The Limnological Effects of River Lesser-Zab on Tigris River, Iraq

Thaer I. Kassim* ***Anmar W. Sabri.*****

Mohammed S. Salman****

Date of acceptance 23/4/2007

Abstract:

The present study included the physico-chemical parameters of Lesser-Zab river and its effects on Tigris river. Monthly water samples were taken from the two rivers during January to October 1999.There were no signifcant difference in water temperatures. Both rivers were fresh to oligohalin, alkaline and very hard. Close values were determined in total suspended solids in both rivers with little increasing during rainfall period and high discharge. Water was well areated and over saturation was recorded in several occasions. Dissolved oxygen values of Tigris river were influenced by Lesser-Zab. Cations were more dominant than anions in both rivers. In Lesser-Zab, the anions were increased during spring season and declined in summer which their values influenced in Tigris river. The concentration of plant nutrients (NO_2,NO_3,PO_4 and SiO_2) were fluctuated during the study period in Lesser-Zab and their effects were cleared on Tigris river.N:P ratio values were indicated the deficiency of nitrogen in both rivers.

Introduction:

The limnological studies on the river Tigris have been conducted on different parts of the river (1,2,3,4,5,6,7). Lesser Zab is one of the main tributaries of the river Tigris. However, limited information is known about its limnological character (8).

The present investigation was aimed to study the physico-chemical factors of Lesser-Zab and their effects on river Tigris.

Study area:

Lesser-Zab is one of five tributaries of the river Tigris and the main river draining through the Sulaimaniyh province, it is about 175 km long and 200 m width. Dukan reservoir lies on-stream impoundment. Geologically, the district surrounded river Lesser-Zab consist of cretaceous and ecocene limestones and shales, which gives the water an alkaline status (9). Lesser-Zab descending from mountains and join river Tigris at Al-Shagara village.

Three localities were selected to obtain understanding of the influence of the discharge from Lesser-Zab to the river Tigris (Fig.1). The first one (Z) is located at Lesser-Zab of about 5km long on a distance of about 6.5 km from the junction point. While the other two localities were selected in river Tigris, up-stream (T1,1.5 km long) and down-stream of the junction (T2,16 km long).

*Institute of Genetic Engineering and Biotechnology for Post Graduate Studies, University of Baghdad.

**Ministry of Science and Technology, Directorate of Hazard Materials and Environment.

***Environmental Engineering Department, College of Engineering, University of Baghdad

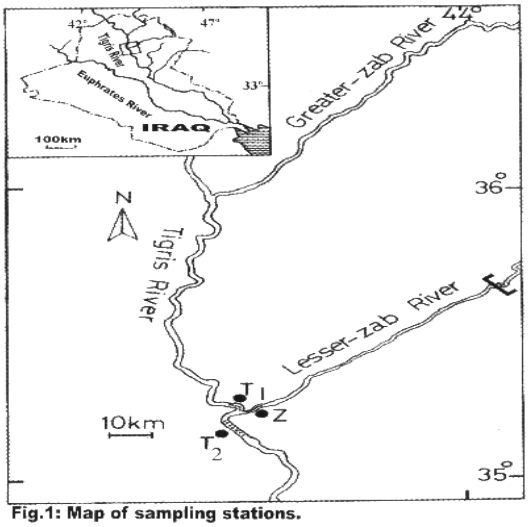


Fig.1: Map of sampling stations.

T1; up-stream and T2; down stream of Tigris River , Z; represent Lesser _ Zab River.

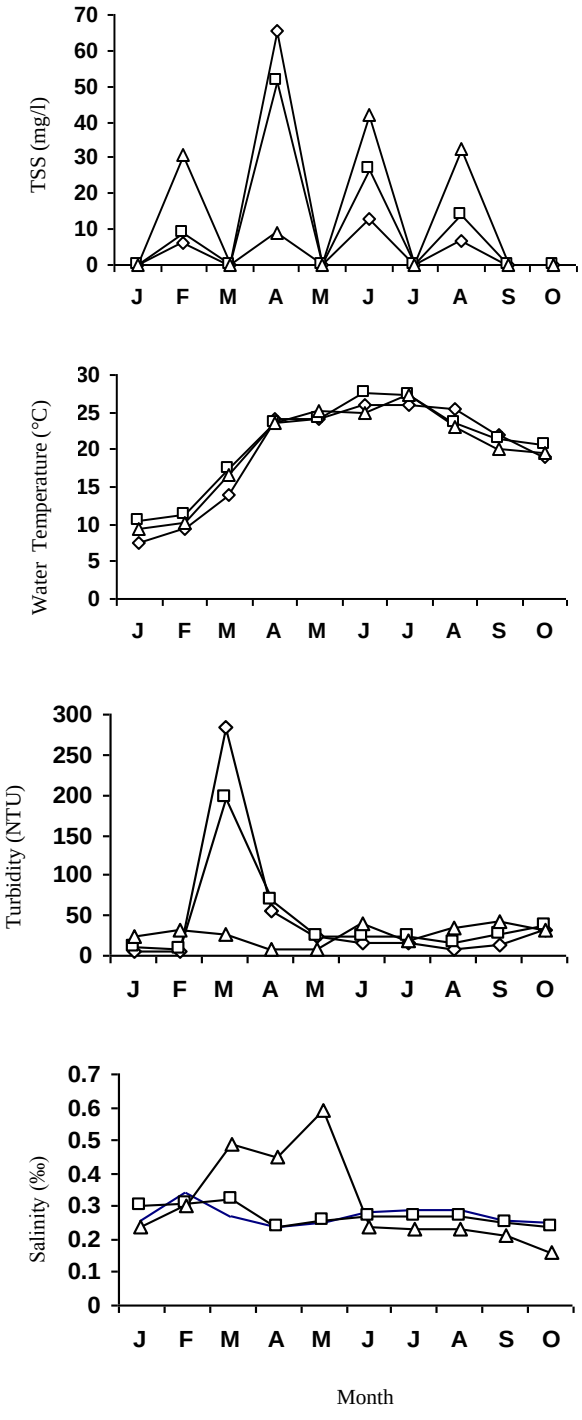
Materials and Methods:

Monthly sampling was carried out from three localities between January to October 1999. Water temperature was measured with a mercury thermometer and the values of pH were obtained using digital portable pH-meter. Conductivity and turbidity were measured in field using a digital portable conductivity and turbidity meters, respectively. Salinity was calculated from conductivity value, using linear equation (10).

Total hardness, alkalinity, chloride, calcium , magnesium and dissolved oxygen concentrations were determined by titration according to the methods reported by Lind (10). Nitrite, nitrate, phosphate, silicate, total suspended solid (TSS) and sulphate were determined following methods described by APHA (11).

Results and Discussion:

There was no clear difference in water temperature between the two rivers.It ranged from 7.5 °C in January to 27.7°C in June (Fig.2). The water in both rivers was almost fresh or little oligohaline with the highest salinity and conductivity of 0.59‰ and 965µs/cm in river Lesser-Zab, respectively. Similar results were recorded by (4,6,7) in Tigris, and lower than those in Euphrates river (5,12). Seasonal variations in salinity and conductivity were observed, with lower values in winter and autumn due to the high precipitation. While high values in summer and spring were due to the high temperatures, and evaporation.



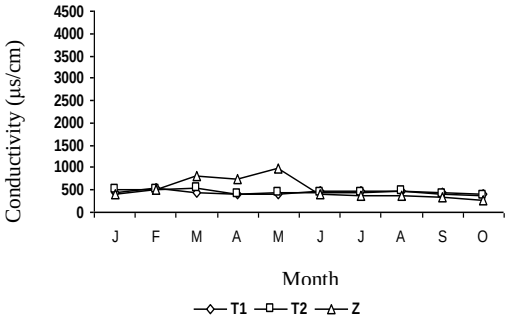
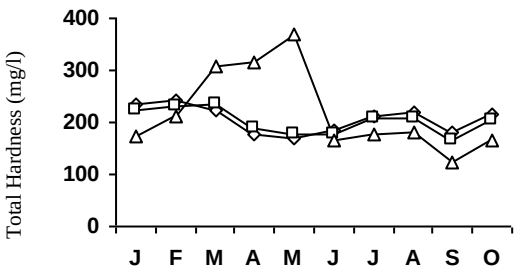


Fig.2: Seasonal variations of water temperature, total suspended solids (TSS), turbidity, conductivity and salinity values at the studied stations during study period (Jan – Oct 1999).

The total suspended solid (TSS) values were ranged between 6.2mg/Lto 65.6mg/L in river Tigris, and 8.8mg/L to 42.1mg/L in river Lesser-Zab . These values were lower than those recorded in upstream of Tigris river (6). The higher values were during April and June which attributed to the river flooding as well as the higher phytoplankton biomass. A similar pattern of the turbidity was observed by (8).

The water in both rivers were well aerated which mainly due to the high mixing processes and water flow and also to low organic matter especially in the river Lesser-Zab (8). The lowest dissolved oxygen value was recorded during warmer months (Fig.3). Dissolved oxygen influenced by water temperature and other characters of water. The higher values of dissolved oxygen in river Lesser-Zab during cold months affected river Tigris water at station T2.



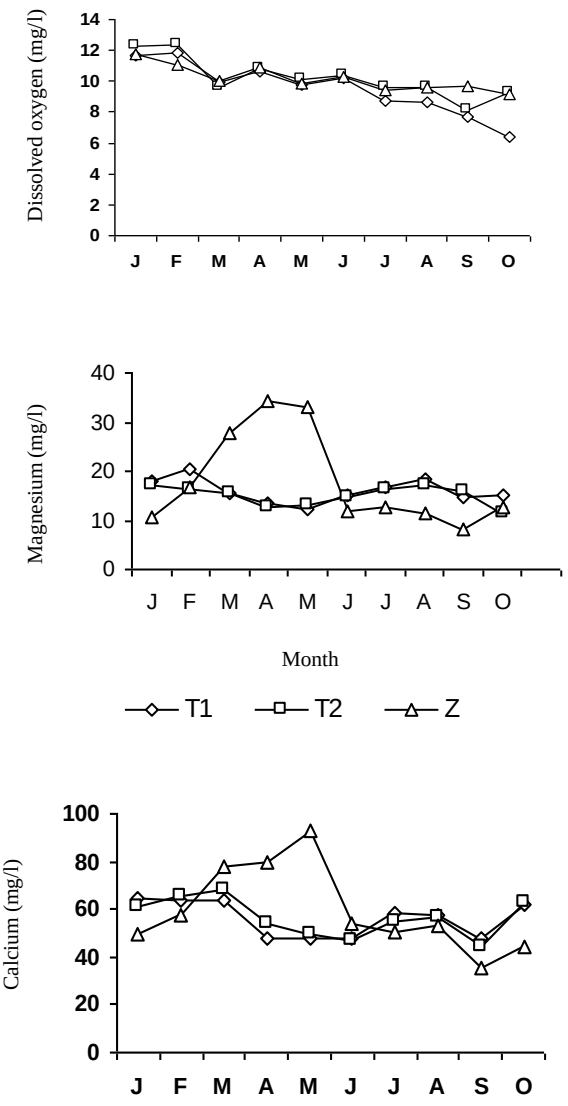
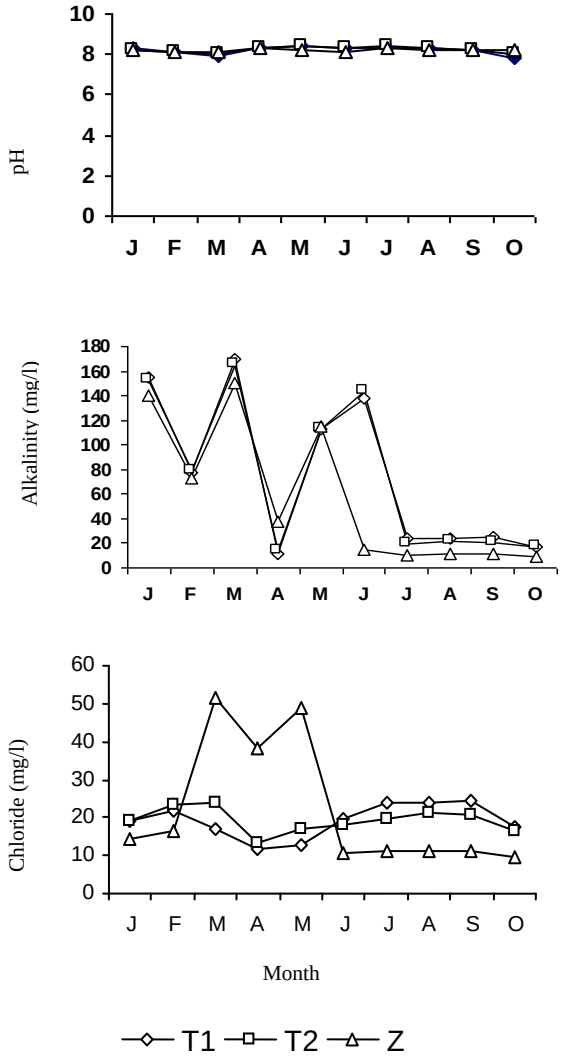


Fig.3: Seasonal variations of the total hardness, dissolved oxygen, calcium and magnesium ions at the studied stations during study period (Jan – Oct 1999).

The water in both rivers was considered as very hard due to the total hardness values. The highest values of total hardness were observed in river Lesser-Zab during May (376.2mg/L). Similar phenomenon was found in calcium (95.8 mg/L) and magnesium (35.1mg/L) ions ,which mainly related to the high flow discharge.The degree of hardness is predominantly determined by the concentration of calcium and

magnesium (10). Maulood & Hinton (12) also found that the Serchinar stream water is very hard (range from 250-800mg/L). This is the character of Iraqi inland water due to the higher concentration of calcium carbonate.

The values of the pH were always on the alkaline side (above 7.5). Same thing for the alkalinity. The alkalinity was due to the bicarbonate ions. These features were common in Iraqi inland water (2,3). The pH values did not affected by the alkalinity in the river water which may be due to the high buffering characteristic of the water enriched with calcium bicarbonate ions (13). No pronounce variations between the two rivers in pH and alkalinity values,while monthly fluctuation was observed (Fig.4).



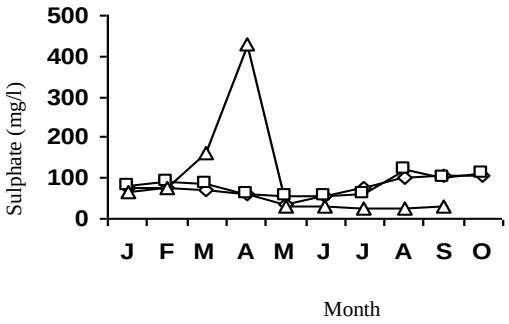


Fig.4: Seasonal variations of pH, alkalinity, sulphate and chloride at the studied stations during study period (Jan – Oct 1999).

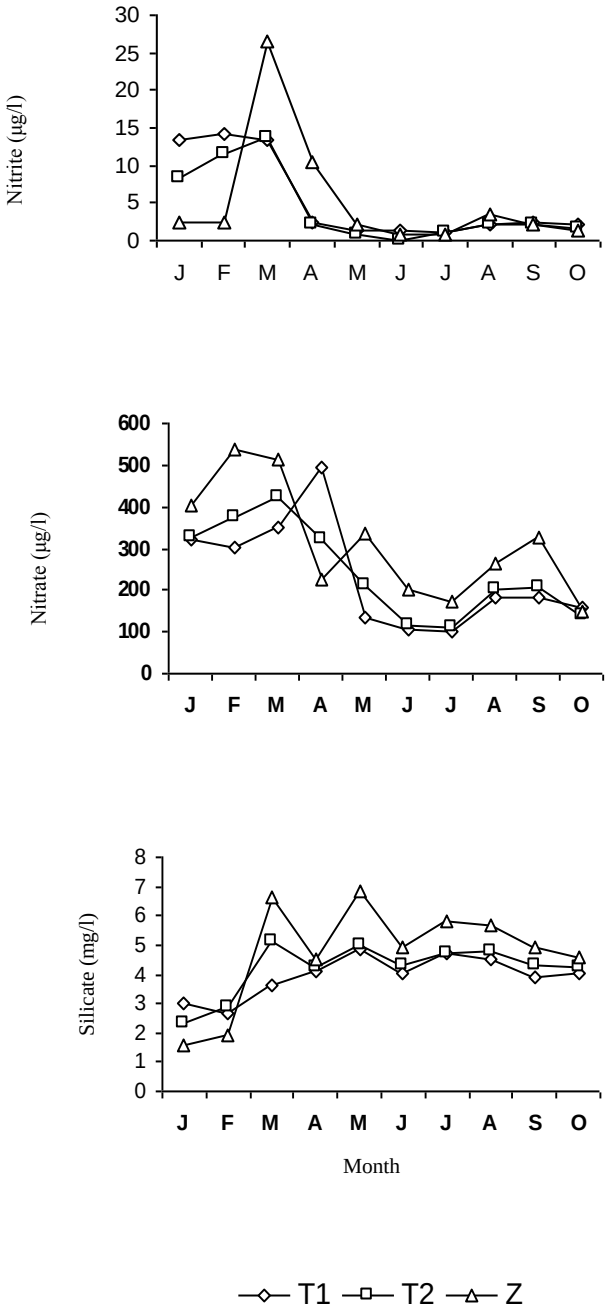
The high values of anions, sulphate and chloride were observed during Spring at river Lesser-Zab. These increased was affected river Tigris at station T2 during the same season. Whereas, lower values were recorded during summer and autumn in river Lesser-Zab, and their affects were as a dilution for both ions. The high concentrations of sulphate and chloride during April were attributed to the gypsum nature of the nearby area. However the anions values of the river Lesser-Zab were higher than the values reported by (6,7) in Tigris and (3) in Tigris and Euphrates rivers.

The river Tigris was effected by Lesser-Zab especially on increasing or decreasing the concentration of nitrite during all the study period (Fig.5). The seasonal variations of both ions concentrations were higher during winter and spring due to the rainfall and flood period (14). Similar results were found in river Lesser- Zab and Tigris (8,15). The concentrations of both ions were within the range of Tigris (6). Similar feature was for phosphorus . The N:P ratio in river Lesser- Zab was higher (12:1) than Tigris (10:1).A deficiency in nitrogen in both rivers was revealed.

The concentrations of silicate were higher in Lesser- Zab and affected on Tigris during most of the study

period, except in winter . Meanwhile, the silicate values found in a sufficient quantities for growth and reproduction of diatoms (>0.5mg/L). This was inconsistence with all inland water bodies in Iraq.

It can be concluded that the river Tigris was influenced by river Lesser- Zab which represented by either increasing or by diluting of the chemical components of the river Tigris during the study period.



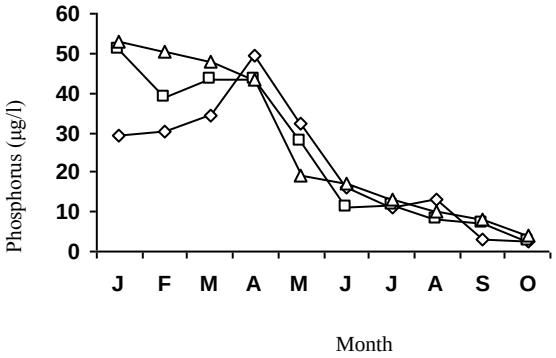


Fig.5: Seasonal variations of nitrate, nitrite , phosphorus and Silicate at studied stations during study period (Jan – Oct 1999).

References

1-Saad,M.A. and Kell,V.(1975). Observations on some environmental conditions as well as phytoplankton blooms in the lower reaches of Tigris and Euphrates.Wiss. Zeitchr. Univ. Rostock, 24:781-787.

2-Saad,M.A. and Antoine,S.E. (1978). Limnological studies on the river Tigris, Iraq.I. Environmental characteristics. Int.Rev.Ges.Hydrobiol., 63:685-704.

3-Al-Nimma,B.A.B.(1982).A study on the limnology of the Tigris and Euphrates rivers.M.Sc.thesis,Univ. Sulaimanyah ,Iraq.

4-Sabri, A.W.;Moulood ,B.K.and Sulaiman,N.E (1989) .Limnological studies on river Tigris:Some physical and chemical characters .J.Bio.Sci. Res ,20(3):565-579.

5-Maulood, B.K.; Al-Saadi,H.A. and Hadi,R.A.M.(1993).A limnological study on Tigris, Euphrates and Shatt Al-Arab,Iraq.Mutah J.Res.Stud., 8(3):53-87.

6-Al-Lami,A.A.; Kassim,T.I. and Al-Dylymei,A.A (1999).A limnological study on Tigris river,Iraq.Sci.J.Iraqi Atomic Eenergy Commission, 1:83-98.

7-Al-Sarraf, M.A.A. (2006). Ecological and taxanomical study for phytoplankton in Al-Adaim and Diyala tributaries and their effects on Tigris river.Ph.D. Thesis,

College of Science for Women, University of Baghdad.
8-Abdul-Jabar,R.(1983).Ecological study of phytoplankton in river Lesser-Zab.M.Sc.thesis,Univ. of Sulaimaniyah ,Iraq.
9-Guest ,E.(1966).Flora of Iraq.Vol. 1, Ministry of Agriculture,Baghdad.
10-Lind,T.O. (1979). Handbook of common methods in limnology, 2nd ed C.V.Mosby Co.,London.
11-APHA (1985). Standard methods for examination of water and wastewater. 16th ed American Publ. Health Assoc. Publ..
12-Maulood,B.K. and Hinton, G.C.F. (1978). Observations on the algal polar of the Sulaimaniyah area: Green and blue-green algal,Zanco Sci.J., Univ. of Sulaimaniyah,4(1):55-75.
13-Al-Saadi,H.A.;Hadi,R.A.M.and Al-Lami,A.A.(1989). Limnological studies on some marsh areas in southern Iraq. Limnologica, 20(2).
14-Neill,M.(1989).Nitrate concentrations in river water in the south-east of Ireland and their relationship with agricultural practice.Water Res.23(11):1339-1355.
15-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.Educ.&Sci.J., 29:38-50.

التأثيرات اللمنولوجية لنهر الزاب الأسفل في نهر دجلة-العراق

ثائر ابراهيم قاسم* ***أنمار وهبي صبري****

محمد صادق سلمان**

*معهد الهندسة الوراثية والتقنيات الاحيائية للدراسات العليا،جامعة بغداد
**وزارة العلوم والتكنولوجيا، دائرة المواد الخطرة والبيئة
***قسم الهندسة البيئية، كلية الهندسة ، جامعة بغداد، العراق

الخلاصة:

شملت الدراسة العوامل الفيزيائية والكيميائية في نهر الزاب الأسفل وتأثيرها في نهر دجلة.جمعت نماذج شهرية من النهرين خلال المدة من كانون الثاني ولغاية تشرين الأول من عام 1999. لم تكن هناك اختلافات معنوية في درجة حرارة الماء بين الموقعين خلال مدة الدراسة.كانت مياه كلا النهرين عذبة الى قليلة الملوحة وقاعدية وعسرة جدا.كذلك لم تكن هناك فروقات كبيرة جدا بين النهرين بكمية المواد العالقة الصلبة والتي تزداد خلال موسم سقوط الأمطار. امتازت مياه النهرين بكونها ذات تهوية جيدة وقد شخصت حالات فوق الأشباع في عدة مرات. تأثرت قيم الأوكسجين الذائب لنهر دجلة بنهر الزاب الأسفل. سادت الأيونات الموجبة على الأيونات السالبة في النهرين. ازداد تركيز الأيونات السالبة في نهر الزاب خلال فصل الربيع وانخفضت في الصيف وقد اثر ذلك في نهر دجلة، وتذبذبت تراكيز المغذيات النباتية (النتريت والنترات والفسفور والسليكات) طوال مدة الدراسة في الزاب الأسفل، وكان تأثيرها واضح في نهر دجلة.وأشارت قيم نسبة النيتروجين:الفسفور الى وجود نقص في النيتروجين في كلا النهرين.