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Research Article

SPATIAL AND TEMPORAL DISTRIBUTION OF PHYTOPLANKTON AND SOME RELATED PHYSICAL AND CHEMICAL PROPERTIES IN AL –ABASIA RIVER (EUPHRATES), IRAQ

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ABSTRACT
The present study was carried out monthly in four sites located in Najaf of Iraq at Al-Abasia River for the period from March 2012 to February 2013 included study some physiochemical properties of phytoplankton in order to study the quality and the quantity of phytoplankton and also the study includes the measurement of physical and chemical properties of the river. The result showed that the air temperature ranged between (10-45.3)Cº while the water temperature was (6.3-33) Cº. Electrical conductivity and Salinity is approximately about (163.33-1157) µS.cm and (3.68–23)0 ‰ respectively. Total dissolved solids values are about (277) mg/L to(900)mg/L. Total suspended solids values ranged between (0.09-37) mg/l.
The Al-Abasia River water revealed that it was too hardness values is about (60-2000) mg $caco_3$/L. While calcium concentrations are (86.84-1783) $caco_3$/L. and Magnesium concentrations are (6.70–268.66)mgcaco3. Result of this study showed that Reactive phosphate concentrations are about (0.01-5.06) mg /L, and Nitrite concentrations are about (N.D -5.20) mg /L, Nitrate concentration are about (0.09 – 6.47) mg /L. The number of recorded species of phytoplankton reached 213 species most of them are belonging to Diatoms algae consisting 59.13%. Ninety nine species were belonging to Pennales, followed by Chlorophyta and Cyanophyta 46, 22 species respectively. Pyrrophyta2, Euglenophyta2, Pheophyta5, Chrysophyta5 species. Bacillariophyta highest total number was 9309×10^4 to 1074 cell / l of wet weight was recorded in site 1 during April and May while others algae 9823×10^4cell/l in the site 3 at July at 1036×10^4cell/l in the site 4 at April from total phytoplankton population density .

Key Words: *Water Quality, Limnology, Phytoplankton, Al-Abasia River (Euphrates*)

INTRODUCTION
Many aquatic organisms show sensitivity to physical and chemical changes in aquatic environment which they live (Shiklomanov, 1999).
Phytoplankton are tiny (one-celled) algae, plant-like organisms that use sunlight as an energy source to make their own food in a process called photosynthesis while The definition of phytoplankton adopted for sunlight as an energy source to make their own food in a process called photosynthesis while The definition of phytoplankton adopted for (Reynold, 2006) is the collective of photosynthetic microor-ganisms, adapted to live partly or continuously in open water ,where remain near the surface because the surface waters of the open sea and large lakes are regularly mixed each day by the wind (Hamner). Hydrological factors are most important for determining the growth of phytoplankton in rivers than in lakes, biomass of phytoplankton in lakes linked the abundance of nutrients while in the rivers they are associated factors hydro biological (Basu and Pick, 1996).
Temperature appear to enhance rate of Cyanophyta, Washigton (1984) elevated the growth of phytoplankton community affected of the environmental changes which may be to modified of the specific composition of algae. Electrical conductivity is considerable indicator of ionized substances in the water and is mainly concerned with total dissolved solids and temperature (Wetzel, 2001). The hardness role in knowing some of dissolved ions such as calcium and Organizational buffer capacity while in the rivers they are associated factors hydro biological (Basu and Pick, 1996). In Iraq many study deal with the distribution of phytoplankton in the Shatt AL-Arab, Hadi and AL-Saboonchi (2009) studied

the seasonal change for phytoplankton and epipelic addition to estimate biomass of algae ,as this study referred Bacillariophyta have covered 80% of the total number studying ,were dominant species *Cocconeis placentula, Synedra ulna, Cyclotella meneghianiana.* In Al-Rehba region south of Bahr Al najaf \Iraq from was conducted water quality of the studied Artesian walls tend to be slightly alkaline, hard, and has overcritical Oxygen and About36 Algal taxa has been classified in this study. Bacillariophyceae was the most dominant algae (86.1%) such as *Fragilaria crotonensis, Nitzschia dubia, Rhoicosphenia curvata, Nitzschia gracilis, Microsystis aeruoginosa, Chroococcus varius* followed by Cyanophyceae (13.9 %) like *Microsystis aeruoginosa* and *Chroococcus varius (*Alkam *et al*., 2009). Al – Fatlawi (2011) asserted in studying of the algae in Euphrates river, some phytoplankton presented only in the water column such as *Melosira distans, Achnanthes exigua, Asterionella Formosa, Chroococcus disperses Ankist- rodesm spiralis,* while, Salman *et al.,* (2013) deal with the study of phytoplankton and related environmental properties in Euphrates river ,middle of Iraq.
The objective of this study was to identify the composition and distribution of the phytoplankton species and related the physical and chemical properties of Al-Abasia River (Euphrates), Medill of Iraq.

MARERIALS AND MATHODS

Study Area

Euphrates River is one of major water resources in Iraq, it is branched before AL-Najaf AL-Ashraf provinous by 8 km, into rivers AL-Kufa River and AL-Abasia river. AL- Abasia River is representing the old natural rivers at the middle of Iraq.

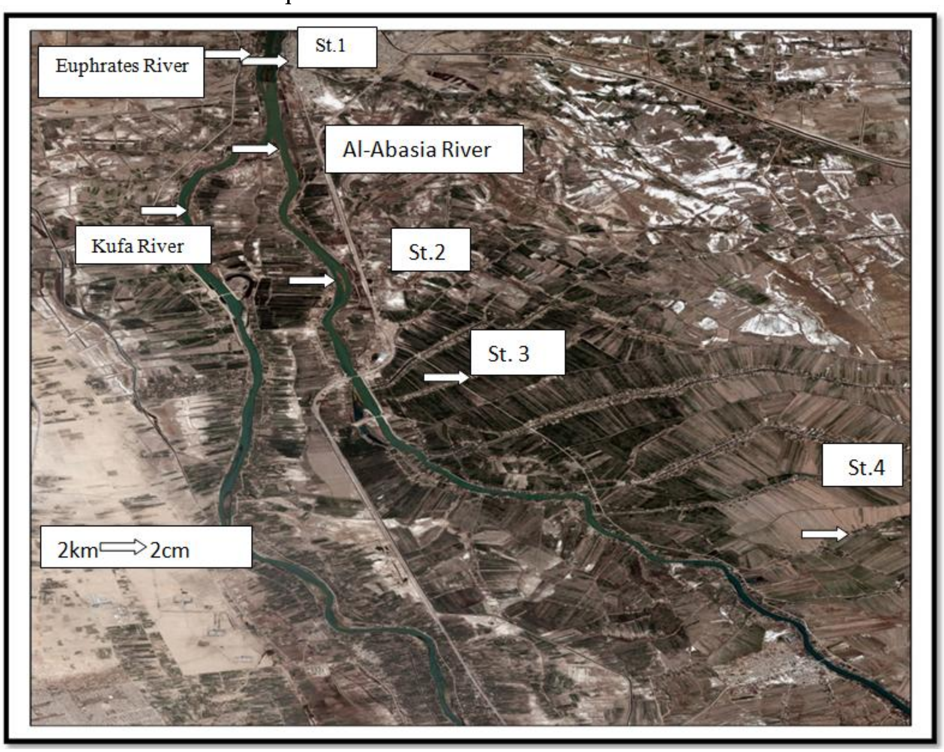

Figure 1: Satellite image of study area on Al-Abasia River, middle/Iraq

The length of Al- Abasia river is about 28km, it reaches as length as 31.23Km beginning of Euphrates branching after AL- kifil town by 1 km. It cover 12000 acres from agricultural area in AL- Najaf and AL-Qadysia provinous, site 1 selected on A[- Kifil city, before river branched OF Euphrates into Kufa and Al-Abasia rivers by about 1Km at Longitude East 439703.12 and

Latitude North 3565516.95, site 2 is located at AL- Kufa factory of soft drink, near AL- Abasia bridge distant about 3Km at Longitude East 439703.12 and Latitude North 3557016.22 from the site 1, site 3 located at AL- Abasia barrage distant about 9Km at Longitude East 441037.00andLatitude North N 3557016.22, site 4 The investigation area represents AL- Abasia center city about 13 Km at Longitude East 447777.39 and Latitude North N 3549322 (Figure 1).

Water Quality

Air and water temperature was measured direct in and water in the field by thermometer. pH. and Electrical Conductivity achieve in field used pH meter & E.C. meter(type ISO 9200 centric meter portable, U.S.A). TDS, TSS, Salinity, Dissolved oxygen, BOD5, Total Hardness, Calcium, Magnesium and total alkalinity were determinate by (APHA, 2003). Nitrite, Nitrate and reactive phosphate were determined following methods given by Parson *et al.,* (1984), chlorophyll-a and phyeophytine in study site was measured (Amino and Rey, 2000).

Study of Phytoplankton

Phytoplankton were sampled at each station using plankton net with mesh size 50µm and were preserved immediately using Formalin solution (10%) and diagnosed it (other algae) by prepare temporary slides and examined on the strength of X40 by the compound microscope using diagnosis keys (Prescott, 1973; Desikachary, 1959).

The diatomic Phytoplankton sample were collected at each site using Polyethylene bottles 1000ml were preserved immediately adding 1ml of Logul's solution (Vollenweider, 1974) to return the lab. Phytoplankton diagnosed (Non-diatomic algae) by according to (Prescott, 1973; Hassan *et al.,* 2012). While the diatomic algae the diagnosis by (Foged, 1976; Hustedt, 1985; Hadi *et al.,* 1984; Germain, 1981; AlFatlawi, 2012; Hassan *et al.,* 2012).

Relative abundance index (Omori and Ikeda, 1984); Species richness; Shanon –Weiner Index (Mangurran, 1988) were made to phytoplankton in study sites.

RESULTS AND DISCUSSION

The water quality parameters in the study area are shown in Table (1). The air temperature variation were ranged between 10C ° in August 2012 to 45.3 10C ° in February 2013 at the site 2 while the highly value of water temperature C° was recorded in August 2012 across all sites and low water temperature was recorded in January 2013 6.3 C°, the results for both air and water temperatures value were high in the hot seasons more than cold season and matched with other studies (Salman, 2006; AL-fatlawi, 2010). p H value variation sites and sessions according to photosynthesis , metabolic process and water quality (Ayoade *et al.,* 2009). The high values of EC 1157µs/cm was recorded in March 2012, while the lower values 163.33 µs/cm was recorded through April 2012. E.C. depended on the temperature and the total concentration of ionized material (APHA, 1985). The present study recorded significant changes in the values of electrical conductivity and salinity compared to previous studies through winter and lower in the May month, decreasing of values may be due to soil washing operations by rainwater (Hutchinson, 1957) or to different uses of water along the river. The results agree with other studies (Al-Saadi *et al.,* 1997) on the Diyala River; (Jaber, 2003; Kadhim, 2005) on the Euphrates River and disagree with (Al-Azawey, 2008). Salinity ranged between 3.68 ‰ at site 1 during April to 23‰ in May 2012, most of the values were relatively high. Higher concentration of total hardness were recorded in the in the March that may be return to discharge of river (Al-Zubaidy, 1985) or to high precipitation and high soil leaching or high present velocities (Saeed, 1997; Salman, 2006; Al-Azawee, 2012), and the reason low value of total hardness in the summer to consumption CO_2 for organisms photosynthesis. This study matched with (Al-Fahnrawee, 2012; Al- Saadi, 2013). The results of the study refers to high concentrations of calcium more than magnesium in most study period which may due to solubility of CO_2 in water and reaction with calcium, in contrast to magnesium tend to precipitate (Goldman and Horne, 1983) or may be also to high concentration of Sulphate ions that precipitate magnesium as magnesium Sulphate (Al–Musawi *et al.,* 1994). The lower values of calcium in some months was attributed to consumption by organisms or precipitation when formed compounds dissolved in water (Lind, 1979), or because the drift of magnesium from soils and sewage drainage (Al-Lami *et al.*, 2002; Salman *et al.*, 2008; Hassan *et al.*, 2010). The study recorded high concentration of dissolved oxygen in most sites during study period, ranged between (1.7mg/l) in st.1 and (12.33 mg/l) inst.4.

Table 1: Some physical; chemical and biological proper ties of AL-Abasia River between March 2012 to February 2013. [First line: Range, Second line: Mean ± S.D]

properties	Site 1	Site 2	Site 3	Site 4
Air Tem.(Cº)	10.3340.33 (26.72±3.3)	10-45.67 (27.42±5.6)	10.33-37.33 (25.97± 2.3)	11-37 (26.81±2.1)
WaterTem.(Cº)	6.5-33 (20±2.4)	6.67-34 (22±3.2)	7-33 (22±2.75)	7.67-33 (20± 1.9)
pH	6.9-9 (7.64±1.3)	7-8.83 (7.63± 1.6	7-8.7 (7.65±1.2)	6.97-9.13 (7.75±9)
Salinity ‰	3.68-23 (13.70±3.2)	5-16 (12.76±2.1)	6.47-17.50 (12.99±1.3)	6.40-18.80 (12.71± 2.9)
E.C(µs/cm)	163.3-1083 (780±22.6)	320.67-1076 (829.54±78.9)	419.67-1036 (800.64±180.75)	510- 1157(825.9±241.49
D.O(mg/L)	2.50-8.17 (4.52±0.35)	2.33-9.83 (5.13±1.44)	1.83-7(4.19±1.69)	2.30-12.33 (6.01±1.41)
$BOD_{5(}$mg/L)	1.5-6.6 (3.2±0.4)	1.7-5.5 (2.8±0.74)	1.4-7.3 (3.57±1.23)	1.5-8 (3.8± 0.56)
T.S.S(mg/L)	0.05-35 (6.12±1.69)	0.05-37 (5.84±3.52)	0.13-22.33 (3.46±0.24)	0.09-24 (3.62± 0.93)
T.D.S(mg/L)	277-510 (41-842.4)	313-2114 (625±50.14	281.67-607.67 (432.27±65.56)	322-550 (451± 72.3)
Alkalinity(mg$CaCo_3$/L)	42.17-810 (342.61±162.)	70-582.17 (329±111.6)	170-610.17 (318.51±105.3)	50.50-573.40 (315± 163.2)
Hardness (mgc$CaCo_3$/L)	60-1650 (576.08±105.86)	150-1850 (649.2±87)	150-1500(400.08±127.7)	200-1489 (580.48± 44.6)
Calcium (mg$CaCo_3$/L)	86.48-1429.52 (493±59.4)	124.2-1783.3 (570.4± 26.7)	109.55-1255.86 (572.44±26.5)	200-1489 (580.48±44.6)
Magnesium (mg$CaCo_3$/L)	8.14-126.94 (35.19± 2.6)	7.63-72.50 (21.33±6.3)	11.07-268 (61.59±2.6)	6.70-206 (57.33±3.1)
Reactive Phosphate (mg/L)	0.01- 4049(1.11±0.52)	0.05-3.47 (1.14± 0.45)	0.20-4.17 (0.99± 0.11)	0.04-5.06 (1± 0.44)
Nitrate (mg/L)	0.11-6.47 (1.80±0.4)	0.12-4.13 (1.34±0.10)	0.09-3.43 (1.60±0.11)	0.10-3.40 (1.45± 0.44)
Nitrite (mg/L)	N.D-5.20 (1.22±0.33)	0.01-3.11 (0.78±0.16)	N.D-2.65(1.01± 0.41)	N.D-2.82 (0.83± 0.69)
Total diatoms algae (cell/cm3)	(1074-9637)×10^4 (5246±2618)	(1019- 9856)×10^4 (5807±3231)	(1085- 9747)×10^4(4535±2703)	(116-9747)×10^4 (6468± 3087)
Total non-diatomic algae (cell/cm3)	(1179-6250)×10^4 (2643± 1798)	(1125- 9643)×10^4 (5049±4158)	(1108-9823)×10^4 (3008±2979)	(1036-7322)×10^4 (2550±1875)
Chlorophyll–a (µg/L)	2.13-19.54 (5.68± 4.97)	0.41-7.65 (4.24±2.68)	1.39-8.68 (3.59±2.56)	0.16-14.15 (5.19±4.60)
Pheophytine–a (µg/ L)	0.18-1.55 (0.48±0.38)	0.03-1.47 (0.50±0.42)	0.02-1.12 (0.43±0.30)	0.01-1.43 (0.55±0.45)

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Table 2: Total number (cell*10³) and species of phytoplankton in Al-Abasia river

PHYTOPLANKTON	St_1	St_2	St_3	St_4
Cyanophyta				
*Anabaena cylindrica*Lemm.	0.028	0.034	0.053	0.049
A.doliolum Bhara.	0.023	-	0.26	0.089
A.sp	0.045	-	1.02	0.066
Anacystisnidulans(Rich) Dro.and Dai.	-	0.078	0.071	-
Aphanocapsa elachista West and west	-	-	-	0.045
Chrococcus leminticus Lemm.	-	-	-	0.098
C.disperus(Keissle.)Lemm.	-	-	0. 049	0.092
C. minutes (Kütz.)Näg	0.058	-	0.097	-
C.turgidus (Kütz.)Näg	-	-	-	0.032
Chlamydomonas moewusii	0.060	-	0.061	-
Cylidrospermum .sp	-	-	-	0.059
*Enteromorpha intestinalis (*L.)Grev.	-	0.73	-	-
*Gleocpsasp*sp	-	0.31	-	0.033
Gleotheca sp	0.064	-	-	0.058
Gleotrictiasp	-	-	-	0.064
Gomphorspaeria sp.	-	-	0.018	0.090
Lyngba aestuarii Lemm.	0.043	-	0.073	-
Mersmopedia glauca(Her.)	-	0.062	-	0.082
Microcystis aeruginosa (Kütz)	0.071	0.041	-	-
Nostic linckia	0.062	-	0.075	-
*Oscillatoria articulate*Gard.	-	0.089	-	-
O. tenuis Näg.	-	0.035	-	0.042
Phormidumambigun Gom.	0.021	0.041	-	-
Spirulina laxissina West	-	0.078	-	-
*Trichosarcinapolymorpha*Nichanols *and Bold*	0.059	-	-	-
Chlorophyta				
Acrosiphoniaarcta(Dillw) Ag.		-	0.091	0.079
*Ankistrodesmus falcatue (*Corda)Ra.	-	-	0.81	0.095
*Atractomorphaechinata*Hof.	0.079	-	0.60	-
Batophoraaerstedii Ag	-	0.064	-	-
*Bryopsishypnoides*Lamour	0.083	-	-	-
*Bulbochaeteinsignis*Pri.	0.064	-	-	0.19
Cladophoragolmerata(L.) kütz.	-	-	0.099	-
Closteriopsislongissima Lemm.	-	0.093	-	-
Cosmacladiumtuberculatum pres.	0.071	-	-	-
Cosmarium botrytis Men.&Raf.	-	-	0.073	0.11
*C. leaven*Rab.	-	-	0.873	+
Crucigeniatetrapedia(Kirch.)West	0.039	0.063	-	0.029
Dimorphococcus lanatus Bra.	0.041	0.19	0.024	-
Draparnaldia judayi Pres.	0.050	+	0.051	0.076
*Hyalothecadissiliens*Smi.	-	-	0.091	0.079
*C. leaven*Rab.	-	-	0.081	0.095
Crucigeniatetrapedia(Kirch.)West	0.079	-	0.060	-

Dimorphococcus lanatus Bra.	-	0.064	-	-
Draparnaldia judayi Pres.	0.083	-	-	-
*Hyalothecadissiliens*Smi.	-	0.039	-	-
Crucigeniatetrapedia(Kirch.)West	0.042	0.179	0.036	0.044
Dimorphococcus lanatus Bra.	-	0.089	0.095	0.17
*Euastrumdubium*Näg.	-	0.099	-	-
Gleocystisampla (Kütz.)Lag	-	-	0.415	0.078
*Mesotaeniumkramstia*Lemm	-	0.053	-	-
Monostromagroenlandicu. Ag.	0.022	0.024	-	-
Mougeeotia sp.	-	-	0.086	0.068
Netriumdigitus var .*lamellosum*	-	-	-	-
Nitella sp.	0.078	-	-	-
Oedogoniumcardiacum (Hass.) Witt.	-	-	-	0.062
Palmellaminiata Lei.	0.067	0.078	0.028	-
*Palmellococcusminiatus (*Kütz.)Chod.	-	-	-	0.095
Palmodictyonsp	-	0.067	-	0.089
Pediastrumboryanum (Turp.)Men.	0.022	-	-	0.11
P.simplex(Mayen)Lemm.	-	-	0.088	-
Pithophoraoedogonia(Mont)Wit.	-	0.022	-	-
Pyramimonascirolanae	-	-	-	-
*P. tetrahynchus*Scha.	0.030	-	0.030	-
Scenedesmus quadricauda(Turp.)Brĕb.	0.034	-	-	0.034
S. bijuga(Turp.)Lag.	0.081	0.030	-	0.077
S. dimorphus(Turp.) Kütz.	-	0.034	0.020	-
*Selenastrumbibraianum*Rei.	0.079	0.081	-	-
Sphaerocystis sp.	0.045	-	-	-
Spirogyra scrobiculata(Stoch.) Czu.	-	0.075	-	0.052
Stigoclonium sp.	0.042	0.045	-	0.080
*Trebouxiacladoniae (*Chod) Sm.	-	-	0.039	-
Treubariasetigerum(Archer)Sm.	-	0.047	0.067	-
Trochisciareticularis(Reins)Han.	-	-	-	0.033
UdoteajavensisGepp et Gepp.	-	-	0.41	-
*Ulothrixaequals*Kütz.	0.022	-	-	-
Volvox sp.	-	0.071	-	-
Zygnema sp.	-	0.091	0.061	-
Rhodophyta				
Rhodocytriumspilanthidis Lag	-	0.02	0.11	0.054
Compospogon sp.	0.025	0.058	0.14	0.034
Pyrrophyta				
Ceratiumhirundinella(O.F.M.)Duj	0.021	-	-	0.023
Euglenophyta				
Euglena sp.	0.18	0.003	0.021	-
Phacustriqueter(Ehr.)Duj	0.09	-	-	0.042
Phyeophyta				
Chorda filum (L.) Stac.	-	0.08	0.025	-
*Desmarestiatabacoides*Okam	0.024	-	-	-
Pilayellalittoralis sp.	0.11	-	0.041	-
Streblonemasp	-	0.051	-	-
*Scytosiphonlomentaria (*Lyng)Link	-	-	-	0.11

Chrysophyta				
*Chrysoamoeba radians*klebs	-	0.007	-	-
Chrysocapsaplanctonica (West&West)Pas.	0.017	-	-	0.010
Chrysochromulin sp.	-	-	0.023	-
*Eustigmatosvischeri*Hib.	-	-	0.018	-
Ophiocytiumgracilipes (Braun)Rab	0.019	0.07	-	-
Baacillariophyta(centrales)				
Actinoptychussplendens(Shad.)RaflsexPritch.	0.107	0.125	0.111	0.180
Actinocyclus sp.	-	-	0.119	0.160
Auliscus sp.	-	0.081	-	-
*Biddulphialaevis (*Ehr.)Hust	0.139	-	-	-
*Chaetoceroscapense*Karsten	1.002	-	-	-
*Coscinodiscusgranii*Gough	-	-	0.149	-
*C. lacustris*Grunow	-	-	-	0.191
*Coscinodiscusstellaris*Roper	0.083	-	-	-
Cyclotella bodanica var *.michiganensis* Skv	0.031	0.171	0.135	0.144
C. comensis K Rüh.	0. 190	0. 241	0.604	0.541
C. comta(Ehr.) Kütz.	-	-	0.151	0.170
*C. meneghiniana*Kütz	-	0.610	-	-
*Ditylumbrightwelli (*West)Grunow	0.191	-	-	-
Ellerbeckia sp.	-	-	-	0.641
Hyalodiscus sp.	-	-	0.810	-
Guinardiadelicatula(Cleve)Hasle	0.841	-	-	-
*G. striata(*Stolter.)Hasle	0.155	-	-	-
Lincmophoraehrenebergii(Kütz)	-	0.043	0.209	-
Melosira distance (Ehr.)Kütz	-	0.173	0.159	0.164
M. jurgensi Ag.	1.002	1.001	1.002	-
*M.*cf. *spaerica*Setch.exGard.	0.192	-	-	-
*Rhizosoleniahebetata*Baily	0.169	-	-	-
*Rh. imbricata*Brig.			-	-
*Stephanodiscusastraea*var. *intermedia* Fri.	0. 160	0.069	-	-
S .dubius(Fric.) Hust.	-	0.127	-	-
*S .hntzshii*Gru.	-		-	-
S. niagarae Ehr.	0.113	0.123	-	-
*S .tenuis*Hust.	-	-	0.140	-
Stephanopyxisturris(Grev.)Rafls	-	0.122	-	-
*Thalassiosiraanguste-lineata (*Schm.)Fryx .ex Hasle	-	-	0.170	-
T.eccentrica(Ehr.)Cleve	-	0.148	-	-
T. decipiens(Grun.)Joørg.	-	-	-	0.151
T. eccentrica(Ehr.)Cleve.	0.620	0. 220	-	-
T. fluviatilis	0.171	-	-	-
T. sp	-	-	0.199	-
Bacillariophyta (pennales)				
*Achanthesexigua*Grun	0.113	-	0.120	0.224
*A.saxonica*Kras.&Hust	-	0.111	-	-
*A. hungarica*Gru.	0.093	-	-	-
*A. lanceolata*de Br.	-	-	-	0.189

A. microcephala (Kütz.)Gr.	-	-	0.152	0.189
*A. minutissima*Kütz.	-	0.147	0.222	-
*Amphiproraalata*Kütz.	-	0.198	-	-
*Amphora bullatoides*Hohn et Grun	-	-	-	-
*A. ovalis*kütz.	-	-	0.135	-
*A. veneta*Kütz.	0.165	-	0.168	-
A. coffeaeformis (Ag.) Kütz.	-	-	0.111	-
A. sp.	0.300	0.174	-	-
*Asterionellaformosa*Hass.	0.125	-	-	-
Bacillariapaxillifer (Muell.)He.	-	-	0.140	-
Caloneis amphisbaena (Bory) Cl.	-	-	-	0.192
C. bacillum(Grun.)Cl.	-	-	-	0.108
C. bacillaric var. *thermlic (*Grun)Cl.	0.208	-	-	-
*C. ventricosa (*Her.)Me.		0.125	-	-
Campylodiscusnoricus var .*hibernica(*Her.)Grun	0.190	-	-	-
*C. solea (*Breb.et Godey) Sm.	0.122	0.113	-	-
Cocconeis pediculus Ehr.	-	0.147	0.109	0.110
C. placentula Ehr.	0.140	0.126	-	-
Cymatoplureasolea (Berb.) Sm.	-	-	0.107	-
Cymbellacistula (Ehren.) Ki.	0.144	-	-	0.192
*C.delicatula*Kütz.	-	0.104	-	-
*C. helvetic*Kütz.	-	0.278	0.331	-
C. microcephala var .cras.	-	-	-	0.320
*C. minuta*His.&Rab.	0.514	0.119	-	-
C. parva(W.Smith)Ki.	-	-	0.103	0.116
*C. ventricosa*Kütz.	-	-	-	0.146
Cymatopleuraelliptica(Brĕb.)Smith	0.155	0.122	-	-
Gyrosigma sp.	0.129	-	-	-
*Denticulaelgans*Kütz	-	-	0.143	-
Diatomaelongatum (lyngb)Ag.	0.320	-	-	0.133
*D. vulgar*Bory	-	-	-	-
Diploneispuella(Schum) Cl.	-	0.201	-	-
*D .smiti (*Berb.) Ce.	0.119	-	-	-
Didymosphenia sp.	-	-	-	0.109
Encyonemasp.	-	-	-	0.201
Epithemiaadnata var. *porcellus (*Kütz.) Patra	-	-	0.201	-
*E. sorer*Kütz.	-	0.355	-	-
Eunotiaarcus(Ehr.)	0.176	-	-	-
E. serra (Ehr.)	-	-	0.133	0.144
Enotiacurvata(Kütz)Larg.	-	0.213	-	-
E. monodron Her	-	-	-	0.103
E .pectinalis (Rafl.)Ra.	0.431	-	0.122	-
*Fragilariabervistriata*Gru.	0.299	-	-	-
*F. capunica*Desm.	-	0.321	-	-
*F.crotonensis*Kiton	-	0.116	-	-
Gomphonemaacuminatum Her	0.301	-	-	-
G. augur(Ehr.)	-	-	0.218	-
Gyrosigemaattenuatum(Kütz.)	-	-	-	0.257
G.tenuirostrum (Grun.) Cl.	-	-	-	0.214

Mastogloiaelliptica(Ag.) Cl.	-	-	-	0.144
*M.smithii*Thw.ex.W.Sm	-	-	-	0.103
Melosira varians Ag.	0.323	0.231	0.276	0.257
M. sp	-	-	0.212	-
*Naviculacryptocephala*kütz	0.216	-	-	0.119
N .cuspidate(Kütz) Kütz.	-	0.199	-	-
N. gracilis Ehr.	-	-	0.182	1.01
*N. jarnefeltii*Hust.	-	0.107	-	-
N. parva (Ehr.)Ra.	-	-	-	0.230
*N. pseudotuscula*Hust.	-	-	-	0.321
*N.reinhardtii*Grun.	-	-	0.209	-
*N.seminulum*Grun.	0.319	0.301	-	-
Nediumaffanis(Her.)Pf.	-	-	-	0.401
*N. irids (*Ehr*)*Cl.	0.416	-	-	-
*Ni. rostellate*Hust.	-	0.115	0.176	0.109
Ni. sigmoidea (Ehr.) Smith	0.190	-	0.123	0.123
*Ni, vermicularis (*Kütz.)Grun.	0.201	-	-	-
*Ni. vitera*Nor.	-	0.192	-	-
Peronia sp.	-	0.189	-	0.108
*Pinulariaacrosphaeria*deB.	-	0.235	-	0.230
P. divergenis Her	0.307	-	-	-
Pinularia sp.	0.416	-	-	-
P. biceps Gre.	-	-	-	0.333
*Rhoicospheniacurvata(*Kütz)Gru.	0.219	-	0.302	-
*Rhopalodiagibba (*Her.)Mul.	-	0.169	-	0.401
Semiorbis sp.	0.235	-	-	-
Stenopterobia sp.	-	-	0.304	-
*Stephanodiscusniagarae*Ehr.	-	-	0.109	-
*Stephanopyxispalmeriana*Grev.	-	-	-	0.129
Surirellaelegens Her.	-	-	-	0.183
*S.ovata*kütz.	-	-	-	-
S .robusta Her.	0.307	-	-	-
*S.rumpens*Kg.	0.320	-	-	-
*Synedravaoucheria*Kütz	-	-	-	0.401
*S .acus*Kütz.	-	-	-	0.219
S. pulchella(Ralfs) Kütz.	-	0.109	-	-
S. rumpens Kg.	0.440	-	-	0.307
*S. tabulate(*Ag)Kütz	0.301	-	-	0.109
S.ulna(Nitz.) Ehr.	0.401	0.109	-	0.396
Tetracyclus sp.	0.298	0.203	-	-
T. weissflogii	0.201	-	-	0.188
Tryblionellacoarctata(Grun.)Mann.	0.311	-	-	-
*T .levidensis*Smith	-	-	0.125	-

The concentration of DO in running water depends on the temperature, chemical and biological process and concentration of organic compounds(Zakariya *et al.*, 2013). The values of BOD5 in this study, ranged between 1.4 mg/ in st.3 and 8 mg/l in st.4, this concentrations may be referred to human activity; urban and industrial waste discharge of sewage into the river (Salman *et al.*, 2013).

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Table 3: Relative abundance index of Phytoplankton during period study

Months	Site 1	Site 2	Site 3	Site 4
March 2012	19.7	32.5	29.7	21.3
April 2012	26.3	13	44.5	19.3
May 2012	13.2	9.1	9.9	6
June 2012	9.8	16.9	6.9	8.7
July 2012	11.2	19.5	11.8	4
August 2012	19.7	13	11.9	4.7
September 2012	26.3	11.7	10.9	6
October 2012	8.5	16.9	10.9	6.7
November 2012	9.9	15.6	6.9	10
December 2012	11.2	13	7.9	5.3
January 2013	6.6	32.5	12.9	6.7
February 2013	6.6	16.9	11.8	6

Table 4: Richness index of Phytoplankton during period study

Months	Site 1	Site 2	Site 3	Site 4
March 2012	13.2	12.7	14.4	14.2
April 2012	17.8	4.7	21.9	12.8
May 2012	8.7	3.1	4.4	3.6
June 2012	6.4	5.4	2.9	5.5
July 2012	7.3	6.4	2.9	2.2
August 2012	13.2	7.4	5.4	2.7
September 2012	4.1	4.2	5.4	3.6
October 2012	6.4	6.3	4.9	4.1
November 2012	7.3	4.2	3.4	6.4
December 2012	7.3	5.8	5.9	3.2
January 2013	4.1	3.7	5.9	4.1
February 2013	4.1	4.7	4.4	3.2

Table 5: Shanon-wiener index of Phytoplankton during period study

Months	Site 1	Site 2	Site 3	Site 4
March 2012	0.32	0.33	0.35	0.32
April 2012	0.35	0.25	0.36	0.31
May 2012	0.26	0.32	0.22	0.16
Juan 2012	0.21	0.24	0.16	0.20
July 2012	0.31	0.24	0.24	0.12
August 2012	0.16	0.28	0.25	0.12
September 2012	0.22	0.28	0.25	0.16
October 2012	0.24	0.21	0.25	0.33
November 2012	0.16	0.16	0.24	0.16
December 2012	0.22	0.22	0.21	0.036
January 2013	0.22	0.22	0.16	0.15
February 2013	0.21	0.22	0.22	0.20

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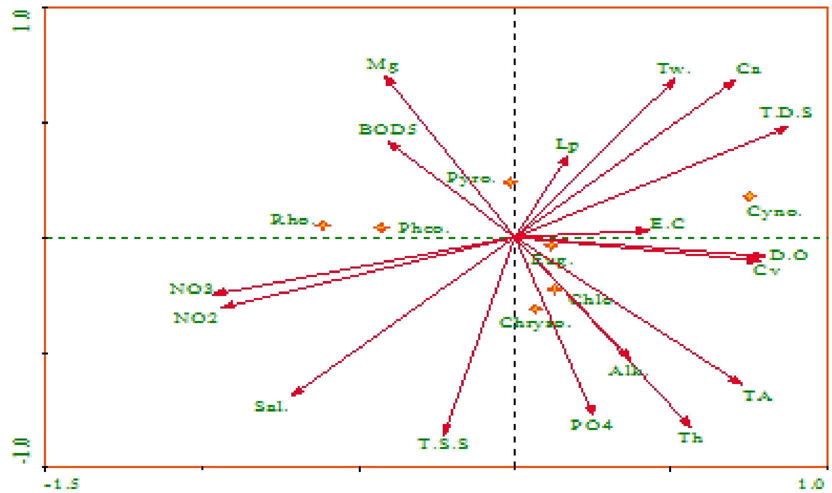
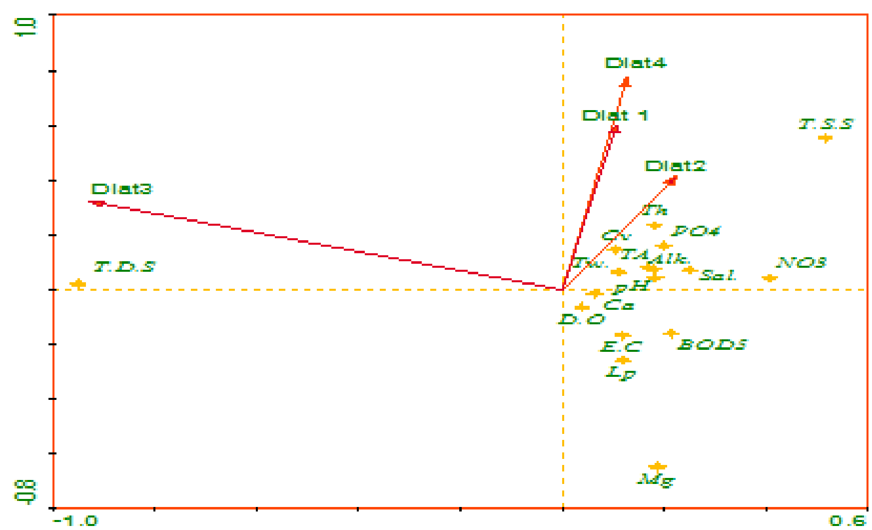


(1)



(2)

Figure 2: Correlations between water quality parameters and non diatomic phytoplankton (1) and diatomic phytoplankton according to Canoco (CCA)

The concentration of nutrients was fluctuated according to the nature of region and time of sampler collection, both nitrate and phosphate concentrations were noticed positive correlation among the study sites. The nitrite, nitrate, phosphate ranged between (N.D-5.2), (0.09-6.67), (0.01-5.05) mg/L respectively.

Similar results were obtained in other aquatic systems (Hadi and Al-Saboonchi, 1989; Kolayli and Sahin, 2009). The high mean value of nutrients in some month could be due to concentration effects because of reduced water volume, and the high concentration of nitrates are only observed during rainy season to the period of the study (Ibrahim *et al*., 2009).

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The phytoplankton comprised of Bacillariophyta, Chrysophyta, Cyanophyta, Euglenophyta, Pheophyta, Pyrrophyta and Rhodophyta, 230 genera were recorded and given the percentage of each division at river sites in the study period, Table (2). The total numbers the Bacillariophyta was135 taxa during the study. Baciliariophyta was observed to be the most dominant division of phytoplankton and its contributed in four sites about (9309 to 1074)$\times10^3$ cell/l in April and May 2012 at site 1 , in total phytoplankton population density. They belong to others (9823$\times10^3$ cell/l in the site 3 at July 2012 to1036 $\times10^3$ cell/l in site 4 at April 2012. The abundance was most pronounced in the term of percentage (59.13%) of the total number was Bacillariophyta, Chlorophyta(20.86%), Cyanophyta(10.86%), Euglenophyta and Rhodophyta (0.86), Pyrrophyta (0.43), Pheophyta(2.17%)and Chrysophyta (2.60%)and Pheophyta were five species (2.17%). The high abundance for species *Nitzschia palea, N.commnis* and *N.kutzingiana* that got the highest abundance was which accounted for an average of 46.80% of the overall phytoplankton sampled. *Nitzschia* was followed by *Ankistrdesmus* (25.53%), *Anabaena* (17.02%). The present study showed numerical of phytoplankton species recorded in the site (4) more than other sites, may be attributed to the difference environmental condition such as present aquatic plants that are on the growth of several numerical and variety of algae that attach to them and distribution in the water column lead to increase in the numbers of phytoplankton this result matched with another study (AL-Zubadi, 1985; ALFatlawi, 2005; AL-Azwi, 2012).

Bacillariophyta showed dominated in the species recorded in the all sites formed (26.10, 21.18, 19.21, 23.26)% respectively causes by capacity of Bacillariophyta growth in the difference aquatic environment (Leelahakriengkrai and Peeraporpisal, 2010).

The dominate of Bacillariophyta followed Chlorophyta, Cyanophyta, Chrysophyta, Pheophyta, Pyrrophyta Euglenophyta and Rhodophyta respectively similarity with the local and world study (AL-Mousawi *et al.*, 1999; AL-Saadi, 1995; AL-Lami and Salman, 2003; AL-Fatlawi, 2011; Al-Taai, 2012; Adesalue, 2008; Wei-hua *et al.*, 2008). Cyanophyta in the hot months was showed due to capacity the tolerance high temperature. Chlorophyta were important component in the fresh water, several species identified during study such as *(Crucigenia, Dimorphococcus, Scendesmus Spirogera scrobiculata, Ulothrix, Udota)*. 22 and 45 species of Cyanophyta and Chlorophyta identified in the phytoplankton such as *(Anabaena cylindrical, Ankistrodesmus falcate Chroococcus dispersu,s, Mersmopedia glauca, Spirulina laxissina Draparnaldia judayi*) due to adaptations to their small size and the presence of spines to resist predators and the wide ranges of tolerant temperatures, light and food (Khuantrairong and Traichaiyaporn, 2002).

The results showed high relative abundance (Table 3) and species richness(Table 4) of phytoplankton in the sites ranged between (4- 44.5) and (2.2 – 21.9) respectively , but the value of Shanon –wiener index of diversity (Table 5) ranged between 0.03 in December 2012 in st.4 and 0.33 in October 2012 in st.4 too, this value referrer to low density of phytoplankton during study period ,may be due to the increase of pollution in river, grazing by zooplankton (Ghosh *et al.*, 2012).

CCA phytoplankton and physical –chemical characters (Figure 2) indicated that different relationship , the interaction between various physical, chemical and biological factors is the causative regulator for seasonal variation and standing crop of phytoplankton (Olele *et al.*, 2008; Salman *et al.*, 2013).

Conclusion

The results indicate that the variables of physical and chemical properties of water are expressed in the phytoplankton community fluctuation. Species richness changed according to variation of spatial and temporal change .Water quality was found to affect the composition of the phytoplankton community and therefore the species dynamic must be monitored.

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