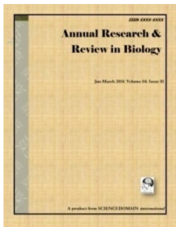

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Biological Monitoring of Gharasou River by Using Macro Benthic Community Structure

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Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

Original Research Article

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ABSTRACT

Maintaining water resourcesquality,due to the recentdroughts andurban, ruraland industrialdevelopments isan important taskinenvironment. According to the importance and critical role of GharasouRiver inwatersupplyof Ardabil province which is located onNorth West of Iran, its quality evaluationseemsnecessary.In order to evaluate water quality of GharasouRiver for this purpose, samplingof benthoswas conductedinlowwaterandhigh waterseasons in 2012-2013 growing season. According to the results based on Hilsenhoffindex values, water qualities is average in first round and second round at all stations.The first and second stations were in the best situation. So, physico-chemical parameters including dissolved oxygen(DO), pH and BOD are seen the best in the first and second stations. The results showed that Hilsenhoff index was a good index to be used to indicate the state of the general water quality of the study river.

Keywords: Biological monitoring; Macro benthos; Gharasou River; Hilsenhoff; Ardabil province; Iran.

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1. INTRODUCTION

Survey of water resources quantitative and qualitative features is a basic element for sustainable development and a good management in the different areas of environment, fisheries, agriculture and so on. In normal conditions, aquatic ecosystems can changed, being affected by natural factors such as water, wind, geophysical forces and interactions of organisms (micro-organisms, plants and animals).But during the recent years, humans have been widely a basic element to make changes on the earth [1]. The study of streams and rivers that actually act as circulatory systems, not only are important for ecosystem health diagnosis but also can be indicative of possible pressure exerted on the environment [2].

One way to assessing the quality of surface waters is measurement of physical and chemical agents. Another way is the most effective way and its performance is also emphasized in recent decades is "Bio assessment", particularly by using the macro benthos for water quality monitoring [1].

Macro benthos of aqueous ecosystems is invertebrate animals with low mobility, which can be seen with the naked eyes and are suitable Indicators for the assessment of contaminated aquatic ecosystems [3]. Bio assessment based on aquatic macro benthos can demonstrate the problems of water quality associated with pollution or other effects of perturbations (disturbances) in a shorter time and with less cost than other quantitative methods.

Because of that, assessment of macro benthos communities is one of the most common tools to detect turbulence effects on biological communities of the streams.

Damage of macro benthos communities causes disturbance of population structure and food chain and subsequently causes damage of fish biological communities. In general, functional and structural features of benthic community will allow to survey the river's response to stressful factors and to identify the damages of various indicators such as bio-indicators now a day, a wide variety of environmental groups are used. During a basic study that was performed by Vincent Reshand Norma Kobzinain Berkeley, California, proved that large invertebrates are the most common bio-indicators groups [3].

Voelker and Renn studied America's White River by using Hilsenhoff biotic index and estimated river biological index degree in the range of very good to very bad [4].

YAP et al. used biological indicators on Malaysia Peninsular Selang or City Simonyi River and observed that benthic macro-invertebrates at upstream sampling stations have more diversity and pollution-resistant species at downstream were overpowered due to reduced quality of water affected by sewage entry, industrial and agricultural activities [5].

Saunders et al.ina study which conducted in the United Arab Emirates on Dubai Creek observed that increasing pollution causes density reduction of benthic macro-invertebrates while in the depolluted areas, opportunistic pieces are dominant, which are indicators of pollution [6].

Tavan Magsoodi et al. based on macrobenthic communities did quality classification in Siyahkal town on Shemrood river and observed that abundance of different families of macrobenthic at mountainous stations have been almost identical to each other and diversity of families has been more but at downstream stations, abundance of some infections resistant families has been increased and their diversity has been reduced and finally evaluation of this river water quality was good [7].

Kamali et al. studied Karim Chai, Lavand oil and Chelv and rivers water quality in Astara city by using Hilsenhoff biotic index. In this study, 26 families of 7 orders of benthic aquatic insects were identified and biological index of Karim Chai and Lavand oil rivers estimated respectively 6.11 and 5.79 and water quality of both rivers was relatively weak(significant contamination possibility). Biological index of Chelv and River estimated 5.33 with relatively good water quality (relatively significant contamination npossibility) [8].

Mirzajani et al. based on macro benthic communities performed the quality assessment of rivers that end to Anzali lagoon and the water quality of the rivers, especially in the vicinity of the cities estimated weak to very weak [9].

Mahdavi et al. selected 5 biological sampling stations along the Taleghan River (located in Taleghan city-Tehranprovince).The sampling was conducted seasonally and Hilsenhoff biotic index was used in order to determine the levelof tolerance of benthic invertebrates. This index showed the high quality of Taleghan river water [10].

Karimiyan et al. defined the water quality of Sannandaj city Geshlag River with intended index. The three stations sampledin May, July and August. 12 families of 3 macro benthos branches observed and Hilsenhoff biotic index of sampled stations during the study ranged from3.89to5.78and were in 4qualitativedegrees,very well, good, average and somewhat weak [11].

Considering the importance of Gharasou River in required water supply for drinking, agriculture and industry and on the other hand entry of different rural, urban, agricultural, industrial pollutants, this study was conducted to assess the quality of Gharasou River by using Hilsenhoff method.

1.1 Study Area

Garasou River is one of the most important Ardabil Province Rivers that pours to Aras Boundary River (it is one of the main Caspian Sea water sheds). This river receives major waters of Meshginshahr and Ardebil cities Fig. 1.

To access information none the status of Ardabil Gharasou water quality was determined 4 stations (Table 1).

Table 1. Coordinates of stations sampled

Station name	Number of station	X	Y
Hour after village up stream Sagezchi	1	483549	381448
After Paul Nyarq	2	483119	381915
Samian (before slaughter)	3	48167	38293
Samian (after slaughter)	4	481455	382246

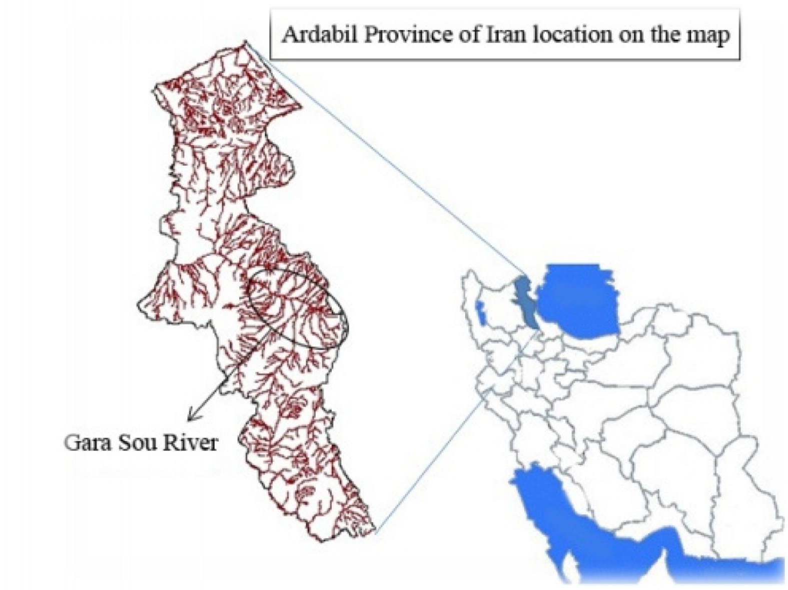

Fig. 1. Study area situation in Ardabil Province and Iran

2. MATERIALS AND METHODS

Benthic sampling was done by using Surber sampler with dimensions of 40 x40 cm2 (1600 cm2 useful level and 250microns net) with 3 replications were performed at each station [11]. Samples collected in containers that have recorded station identification, location and date of sampling on them, were discharged and fixed with 4%formalin.

One method of assessing river pollution and quality is using biological index that shows composite effect of physicochemical and biological parameters. Using this index to determine the quality and biological monitoring of streams is one of the best and most cost-effective ways which is common in America and Europe and is based on macro benthos limit detection in family and defining their tolerance to water organic pollution. According to principle of this method, it is given a certain degree of resistance for each macro benthos family. Macro benthos tolerance limit in Hilsenhoff method is rated between (0-10) that the rating of zero indicates Lack of family resistance to contamination and the result is clean water and Rating of 10 shows high family resistance to contamination. Tolerance valuesfor each family were presented based on the irrelative abundance in the Wisconsin state of America[6] and the following formula is used:

$$HBI = \frac{\sum(x_i t_i)}{n}$$

Xi: the number of people in each group, ti: Pollution tolerance values in that group, n: number of sampled individuals. In Table2is presented Hilsenhoff index Classification of waters in seven categories.

Table 2. Index classification Hilsenhoff

Degree of organic pollution	Water quality	Biotic index
No apparent organic pollution	Excellent	0.00-3.50
Possible slight organic pollution	Very good	3.51-4.50
Some organic pollution	Good	4.51-5.50
Fairly significant organic pollution	Fair	5.51-6.50
Significant organic pollution	Fairly poor	6.51-7.50
Very significant organic pollution	Poor	7.51-8.50
Severe organic pollution	Very poor	8.51-10.00

Note: this formula is used different species, genera and families [7].

3. RESULTS AND DISCUSSION

In this study, to evaluate the water quality of the Gharasou River Hilsenhoff index was used. Quality Classification of river water was done by the indicators in the four stations. To determine the quality of the stations related to uses (agriculture, animals, aquatic, public drinking and recreation) was used the Hilsenhoff water bio-indicators. The results of used biological indicators Classification are described in the table:

1 - Analysis of the samples by using of Hilsenhoff index. In Table 3 is provided respectively fall 2012 and spring 2013 benthos samples.

In Tables 4 and 5 are provided Determination of Hilsenhoff indicators for fall 2012and spring 2013 benthos samples.

Based on calculations for the Hilsenhoff index in Tables 4 and 5 were found to be the best water quality for the first station (upstream of Hoor village after Sagezchi dam) is in fall and spring and lowest water quality for stations 2, 3 and 4 is fall. In the spring, there is the best quality of water at stations1, 2, and 3 and there is a poor quality of water at station 4 due to slaughter house sewage entering (Fig. 2).

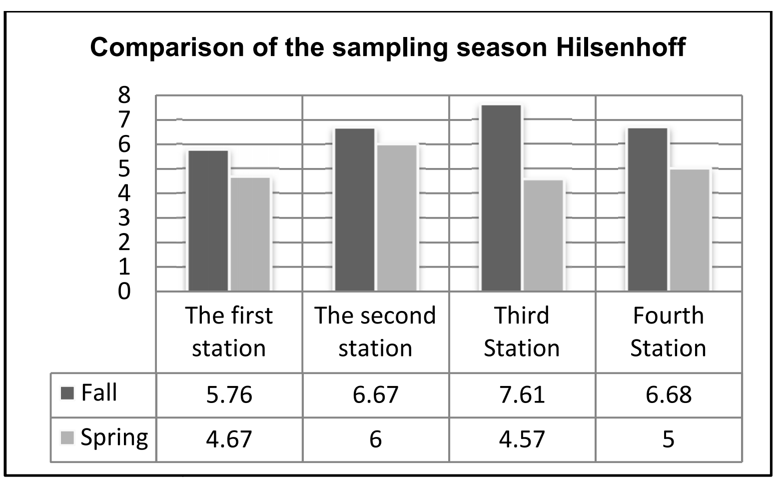

Fig. 2. Changes in water quality of Gharasou River based on Hilsenhoff biotic index in 2012-2013

Table 3. Benthos samples taken from Gharasou River in two sampling seasons

Order	Family			The first station		The second station		Third Station		Fourth Station	
				Fall	**Spring**	**Fall**	**Spring**	**Fall**	**Spring**	**Fall**	**Spring**
Diptera	***Chironomidae***	***Orthocladiinae***		2	4	25	11	38	7	25	9
		Pupae									
		Adult									
		Ceratopogonidae									
	Dolicopodidae										
	Tipulidae		**tipula**		6		1				
	Simuliidae						6				
EphemeropterA	***Baetidae***		**baetis**	8	12	1	8				1
	Caenidae					2			2		
	Heptageniidae		**Epeorus**								
Trichoptera	***Hydrortilidae***			14							
	Hydropsychidae					3					
	leopidostomatidae										
Pulmonata	***Physidae***					1		12		21	5
	Planorbidae										

Table 3 Continued……….

Oligochaeta									5
Hirudinida	***Hirudinidae***	**Hirudo**	9	4	11		1	7	1
Isopoda	***Crustacea***					14		38	

The results of river's water physico-chemical agents measurements are presented in Tables 6 and 7.

Table 4. Determination of indicators for fall 2012 benthos samples

Index	First Station	Second Station	Third Station	Forth Station
Hilsenhoff	5.76	6,67	7.61	6.68

Table 5. Determination of indicators for spring 2013 benthos samples

Index	First Station	Second Station	Third Station	Forth Station
Hilsenhoff	5	4.57	6	4.67

Table 6. Measured physico-chemical parameters in the first round of sampling

Stations	DO	BOD	pH
First Station	7.2	0	7.5
Second Station	6.2	0	7.4
Third Station	7	0	7.1
Forth Station	6	3	7

Table 7. Measured physicochemical parameters in the second round of sampling

Stations	DO	BOD	pH
First Station	8	2	8.4
Second Station	7.2	2	8.4
Third Station	8.97	9	8.9
Forth Station	5	32	8.34

4. CONCLUSION

According to the results of biological monitoring, river's status is located in Significant organic pollution, Compared with the results of studies [2], the river water quality of adjacent cities and leading to the Anzali Lagoon have been estimated relatively poor to very poor but status of studied river showed less pollution. Also compared with good quality of Kazeroon's Shapo or river [4] the water quality of Gharasou River was estimated poor but compared to relatively poor water quality of Kor river in Fars province [5]was estimated with less pollution. Also compared with the research [3] based on benthic communities has evaluated Siyahkal Shemrood river water quality good, the status of studied river is moderate. Using of Hilsenhoff index in order to determine Quality and Biological Monitoring of rivers is the best and most economical method that nowadays it is common in America and Europe, which is based on macro benthos identification in the family and their tolerance to water organic pollution.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Resh VH. River blindness (Onchocerciasis). In V.H. Resh and R. Cardé. (Eds.). The Encyclopedia of Insects. Academic Press. 2003;1007-1008.
2. Davies A. The use and limits of various methods of sampling and interpretation of benthic. Macro invertebrates. J. Limnol. 2001;60(suppll.1):1-6.
3. Mirzajani A, Gane A, Khodaparast Sh. Survey of Benthos community relations and water organic properties of rivers that leading to Anzali Lagoon. Journal of Ecology. Iran. 2008;45(34):38-123.
4. Voelker DC, Renn DE. Benthic invertebrates and quality of the streambed sediments in the White River and selected tributaries in and near Indianapolis, Indiana, 1994–96: U.S. Geological Survey Water-Resources Investigations Report. 2000;52.
5. Yap CK, Al-Barwani M. A Comparative Study of Condition Indices and Heavy Metals in *Perna viridis* Populations at Sebatu and Muar, Peninsular Malaysia. Sains Malaysiana. 2012;41(9):1063–1069
6. Saunders M, Lewis P, Thornhill A. Research methods for business students. 4thed. London: Prentice Hall. 2007;27.
7. Tavan Magsoodi M, Ahmadi MR, Keivan A. Study on diversity and abundance of benthic productivity in the Shamrod River. Journal of fisheries. 2003;123-138.
8. Kamali M and Esmaeilisari A. Biological assessment of Lasem river (Amol city) using a large population of benthic invertebrates. 2009;3(1):51-61.
9. Mirzajani A, Ghanesasansarabi A, Khodaparastsharifi H. The wetlands of the river leading to qualitative evaluation based on macrobenthic communities. Journal of Environmental Studies. 2008;45:31-38.
10. Mahdavi TM, Bazrafshan O, Javanshir A, Mosavinadoshni R, Babapour M. Explore the possibility of benthic community impact on the quality of Taleghan river water, Iran. Natural environment Journal. 2010:63(1):75-91.
11. Karimiyan A, Jafarzadeh N, Nabizadeh R and Afkhami M. Zoning of water quality criteria based on WQI. Tenth National Conference on Environmental Health, Tehran, Iran; 2009.

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