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ENVIRONMENTAL EFFECT FOR NITROGEN AND PHOSPHORUS RATES IN WATER OF TALEGHAN RIVER DURING 2008-2009

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ABSTRACT

In this study we conducted an experiment on the water of Taleghan River which is used as drinking water for Metropolitan Tehran. Between August 2008 and July 2009, 12 samples were taken from 6 stations along the river monthly. We have evaluated nitrate, nitrite and orthophosphate rate as the main parameters in order to determine the introduction of wastewater in this river. Results show that there is no serious problem regarding the parameters checked in this study. So, the water can be used as drinking water without any serious problem.

Key words: *nitrate, nitrite, orthophosphate, Taleghan Rever, Iran*

INTRODUCTION

Understanding physical and chemical factors of rivers are important these days .in this paper the authors want to unveil mentioned factors for Taleghan River that releases to Taleghan dam because this water use for drinking water for Tehran city and agriculture. Region of Taleghan has been rapidly developed during the past two decades. Mentioned river is very important for local economic, irrigation, and place for abandon a valuable truism species, natural environment for biotic characteristics.

Discharge of pollutants to a water resource system from domestic sewers, storm water discharges, industrial wastes discharges, agricultural runoff and other sources, all of which may be untreated, can have significant effects of both short term and long term duration on the quality of a river system.

N is an important element of the ecosystem and is a key constituent of various organic and inorganic substances. Aquatic systems contain small concentrations of nitrogen in organic and inorganic forms [7]. Besides N, P is the second most important essential elements of primary production and is the most important nutrient which causes the eutrophication of freshwater which induces algae growth, lowers the content of diluted oxygen in the water, and reduces water clarity [7].

Nitrate concentrations in rivers and groundwater continue to be a matter of concern throughout the developed world [5]. The maximum acceptable concentration in drinking water is 30 μg $N1^{-1}$, but may only be allowed to reach up to 3 or 9 µg $N1^{-1}$. To protect salmonids and coarse fish, respectively, typical values in unpolluted streams are generally between 1 and 3 μg $N1^{-1}$, but may range between 8-17 μg $N1^{-1}$ in highly contaminated rivers [4].

The conversion of NH_4^+ to the intermediate NO_2^- and then through to NO_3^- by nitrifying bacteria (i.e. nitrification) is a key process which mobilize N and promotes losses to watercourses [4].

The coupling of this obligatory aerobic process (nitrification) with an anaerobic process (denitrification) leads to the loss of nitrogen to the atmosphere. Therefore, nitrification is crucial to an understanding of the nitrogen cycle in aquatic systems, particularly, the river/estuarine systems. There have been many examples showing intensive nitrification in polluted rivers/estuaries that directly or indirectly (through organic nitrogen mineralization) receive large amounts of ammonium favorable to the development of nitrification. Transformation of nitrogen species from ammonia and nitrite to nitrate in river/estuaries during transportation not only modulates their relative distributions but also enhances oxygen consumption [3].

The majority of P is flushed from agricultural areas into surface running waters; flushing into ground water is insubstantial. According to the EPA (1984), P losses from farming surfaces amount to 0.97–1.85 *kg/ha*/year [7].

In unpolluted freshwaters, total phosphorus (TP) concentrations are typically below 25μg P 1^{-1}. In water management, it is generally assumed that concentrations above 50 μg P 1^{-1} are the result of anthropogenic influences. A survey of rivers in Europe (European Environment Agency, 1998) revealed that a large proportion of c. 1000 monitoring stations observed TP concentration exceeding 50 μg P 1^{-1}. Only c. 10% of the monitoring stations reported mean TP concentrations below 50 μg P 1^{-1} [6].

In this study, N and P in part of Taleghan River was investigated

MATERIALS AND METHODS

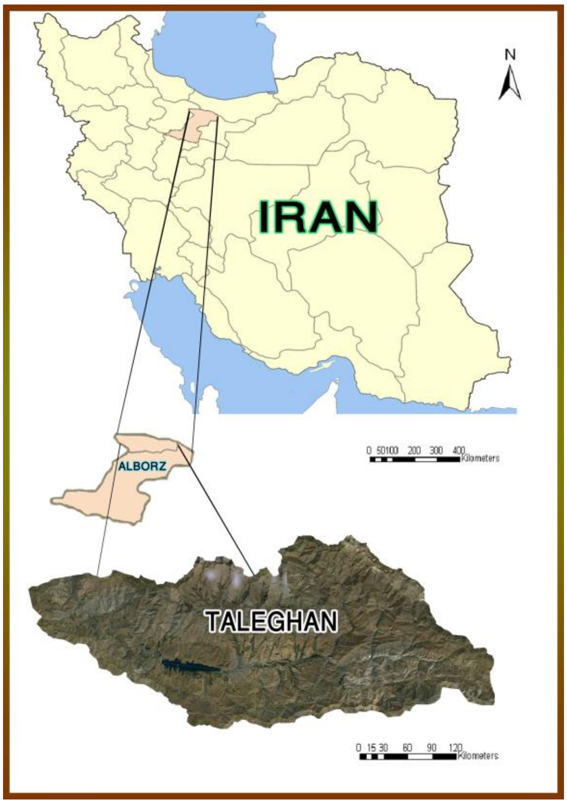

Fig. 1. Position of the Taleghan river.

This study was undertaken during the period August 2008 until July 2009, by monthly sampling of chemical factors of Taleghan River.

Taleghan River is one of the rivers in southern Alborz mountain chain with an approximate length of 55 *km* we studied only on around 51 *km* of it by choosing 6 sampling stations (*Fig. 1*, *Table 1*). The area of investigation is shown in *Fig. 1*. Taleghan River can receive drainage of all flood, waste waters and runoff derived from precipitation of its basin.

Samples were analyzed to NO_2^-, NO_3^{2-}, PO_4^{3-}, using standard methods [Wetzell, Likens, 1991].

All the statistical analysis was performed using JMP and Excel Software. Data present as mean ±SD. All analyses were performed using JMP software.

Table 1. Location of the sampling stations with UTM.

Station	X	Y
1	3610480	05059160
2	3610927	05054325
3	3610963	05052928
4	3610550	05050867
5	3610215	05046380
6	3610007	05044880

RESULTS AND DISCUSSION

PO_4^{3-} levels were significantly affected by season but not the station or their interaction (*Table 2*). *Fig. 2* shows the lowest values were related to spring while there was no significant difference between the other three seasons.

Table 2. Analyze of variance for PO43- values in seasons.

Source	DF	SS	Mean Square	F Ratio	Prob > F
Season	3	0.032453	0.01082	3.25678	0.0431
Within	20	0.066432	0.00332		
Total	23	0.098885	0.0043		

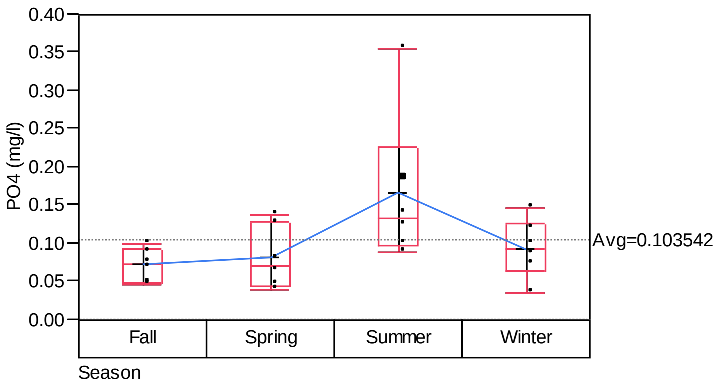

Fig. 2. Seasonal changes of PO_4^{3-} values.

The low level of PO_4^{3-} might be related to more flood currents in spring that leaches PO_4^{3-} from the river (dilution) and decreasing the resident time.

Although the river have been receiving the waste water from village recourses in station 5 (City of Taleghan) and agricultural recourses between station 3-6, there was no significant change between the stations (*Table 2*).

The reasons might be related to:

1) Measuring of only one form of P (PO_4^{3-}) instead of all forms (TP, total dissolved P, organic P…), unlike N; transformations between different forms of P might mask the change in PO_4^{3-} levels in related to stations and seasons.
2) Instead of N, P trends to attach to suspended particle and sediment and forms complex [8].

Since the studied part of Taleghan River is turbid with high fine sediment on its bottom, P might be removed from water body by attaching to the sediment and suspended materials; the effect that can be neutralized by measuring sediments' P and water TP.

Nitrogen

Results showed the main form of N-Min was related to NO_3^{2-} which was not surprising considering levels of DO in all stations and seasons. Results showed the lack of significant changes in NH_4^+ levels in stations and season (*Table 4*, *Fig. 4*) is due to the levels of DO, too. Major portion of N-Min was related to NO_3^{2-}. Similarly, Abdel-Satar (2005) reported major portion of N-Min was NO_3^{2-} in Nile River which had high measured DO levels. N-Min levels were significantly affected by stations and interaction between seasons and stations (*Table 3*). As respects, station 1 and 5 showed pattern during the seasons compared the other stations (*Fig. 3*). In station 1-4, N-Min levels decreased from spring to summer and then increased until winter, exception of station 1 that had same levels of N-Min in autumn and winter (*Fig. 3*).

However, in station 6, N-Min levels was similar in season spring and summer, followed by decrease and increase in autumn and winter, respectively (*Fig. 3*). Decrease in N-Min levels in summer compared to spring in station 1-4 is believed to be due to development in aquatic plant communities in summer and absorption of NO_3^{2-} which is the main form of N-Min in the river. Abdel-Satar (2005) reported decrease in NO_3^{2-} when phytoplankton communities developed in Nile River.

NO_3^{2-} and N-Min levels increased in stations 1-4. In this case, increase in NO_3^{2-} and N-Min levels in stations 1-5 is related to crash in aquatic plants communities due to lack of suitable environmental conditions (mainly light and temperature) in autumn.

Abdel-Satar (2005) mentioned increase in NO_3^{2-} levels in cold season was due to crash in planktonic communities and conversion of ammonium to nitrate in Nile River.

In all stations, N-Min levels increase from autumn to winter, exception station 1 (*Fig. 3*). Increase in NO_3^{2-} and N-Min levels in stations 2-6 in winter might be related to more flood current in winter and slightly late autumn that have been led to increase in leach of N from lands (fertilizers that have been applied for agricultural purposes) to river.

However, lack of change in N-Min in station 1, seems to be due to higher levels of NO_{2-} in autumn (*Fig. 5*) that has been led to increase in N-Min levels in autumn and in turn, no change in winter.

Low values of NO_{2-} in all stations and seasons compared to other forms of N is due to high DO levels and fast conversion to NO_3^{2-} [1].

CONCLUSION

Taleghan River is used for different purposes such as drinking water in Tehran metropolitan and Karaj city, local economic and irrigation. Of course, inlet waters

Table 3. Analyze of variance for N-Mineral values in seasons.

Source	DF	SS	Mean Square	F Ratio	Prob > F
Season	3	1.641895	0.5473	1.83384	0.1735
Within	20	5.968875	0.29844		
Total	23	7.610771	0.3309		

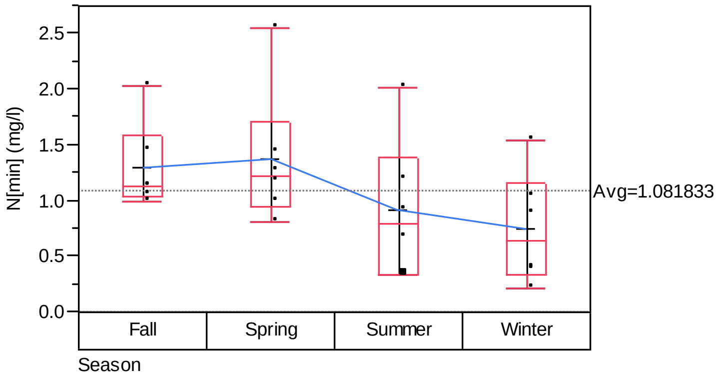

Fig. 3. Sessional changes in N-Min values.

Table 4. Analyze of variance for NO_2^- values in seasons.

Source	DF	SS	Mean Square	F Ratio	Prob > F
Season	3	0.11348659	0.014186	1.8767	0.0002
Within	20	0.11338407	0.007559		
Total	23	0.22687066		0.1396	

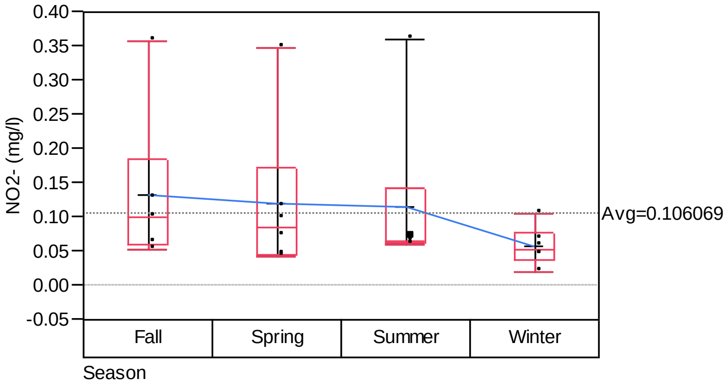

Fig. 4. Sessional changes of NO_2^- values.

Table 5. Analyze of variance for NO_3^{2-} values in seasons.

Source	DF	SS	Mean Square	F Ratio	Prob > F
Season	3	14.35679	4.7856	11.0245	0.0002
Within	20	8.681728	0.43409		
Total	23	23.03852	1.00167		

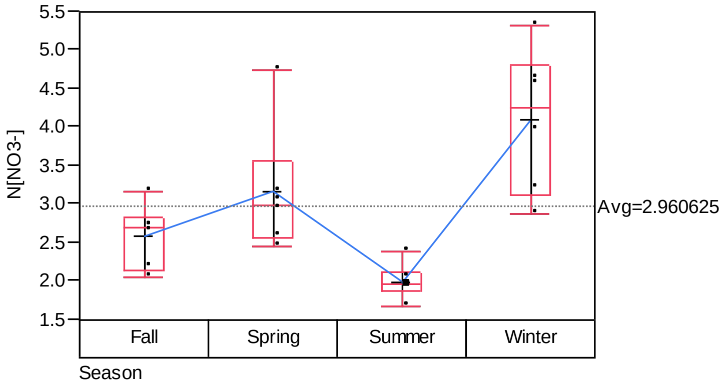

Fig. 5. Sessional changes of NO_3^{2-} values.

were limited at this period and wastes were introduced to the river, however, examined parameters did not show critical point and no serious problems seems to be existed in the aspect of the water quality. But optimization of sampling stations and controlling the water of the River needs to be continued. Controlling tourists and other visitors that camp near the River bank can help improve the quality of the water behind in Taleghan dam.

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Reviewer: *PhD* ***S. H. Arevshatyan***