
ANOVA Table	SS	df	MS
Treatment (between columns)	916,7	3	305,6
Residual (within columns)	87,5	8	10,94
Total	1004	11	
Newman-Keuls Multiple Comparison Test	Mean Diff.	q	P value
Southern Khobar vs Anfoushy	-21,67	11,35	P < 0.001
Southern Khobar vs Abu Qir	-18,33	9,602	P < 0.001
Southern Khobar vs Northern Khobar	-6,667	3,491	P < 0.05
Northern Khobar vs Anfoushy	-15	7,856	P < 0.01
Northern Khobar vs Abu Qir	-11,67	6,11	P < 0.01
Abu Qir vs Anfoushy	-3,333	1,746	P > 0.05

Table 42 : Clarifying Cnidaria Densities in the Four Study Marine Localities during 2010 & 2013

Table Analyzed Table 42			
Cnidaria density 2 during 2010 & 2013			

© 2015 Global Journals Inc. (US)

One-way analysis of variance			
P value	P<0.0001		
P value summary	***		
Are means signif. different? (P < 0.05)	Yes		
Number of groups	4		
F	49,94		
R squared	0,9493		
ANOVA Table	SS	df	MS
Treatment (between columns)	468,2	3	156,1
Residual (within columns)	25	8	3,125
Total	493,2	11	
Newman-Keuls Multiple Comparison Test	Mean Diff.	q	P value
Southern Khobar vs Anfoushy	-16,67	16,33	P < 0.001
Southern Khobar vs Abu Qir	-10,83	10,61	P < 0.001
Southern Khobar vs Northern Khobar	-5	4,899	P < 0.01
Northern Khobar vs Anfoushy	-11,67	11,43	P < 0.001
Northern Khobar vs Abu Qir	-5,833	5,715	P < 0.01
Abu Qir vs Anfoushy	-5,833	5,715	P < 0.01

l) Rotifera

During 2009& 2012, *Paraseison annulatus* and *Seison nebaliae*dominated Anfoushy in summer season and were highly dense in Abu Qir, sparse in Northern Khobar and not found in Southern Khobar.The general densities of rotifers declined in 2010 in both Anfoushy and Abu Qir (see Tables 37 & 38).Rotifers were collected mainly from Anfoushy and Abu Qir Bay (Mediterranean Sea) Egypt during 2009 & 2010. Maximal density of rotifers were found in Anfoushy in summer season 2009 & 2010 while rotifers were highly abundant in Abu Qir Bay in summer season 2009 and many were found in summer season 2010. Sparse amount were collected from Northern Khobar only in summer season of 2012 & 2013. This study did not found any rotifers in Southern Khobar.The minimal distribution of rotifers were found in Northern Khobar of the Arabian Gulf. Maximal density of Rotifers were collected during the summer season from Abu Qir compared with Anfoushy. Newman-Keuls Multiple Comparison Test showed Mean Diff. -3,333 at P > 0.05 between Anfoushy vs Abu Qir during 2009 and -1,25 at P > 0.05 during 2010. There were signif. means different at P < 0.05 between Northern Khobar vs Abu Qir faunal composition of rotifers (see tables 43-44 and Histograms 23-24).

Table 43 : Clarifying Rotifera Densities in the Four Study Marine Localities during 2009 & 2012

Table Analyzed Table 43			
Rotifer density 1 during 2009 & 2012			
One-way analysis of variance			
P value	0,0001		
P value summary	***		
Are means signif. different? (P < 0.05)	Yes		
Number of groups	4		
F	11,69		
R squared	0,6369		
Bartlett's test for equal variances			
Bartlett's statistic (corrected)			

© 2015 Global Journals Inc. (US)

P value			
P value summary	ns		
Do the variances differ signif. (P < 0.05)	No		
ANOVA Table	SS	df	MS
Treatment (between columns)	1122	3	374
Residual (within columns)	639,6	20	31,98
Total	1761	23	
Newman-Keuls Multiple Comparison Test	Mean Diff.	q	P value
Southern Khobar vs Abu Qir	-16,25	7,039	P < 0.001
Southern Khobar vs Anfoushy	-12,5	5,414	P < 0.01
Southern Khobar vs Northern Khobar	-2,083	0,9024	P > 0.05
Northern Khobar vs Abu Qir	-14,17	6,136	P < 0.001
Northern Khobar vs Anfoushy	-10,42	4,512	P < 0.01
Anfoushy vs Abu Qir	-3,75	1,624	P > 0.05

Table 44 : Clarifying Rotifera Densities in the Four Study Marine Localities During 2010 & 2013

Table Analyzed Table 44			
Rotifera density 2 during 2010 & 2013			
One-way analysis of variance			
P value	0,0005		
P value summary	***		
Are means signif. different? (P < 0.05)	Yes		
Number of groups	4		
F	78,33		
R squared	0,9833		
ANOVA Table	SS	df	MS
Treatment (between columns)	183,6	3	61,2
Residual (within columns)	3,125	4	0,7813
Total	186,7	7	
Newman-Keuls Multiple Comparison Test	Mean Diff.	q	P value
Southern Khobar vs Abu Qir	-11,25	18	P < 0.001
Southern Khobar vs Anfoushy	-10	16	P < 0.001
Southern Khobar vs Northern Khobar	-2,5	4	P < 0.05
Northern Khobar vs Abu Qir	-8,75	14	P < 0.01
Northern Khobar vs Anfoushy	-7,5	12	P < 0.01
Anfoushy vs Abu Qir	-1,25	2	P > 0.05

m) Nematoda

During 2009 & 2012, in summer season*Anisakis simplex*was highly abundant in Anfoushy, and Abu Qir, many inNorthern Khobar and Southern Khobar.

Nematoda were collected from Anfoushy and Abu Qir Bay (Mediterranean Sea) Egypt during 2009 & 2010 and Northern Khobar andSouthern Khobar during 2012 & 2013. The general densities of nematodsfluctuated in 2010 in both Anfoushy and Abu Qir (see Tables 37 & 38).Nematodes were generally highly abundant in Abu Qir Bay and Anfoushy in summer season 2009 & 2010 while many nematodes

© 2015 Global Journals Inc. (US)

were collected from Northern Khobar and Southern Khobar in summer season of 2012 & 2013. Newman-Keuls Multiple Comparison Test showed Mean Diff. -5 at P > 0.05 between Anfoushy vs Abu Qir during 2009 and -2,5 at P > 0.05 during 2010. There were signif. means different at P < 0.05 between Southern Khobar vs Abu Qir faunal composition of nematodes (see tables 45-46 and Histograms 25-26).

Table 45 : Clarifying Nematoda Densities in the Four Study Marine Localities During 2009 & 2012

Table Analyzed Table 45			
Nematoda density 1during 2009 & 2012			
One-way analysis of variance			
P value	0,0017		
P value summary	**		
Are means signif. different? (P < 0.05)	Yes		
Number of groups	4		
F	13,4		
R squared	0,834		
ANOVA Table	SS	df	MS
Treatment (between columns)	314,1	3	104,7
Residual (within columns)	62,5	8	7,813
Total	376,6	11	
Newman-Keuls Multiple Comparison Test	Mean Diff.	q	P value
Southern Khobar vs Anfoushy	-12,5	7,746	P < 0.01
Southern Khobar vs Abu Qir	-7,5	4,648	P < 0.05
Southern Khobar vs Northern Khobar	-0,8333	0,5164	P > 0.05
Northern Khobar vs Anfoushy	-11,67	7,23	P < 0.01
Northern Khobar vs Abu Qir	-6,667	4,131	P < 0.05
Abu Qir vs Anfoushy	-5	3,098	P > 0.05

Table 46 : Clarifying Nematoda Densities in the Four Study Marine Localities During 2010 & 2013

Table Analyzed Table 46			
Nematoda density 2 during 2010 & 2013			
One-way analysis of variance			
P value	0,2421		
P value summary	ns		
Are means signif. different? (P < 0.05)	No		
Number of groups	4		
F	1,708		
R squared	0,3905		
ANOVA Table	SS	df	MS
Treatment (between columns)	64,06	3	21,35
Residual (within columns)	100	8	12,5
Total	164,1	11	
Newman-Keuls Multiple Comparison Test	Mean Diff.	q	P value

© 2015 Global Journals Inc. (US)

Northern Khobar vs Anfoushy	-5	2,449	P > 0.05
Northern Khobar vs Abu Qir	-4,167	---	P > 0.05
Northern Khobar vs Southern Khobar	0	---	P > 0.05
Southern Khobar vs Anfoushy	-5	---	P > 0.05
Southern Khobar vs Abu Qir	-4,167	---	P > 0.05
Abu Qir vs Anfoushy	-0,8333	---	P > 0.05

n) Annelida

During 2009 & 2012, *Harmothoe* sp. , *Pomatocerous triqueter*, *Nemidia lawrencii* and *Notomastus latericeus* were highly intensive dense in Anfoushy, dense in Abu Qir and Southern Khobar , many inNorthern Khobar. The general densities of annelids declined in 2010 in both Anfoushy and Abu Qir (see Tables 37 & 38). Generally, annelida were collected from Anfoushy and Abu Qir Bay (Mediterranean Sea) Egypt during 2009 & 2010 and Northern Khobar andSouthern Khobar during 2012 & 2013. Annelida were highly abundant in Abu Qir Bay in summer season and the maximal density was found in Anfoushy in summer season 2009 & 2010 while many annelids were collected from Northern Khobar and Southern Khobar in summer season of 2012 & 2013. Newman-Keuls Multiple Comparison Test showed Mean Diff. -2,5 at P > 0.05 between Anfoushy vs Abu Qir during 2009 and -2,5 at P > 0.05 during 2010. There were signif. means different at P < 0.05 between Southern Khobar vs Abu Qir faunal composition of annelids (see tables 47-48 and Histograms 27-28).

Table 47 : Clarifying Annelida Densities in the Four Study Marine Localities During 2009 & 2012

Table Analyzed Table 47			
Annelida density 1 during 2009 & 2012			
One-way analysis of variance			
P value	P<0.0001		
P value summary	***		
Are means signif. different? (P < 0.05)	Yes		
Number of groups	4		
F	32,41		
R squared	0,8902		
ANOVA Table	SS	df	MS
Treatment (between columns)	1469	3	489,6
Residual (within columns)	181,3	12	15,1
Total	1650	15	
Newman-Keuls Multiple Comparison Test	Mean Diff.	q	P value
Northern Khobar vs Abu Qir	-22,5	11,58	P < 0.001
Northern Khobar vs Anfoushy	-20	10,29	P < 0.001
Northern Khobar vs Southern Khobar	-5	2,573	P > 0.05
Southern Khobar vs Abu Qir	-17,5	9,006	P < 0.001
Southern Khobar vs Anfoushy	-15	7,719	P < 0.001
Anfoushy vs Abu Qir	-2,5	1,287	P > 0.05

Table 48 : Clarifying Annelida Densities in the Four Study Marine Localities During 2010 & 2013

Table Analyzed Table 48			
Annelida density 2 during 2010 & 2013			
One-way analysis of variance			
P value	0,0002		

© 2015 Global Journals Inc. (US)

P value summary	***		
Are means signif. different? (P < 0.05)	Yes		
Number of groups	4		
F	15,05		
R squared	0,79		
ANOVA Table	SS	df	MS
Treatment (between columns)	476,2	3	158,7
Residual (within columns)	126,6	12	10,55
Total	602,7	15	
Newman-Keuls Multiple Comparison Test	Mean Diff.	q	P value
Northern Khobar vs Abu Qir	-13,75	8,468	P < 0.001
Northern Khobar vs Anfoushy	-11,25	6,928	P < 0.001
Northern Khobar vs Southern Khobar	-4,375	2,694	P > 0.05
Southern Khobar vs Abu Qir	-9,375	5,774	P < 0.01
Southern Khobar vs Anfoushy	-6,875	4,234	P < 0.05
Anfoushy vs Abu Qir	-2,5	1,54	P > 0.05

o) Crustacea

During 2009 & 2012, in summer season amphipods *Gammaropsis* sp.&*Monocorophium acherisicum* ; copepods *Megacyclops viridis*; the isopodCaecocassidias patagonica and crustacean larvae nauplius, zoaea and megalopod were intensively dense in Anfoushy and dense in Abu Qir, highly abundant in Northern Khobar and sparse in Southern Khobar.The general densities of Crustacea declined in 2010 in both Anfoushy and Abu Qir (see Tables 37 & 38).Generally, Crustacea were collected from Anfoushy and Abu Qir Bay (Mediterranean Sea) Egypt during 2009 & 2010 and Northern Khobar andSouthern Khobar during 2012 & 2013. Crustacea were intensive dense in Abu Qir Bay andhighly intensive abundant in Anfoushy in summer season 2009 & 2010 while highly abundant Crustacea were collected from Northern Khobar and sparse in Southern Khobar in summer season of 2012 & 2013. Newman-Keuls Multiple Comparison Test showed Mean Diff-0,9091at P > 0.05 between Abu Qir vs Anfoushy during 2009 and -1,042 at P > 0.05 during 2010. There were signif. means different at P < 0.05 between Southern Khobar vs Anfoushy faunal composition of Crustacea (see tables 49-50 and Histograms 29-30).

Table 49 : Clarifying Crustacea Densities in the Four Study Marine Localities During 2009 & 2012

Table Analyzed Table 49			
Crustacea density 1 during 2009 & 2012			
One-way analysis of variance			
P value	P<0.0001		
P value summary	***		
Are means signif. different? (P < 0.05)	Yes		
Number of groups	4		
F	47,21		
R squared	0,7798		
Bartlett's test for equal variances			
Bartlett's statistic (corrected)	5,093		
P value	0,1651		
P value summary	ns		

© 2015 Global Journals Inc. (US)

Do the variances differ signif. (P < 0.05)	No		
ANOVA Table	SS	df	MS
Treatment (between columns)	2217	3	739
Residual (within columns)	626,1	40	15,65
Total	2843	43	
Newman-Keuls Multiple Comparison Test	Mean Diff.	q	P value
Southern Khobar vs Anfoushy	-15,68	13,15	P < 0.001
Southern Khobar vs Abu Qir	-14,77	12,38	P < 0.001
Southern Khobar vs Northern Khobar	-2,273	1,905	P > 0.05
Northern Khobar vs Anfoushy	-13,41	11,24	P < 0.001
Northern Khobar vs Abu Qir	-12,5	10,48	P < 0.001
Abu Qir vs Anfoushy	-0,9091	0,7621	P > 0.05

Table 50 : Clarifying Crustacea Densities in the Four Study Marine Localities During 2010 & 2013

Table Analyzed Table 50			
Crustacea density 2 during 2010 & 2013			
One-way analysis of variance			
P value	P<0.0001		
P value summary	***		
Are means signif. different? (P < 0.05)	Yes		
Number of groups	4		
F	24		
R squared	0,6207		
Bartlett's test for equal variances			
Bartlett's statistic (corrected)	1,583		
P value	0,6633		
P value summary	ns		
Do the variances differ signif. (P < 0.05)	No		
ANOVA Table	SS	df	MS
Treatment (between columns)	826,8	3	275,6
Residual (within columns)	505,2	44	11,48
Total	1332	47	
Newman-Keuls Multiple Comparison Test	Mean Diff.	q	P value
Southern Khobar vs Anfoushy	-9,375	9,585	P < 0.001
Southern Khobar vs Abu Qir	-8,333	8,52	P < 0.001
Southern Khobar vs Northern Khobar	-1,271	1,299	P > 0.05
Northern Khobar vs Anfoushy	-8,104	8,285	P < 0.001
Northern Khobar vs Abu Qir	-7,063	7,22	P < 0.001
Abu Qir vs Anfoushy	-1,042	1,065	P > 0.05

© 2015 Global Journals Inc. (US)

p) Mollusca

During 2009 & 2012, in summer seasonthe bivalve *Microgloma tumidula* and molluscan larvae trochophore, veliger and glochidia were intensively dense in Northern Khobar, dense in Southern Khobar and Anfoushy and highly abundant in Abu Qir. The scaphopod*Dentalium vulgare* wasintensively densein Northern Khobar and dense in Southern Khobar ; totally absent in Abu Qir Bay and Anfoushy. Generally, Mollusca were collected from Anfoushy and Abu Qir Bay (Mediterranean Sea) Egypt during 2009 & 2010 and Northern Khobar andSouthern Khobar during 2012 & 2013. Bivalvia were dense in Abu Qir Bay andhighly abundant in Anfoushy in summer season 2009 & 2010 while intensive dense Scaphopoda and Bivalvia were collected from Northern Khobar and highly abundant in Southern Khobar in summer season of 2012 & 2013. The general densities of Mollusca declined in 2010 in both Anfoushy and Abu Qir (see Tables 37 & 38).Newman-Keuls Multiple Comparison Test showed Mean Diff-5 at $P > 0.05$ between Southern Khobar vs Northern Khobar during 2012 and -3,5 at $P > 0.05$ during 2010. There were signif. means different at $P < 0.05$ between Anfoushy vs Northern Khobar faunal composition of Mollusca (see tables 51-52 and Histograms 31-32).

Table 51 : Clarifying Mollusca Densities in the Four Study Marine Localities During 2009 & 2012

Table Analyzed Table 51			
Mollusca density 1 during 2009 & 2012			
One-way analysis of variance			
P value	0,3523		
P value summary	ns		
Are means signif. different? (P < 0.05)	No		
Number of groups	4		
F	1,169		
R squared	0,1798		
Bartlett's test for equal variances			
Bartlett's statistic (corrected)	2,087		
P value	0,5545		
P value summary	ns		
Do the variances differ signif. (P < 0.05)	No		
ANOVA Table	SS	df	MS
Treatment (between columns)	236,3	3	78,75
Residual (within columns)	1078	16	67,34
Total	1314	19	
Newman-Keuls Multiple Comparison Test	Mean Diff.	q	P value
Anfoushy vs Northern Khobar	-9,5	2,589	P > 0.05
Anfoushy vs Southern Khobar	-4,5	---	P > 0.05
Anfoushy vs Abu Qir	-3	---	P > 0.05
Abu Qir vs Northern Khobar	-6,5	---	P > 0.05
Abu Qir vs Southern Khobar	-1,5	---	P > 0.05
Southern Khobar vs Northern Khobar	-5	---	P > 0.05

Table 52 : Clarifying Mollusca Densities in the Four Study Marine Localities During 2010 & 2013

Table Analyzed Table 52			
´Mollusca density 2 during 2010 & 2013			
One-way analysis of variance			

© 2015 Global Journals Inc. (US)

P value	0,4929		
P value summary	ns		
Are means signif. different? (P < 0.05)	No		
Number of groups	4		
F	0,8375		
R squared	0,1357		
Bartlett's test for equal variances			
Bartlett's statistic (corrected)	1,568		
P value	0,6667		
P value summary	ns		
Do the variances differ signif. (P < 0.05)	No		
ANOVA Table	SS	df	MS
Treatment (between columns)	156,3	3	52,08
Residual (within columns)	995	16	62,19
Total	1151	19	
Newman-Keuls Multiple Comparison Test	Mean Diff.	q	P value
Anfoushy vs Northern Khobar	-7	1,985	P > 0.05
Anfoushy vs Southern Khobar	-3,5	---	P > 0.05
Anfoushy vs Abu Qir	-0,5	---	P > 0.05
Abu Qir vs Northern Khobar	-6,5	---	P > 0.05
Abu Qir vs Southern Khobar	-3	---	P > 0.05
Southern Khobar vs Northern Khobar	-3,5	---	P > 0.05

q) Ascidian larvae

Anfoushy contained the maximal density of ascidian larvae in all study periods. Ascidian larvae were collected from Anfoushy and Abu Qir Bay (Mediterranean Sea) Egypt during 2009 & 2010 and Northern Khobar and Southern Khobar during 2012 & 2013. Ascidian larvae were dense in Abu Qir Bay and highly intensive dense in Anfoushy in summer season 2009 & 2010 and Northern Khobar 2012 while many ascidian larvae were collected from Southern Khobar in summer season of 2012 & 2013. Newman-Keuls Multiple Comparison Test showed Mean Diff-2,5 at P > 0.05 between Anfoushy vs Abu Qir during 2009 and -5 at P > 0.05 during 2010. There were signif. means different at P < 0.05 between SouthernKhobar vs Abu Qir faunal composition of ascidian larvae (see tables 53-54 and Histograms 33-34).

Table 53 : Clarifying Ascidian Larvae Densities in the Four Study Marine During 2009 & 2012

Table Analyzed Table 53			
Ascidian larvae density 1 during 2009 & 2012			
One-way analysis of variance			
P value	0,0706		
P value summary	ns		
Are means signif. different? (P < 0.05)	No		
Number of groups	4		
F	3,039		
R squared	0,4318		

© 2015 Global Journals Inc. (US)

ANOVA Table	SS	df	MS
Treatment (between columns)	968,8	3	322,9
Residual (within columns)	1275	12	106,3
Total	2244	15	
Newman-Keuls Multiple Comparison Test	Mean Diff.	q	P value
Southern Khobar vs Abu Qir	-20	3,881	P > 0.05
Southern Khobar vs Anfoushy	-17,5	---	P > 0.05
Southern Khobar vs Northern Khobar	-10	---	P > 0.05
Northern Khobar vs Abu Qir	-10	---	P > 0.05
Northern Khobar vs Anfoushy	-7,5	---	P > 0.05
Anfoushy vs Abu Qir	-2,5	---	P > 0.05

Table 54 : Clarifying Ascidian Larvae Densities in the Four Study Marine During 2010 & 2013

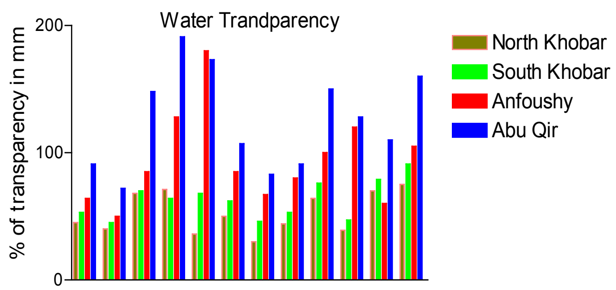
Table Analyzed Table 54			
Ascidian larvae density 2 during 2010 & 2013			
One-way analysis of variance			
P value	0,0946		
P value summary	ns		
Are means signif. different? (P < 0.05)	No		
Number of groups	4		
F	2,673		
R squared	0,4005		
ANOVA Table	SS	df	MS
Treatment (between columns)	918,8	3	306,3
Residual (within columns)	1375	12	114,6
Total	2294	15	
Newman-Keuls Multiple Comparison Test	Mean Diff.	q	P value
Southern Khobar vs Abu Qir	-20	3,737	P > 0.05
Southern Khobar vs Anfoushy	-15	---	P > 0.05
Southern Khobar vs Northern Khobar	-7,5	---	P > 0.05
Northern Khobar vs Abu Qir	-12,5	---	P > 0.05
Northern Khobar vs Anfoushy	-7,5	---	P > 0.05
Anfoushy vs Abu Qir	-5	---	P > 0.05

Histograms 1 – 18 clarifying variations in the abiotic factors in the four study marine localities during the different months of the year.

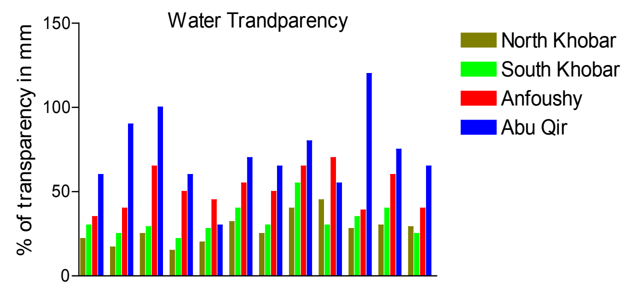
Histograms 19 – 34 clarifyingmonthly density distribution of zooplankton (per sixty litre samples) collected from Anfoushy and Abu Qir Bay (Mediterranean Sea) Egypt during 2009 and 2010 & Northern and Southern Khobar of the Arabian Gulf – Saudi Arabia during 2012 and 2013.

© 2015 Global Journals Inc. (US)

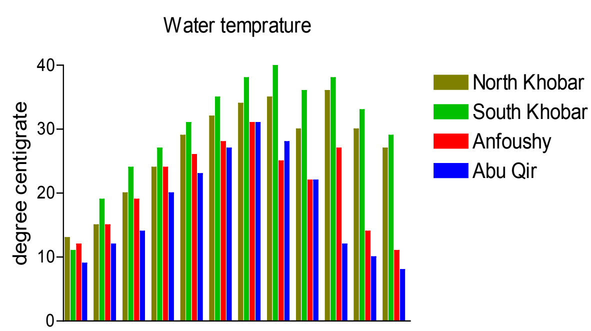
Histogram 1 (Egypt 2009 & Saudi Arabia 2012)



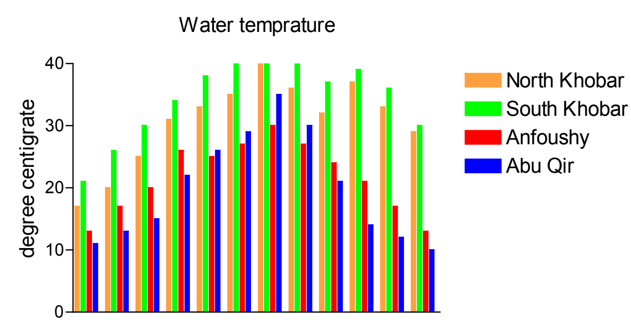
Histogram 2 (Egypt 2010 & Saudi Arabia 2013)



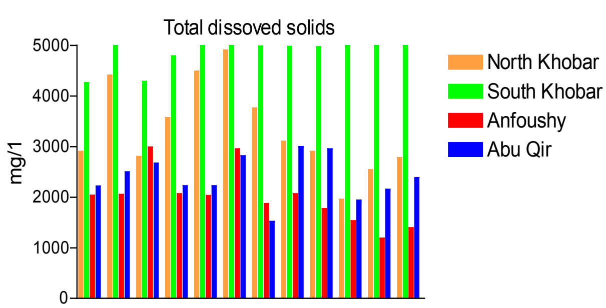
Histogram 3 (Egypt 2009 & Saudi Arabia 2012)



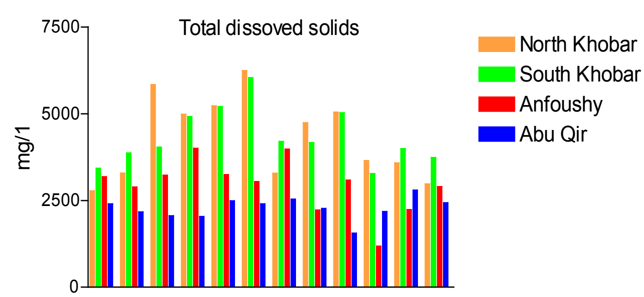
Histogram 4 (Egypt 2010 & Saudi Arabia 2013)



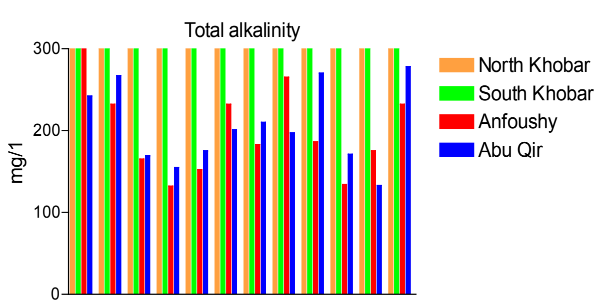
Histogram 5 (Egypt 2009 & Saudi Arabia 2012)



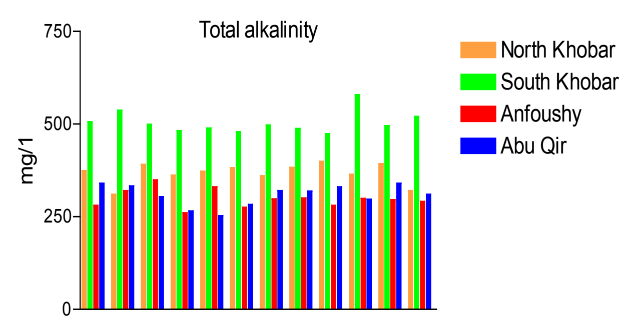
Histogram 6 (Egypt 2010 & Saudi Arabia 2013)



Histogram 7 (Egypt 2009 & Saudi Arabia 2012)

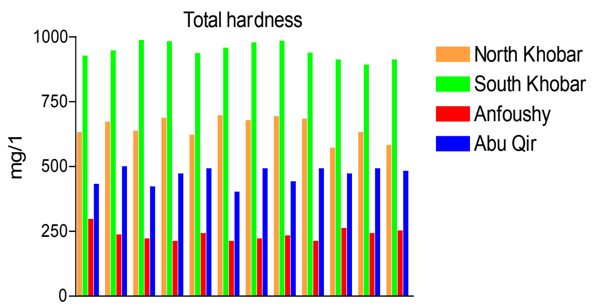


Histogram 8 (Egypt 2010 & Saudi Arabia 2013)

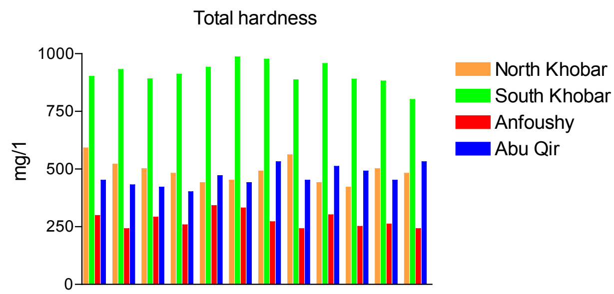


© 2015 Global Journals Inc. (US)

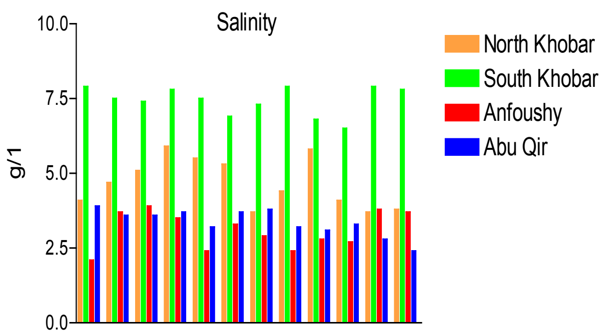
Histogram 9 (Egypt 2009 & Saudi Arabia 2012)



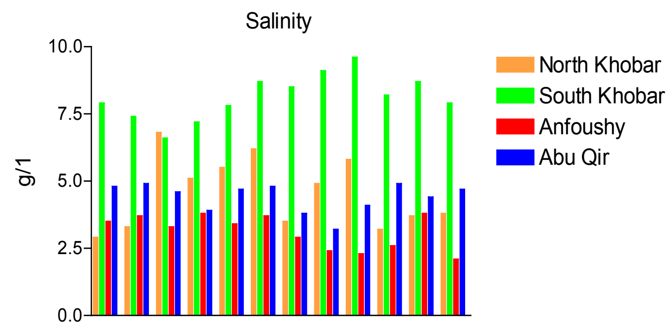
Histogram 10 (Egypt 2010 & Saudi Arabia 2013)



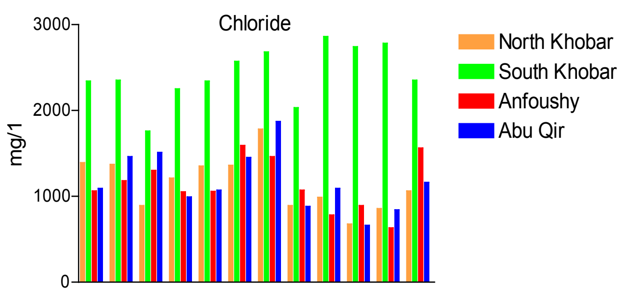
Histogram 11 (Egypt 2009 & Saudi Arabia 2012)



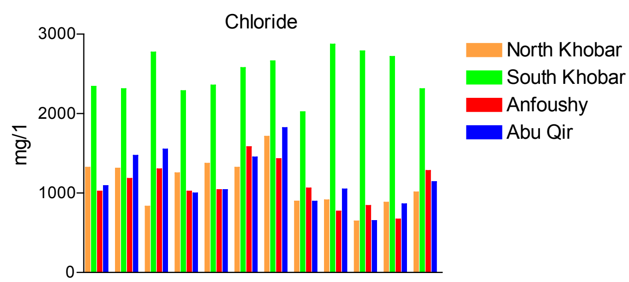
Histogram 12 (Egypt 2010 & Saudi Arabia 2013)



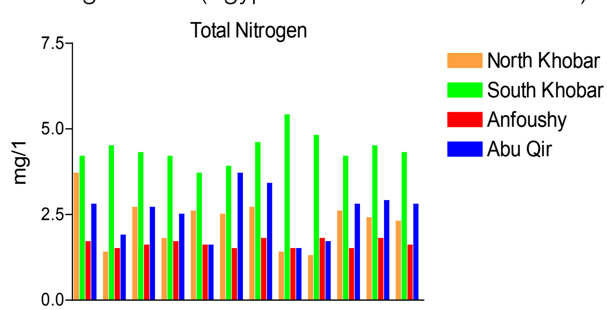
Histogram 13 (Egypt 2009 & Saudi Arabia 2012)



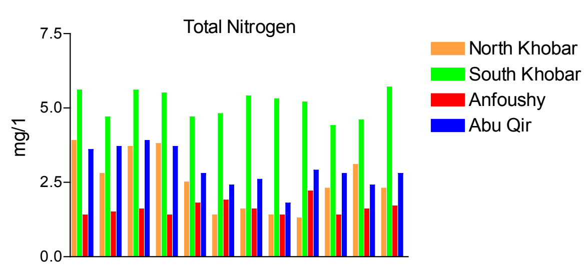
Histogram 14 (Egypt 2010 & Saudi Arabia 2013)



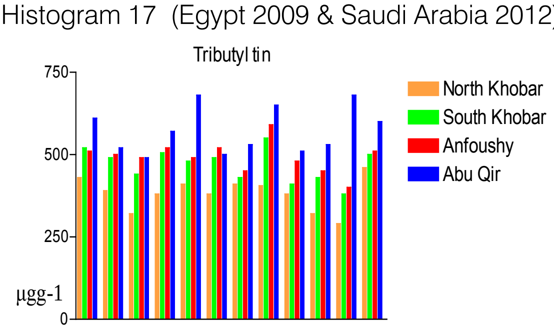
Histogram 15 (Egypt 2009 & Saudi Arabia 2012)



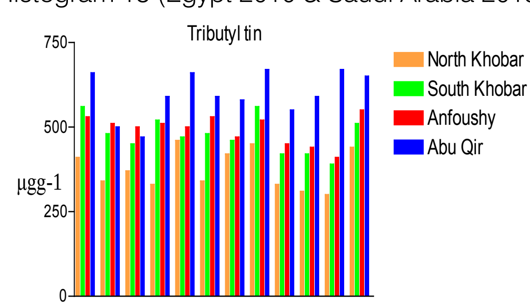
Histogram 16 (Egypt 2010 & Saudi Arabia 2013)



Histogram 17 (Egypt 2009 & Saudi Arabia 2012)

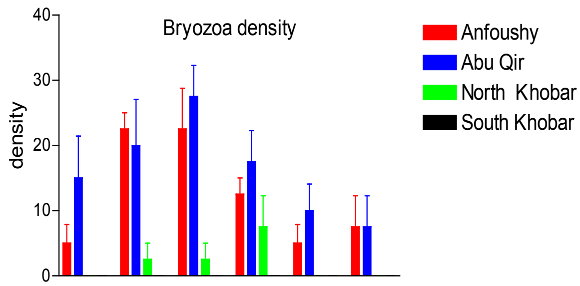


Histogram 18 (Egypt 2010 & Saudi Arabia 2013)

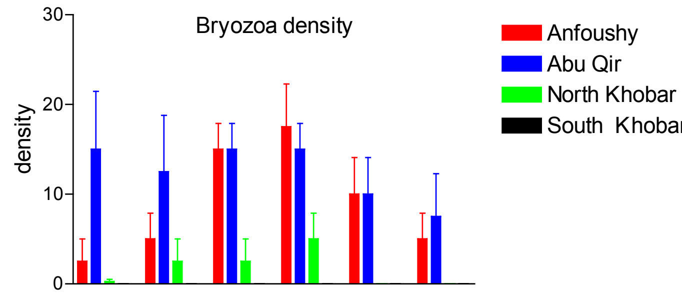


© 2015 Global Journals Inc. (US)

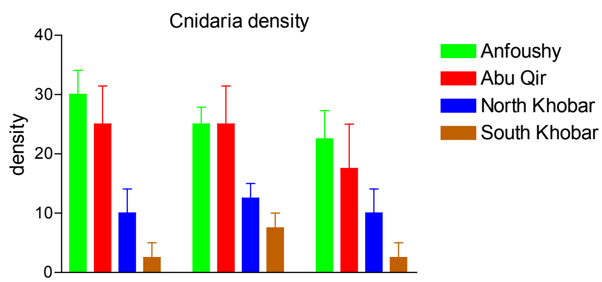
Histogram 19 (Egypt 2009 & Saudi Arabia 2012)



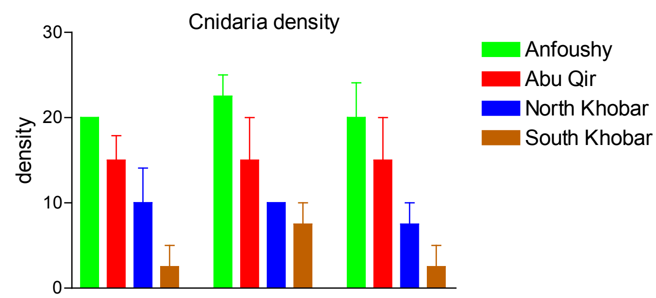
Histogram 20 (Egypt 2010 & Saudi Arabia 2013)



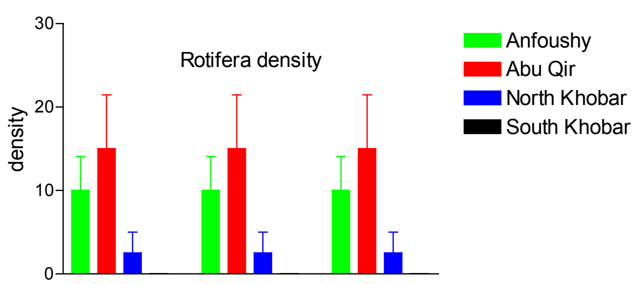
Histogram 21 (Egypt 2009 & Saudi Arabia 2012)



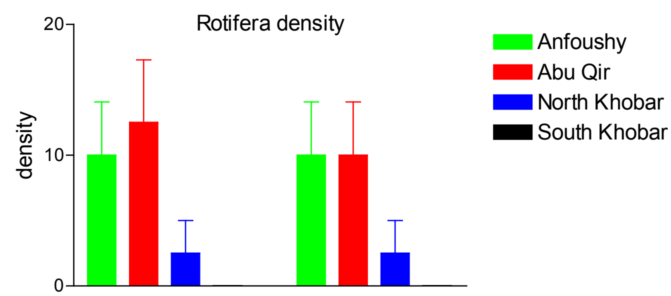
Histogram 22 (Egypt 2010 & Saudi Arabia 2013)



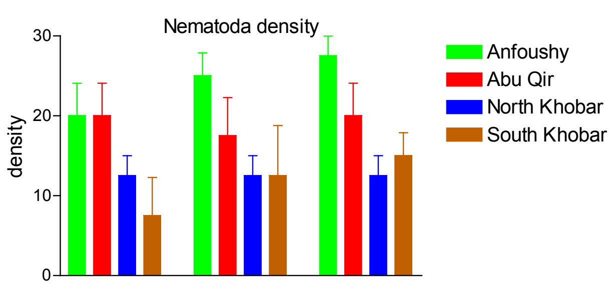
Histogram 23 (Egypt 2009 & Saudi Arabia 2012)



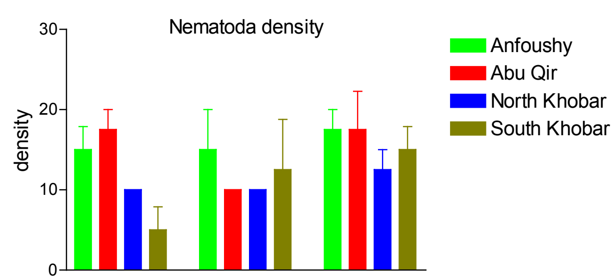
Histogram 24 (Egypt 2010 & Saudi Arabia 2013)



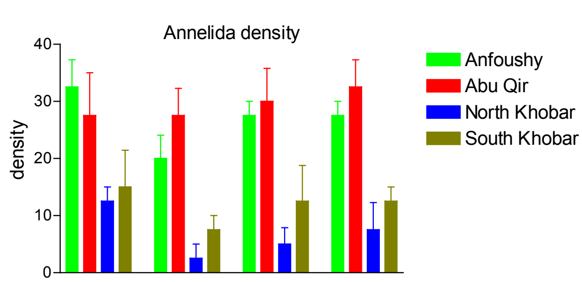
Histogram 25 (Egypt 2009 & Saudi Arabia 2012)



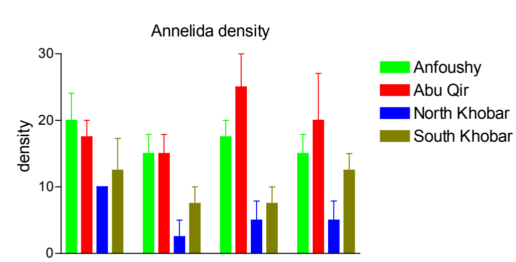
Histogram 26 (Egypt 2010 & Saudi Arabia 2013)



Histogram 27 (Egypt 2009 & Saudi Arabia 2012)

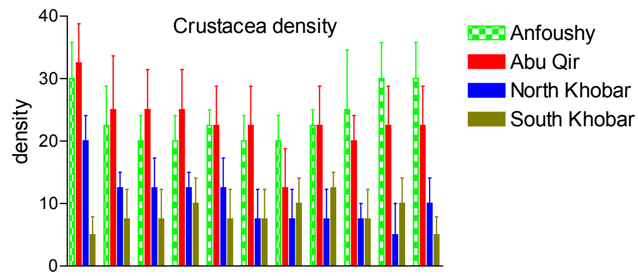


Histogram 28 (Egypt 2010 & Saudi Arabia 2013)

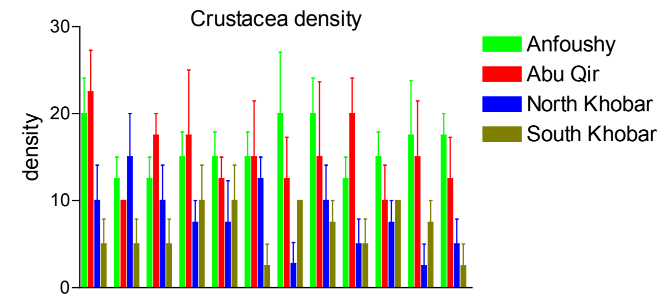


© 2015 Global Journals Inc. (US)

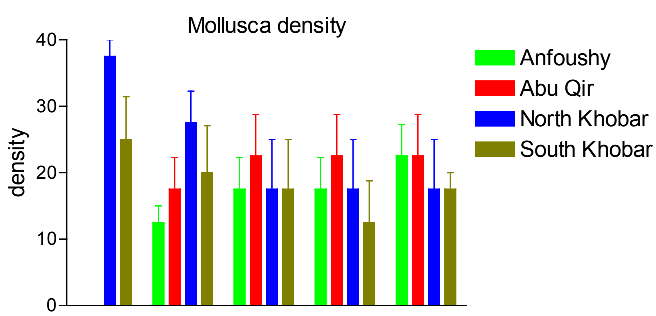
Histogram 29 (Egypt 2009 & Saudi Arabia 2012)



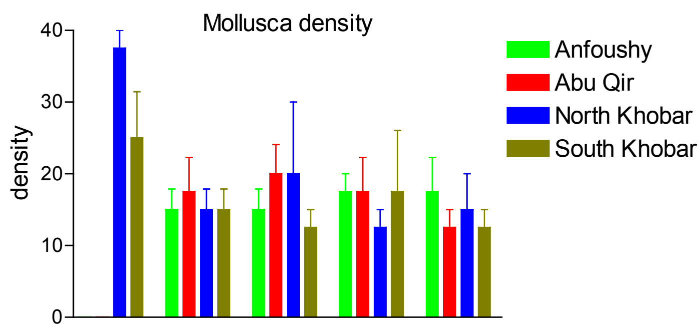
Histogram 30 (Egypt 2010 & Saudi Arabia 2013)



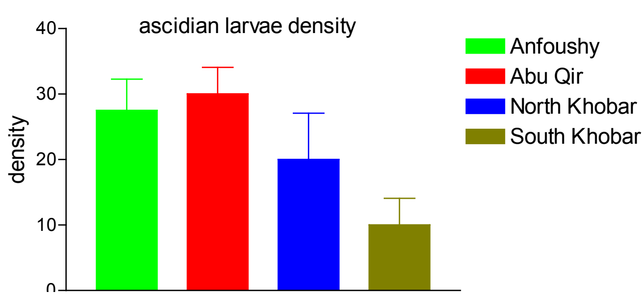
Histogram 31 (Egypt 2009 & Saudi Arabia 2012)



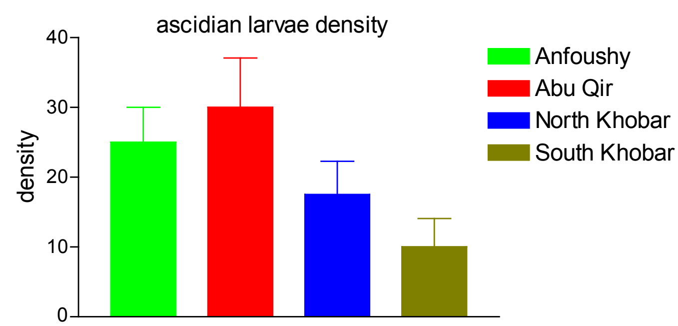
Histogram 32 (Egypt 2010 & Saudi Arabia 2013)



Histogram 33 (Egypt 2009 & Saudi Arabia 2012)



Histogram 34 (Egypt 2010 & Saudi Arabia 2013)



IV. Discussion

The zooplankton composition of the present study are in accordance with other similar studies (Crispim & Watanabe 2000, Simõeset al.2008, Sousaet al.2008). The dominance of rotifers in aquatic ecosystems has been well documented by several authors (Sampaioet al.2002) and is generally attributed to their high fecundity, parthenogenetic reproduction and short developmental rates (Pourriotet al.1997). Furthermore, the less specialized feeding makes rotifers an opportunistic r-strategist group (Allan 1976), which is favoured by the typically unpredictable and seasonal nature of Brazilian semi-arid aquatic systems. Among the rotifers, Brachionidae was the predominant family in terms of species richness and densities in the present study. This family is one of the most important rotifer taxa in tropical waters, with most species being planktonic (Almeida, et al.2006, 2010). Studies on seasonal variations of zooplanktonstanding stocks mainly concern marinewaters and demonstrate the importance of the fluctuationsrelated to seasonal biotic and abioticchanges. In the study zooplankton biomassesin the Meditrranean Sea Egypt are usually found in summer whereas the loSouthernvalues are observed inwinter.

Arabian Gulf contained the loSouthern quantity of zooplankton. Densities of zooplankton in this study were in order Anfoushy >Abu Qir > Northern Khobar > Southern Khobar all the year round. The maximum count of zooplankton in summer is due to high tempratures values and concentration of nutients. Results presented in this study have implications not only for the densities of zooplankton of the four marine systems in Mediterranean Sea and Arabian Gulf , but also to their abiotic environments. Since zooplankton have been regarded as an important trophic link between primary production and other consumers according to (Medeiros & Arthington 2008, 2011). Changes in their composition may have a cascading effect up and down the food web (Joneset al.1999). Furthermore, given the notion that factors affecting the structure and

© 2015 Global Journals Inc. (US)

composition of the zooplankton community, as well as the potential mechanisms that maintain their diversity lie at several levels of the marine watershed, decision-makers must identify the parts of the marine ecosystems that are vital to maintaining itshealth, in order to propose management and conservation policies for Mediterranean Sea and Arabian Gulf. The temperature of water is of enormous importance to marine organisms as it regulates various physico-chemical and biological activities of the organisms. Depending on temperature fluctuations the various species of zooplankton thrive and grow in waters in different months. In summer season increasing temperature enhances the rate of decomposition due to which the water becomes nutrient rich, similarly due to concentration followed by evaporation in summer season. The nutrient concentration increased and abundant food present in the form of phytoplankton and micro-organisms to zooplankton that is why high zooplankton population density during the summer season could be related to stable hydrological factors and low water level. They were resumed again in monsoon due to dilution and high water level which has been reported by Rajagopal et al.,(2010), Mulani et al., (2009), Pejaver and Gurav (2008), Jayabhaye and Madlapure (2006). The growth of rotifers occurs in summer months (Dumont, 1983), while it gives a thrust of increase to copepods and amphipods in winter months. It has been stated that the physico-chemical parameters and quantity of nutrients in water play significant role in distributional patterns and species composition of plankton (Mahar et al., 2000). Fluctuation in plankton population is a general phenomenon in the aquatic impoundments (Welch, 1952). Factors contributed to its variations are rainfall, depth, silting and other physicochemical parameters. The presence of a species depend on its environmental tolerance, but the resources available would determine their abundance. If competition or predation is reduced or food supply or suitable habitat increased, the species would become more abundant. The addition of sewage laden wastewater and the open defecation practices in the catchment are fully responsible for enriching its basin. Phosphorus and nitrogen inputs from domestic wastewaters accelerate the process of eutrophication (Rao et al , 1994). A fully eutrophicated lake with organic enrichment sustain a large number of flora and fauna as evident from the statistical analysis of this study. The copepods as a group is the index of eutrophic waters (Sladecek, 1983), and its abundance is considered as a biological indicatror of eutrophication (Nogueira, 2001, Samperio et. al, 2002). Similar observations were recorded in reservoir of Buldhana district by researchers viz. in Nalganga reservoir, Wari reservoir, Takli reservoir which have reached upto eutrophic stages similar to these findings. The present study revealed that zooplankton species richness was high in summer season compared to winter season. In summer the death and decay of macrophytes and the availability of organic matter production is much more on which zooplankton thrive best. The above factors contribute for high species diversity in that season. The increased input of sewage, siltation and high input loading in the form of wastewater are major cause of eutrophication resulting in species increase. Similar observations were recorded by Arora and Mehra (2003b& 2009) in Yamuna river. The study throws light on the rich fauna present in this small water body affected by anthropogenic activities. So from the present study it can be concluded that the four study localities harbors a bio-diverse fauna which fluctuated according to prevailing physico-chemical conditions of the marine ecosystem.

The low species richness of Copepoda during autumn and winter recorded in this study was also observed by Sousa *et al.*(2008) in Brazilian semi-arid reservoirs. Those authors explained the overall patterns of zooplankton composition in terms of trophic status (eutrophication), siltation and salinization due to evaporation. Even though such factors may be at work in the study sites, there wasno indication of eutrophication or siltation during the present study. That is inferred mostly from the low overall turbidity, relatively high rates of dissolved oxygen and low macrophyte growth at most sites.

Alternatively, this study proposed that the inadequacy of water residence time for the Copepoda in the study sites, mostly during the winter, contributed significantly to their low richness and overall paucity. In environments with periods of high flushing rates, due to the short residence time, only organisms with rapid growth and high renewal rates can increase their populations (Pourriot*et al.*1997). As exemplified by Recanto Reservoir, even larger water bodies are subject to flow during the wet Season. Similarly, the longer life cycles attributedto Copepoda (compared to Rotifera) may have been an important factor explaining their low numbers in streams during the dry season, when the rapidly contracting aquatic habitat are associated with increasingly dense fish populations (Brooks & Dodson 1965, Medeiros & Maltchik 2001a & b), more significantly so in small remnant pools in the stream bed than in the larger reservoirs. Nevertheless, low numbers of plankton have been observed in the more stable reservoirs during the dry Season, thus more information is needed on resource use and availability, and population dynamics of zooplankton as well as the dominant fish assemblages in order to fully explain this phenomenon in those water bodies.

Despite low richness, Copepoda showedhigh densities across study sites. The longer residence time of such environments is the most likely factor explaining this observation. Some groups of Copepoda have been reported as first colonizers in temporary environments

© 2015 Global Journals Inc. (US)

(Frisch & Green 2007). This early colonization has been associated to their ability to store sperm and capacity to survive drought. This is corroborated in the present study where large densities of juvenile stages of Copepoda were observed, indicating that early colonization may be in use as an adaptive strategy in these highly variable environments (see Cole 1966). Despite that, some studies have shown copepods to be late colonizers in other semi-arid regions (Hancock & Timms 2002). This is an indication that the local pool of species must also be taken into account in the present study, given that other groups of zooplankton have also been reported to be able to withstand dry periods and are quick colonizers (Crispim & Watanabe 2001, Hancock & Timms 2002, Frisch & Green 2007).

In order to identify patterns of occurrence of zooplankton taxa, grouping was carried out and species groups were associated with study areas (Mediterranean Sea and Arabian Gulf) and habitat type. On a larger spatial scale (study areas), grouping was not possible and the zooplankton fauna was not discriminated between the Mediterranean Sea and Arabian Gulf regions. However, within each area grouping was easily performed, separatingnot only Bay from Gulf sites but also Bay two sites and Gulf two sites between themselves. Similar results were observed by Medeiros *et al.*(2008) when characterizing the structure of the habitat in the study sites. Those authors observed that at larger spatial scales (between the Seridó and Buíque areas) the structure of the habitat could not be distinguished, despite some segregation between sites within study areas. This pattern was explained as the result of a nested hierarchy (Poff 1997) wherevarious levels of catchment-and stream-reach variables are correlated with the habitat structure. Data from the present study indicate that the composition of zooplankton may be influenced by aspects related to spatial hierarchical levels, where a commonlarge-scale pool of species is broken into more specific community traits at local scales (see Tomanova & Usseglio-Polatera 2007), the latter being likely regulated by local-scale physical and biological processes, such as competition, predation and grazing patterns. That being the case, catchment-scale processes, such as climate and geomorphology, are important to define higher levels of organization of the plankton fauna and overall species pool of the marine ecosystem. These higher levels of organization will then influence factors at a variety of lower spatial reach-scale characteristics such as morphology, flow and water variables, and consequently the local species pool, which may be particularly relevant to marine systems.

Management policies for marine systems are based on reservoir and weir construction and different degrees of flow regulation (see Maltchik &Medeiros 2006; Leal,et al. 2013). These alterations greatly modify the hydrological characteristics of the highly variable intermittent streams, which have been reported to have the extremes of flooding and drought as the driving forces organizing biotic communities (Maltchik & Florin 2002). Implications of such modifications in dry lands have been summarized by Bunn & Arthington (2002) and include changes on zooplankton assemblages structure.

References Références Referencias

1. Abbasi, S.A. 1998. Water Quality sampling and Analysis. 1stEd. Discovery publishing house, New delhi.
2. Ahmad, S. and Ashok, K. 2013. Some crustacean zooplankton of Wular lake in Kashmir Himalaya. African J. Environ. Sci.Technol.,7(5): 329-335. DOI:10.5897/AJEST2013.1483.
3. Allan, J.D. 1976. Life history patterns in zooplankton. Am. Nat.,110-180.
4. Almeida, V. ; Larrazábal, M.; Moura, A. and Melo M., 2006. Rotifera das zonas limnética e litorâneado reservatório de Tapacurá, Pernambuco, Brasil. Iheringia, SérieZoologia, 96(4):445-451.
5. Almeida, V. ;Melo M.;Paranaguá, M. ; Larrazabal, M. and Melão, M.2010.
6. Zooplânctonde Água Doce e seu Estudo em Reservatórios do Nordeste do Brasil.In Moura, N .; Araújo, el. ;Bittencourt-Oliveira, M.;Pimentel, R. and Albuquerque, U. (Orgs.).Reservatórios do Nordeste do Brasil: Biodiversidade, Ecologiae Manejo. Bauru: Canal, 6. p. 441-475.
7. Arora, J. and N. K. Mehra, 2003a. Seasonal dynamics of rotifers in relation to physicochemical conditions of river Yamuna (Delhi), India. Hydrobiologia, 491: 101-109.
8. Arora, J. and N. K. Mehra, 2003b. Species diversity of planktonic and epiphytic rotifers in the backwaters of the Delhi segment of River Yamuna, with remarks on new records from India. Zoological Studies 42(2): 239-247.
9. Arora J. and N. K. Mehra, 2009. Seasonal dynamics of zooplankton in a shallow eutrophic, man-made Hyposaline Lake in Delhi (India): role of environmental factors. Hydrobiologia, 626(1): 27-40.
10. Ayodele, H. A. and Adeniyi, I. F. 2006. TheZooplankton Fauna of Six Impoundments onthe River Osun, Southern Nigeria. TheZoologist, 1(4): 49-67.
11. Bass, D. and Potts, C. 2001. Invertebrate community composition and physicochemical conditions of Boehler Lake, Atoka County, Oklahoma. Proc. Okla. Acad. Sci., 81: 21-29.
12. Boyd, C.E. 1998. Water Quality for Pond Aquaculture. Research and Development Series No. 43.International Center for Aquaculture and Aquatic

© 2015 Global Journals Inc. (US)

Environments, Alabama Agricultural Experiment Station, Auburn University, Alabama.
13. Boyd, C.E. and Tucker, C.S. 1998. Pond aquaculture water quality management.Kluwer Academic Publishers, London.
14. Brenman, D. ; Richards, C. and Lozano, S. 2000. Environmental influences on benthic community structure in a Great Lakes embayment. L Great Lakes Res., 26 (3): 287-304.
15. Brooks, J. L. and S. I. Dodson. 1965. Predation,body size, and composition of the plankton.Science, 150: 28-35.
16. Bunn, S.E., Arthington, A.H. 2002. Basic principles and ecological consequences of altered flow regimes for aquatic biodiversity.
17. Environmental Management,30(4), 492- 507. Chakrabarty, R.D. ; Roy, P and Singh, S.B. 1959. A Quantitative study of the plankton and the physicochemical conditions of the river Jumna at Allahabad in 1954 -55. Indian Journal of Fisheries, 4(1),03–147.
18. Cole, G. A. 1966. Contrasts among calanoid copepods from permanent and temporary ponds in Arizona. American Midland Naturalist, 76(2): 351-368.
19. Crispim, M. C. and Watanabe, T. 2000. Ovos de resistência de rotíferos presentes em sedimentos secos de um açudeno semi-árido paraibano. Acta Limnol. Bras,12:89–94.
20. Crispim M. C. and Watanabe T. 2001. What can dry reservoir sediments in a semi-arid region in Brazil tell usabout cladocera? Hydrobiologia,442: 101-105.
21. Cyrus, D. P. and Wepener, V. 1993. Assessment of the potential impact of decreasing water levels on the fauna and flora of Lake Mzingazi, Richards Bay.CRUZ Investigational Report, 13: 1-27.
22. Dejen, E. ; Vijverberg, J. ; Nagelkerke, L. A. J. And Sibbing, F. A. 2004. Temporal and spatialdistribution of microcrustacean zooplankton in relation to turbidity and other environmentalfactors in a large tropical lake L.Tana,Ethiopia. Hydrobiologia, 513, 39–49.
23. Dermott R. 2001. Sudden disappearance of the amphipod Diporeia from Northern Lake Ontario.1993–1995. J. Great Lakes Res., 27:423–33.
24. Dermott, R. and Kerec, D. 1997. Changes to the deep-water benthos of Northern Lake Erie since theinvasion of Dreissena: 1979–1993. Can J. Fish. Aquat. Sci., 54:922–30.
25. Dijana, G. ; Jasminka, D.; Vesna, S. and Teuta, T. 2012. Analysis of Heavy Metals concentration in Wastewater along Highways in Croatia. J. Computing Info. Technol., CIT 20(3):209–215.
26. Dhargalkar, V.K. and Verlecar, X.N. 2004. Zooplankton Methodology, Collection & Identification. S.C. Goswami (Retd.). National Institute of OceanographyDona Paula, Goa - 403 004. Ministry of Environment & Forests, New Delhi. http://www.researchgate.net/publication/237447982_Zooplankton_Methodology_Collection__Identification
27. Doulka, E. and Kehayias, G. 2011. Seasonal vertical distribution and diel migration of zooplankton ina temperate stratified lake. Biologia, 66(2), 308–319.
28. Dumont, H. J. and Van de Velde, G. 1977. Report on a collection of Cladocera and Copepodafrom Nepal. Hydrobiologia, 53(1):55-65.
29. Dumont, H.J. 1983. Biogeography of rotifers. Hydrobiologia 104: 19-30.
30. Edmondson W.T. 1959. Fresh Water Biology. 2nd edition. John Willey and Sons. New York, Pp. 127-169.
31. F. A. O.(Food and Agriculture Organisation), 2006.Interrelationship between Fish and Plankton in InlandWater. Retrieved from:http://w.w.w.fao.org/DocREP/006/X7580E03.htm106k-coached, (Accessedon: September 29, 2007).
32. Flint, R. W. 1979. Responses of freshwater benthos to open-lake dredge spoils in Lake Erie. J. Great Lakes Res.. 5(3-4): 264-275.
33. Frisch, D. and Green, A. J. 2007. Copepods come in first: rapidcolonization of mew temporary ponds. Fundamental andApplied Limnology, Archiv für Hydrobiologie, 168:289–297.
34. Gómez-Gutiérrez, J. ; Palomares-García,R. and Gendron,D. 1995. Community structure of the euphausiids populations along the Southern coast of Baja California, México during the weak ENSO 1986-87. Mar. Ecol. Prog. Ser., 120: 41-51.
35. Gómez-Gutiérrez, J. ; De Silva-Dávila, R. and Lavaniegos, E.B. 1996. Growth production of the euphausiid Nyctiphanes simplex at the coastal shelf off Magdalena Bay, Baja California Sur, México. Mar. Ecol. Progr. Ser.,138: 309-314.
36. Grassle, J.F. ; Grassle, L.S. ; Brown-Leger, R.F. ; Petrecca, T and Copley, N.J. 1985. Subtidal macrobenthos of NarragansettBay. Field and mesocosm studies of the effectsof eutrophication and organic input on benthicpopulations. In: Marine Biology of Polar Regions and Effects of Stress on Marine Organisms, J.S. Gray andM.E. Christiansen, eds. Wiley, New York, 421-434.
37. Guimarães, D.O.; Pereira, L.C.C.; Monteiro, M.; Gorayeb, A., and Costa, R.M. 2009. Effects of the urban influence on the Cereja River and Caeté Estuary (Amazon littoral, Brazil). In: Da Silva, C.P. (ed.), ICS 2009 Proceedings, J. Coastal Res., Special Issue No. 56, pp. 1219-1223.
38. Hancock, M. A. and Timms, B. V. 2002. Ecology of four turbid clay pans during a filling-drying cycle in

© 2015 Global Journals Inc. (US)

the Paroo, semi-arid Australia. Hydrobiologia, 479(1-3): 95-107.
39. Hofmann, W. 1977. The influence of abiotic factors on population dynamics in planktonic rotifers. Arch. Hydrobiol. Beih.. Ergebn. Limnol., 8: 77-83.
40. Hofmann, D.K.; Michael, M. I.; Khalil, S.H.; El-Bawab, F.M. and Saad, G.A.2008. Larval metamorphosis in *Ascidiella aspersa* (Müller, 1776) and *Phallusia mammilata* (Cuvier, 1815) Urochordata, Ascidiacea – An experimental study including an immunocytochemical approach. Proc. 5th Int.Conf. Biol.(Zool.), 5:235-248.
41. Hudec, I. 1987. Perloočky (Cladocera) rastlinných zväzov Lemnion minoris a Hydrocharition. Biológia, Bratislava 42: 547–556.
42. Ikbel, S. ; Samira, B. R. ;, Wassim, G. ; Monia, E. ; Asma, H. ; Mohammed, A. M. ; Bernadette, P. ; Lotfi, A. and Habib, Ayadi,1 2012. Seasonal dynamics of plankton communities coupled with environmental factors in a semi arid area: Sidi Saâd reservoir (Center of Tunisia). African Journal of Biotechnology Vol. 11(4), pp. 865-877.
43. Jayabhaye, U.M. and Madlapure, V.R. 2006. Studies on zooplankton diversity in Paroladam, Hingoli, Maharashtra, India. J.Aquua.Biol., 21(2), 67-71.
44. Jones J. Grey, D. Sleep, and L. Arvola. 1999. Stable isotopeanalysis of zooplankton carbon nutrition in humic lakes. Oikos, 86: 97–104.
45. Jyoti, M.K. ; Sharma, K.K. and Sharma, J. 2009.Population dynamics and community structure ofzooplankton inhabiting in fish pond Jammu, India. Current World Environment, 4(1): 165-169.
46. Kehayias, G. ; Michaloudi, E. and Bexi, A. 2004. Aspects on the seasonal dynamics and the verticaldistribution of the crustacean zooplankton community and the *Dreissena polymorpha* larvaein Lake Trichonis. Medit. Mar. Sci., 5(1): 19–27.
47. Kessler, K. and Lampert, W. 2004. Depth distribution of *Daphnia* in response to a deep-water algalmaximum: the effect of body size and temperature gradient. Freshwater Biol., 49, 392–401.
48. Larson, G. L. ; Hoffman, R. ; Mcintire, C. D. ; Lienkaemper, G. and Samora, B. (2009). Zooplankton assemblages in montane lakes and ponds of Mount Rainier National Park, Washington State, USA. J. Plankton Res. 31: 273-285.
49. Lawal-Are, A.O. ; Onyema, I.C. and Akande, T.R. 2010. The Water Chemistry, Crustacean Zooplankton and some associated faunal species of atropical tidal Creek In Lagos,Nigeria. J. American Science, 6(1):81-90.
50. Leal, M. C. ; Ferrier-Pages, C. ; Calado, R. and et al. 2013. Coralfeeding on microalgae assessed with molecular trophicmarkers. Dryad Digital Repository, doi:10.5061/dryad.3kf75.
51. Levinton, J. S. 1995. Marine Biology: function, biodiversity, ecology. New York: Oxford University Press., Pp 420.
52. Mahar, M.A. ; Jafri,S.I.H. and Leghari,S.M. 2000. Studies on water chemistry and fish productionof Manchar lake, Dadu, Sindh, Pakistan. Pakistan. J. Biol. Sci., 3(12): 2151-2153.
53. Maltchik, L. and Florin, M. 2002. Perspectives of hydrological disturbance as the driving force of Brazilian semiarid stream ecosystems. Acta Limnologica Brasiliensia, 14(3): 35-41.
54. Maltchik, L. and Medeiros, E. S. F. 2006. Conservation importance of semi-arid streams in north-Northern Brazil: implications of hydrological disturbance and species diversity. Aquatic Conservation: Marine and Freshwater Ecosystems, 16(7): 665-677.
55. Medeiros, E. S. F. and Arthington, A. H. 2008. Diel variation infood intake and diet composition of three native fishspecies in floodplain lagoons of the Macintyre River, Australia. J. Fish Biol., 73:12(3): 134-140 doi:10.1111/j.1095-8649.2008.01959.x Medeiros, E. S. F. and Arthington, A. H. 2011. Allochthonous and autochthonous carbon sources for fish in floodplain lagoons of an Australian dryland river. Environmental Biology of Fishes, 90: 1-13.
56. Medeiros, E. S. F. and Maltchik, L. 2001a. Diversity and stability of fishes (Teleostei) in a temporary river of the Brazilian semiarid region. Iheringia, Sér. Zool., 90: 157-166.
57. Medeiros, E. S. F. and Maltchik, L. 2001b. Fish assemblage stability in an intermittently flowing stream from the Brazilian semiarid region. Austral. Ecology, 26(2): 156-164.
58. Medeiros,E. ; Noia, N. P. ; Thais, N. P. and Melo, X. 2008.Zooplankton composition in aquatic systems of semi-arid Brazil: spatial variation and implications of water management - ResearchGate. Available from: http://www.researchgate.net/publication/ Pan-American J. Aquatic Sciences. 4(6): 290-302.
59. Mulani, S.K. ; Mule, N. and Sato, S.U. 2009. Patil: Studies on water quality and zooplankton community of the Panchganga river in Kolhapur city. J. Environ. Biol., 30, 455-459.
60. Nair, V.R. 1978. Zooplankton from the nearshore waters of Karwar. Indian J. Mar. Sci., 7(4): 283-287.
61. Nagdali, S. S., and P. K. Gupta. 2002. Impact of mass mortalityof a mosquito fish, *Gambusia affinis*, on the ecology of afresh water eutrophic lake (Lake Naini Tal, India). Hydrobiologia,468: 45–52.
62. Nalepa, T. F. ; Lang, G. A. and Fanslow, D. L. 2000. Trends in benthic macroinvertebrate populations in southern Lake Michigan. Verh. Int. Verein. Limnol., 27: 2540-2545.

© 2015 Global Journals Inc. (US)

63. Nasar, S.A.K. 1977. Investigation on the seasonal periodicity of zooplankton in a pondin Bhagalpur, India. Acta Hydrochem. Hydrobiol., 5: 577-584.
64. Neumann-Leitão, S. ; Gusmão, L. M. O. ; Silva, T. A. and et al. 1999.
65. Mesozooplankton biomass and diversity in coastal and oceanic waters off North-Eastern Brazil. Arch. Fish. Mar. Res., 1999;47:153-165.
66. Nogueira, M.G. 2001. Zooplankton compositon dominance and abundance asindicators of environmental compartmentalization in Jurumirin reservoir(Paranapanemma River) Sao Paulo, Brazil. Hydrobiol., 455: 1-8.
67. Odum, H.T. ; Nixon, S.W. and DiSalvo, L.H. 1971. Adaptations for photoregenerative cycling. pp. 1-29 in The Structure and Function of Freshwater Microbial Communities, J. Cairns, ed. American Microscopial Society, Virginia Polytechnic Center for Environmental Studies, Blacksburg, VA. 301 pp Okogwu, I.O. 2010. Seasonal variations of speciescomposition and abundance of zooplankton in ebomalake, a Floodplain Lake in Nigeria. Rev. Biol. Trop.,58(1): 171-182.
68. Okogwu, O.I. and Ugwumba, O.A. 2006. The zooplanktonand environmental characteristics of Ologe Lagoon,Southwest, Nigeria. Zoologist, 3: 86-92.
69. Ortega-Mayagoitia, E. ; Rojo, C. and Armengol, J. 2000. Structure and dynamics of zooplankton in asemiarid wetland, the National Park Las Tablas de Daimiel, Spain. *Wetlands*, 20(4), 629-638.
70. Palmer, M. A. and Poff. N. L. 1997. Heterogeneity in Streams: The influence of environmental heterogeneity on patterns and processes in streams. J. N. Am. Benthol. Soc., 16*:* 169-173.
71. Panikkar, N.K. and Rao, T.S.S. 1973. Zooplankton investigations in Indian waters and the role ofthe Indian Ocean Biological Centre. Handbook to the International zooplankton collections, 5: 111-162.
72. Patil, C.S. and Gouder B.Y.M. 1985. Ecological study of freshwater zooplankton of asubtropical pond (Karnataka state, India). Int. Rev.Ges.Hydrobiol., 70(2): 259-267.
73. Paturej, E. and Gutkowska, A. 2014.The effect of salinity levels on the structure of zooplankton communities. Department of Applied Ecology, University of Warmia and Mazury in Olsztyn, Oczapowskiego 5:10-957 Olsztyn, Poland. doiSerbia. www.doiserbia.nb.rs/ft.aspx?id=0354-46641500012P
74. Pejaver, M and Gurav, M. 2008. Seasonal variation of zooplankton in Nirmalya(*religious reguges*) enclosures of Kalawa lake, thane,Maharashtra. *J.Aqua.Biol*. 23 : 22-25. Poff, N. L. 1997. Landscape filters and species traits: towards mechanistic understanding and prediction instream ecology. Journal of the North American Benthological Society, 16(2): 391-409.
75. Pourriot, R. ; Rougier, C. and Miquelis, A. 1997. Origin and development of river zooplankton: example of the Marne. Hydrobiologia, 345(2-3): 143-148.
76. Primicerio, R. and Klemetsen, A. 1999. Zooplankton seasonal dynamics in the neighbouring lakesTakvatn and Lombola (northern Norway). Hydrobiologia, 411, 19–29.
77. Primicerio, R. 2000. Seasonal changes in vertical distribution of zooplankton in an oligotrophic, subarctic lake (Lake Takvatn, Norway). Limnologica, 30: 301-310.
78. Qasim, S. z. 1977. Contribution of zooplankton in the food chains ofsome warm water environments. In: Proceedmgs . of the Sympoium on Warm Water Zooplankton. 700-708. Ptublishedby Natl Inst Oceanogr.; Goa, India.
79. Qasim, S.Z.. 1982. Oceanography of the northern Arabian Sea. Deep-Sea Res.J., 29: 1041- 1068.
80. Rajagopal, T.A. ; Thangamani, S.P. ; Sevarkodiyone.; M. ; Sekar, P. and Archunan, G.2010. Zooplankton diversity and physic-chemical condition in three perennial ponds of Virudhnagar District, tamil Nadu. J.Environ. Biol., 31: 265-272.
81. Rajapaska, R and Fernando C.H.1982. The Cladocera of Srilanka (Ceylon) withremarks on some species. *Hydrobiol*. 94: 49-69.
82. Rao, T.S.S. 1979. Zoogeography of the Indian Ocean. Pages 254-292, In: Vander Spoel, S. andRierrot-Bults, (Editors). Zoogeography and Diversity in Plankton. Bunge Scientific Publishers,Utrecht.
83. Rao, V.N. ; Mohan, R. R. ;Hariprasad, V.and Ramasubramanian, R. 1994. Sewagepollution in the high altitude Ooty lake, Udhagmandalam Cause and Concern. Poll Res., 13(2): 133-150.
84. Reynoldson, T. B. ; Bailey, R. C. ; Day, K. E. and Norris, R. H. 1995. Biological guidelines for freshwater sediment based on benthic assessment of sediment (beast) using a multivariate approach for predicting biological state. Aust. J. Ecol., 20(1): 198-220.
85. Ringelberg, J. 2010. Diel Vertical Migration in Lakes and Oceans: Causal Explanations andAdaptive Significances. Springer Science + Business Media, B.V. Rosenberg, D. M. and Resh, V. R. 1993. Freshwater biomonitoring and benthic macroinvertebrates. New York: Chapman and Hall.
86. Rudnick, D.T. ; Elmgren, R.and Frithsen, J.B.1985. Meiofaunal prominence and benthicseasonality in a coastal marine ecosystem.Oecologia, 67:157–168.
87. Saad, G. A. 2002. Comparative studies of the nervous and reproductive systems of some species of urochordates with emphasis on the role

© 2015 Global Journals Inc. (US)

of the nervous system on reproduction and larval metamorphosis. Ph.D. Thesis, Fac. Sci., Alexandria University, Egypt.
88. Saad, G. A. 215. Description and identification of some selected nektonic and benthic zooplakton inhabiting marine ecosystems. Inter. J. Curr. Res., 7(03):13179-13198.
89. Sameoto, D. ; Wiebe, P.H. ; Runge, J. ; Postel,L. ; Dunn, J. ; Miller, C. and Coombs, S. 2000. Collecting zooplankton. In:Harris, R.P., P.H.
90. Wiebe, J. Lenz, H.R. Skjoldal and M.Huntley (Eds), ICES Zooplankton Methodology Manual.Academic Press, London/San Diego: 55-81.
91. Sampaio, E. V. ; Rocha, O.; Matsumura-Tundisi, T. and Tundisi, J. G. 2002. Composition and abundance of zooplankton in the limnetic zone of seven reservoirs of the Paranapanema River, Brazil. Brazilian Journal of Biology, 62(3): 525-545.
92. Scasso, F., N. Mazzeo, J. Gorga, C. Kruk, G. Lacerot, J.Clemente, D. Fabia´n and S. Bonilla, 2001. Limnologicalchanges of a subtropical shallow hypertrophic lakeduring its restoration. Two years of whole-lake experiments. Aquatic Conserversation: Marine FreshwaterEcosystems 11: 31–44.
93. Sharma, B.K. 1983. The Indian species of the genus Brachionnus (Eurotatoria: Monogononta: Brachionidae). Hydrobiologia., 104: 31-39.
94. Simões, N. R., Sonoda, S. L. and Ribeiro, S. M. M. S. 2008. Spatial and seasonal variation of microcrustaceans (Cladocera and Copepoda) in intermittent rivers in the Jequiezinho River Hydrographic Basin, in the Neotropical semiarid. Acta Limnologica Brasiliensia, 20(3): 197-204.
95. Sladecek, V. 1983. Rotifers as indicators of water quality. *Hydrobiologia* 100: 169-201.
96. Sousa, W. ; Attayde, J. L. ; Rocha, E. S. and Eskinazi-Sant'Anna, E. M. 2008. The response of zooplankton assemblages to variations in the water quality of four man-made lakes in semi-arid northNorthern Brazil. Journal of Plankton Research, 30(6): 699-708.
97. Sreelatha, K. 2007. Seasonal variations of zooplankton of Goutami Godavari estuary,Yanam, Pondicherry (Union territory). J.Aqua.Biol., 22(2): 73-76.
98. Stich, H.B. and Lampert,W. 1981. Predator evasion as an explanation of diumal vertical migrationby zooplankton. Nature, 293,396-398.
99. Tomanova, S. and Usseglio-Polatera, P. 2007. Patterns of benthic community traits in neotropicalstreams: relationship to mesoscale spatial variability. Fundamental and Applied Limnology, 170(3): 243-255.
100. Ugale,B.J. ; Hiware C.J. ; Jadhav, B.V. and Pathan, D.M.2005.
101. Zooplankton diversityin Jagatunga Samudra Reservoir, Kandhar, Nanded Dist.(M.S.). J.Aqua.Biol., 20(2): 49-52.
102. Vivier, L. and Cyrus, D. P. 1999. The zoobenthic fauna of the Nhlabane coastal lake system. KwaZulu-Natal. South Africa, 20 years after construction of a barrage. Water S. A. *25* (4): 533-542.
103. Welch, P.S. 1952. Limnology. McGraw hill, New York, p. 471. Yakub, A.S. 2004. Assessment of water quality andplankton of effluents receiving Awba Streamand Reservoir, Ibadan, Nigeria. African Journal of Applied Zoology and Environmental Biology 6:107-110

© 2015 Global Journals Inc. (US)