Benthic Algae in Lower Zab Tributary and Tigris river

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Abstract

Benthic algae of Tigris river and one of its northern tributary the lower Zab were study at monthly intervals during Nov. 2001-Oct. 2002. Four sites were selected, a total of 115 species of algae were identified during this study, diatoms was the dominating group (86 species) followed by Chlorophyta (18 species), Cyanophyta (7species), Euglenophyta (2 species) and one species for each of Pyrrophyta and Chryzophyta. Pennate diatoms formed the major density within the identified algae and distributed among all stations especially the species Achnanthes minutissima, Navicula gracilis and Nitzschia palea, the diatoms bloomed in spring and autumn seasons. Bio-diversity and density of benthic algae in Tigris river was affected negatively by the entering waters from Lower Zab tributary, this was indicated by the decreasing values after the confluence.

INTRODUCTION

Studies related to benthic algae are few compared to the phytoplankton , and all were carried out on the southern marshes and Shat AL- Arab [1,2,3] . In addition , to other studies involved some Iraqi water systems [4], Sammarrah and Qadisiah dams [5,6] , as well as the Euphrates , Audhaim ,Tigris rivers [7,8] and Thirthar arm [9]. All the studies pointed towards the dominancy of diatoms , quantitatively and qualitatively among the benthic algae in the Iraqi water area .The present study involved a quantitative and qualitative distribution of benthic algae in Tigris river and lower Zab tributary . the study aimed to know the effect of lower Zab tributary on species diversity and density in Tigris river .

MATERIALS AND METHODS

In the study area , four stations were selected . two stations were in the lower Zab tributary , and two in Tigris river . One station in Tigris river was chosen before the confluence as a control , and the second was after it (figure-1) . The river bottom at the study area varied from gravel -stones- fine stone [10] . Monthly samples were collected during the period from Nov. 2001 to Oct. 2002 . 40 grams of benthic mud was taken for quantitative and qualitative measurements . This was made by removing the top 0.5-1 cm of the bottom mud into a bottle , added by small amount of the top water [11]. The bottles were kept in dark place without disturbance for 5-6 hours for mud precipitation . The upper water was removed , and the mud was evenly distributed in a petridish . The petridish was then covered with a clean

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Whatman No.105 lens tissue in an open area , subject to sun light for 24 hrs . Finally , the lens tissue was removed with its attached algae , because the algae stick to the tissue surface during its movement for photosynthesis . This lens tissue was then used for the algae identification and counting as follows :

The lens tissue was lacerated into small pieces and placed in bottle, 5 ml of distilled water was added with few drops of lugols solution. The bottle was shaken gently in order to separate the algae from the tissue [11] . All algae were counted using a haemocytometer. However , the diatoms were counted by taking a drop of the solution onto a slide, placed on a hot plate . Concentrated nitric acid was then added to the drop. To dissolve the organic substances to mount diatoms skeletons. A drop of Canada balsam was placed on a cover slide, and gently placed onto the slide. The alga species were identified and represented as individual /ml [11]. The following references were used for the algae identification [12,13,14] .

Air and water temperatures were measured using a thermometer. Salinity was measured using a field conductivity meter [YSI -33cc] . Turbidity measured using a turbidity meter [16800-HACHcc]. A field pH meter [WPAC6/T Japan] was used to measure the pH. Dissolved oxygen was measured using an oxygen meter, type YSI-5IB.

Algal bio-diversity was counted using Shannon-Weiner equation (15)

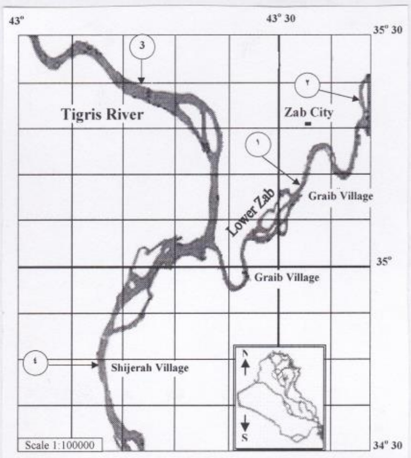


Fig. 1: Study Area: Lower Zab (stations 1,2) & Tigris river (stations 3,4)

RESULTS AND DISCCUSION

Water temperature in lower Zab ranged [10-27]°C, and in Tigris river was [10-28]°C. In the study area , the water was generally alkaline, pH ranged 7.71-8.37 in lower Zab , and 7.5-8.6 in Tigris river. Salinity in lower Zab and Tigris river varied [0.19-0.59]‰ and [0.16-0.46]‰ respectively. Dissolved oxygen in lower Zab was [5.2-10.35] mg /L , and in Tigris river was [6.1-10] mg/L. Generally water characterization in the study area was within the Iraqi river water qualification [10]. Table (1) show these results . 115 species of benthic algae were identified in the present study . Of this 86 species were diatoms [72.2%] , 18 species were chlorophyta [15.1%] , 6 species were cyanophyta [5%] , and 2 Euglenophyta [1.7%] , Pyrrophyta and chryzophyta was represented by one single species for each [0.86%] . Table [2] show these results . The dominancy of diatoms in the present study agreed with other studies conducted on Tigris and other Iraqi water area [1,2,3,5,6,7,8,9]. In addition to what was recorded by Hynes [16] related to the importance and dominancy of diatoms in many river in the world . This is due to the high resistance variations in temperature and salinities [17] . 96 benthic algae was recorded in the lower Zab , 90 in Tigris river before the confluence , and 76 after the confluence . Most of the recorded species in the present study belongs to genus Nitzschia , which was represented in 15 specie , followed by genus Navicula , which was represented in 11 species. Genus Gomphonema represented by six species only (table -2).The highest density record was in station [N0.3] in Tigris river before the confluence of the lower Zab , and was [162.02 x10^4] ind /ml , followed by station [N0.1] in lower Zab [116.45x10^4] ind/ml , and then station [N0.4] in Tigris river after the confluence [90.45x10^4] ind/ml . The lowest density record was in station [N0.2] in lower Zab and was [43.7x10^4] ind/ml . These results are shown in figure (2). This indicate the negative affect of the lower Zab tributary on the benthic algae density in Tigris river , and could be related to the effect of water currents . This result agree with AL-Rubaiae [7] She founded low benthic algae density in Tigris river after the confluence of AL-Audaim Tributary. However , AL-Lami [9] did not observed low density of benthic algae after the confluence of Thirthar to Tigris river .

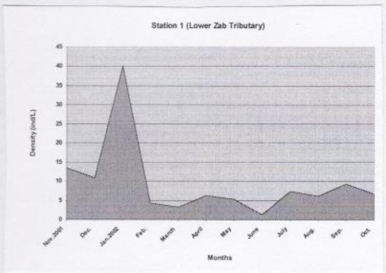
Table 1: Range, Mean and standard deviations of the physical and chemical measurements for the surface water at the different stations during 2001-2002.

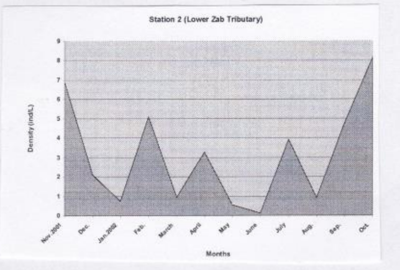
Station / Factors	Lower Zab tributary 1	Lower Zab tributary 2	Tigris river 3	Tigris river 4
Air Temperature °C	12-36	12-34	13.5-38	10-31
Water Temperature °C	11-27	10-27	10-28	10-24
pH	7.87-8.26 8.12±0.1	7.71-8.37 8.1±0.1	7.81-8.28 8.1±0.1	7.52-8.6 8.1±0.3
Salinity ‰	0.19-0.46 0.31±0.1	0.2-0.59 0.33±0.1	0.22-0.46 0.28±0.1	0.16-0.35 0.25±0.04
Turbidity NTU	0.37-111 27.1±30	0.2-109 22±30.7	0.24-185 34.4±54.8	2.57-72 26.5±23
Dissolved Oxygen mg/l	5.2-10 7.9±1.2	6.3-10.35 7.9±1.2	6.5-7.9 7.6±0.9	6.1-10.0 7.7±1.1

Some species dominated by its presence in the four stations , as Nitzschia palea [19x10^4] ind /ml in station [N0.3] ; Achnanthes minutissima [5.3x10^4] ind /ml in station [N0.4] ; and Navicula gracilis [3.7x10^4] ind / lm in station [N0.1] . These results are shown in figure (3) and table (2). The importance of the recorded species among the benthic algae has been reported in most studies carried out on Tigris river and other Iraqi waters [1,3,5,7,9], in addition to other studies conducted in different parts of the world . As the study carried out by Cho[15] in Naktong river in southern korea . Patarson [17] studied Makonawi lake in Nebraska in USA . He founded a fast invasion of the mentioned species compared to others . The highest diatoms density recorded in Autumn . This can be related to the suitable light and temperature during the period .The bio – diversity was equal in the stations of lower Zab tributary and were 2.61 and 2.61. In Tigris river was 2.52 in the control station before the confluence of lower Zab , and was1.71 after the confluence [Table2] which indicate the negative effect of the lower Zab in Tigris river. This result has no agreement with Al- Lami [9]. He founded no variations in the bio – diversity values in his study as were 2.24 and 2.19 in Thirthar arm , and 2.2 and 1.93 in Tigris river .

Table 2: Benthic algae density (ind x 10000 /cm^3), and times of presence (in brackets) in Lower Zab tributary (stations 1,2) & Tigris river (stations 3,4) during 2001-2002.

No.	Taxa	3	2	4	1
	CYANOPHYTA				
1.	*Lyngbya limnetica*	0.78(3)	0.0001(1)		1.56(3)
2.	*Lyngbya sp.*	0.80(1)			
3.	*Merismopedia elegans*			1.20(1)	
4.	*Oscillatoria limnetica*		1.06(2)	082(2)	1.10(4)
5.	*Oscillatoria tenuis*	0.0001(1)			1.12(3)
6.	*Oscillatoria sp.*	18.30(5)	6.68(5)	2.52(4)	6.09(7)
7.	*Spirulina major*	0.30(1)			0.60(1)
	CHLOROPHYTA				
8.	*Characium sp.*	0.3(1)			
9.	*Chlamydomonas sp.*	22.34(5)	3.00(20	0.95(7)	10.13(3)
10.	*Chlorella vulgaris*	1.64(4)	1.90(3)	0.56(4)	0.03(3)
11.	*Chroococcus dispersus*		0.26(1)	0.54(1)	
12.	*Coelastrum astroideum*				0.0002(2)
13.	*Cosmarium hammerei*	0.0002(2)	0.0001(1)	0.56(2)	0.26(2)
14.	*Cosmarium sp.*		0.30(1)	0.30(1)	0.52(2)
15.	*Gomphosphaeria sp.*			0.0001(1)	
16.	*Oedogonium sp.*		0.0001(1)		0.0001(1)
17.	*Oocystis sp.*		0.0001(1)		
18.	*Pediastrum boryanum*				0.0001(1)
19.	*Scenedesmus bijuga*	1.12(4)	0.26(2)	0.26(1)	0.6(2)
20.	*S. dimorohus*	0.0001(1)			
21.	*S. quadricauda*	0.0003(3)	0.3(1)		0.3(1)
22.	*Scenedesmus sp.*	0.8(1)	0.3(1)		0.3(1)
23.	*Spirugyra sp.*	0.0001(1)	1.1(1)	0.26(2)	1.82(3)
24.	*Tetraedron minimum*			0.0001(1)	
25.	*Ulothrix sp.*	0.0001(1)			
	PYRROPHYTA				
26.	*Peridinium cinctum*	0.0001(1)	0.0001(1)		
	EUGLENOPHYTA				
27.	*Euglena sp.*	0.3(1)	0.0001(1)		0.86(3)
28.	*Phacus sp.*			0.26(1)	
	CHRIZOPHYTA				
	CHRIZOPHYCEAE				
29.	*Dinobryon sp.*		0.0001(1)		
	BACILLARIOPHYCEAE				
	CENTRALES				
30.	*Coscinodiscus lacustris*	0.0001(1)			0.0001(1)
31.	*Cyclotella comta*	0.0001(1)	0.0001(1)	0.0001(1)	
32.	*C. knetzingiana*	0.10(1)	0.0002(2)		0.0001(1)
33.	*C. meneghiniana*	0.63(4)	0.0002(2)	0.09(5)	0.13(2)
34.	*C. ocellata*	0.95(8)	0.16(5)	0.12(5)	0.56(6)
35.	*Melosira granulata*	0.2(3)	0.35(6)	0.03(7)	0.26(2)
36.	*Stephanodiscus astera*	0.0001(1)			
	PENNALES				
37.	*Achnanthes minutissima*	5.07(9)	1.58(7)	7.61(9)	6.85(10)
38.	*Amphora ovalis*	0.36(6)	0.0001(1)	0.06(3)	0.1(2)
39.	*Amphora veneta*	0.17(2)	0.03(1)		0.03(1)
40.	*Amphora sp.*	0.5(1)	0.3(3)	0.0001(1)	0.8(2)
41.	*Anomoeoneis exitis*	0.24(3)	3.38(6)	4.23(7)	1.23(5)
42.	*Caloneis permagna*	0.0001(1)	0.0001(1)		
43.	*Cocconeis pediculus*	1.38(9)	0.33(5)	0.21(5)	1.1(8)
44.	*C. placentula*	5.06(3)	0.06(3)	0.1(2)	0.8(2)
45.	*C. placentula var. euglypta*	1.7(8)	0.06(2)	3.75(6)	0.93(7)
46.	*C. placentula var. lineate*	0.28(2)	0.0001(1)	0.0001(1)	0.03(3)
47.	*Cymatopleura solea*	1.06(7)		0.0001(1)	0.03(3)
48.	*Cymbella affinis*	3.03(10)	0.28(6)	0.94(7)	2.13(7)
49.	*C. amphicephala*	0.0001(1)	0.0001(1)	0.36(2)	1.05(2)
50.	*C. aspera*	0.0002(2)	0.0001(1)		0.05(1)
51.	*C. cistula*			0.1(3)	1.1(2)
52.	*C. microcephala*	1.83(6)	0.83(6)	2.07(9)	4.1(9)
53.	*C. obtusuiscula*	0.03(3)	0.16(3)	0.05(3)	0.03(1)
54.	*C. parva*	0.0001(1)			
55.	*C. prostata*	0.46(4)	0.03(1)	0.06(2)	0.09(3)
56.	*C. sinuta*	0.06(4)	0.17(3)	0.05(1)	0.03(2)
57.	*C. tumida*	0.06(4)	0.4(3)		1(3)
58.	*C. ventricosa*	0.49(7)	0.1(3)	0.05(5)	0.0002(2)
59.	*Cymbella sp.*	0.1(1)	0.03(1)		0.0001(1)
60.	*Denticaula elegans*	0.1(1)	0.3(2)	1.21(3)	0.06(1)
61.	*Diatoma elongatum*	0.24(5)	0.28(4)	0.03(1)	1.15(6)
62.	*D. vulgare*	9.45(11)	0.62(9)	1.86(6)	6.44(10)
63.	*Diploneis ovalis*		0.03(2)	0.0001(1)	0.0001(1)
64.	*D. pseudovalis*	0.1(1)	0.03(3)	0.13(3)	
65.	*Epithemia sorex*	0.09(2)	0.09(2)	0.1(2)	
66.	*Fragilaria construence*	0.2(2)	0.0001(1)	0.0001(1)	0.28(3)
67.	*F. vaucheriae*	0.52(5)	0.4(8)	0.82(7)	0.0004(4)
68.	*Gomphoneis olivacea*	4.85(10)	0.6(2)	3.46(5)	3.45(8)
69.	*Gomphonema angustatum*	0.8(2)	0.03(2)	0.2(2)	0.225(2)
70.	*G. constrictum*	0.0001(1)		0.0001(1)	
71.	*G. intricatum*	0.0002(2)	0.0001(1)		
72.	*G. parvulum*	0.0001(1)			0.03(1)
73.	*G. tergestinum*	1.49(5)	0.15(4)	0.3(3)	2(5)
74.	*Gyrosigma peisonis*	0.35(5)	0.06(3)	0.15(4)	0.03(4)
75.	*G. spencerii*	0.54(6)	0.05(3)	0.06(3)	0.0001(1)
76.	*Hantzschia amphioxys*	0.14(5)	0.04(3)	0.08(4)	0.0003(3)
77.	*Mastogoloia smithii*		0.3(2)		
78.	*Navicula anglica*			0.6(2)	0.0001(1)
79.	*N. cryptocephala*	1.82(9)	3.05(9)	6.07(10)	2.64(8)
80.	*N. cryptocephala var. veneta*	22.41(4)	0.06(2)	0.15(3)	0.51(3)
81.	*N. cuspidata*	0.0002(2)			
82.	*N. gracilis*	2.43(11)	0.45(9)	13.25(5)	10.86(11)
83.	*N. nivaloides*		0.0001(1)		
84.	*N. parva*	3.03(6)	0.31(5)	0.16(2)	0.455(6)
85.	*N. pygmya*		0.0001(1)		
86.	*N. radiosa*	0.78(6)	1.27(7)	0.64(5)	0.84(7)
87.	*N. spicula*		0.0001(1)		
88.	*Navicula sp.*	0.31(2)	0.0002(2)		0.21(1)
89.	*Nitzschia acicularis*			0.13(2)	0.03(1)
90.	*N. amphibia*	1.53(4)	0.29(6)	2.59(8)	0.1(1)
91.	*N. apiculata*	1.49(4)	0.41(4)	0.23(6)	0.12(4)
92.	*N. dissipata*	0.5(9)	1.12(7)	7.38(7)	5.76(9)
93.	*N. fasiculata*	0.17(5)	0.06(3)	0.0002(2)	0.36(3)
94.	*N. filiformis*			0.03	
95.	*N. frustulum*	4.08(8)	1.5(7)	3.65(9)	7.56(8)
96.	*N. hungarica*	3.43(6)	0.23(4)	0.6(5)	5.06(2)
97.	*N. intermedia*	0.03(1)	0.05(1)	0.16(1)	
98.	*N. microcephala*	0.0001(1)	0.0001(1)		0.1(1)
99.	*N. obtusa*	0.0001(1)	0.0002(2)	0.1(1)	
00.	*N. palea*	22.63(10)	4.2(10)	13.49(9)	15.77(9)
01.	*N. romana*				0.0001(1)
02.	*N. sigma*		0.1(1)	1.53(2)	0.3(1)
03.	*N. sigmoidea*	0.0003(3)		0.24(2)	0.3(1)
04.	*Pinnularia brebisoni*			0.06(1)	
05.	*P. lundii*	0.36(3)	0.09(4)	0.16(4)	
06.	*Pleurosigma angulatum*	0.03(1)			
07.	*Rhoicosphenia curvata*	3.71(7)	0.2(1)	0.7(2)	1.52(9)
08.	*Rhopalodia gibba*	0.0001(1)	0.6(1)	0.0001(1)	
09.	*Surirella angustata*	0.0001(1)	0.03(1)		
10.	*S. ovalis*	0.39(4)	0.0001(1)	0.03(3)	0.18(3)
11.	*S. ovata*	0.33(2)	0.06(1)		0.1(1)
12.	*Surirella sp.*	0.0001(1)			
13.	*Synedra acus*	0.53(5)	1.02(4)	1.75(5)	0.0001(1)
14.	*S. capitata*			0.0001(1)	
15.	*S. ulna*	2.76(9)	2.21(9)	0.24(8)	2.29(7)
	Total				
	Bio. Diversity	2.52	2.61	1.71	2.61





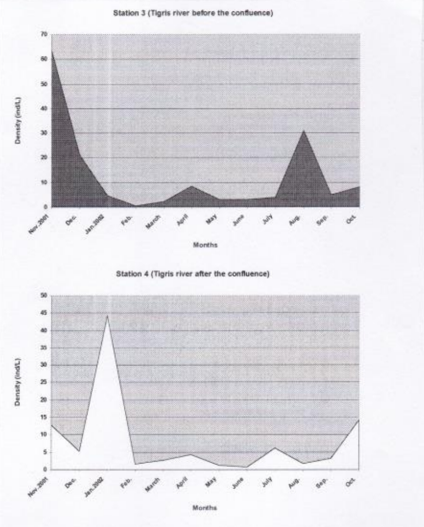


Fig. 2 : Seasonal Variation of the Benthic Algae in Lower Zab (St.1,2) and Tigris River (St.3,4).

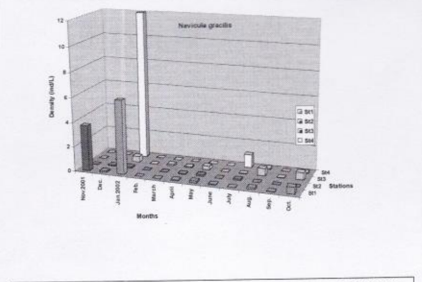
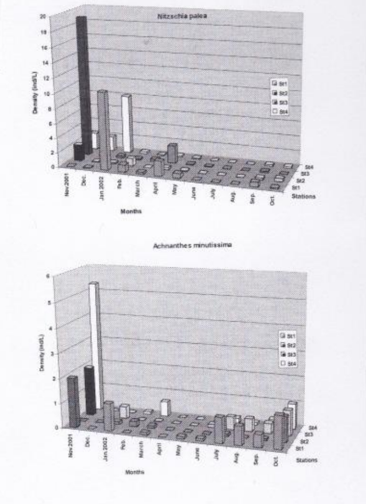


Fig. 3 : Seasonal Variation of the dominated Benthic Algae in Lower Zab (St.1,2) and Tigris River (St.3,4).



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الطحالب القاعية في رافد الزاب الأسفل ونهر دجلة

رياض عباس عبد الجبار

كلية العلوم ـ جامعة تكريت ـ العراق

الخلاصة

تناولت الدراسة الطحالب القاعية في نهر دجلة و أحد روافده الشمالية وهو الزاب الأسفل حيث جمعت العينات شهرياً من أربعة مواقع ولمدة عام كامل خلال ٢٠٠١ – ٢٠٠٢. تم تشخيص ١١٥ وحدة تصنيفية كانت الدايتومات هي السائدة حيث بلغ عددها ٨٦ نوعاً وسجل ١٨ نوعاً للطحالب الخضراء و ٧ أنواع للطحالب الخضراء المزرقة ونوعين للطحالب اليوغلينية ونوع واحد لكل من الطحالب الذهبية والبروات . تغلبت الدايتومات الريشية على بقية الأنواع وكانت الأكثر انتشاراً في جميع محطات الدراسة اذ سادت الأنواع Achnanthes minutssima و Navicula gracilis و Nitzschia palea على بقية الطحالب، وقد ارتفعت كثافة الدايتومات خلال فصلي الربيع والخريف . تشير الدراسة الحالية إلى تأثر نهر دجلة بالمياه القادمة من رافد الزاب الأسفل حيث انخفض تنوع وكثافة الطحالب القاعية بعد مصب الرافد في نهر دجلة .