Limnological features of Diwanyia River, Iraq

Fikrat Majied Hassan *

Date of acceptance 21/11/2002

Abstract

Monthly water samples from three stations in Diwanyia river at Diwanyia city were collected during December 1999 to June 2000 . Variables from each stations were determined including ; temperature, pH ,dissolved oxygen, dissolved carbon dioxide , alkalinity ,total hardness, calcium ,magnesium , phosphate ,nitrite ,nitrate, chlorophyll-a , and total number of phytoplankton .The river considered as fresh water , alkaline ,very hard .The parameters recorded at different values from up and down stream .

Introduction

The pioneer limnological works on different region of Euphrates river by several workers (1,2,3,4,5,6,7,8) ,but no detailed work has been published on the biology and chemistry of Diwanyia river (9,10).This river is the water resource for two cities, namely Diwanyia and Rumitha. The present work started after the decline of water level in Euphrates river within Iraq due to rainless years, and shortage of river water income to Iraq.

The study area

The Euphrates river is ramified into two rivers namely Hindia and Hilla (5), the last passes through Hilla city and Diwanyia city toward the south . The investigation area was chosen along Diwanyia river and lies on latitudes between 33° to 34° and longitudes 45° to 46° (Fig 1). The stations were chosen according to center of Diwanyia city(station 2) , stations 1,3 were taken before and after the city .

Material and Methods

Subsurface water samples were collected during December 1999 to June 2000, water temperature was recorded by simple thermometer graduated to 0.1 C° , pH was measured by portable pH meter type labsco model PM4 .Electrical conductivity was determined using a portable conductivity meter (Bischof L17) . Salinity was estimated from conductivity value(11). The dissolved oxygen and saturation percentage were determined according to modified Winkler method as described in Hassan *et al.*(12) . The total available carbon dioxide was determined according to Golterman *et al.* (13) . Total alkalinity ,total hardness, calcium,

*Dr. – Assistant Prof. – Biology Dept. – College of Science – University of Babylon - Iraq

magnesium , chloride were determined after methods given by APHA(14) .Nitrogen (nitrate &nitrite)and phosphorus (phosphate) were determined following methods given by Parsons *et al.* (15). Total count of phytoplankton was determined according to the modification of McNabb method (16). Chlorophyll - a measurements were made according to Parsons *et al.* (15) .

Results and Discussion

The average, maximum and minimum values for each variable recorded at the river during the study period(December 1999 to June 2000) are shown in table 1 . The seasonal variations of these variable throughout the sampling period are presented in figs 2-6 . The water temperature of the three stations fluctuated in a similar manner in the range of (10- 28) C° during the study period . The pH was alkaline, ranged between 7.3-8.3 . Similar results were obtained in Euphrates river in different part before and after passing in Diwanyia city (5 , 8, 9 , 10) . The river water is fresh to oligohaline , the data of conductivity and salinity showed the same results to those recorded at the river (9,10) and it's higher than that recorded at upper of the Diwanyia river (8). Many Iraqi limnologist noticed that the conductivity and salinity values were gradual increasing toward south (5,8) . These values higher than those recorded in the upper part of river (5,8) . Total hardness was ranged between 300-460 mg/l at stations 2 and 3 during June and Decmber 2001 respectively which was higher than values of total alkalinity (Fig 3) , and indicated for the peresence of ions rather than Ca^{+2} and Mg^{+2} (17) . Similar results were found on the other parts of the same river (8) and little lower values were determined at the same part of the river (10) .The major studied ions, were ranged 82-184 , 71- 124 and 16-73 mg/l for Cl, Ca, and Mg ions respectively without pronounced spatial variations (Fig 4) . Total available carbon dioxide values ranged from 83-400 mg /l at stations 2 and 3 during June and April respectively . These results were higher values than recorded in the same river and upper portion of Euphrates river (4,5) ,and may be due to the discharging of organic pollutant and domestic waste or high rate of hydrolysis of organic material (18,19). Dissolved oxygen values were ranged between 4 to 9 mg/l at station 1 during May and Feb. respectively , the same results were recorded in other studies (5,10) . The lowest values may be because industries waste water , high rate of hydrolysis and high dissolved salts (19) .Dissolved oxygen and temperature showed negative correlation($r = -0.74$, $P < 0.05$) also with chloride concentration ($r = -0.61$, $P< 0.05$). The inorganic nitrogen fractions were dominated by nitrate , the highest values recorded in station 3 at March 2000 that may be due to tributaries from the soils during the rain period (20) . Hall *et al.* (21) suggested that nitrate comes predominantly from the atmosphere entering river Zambezi via the rainwater .Nitrite concentration showed positive correlation ($r =0.34$ $P< 0.05$) with temperature while negative correlation ($r = - 0.16$ $P< 0.05$)with dissolved oxygen, that means an pollutant sources of nitrate may be input to the river . Phosphate concentration was ranged between 1.6 to 8.3 µg/l in station 1 and 3

during Feb.2000 respectively .The chlorophyll -a concentration and total phytoplankton cell count number were recorded highest values during April which coincide with the decline of nitrate concentration at the same month .The chlorophyll-a concentration was ranged between 0.68 to 6.85 µg/l in stations 2 and 1 during Dec 1999 and April 2000 respectively . The chlorophyll-a concentration was showen in fig. 6 , which it's remarkable that regular bimodal model but is not distinct ' such as in temperate regions (22) and showed positive correlation (r = 0.46 P< 0.05) with temperature . Total phytoplankton cell number were ranged between 21cellx10^3 /l in stations 1and 2 during Jan.2000 to 218 cellx10^3 /l in station 3 during April 2000. Apositive correlation (r = 0.42 P< 0.05) showed between chl-a concentration and total number of phytoplankton . This study showed obvious high values of the studied limnological parameters than recorded in the upper region of river (5,23) and clearly shown the water characters were different among the studied stations. The same conclusion was noted previously on Mesopotamian inland waters (3 ,24)

Table 1 : The average value (range) of the studied limnological parameters of Diwanyia river during the study period (December 1999 to June 2000).

Parameter	Stations		
	1	2	3
Water Temperature C°	17.4 (10-27)	18.4(12-27.5)	18.7(12-28)
Conductivity µS/cm	1192(842-1594)	1170(849-1563)	1350(693-1532)
Salinity ‰	0.76(0.53-1.02)	0.78(0.54-1)	0.86(0.44-1.03)
pH	7.77(7.5-8.3)	7.68(7.3-8)	7.8(7.3-8.1)
Alkalinity mg $CaCO_3$/l	99(72-136)	101(72-130)	109(80-135)
Total Hardness mg/l	361(290-419)	377(300-436)	397(320-460)
Calcium mg/l	87(71-105)	90(72-112)	97(74-124)
Magnesium mg/l	43(20-66)	44(16-63)	49(28-73)
Chloride mg/l	102(82-142)	106(83-141)	111(85-184)
Total available CO_2 mg $CaCO_3$/l	235(95-396)	234(83-396)	241(92-400)
Dissolved Oxygen mg /l	6.4(4-9)	6.3(5-8.1)	5.6(4.7-6.8)
Nitrite µg/l	3.9(2.3-5)	4.4(3-6.1)	5(3.2-6.3)
Nitrate µg/l	47.5(23.14-60)	58(49.5-65)	57(20.6-71)
Phosphate µg/l	4.3(1.6-5.6)	3.3(2-4.5)	5.8(3.5-8.3)
Chlorophyll-a µg/l	3.6(0.69-6.85)	3.4(0.68-5.06)	3.1(0.72-5.4)
Total number of phytoplankton cellx10^3/l	91(21-197)	70(21-203)	83(27-218)

Fig.(1) Map showing the studied area .

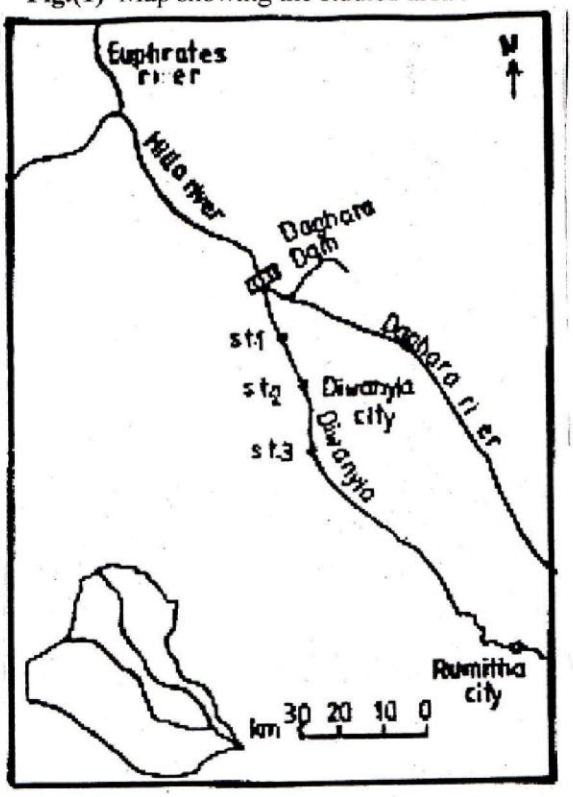


Fig (1) Map Showing the studied area

Fig.(2) Seasonal variations of temperature, conductivity , and salinity in the studied stations at Diwanyia river .

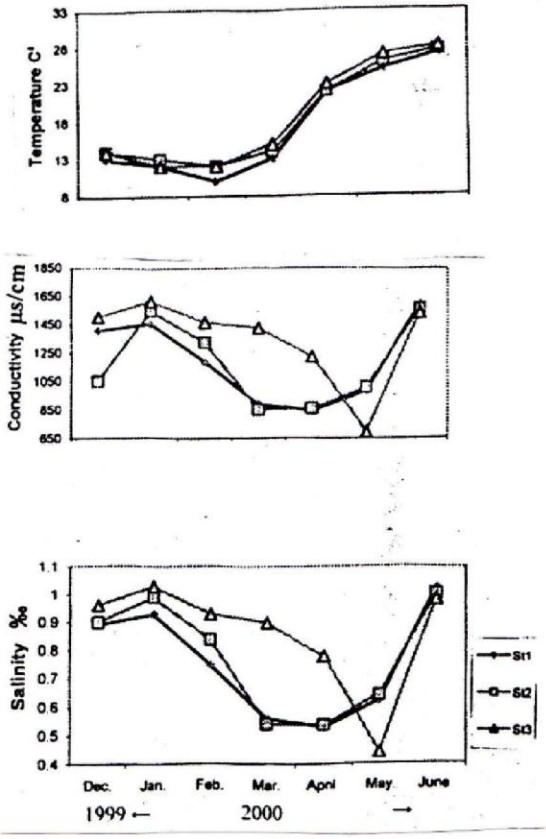


Fig.(3) Seasonal variations of pH, alkalinity , CO_2 , and dissolved oxygen in the studied stations at Diwanyia river .

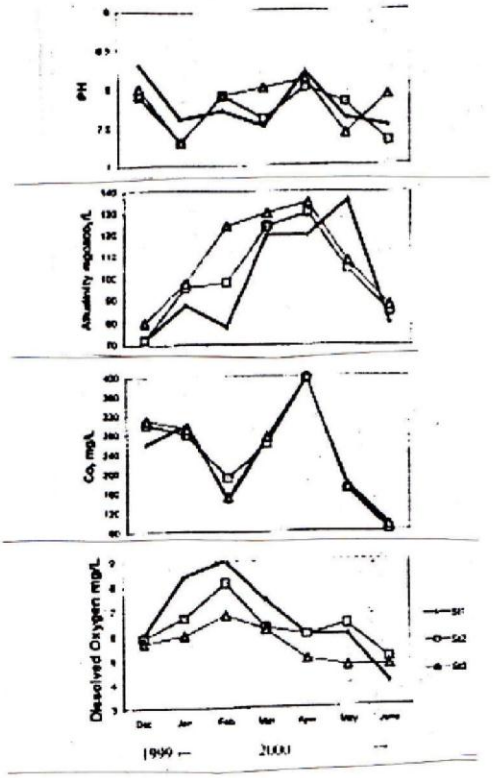


Fig.(4) Seasonal variations of Chloride , Magnesium, Calcium, and total hardness in the studied stations at Diwanyia river .

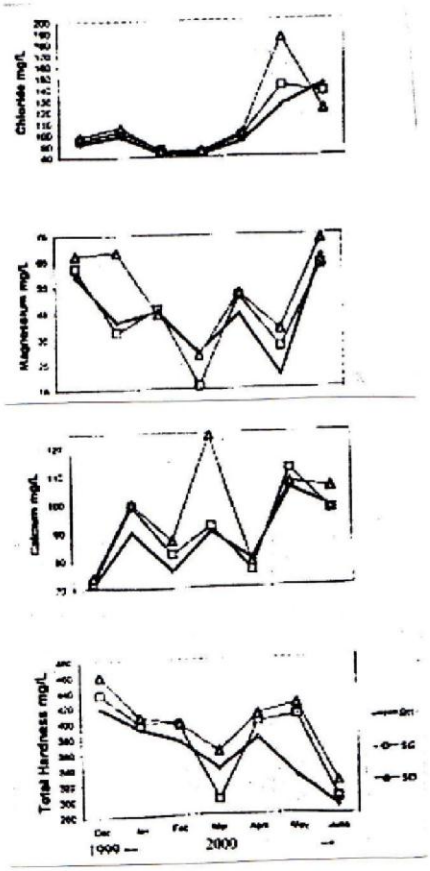
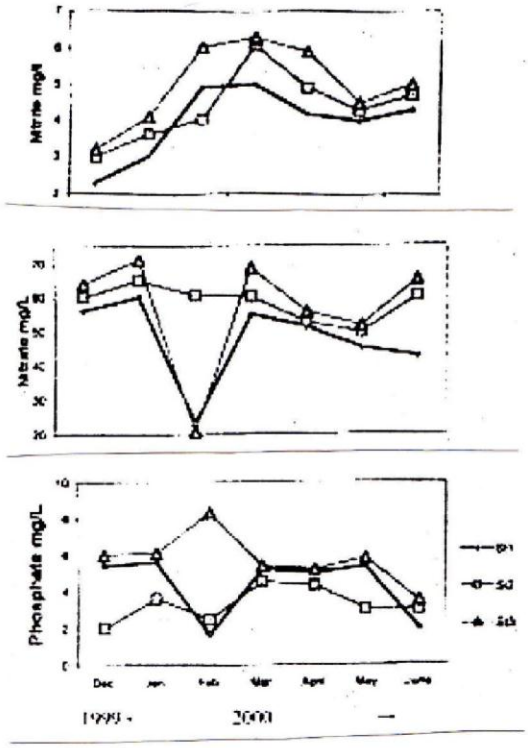
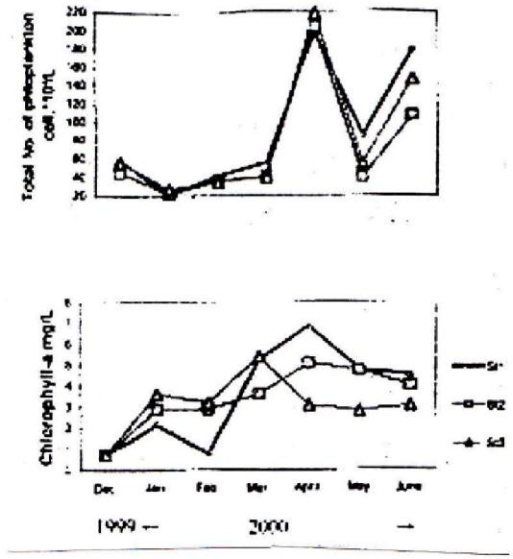


Fig.(5) Seasonal variations of Nitrite, Nitrate, and Phosphate in the studied stations at Diwanyia river .



Fig(6) Seasonal variations of total number of phytoplankton cells and chlorophyll-a concentration in the studied stations at Diwanyia river .



References

1. Talling,J.F.1980. Water characteristics in Euphrates and Tigris. In : J. Rzoska (ed.) , Mesopotamia ecology and desting.Vol.38. Monogr.Biol.London.
2. Al-Saadi,H,A.1993. Primary productivity of phytoplankton in Iraq aquatic system . Marina Mesopotamia 8(2): 254-276 .(in Arabic)
3. Maulood, B .K., Al-Saadi, H. A. and Hadi,R.A.M.1993. A Limnological studies on Tigris, Euphrates and Shatt Al-Arab, Iraq.Mu'tah J. for Res. and Studies 8 (3) : 53 – 67 .
4. Haideri, A. M., Al-Joboury, M. I., Idaan,K.A.and Maulood, B. K. 1988. An ecological study on some water system at central Iraq (Baghdad- Hilla) , chemical and physical aspects. Al-Ustath , 1 : 3- 18 .
5. Hassan, F. M. 1997. A Limnological study on Hilla river. Al- Mustansiryah J.8(1):211-232
6. Hassan,F-M and Al-Saadi , H.A. 1995. On the Seasonal variation of phytoplankton population in Hilla River . Iraq. J. Coll. Educ . for women , vniv . Baghdad 6 (2) :55-61
7. Al-Nimma , B-A. 1982. A study on the Limnology of the Tigris and Euphrates rivers . M. Sc. Thesis . Univ. Sulaimaniyah . Sulaimaniyah , Irag . 251 pp .
8. Al-Lami , A.A., Al- Saadi , H. A. , Kassim , T. I. and Al- Aubaidi , K. H. 1998 . On the Limnological features of Euphrates River , Iraq . J. Educ . Sci 29 : 38-50 .
9. Abdul Ridha , N.A, Habelb, H., Hussain , F.H. and Al- Imarah , F. J. M. 1996 . Evalution of the efficiencyof Water supplies and Water-Works in Diwanyia . J. Al-Qadisiya 1(3): 53- 61.
10. Alkam , F.M 2001 Alimnological study on Al- Diwaniya river , Iraq. J. Al – Qadisiya 2(6):68-81 .
11. Mackereth, F.J.H. , Heron , J. and Talling , J. F. 1978 . Water Analysis : Some revised methods for limnologists . Sci publ. Freshwater Biol Assoc (England) .
12. Hassan ,F.M.,Al-harify,A.N.,Hindi,A.Kadum,Saleh,M. M. 2000. Practical Manual of Ecological Measurement. College of Science, University of Babylon.
13. Golterman , H.L. Clymo , R.S. and Ohnstad , M. A. M . 1978 . Methods for physical and chemical analyisis of freshwater . 2nd. Edi. IBP. Hand No . 8. Blackwell Scientific publication , Osney Nead , Oxford 213pp.
14. APHA 1985. Standard Methods for Examination of Water and Wastewater , American Public Health Association Pub. 16th edition , 1193 pp .
15. Parsons , T.R 84 , Maita, y. and lalli , C.M 1984 Amanual of Chemical and Biological Methods for Seawater Analysis. Oxford.
16. Hinton , G.C.F. and Maulood , B.K. 1979. A modified membrane filtration method for phytoplankton enumeration in marine and fresh water ecosystem , Trop . Ecol . 20 (2): 192-194.
17. Lind, O.T. 1979. Handbook of Common Methods in Limnology. C. V. Mosby Co. St. Louis 199 pp.
18. Antonine , S.E and Al-Saadi, H.A1982. Limnological studies on the polluted Ashar canal and shatt Al-Arab river at Basrah (Iraq) 1nt. Rer. Ges. Hydrobiol . 67 (3) : 455-418

19. Weiner , E.R. 2000 . Application of Environmental Chemistry . Lewis publishers . USA.
20. Sinda;F.Abdel karim A-G, 1989. Physical and chemical characteristics of the Blue Nile and the White Nile at Kartoum. Hydrobiologia 110: 21-32 .
21. Hall, A. , Valente, I.and Davies, B. R. 1977. The Zambezi river in Mozambique : The physico-chemical status of the middle and lower Zambezi prior to the closure of the cabora Bassa dam . Freshwater Biol. 7: 187 – 206 .
22. Kim, B. C. 1987. An Ecological study of phytoplankton in the lake soyang. Ph.D. Thesis Univ. Seoul Nat. Korea .
23. Al- Saadi , H. A., Kassim, T. I. , Al-Lami, A.A. , and Salman, S.K. 2000. Spatial and sesasonal variations of phytoplankton populations in the upper region of the Euphrates river ,Iraq . Limnologica 30 : 83 – 95 .
24. Sabri, A.W. , Maulood , B.K. and Sulaiman , N.E. 1989 . Limnological studies on river Tigris : some physical and chemical characters J. Biol.Sci. Res. 20(3) : 565 – 579 .

الخواص اللمنولوجية لنهر الديوانية،العراق

د.فكرت مجيد حسن

أستاذ مساعد–قسم علوم الحياة–كلية العلوم–جامعة بابل–العراق

الخلاصة

جرت دراسة شهرية لثلاث محطات مختارة في نهر الديوانية المار في مدينة الديوانية للمدة من كانون الاول عام ١٩٩٩ الى حزيران عام ٢٠٠٠.وتم قياس درجة الحرارة،ودرجة الاس الهيدروجيني،والاوكسجين الذائب،وثنائي اوكسيد الكاربون،والقاعدية،والعسرة الكلية،والكالسيوم،والمغنيسيوم،والفوسفات،والنتريت،والنترات،والكلوروفيل–أ،والعدد الكلي للهائمات النباتية.عدت المياه قاعدية وعسرة جدا.وبينت النتائج وجود فروق في قيم العوامل التي قيست في اعلى النهر وادناه.