



Public environmental awareness of water pollution from urban growth: The case of Zarjub and Goharrud rivers in Rasht, Iran



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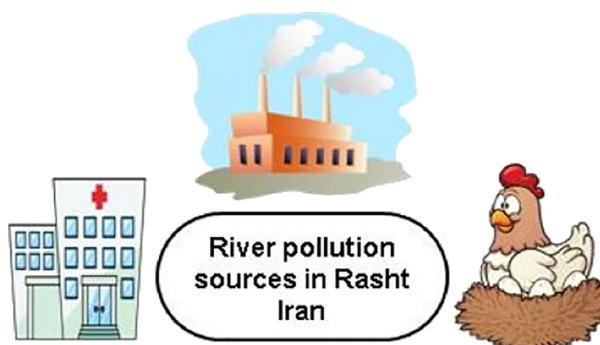
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HIGHLIGHTS

- Industrial areas, hospitals, and poultry farms were main factors of water pollution.
- The discharge of urban sewage into the rivers was also an important polluting factor.
- Overall, 62.7% of the residents had moderate and 20% had high environmental awareness.
- Families and mass media were perceived of being the most common information source.
- Data provide a valuable reference source for formulating appropriate environmental policy.

GRAPHICAL ABSTRACT



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ABSTRACT

Rivers in urban areas have been associated with water quality problems because of the practice of discharging untreated domestic and industrial waste into the water bodies. However, to what extent the public can identify specific environmental problems and whether people are ready to cope with potential risks is to a great extent unknown. Public environmental awareness of factors underpinning the pollution of rivers and approaches for reducing it were studied in Rasht City of Guilan Province in northern Iran, with Zarjub and Goharrud rivers as a case study. Data were collected from residents on the banks of the studied rivers using a questionnaire. Industrial areas, hospitals, and poultry farms were perceived as the main factors deteriorating water pollution of Zarjub and Goharrud rivers in Guilan Province. The discharge of urban sewage into the rivers was the second most important polluting factor. Most residents on the banks of Zarjub and Goharrud rivers showed high interest in the conservation of the environment. Overall, 62.7% of the residents had moderate, 20% had high, and 4% had very high environmental awareness. Families and mass media (TV and radio) were perceived of being the most important sources of information of family members concerning environmental awareness. According to the residents, the main approach for alleviating the pollution of Zarjub and Goharrud rivers were creating green spaces, dredging the rivers, establishing a water purifying system, and establishing a waste incinerator with a separation system (based on municipal planning). The public in the study area appeared well prepared to cope with the risks of water pollution, but further improving environmental awareness of the community

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can be a first step for preventing environmental degradation. The positive attitudes of the residents towards environmental conservation, the use of proper information sources, and practical training in the context of extension services can be effective in conserving water resources in urban areas.

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1. Introduction

Contamination in the aquatic environment has been in the center of global attention the last decades owing to its environmental toxicity, abundance, and persistence (Armitage et al., 2007; Yuan et al., 2011; Cao et al., 2015; Chen et al., 2016; Kiguchi et al., 2017; Mandaric et al., 2017). Hazardous chemicals are detected into rivers worldwide due to global rapid population growth and intensive domestic activities, as well as expanding industrial and agricultural production (Srebotnjak et al., 2012; Su et al., 2013; Islam et al., 2014). Due to the common practice of discharging untreated domestic and industrial waste into the water bodies, there is often an increase in the level of metals in river waters, so that several rivers in urban areas are associated with water quality problems (Khadse et al., 2008; Venugopal et al., 2009). A comprehensive approach to water resource management is needed to address the myriad water quality problems that exist today from nonpoint and point sources as well as from habitat degradation.

Water quality of urban rivers is of major importance to residents, not only for drinking, but also for entertainment. In addition, the presence of water is critical to the landscape decoration and the ecological environment. Thus, the river water is an important tourism resource for urban areas, offering numerous opportunities for recreation (Prideaux et al., 2009), such as water-based recreational activities (Kakoyannis and Stankey, 2002). In this context, the assessment of the river water quality is critical for sustainable water resource management and urban development (Nakagami and Nwe, 2009). Therefore, protecting water quality through the collection and treatment of wastewater is important to human health and the environment in urban areas. However, with the rapid development of the economy and the acceleration of urbanization, river pollution occurs continuously, resulting in serious damage of the river ecosystems. Large quantities of domestic and industrial wastewater flow into the rivers, leading to severe pollution of the river water system (Schaffner et al., 2009).

Zarjub River in Guilan Province of northern Iran, also known as Siahrud, originates from the low mountains of Hezarmarzb, Neyzehsar, Chakulbandan, and Kachavar about 25 km south of Rasht City with a maximum altitude of 810 m from the sea level. It flows in a south-north path through several villages, then passes through Rasht for 8 km to join Garm Rud River in Bosar Region of Rasht, and finally enters Anzali Lagoon. It is 41 km long from the main originate to its joint to Garm Rud with a mean discharge rate of 173.4 million m³. Guilan Province and Rasht, as its center and a major touristic destination, suffer from the problem of agricultural, industrial, and urban garbage and sewage. More importantly, Zarjub River flows through Rasht leaving a lot of houses behind and taking all pollution into the appealing Anzali Lagoon. Industrial development, urbanization, and population growth play an essential role in the quantity and quality of pollution and the rapid degradation of natural resources. Urban growth and industrial development are two distinct, but interrelated and interacting, factors influencing the pollution of Zarjub River. Rasht has the highest population growth and urbanization rate in Guilan Province and, consequently, population growth brings a lot of problems in the surrounding environment. An overview of environmental challenges in Guilan Province points to people's major role in degrading natural resources and contaminating water resources (Ghodrati et al., 2007).

Studies on Zarjub River showed that it is contaminated by heavy metals caused by the discharge of industrial, urban, and agricultural effluents of Rasht region and the concentration of these metals has

exceeded the critical thresholds (Ghodrati et al., 2012). The pollution of Zarjub River originates from different effluents including sewages, urban runoff, and garbage which are leached by rainfall through sanitary sewage, domestic sewage, and sewage from public places, like hospitals, hotels, and public bathrooms. Ghodrati et al. (2007) reported that the pollution in the upper parts of Zarjub River mainly results from small and large industries. The river is polluted in the next step by domestic sewage rooted from high population density. At the third step, the farms at the lower parts are affected by the contamination resulted from the transfer of agricultural runoff into the river.

Public environmental awareness is one of the most important indicators for displaying national civilization (Huang et al., 2006). It reflects many aspects of environmental status, such as people's knowledge, personal consideration and behaviour, public capacity, and the local citizens' attitudes towards a sustainable society as a whole. Many environmental problems and their consequences are the result of ignorance (Trevors, 2010). Therefore, the public must be aware of the environmental issues, their consequences, and the actions that have to be taken to address these issues. This information is useful for decision-makers in planning for social sustainable development. It is widely accepted that people's choices, behaviors, and lifestyles will play a critical role in achieving sustainable development (Jackson and Michaelis, 2003). Over the last decades, studies related to people's environmental awareness have been carried out by researchers in different countries (Ogunbode and Arnold, 2012; Ziadat, 2010). Although those studies provided valuable implications, further studies in the field of people's awareness and behaviors are still necessary to tap into local knowledge and identify the knowledge needs of all the stakeholders through participative approaches (Behmel et al., 2016). However, up to date, there is very limited literature available that concerned with public perceptions of water pollution in Iran, as a developing country in Asia. The objective of the present study was to examine public environmental awareness of factors underpinning the pollution of rivers and approaches for reducing it in Guilan Province, with Zarjub and Goharrud rivers as a case study. This paper seeks to provide opportunities for accumulating scientific knowledge within a perspective of a developing country and then urges to promote a policy agenda in the water management system, taking international development into consideration.

2. Methodology

2.1. Study area and sample selection

The study was carried out in Rasht City of Guilan Province. The statistical population included all inhabitants living on the banks of Zarjub and Goharrud rivers (Fig. 1). Of those inhabitants, respondents were selected by a convenience sampling, focusing on residents living along riverside and directly affected by pollution. In this context, residents who were complaining that pollution affects their living (e.g. bad smells, destructed landscapes, and health effects) were selected at random. Given the population of interest and that no previous hypothesis existed, a convenience sample was deemed to be appropriate (Peterson, 2001). However, due to selection bias associated with the research design, the results may provide useful trends, but are not generalizable beyond the sample (Ary et al., 2010). According to the least sample size table of Bartlett et al. (2001) and assuming 5% error, the sample size was determined to be 150 people. Respondents were

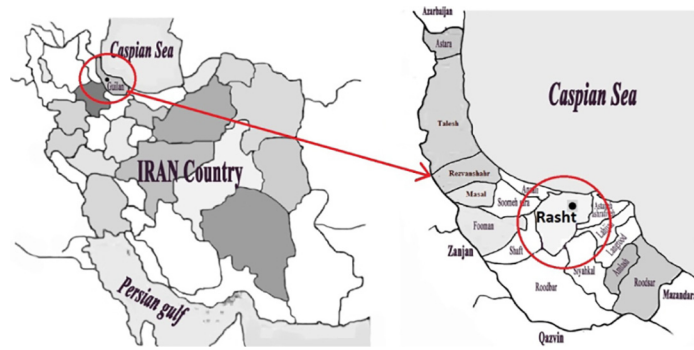


Fig. 1. Map of the study area.

residents on the banks of Zarjub and Goharrud rivers. Data were obtained from 150 residents using a face-to-face interview within a friendly discussion.

2.2. Data collection

The data collection tool was a questionnaire composed of some closed-ended questions for which a five-point Likert-type scale (very low, low, moderate, high, very high) was used. Open-ended questions were also included to capture more information by the respondents (if required) and the information was categorized on the same scale with the closed-ended questions. The questionnaire contained six distinct sections. Section 1 was devoted to respondents' demographic data, such as age, gender, education level, and income. Section 2 was related to respondents' awareness about environmental conservation, including 10 items for its estimation on the basis of a five-point Likert-type scale (from very low to very high). Section 3 was about residents' point of view to sources of river pollution. In this respect, four items on a five-point Likert-type scale (from very low to very high) were designed. Section 4 was about the influence of extension methods on awareness of environmental conservation. We asked respondents to rate each method on a five-point Likert-type scale (from very low to very high). In Section 5, six sources of information were introduced to respondents to rate them in terms of usefulness for obtaining required knowledge of environmental conservation. A five-point scale from none to very much was used. Finally, in Section 6, eight different strategies were proposed to the respondents and we asked them to show how effective could be each strategy for the control of pollution. Residents were asked to rate those items from strongly agree to strongly disagree. The face and content validity of the questionnaire was confirmed by a panel of experts. Construct validity confirmed that the questionnaire's scores actually reflected the conceptual area that it intended to measure. Evidence of construct validity was collected from the responses and suggestions from the panel of experts and from a pilot test. Also, Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity were used to confirm the construct validity (Anastasiadou, 2011; Yesil, 2010). To estimate its reliability, a pilot study was conducted out of the main research area and the questionnaire was adjusted according to the results.

2.3. Data analysis

All data were analyzed statistically using SPSS software package (version 21). First, descriptive statistics were calculated to depict the demographic profile of the sample. Frequency distributions, percentages, means, and variation ratios were used in the descriptive part. The variation ratio or Freeman index VR (Evren and Ustaoglu, 2017), is a simple measure of statistical dispersion in categorical distributions, while standard deviation is used for continuous data. It is the simplest measure of qualitative variation. It is defined as the proportion of cases which is not in the mode category based on the following

equation:

$$VR = 1 - f_{\max}/N$$

where f_{\max} is the frequency (number of cases) of the mode and N is the total number of cases. VR reports the dispersion among cases. The larger the variation ratio, the more differentiated or dispersed the data are; and the smaller the variation ratio, the more concentrated and similar the data are. Items in each area (i.e., factors deteriorating pollution, usefulness of information sources, extension methods, and municipal strategies for reducing the pollution) were ranked based on weight scores, which were calculated according to the following equation, modified from Farouque and Takeya (2008):

$$\text{Weight score} = P_{vh} (5) + P_h (4) + P_m (3) + P_l (2) + P_{vl} \quad (1)$$

where: P_{vh} = percentage of respondents perceiving very high importance, P_h = percentage of respondents perceiving high importance, P_m = percentage of respondents perceiving moderate importance, P_l = percentage of respondents perceiving low importance, and P_{vl} = percentage of respondents perceiving very low importance.

Weight scores of any item could range between 150 and 750 (indicating very low importance and very high importance, respectively) and the value 450 is the cut-off-point. Morris index score (M), as a normalizing method (Evren and Ustaoglu, 2017), was used for grouping respondents' answers in terms of their awareness to environmental conservation according to the following equation:

$$M_{ij} = [X_{ij} - X_{i(\min)}] / [X_{i(\max)} - X_{i(\min)}]$$

where M_{ij} = Morris index score, X_{ij} is the numerical value of the index i for respondent j , $X_{i(\min)}$ is the lowest value of the index i and $X_{i(\max)}$ is the highest value of the index i . Then, the Awareness Index (AI) was calculated by the following equation:

$$AI = \sum M_{ij} / N$$

In this model, the level of environmental awareness of each person compared to others is determined based on the selected items (Table 3), using the gathered data for each person. This method is used for reporting human resource development by the United Nations and the obtained index is the evidence showing countries' ranking regarding human resource development (Javani et al., 2015). In this study, we modified this method to use it for grouping respondents.

AI ranges between zero and one and we categorized respondents in four quartiles based on their AI scores as follows: Q1: low ($AI < 25\%$), Q2: moderate ($25\% < AI < 50\%$), Q3: high ($50\% < AI < 75\%$), and Q4: very high ($AI > 75\%$). Because of the nature of data, Friedman test, a non-parametric test, was applied to detect differences among i) usefulness of information sources about environmental conservation, ii) extension methods, and iii) mitigation strategies in terms of respondents' point of view. When Friedman's test yielded significant results,

Table 1
Respondents' demographic features.

Variable	Frequency	Percentage
Age (years)		
Less than 25	41	27.3
From 25 to 40	58	38.7
From 41 to 55	38	25.3
More than 55	13	8.7
Gender		
Female	77	51.3
Male	73	48.7
Educational level		
Illiterate	3	2.0
Elementary school	15	10.0
Intermediate school	13	8.6
High school and diploma	64	42.7
Academic degree	55	36.7
Income (Rials) ^a		
Less than 10,000,000	128	85.3
From 10,000,000 to 30,000,000	19	12.7
Above than 30,000,000	3	2.0

^a 1\$ ≈ 30,000 Rials (IRR).

we performed Wilcoxon signed-rank tests as a post hoc analysis with the Bonferroni correction. In this method, instead of using 0.05 as the critical value for significance for each test, we used a critical value of 0.05 divided by the number of tests conducted (Field, 2013).

3. Results

3.1. Respondents' demographic features

About 27% of the residents were younger than 25 years, 39% were in the age group of 25–40 years, 25% were in the age range of 41–55 years, and the remaining was older than 55 years (Table 1). About half of the respondents were male and half were female. In terms of educational level, about 80% had a diploma or an academic degree and a few had lower education. The majority of the residents had an income less than 10,000,000 IRR. Results of parametric tests (*t* and *F* test) revealed no significant differences in environmental awareness in terms of sex, age, level of education, and income of the respondents.

3.2. Factors deteriorating pollution of rivers

Industrial areas, hospitals, and poultry farms were the most important factors deteriorating the pollution of Zarjub and Goharrud rivers in Rasht City (*M* = 4.45) (Table 2). Urban sewage discharge to the rivers was found to be the second most important deteriorating factor (*M* = 4.35). Inattention of Guilan Environment Organization to their responsibility (*M* = 4.09) and subsistence of residents on the banks of the rivers (*M* = 3.97) had lower means.

3.3. Residents' awareness of environmental conservation

Interest in environmental conservation was ranked first among residents (*M* = 4.11, *SD* = 0.931). Visiting parks and green spaces was ranked second (*M* = 3.54; *SD* = 1.213) (Table 3). Then, awareness of environmental conservation and intention to establish environmental

Table 2
Factors deteriorating the pollution of Zarjub and Goharrud rivers.

Item	Mean	WS	VR
Industrial areas, hospitals, and poultry farms	4.45	668	0.37
Urban sewage discharge to the rivers	4.35	656	0.44
Inattention of Guilan Environment Organization to their responsibility	4.09	613	0.57
Subsistence of residents on the banks of the rivers	3.97	595	0.56

WS: weight score; VR: variation ratio.

Table 3
Awareness of residents about environmental conservation.

Item	Mean	SD	Morris index score
Interest to conserve the environment	4.11	0.931	0.78
Extent of visiting parks and green spaces	3.54	1.213	0.64
Extent of awareness of environmental conservation	3.37	0.987	0.59
Intention to establish environmental organizations	3.00	1.253	0.50
Extent of experts' informing about environmental conservation	2.38	1.060	0.35
Participation in voluntary activities	2.29	1.143	0.32
Use of environment-related documentaries, magazines, and journals	2.29	1.144	0.32
Visiting environment-related scientific centers	2.16	1.165	0.29
Extent of use of practical training on environmental conservation	2.07	1.085	0.27
Extent of contact with environment experts	1.92	1.065	0.23

SD: standard deviation.

organizations had a mean of 3 or over, showing a higher-than-moderate attitude. Overall, 62.7% of the residents had moderate, 20% had high, and 4% had very high environmental awareness (Table 4).

3.4. Usefulness of information resources for environmental conservation

There were significant differences in the usefulness of information resources for environmental conservation in terms of respondents' point of view (Table 5). Family (*M* = 2.99) and mass media (TV and radio) (*M* = 2.96) were perceived of playing the most useful role in supplying information about environmental conservation among family members (Table 5). The next ranks of usefulness were assigned to the internet (*M* = 2.44), environment experts (*M* = 2.35), environmental organizations (*M* = 2.14), and studying magazines and journals (*M* = 2.12).

3.5. Extension methods affecting environmental conservation

There were significant differences in the extension methods affecting environmental conservation in terms of respondents' point of view (Table 6). Visit of environment-related scientific centers, practical training on environmental conservation, and documentaries for environmental recognition were found to be the most important extension methods (*M* = 3.65, *M* = 3.44, and *M* = 3.37, respectively). The next rank was assigned to environment training magazines and journals (*M* = 2.95).

3.6. Municipal strategies for alleviating pollution of rivers

There were significant differences in the preferred municipal strategies for alleviating the pollution of the rivers in terms of respondents' point of view (Table 7). The most important municipal strategies for mitigating the pollution of Zarjub and Goharrud rivers included developing green spaces (*M* = 4.39), dredging the rivers (*M* = 4.21), and establishing a water purifying system (*M* = 4.17) (Table 7). The next ranks of importance were devoted to establishing a garbage incinerator system (*M* = 4.06), establishing a garbage separation system (*M* = 4.01), building channels inside city to gather rainwater

Table 4
Grouping residents based on Awareness Index (AI) values.

Awareness group	Frequency	Percentage
Low (AI < 25%)	20	13.3
Moderate (25% < AI < 50%)	94	62.7
High (50% < AI < 75%)	30	20.0
Very high (AI > 75%)	6	4.0

Table 5
Usefulness of information sources about environmental conservation.

Source	Mean	VR	WS	Mean rank
Family	2.99	0.64	449	4.30a
Television and radio	2.96	0.59	444	4.22a
The Internet	2.44	0.70	366	3.44b
Environment experts	2.35	0.69	352	3.32b
Environmental organizations	2.14	0.69	321	2.91b
Studying magazines and journals	2.12	0.57	318	2.80b

VR: variation ratio; WS: weight score; Friedman $\chi^2 = 107.87$, $df = 5$, $P < 0.01$; Different letters indicate significant differences.

Critical value for Bonferroni correction: $0.05/3 = 0.01$.

($M = 3.97$), establishing voluntary associations for garbage collection ($M = 3.93$), and increasing the number of sweepers ($M = 3.51$).

4. Discussion

This study sheds some light to the extent to which river water pollution is seen as a community problem in an urban area in northern Iran; it provides an examination of the circumstances under which river water pollution is identified as a community problem in Rasht and offers a general view of residents' awareness level of river water pollution. Environmental awareness is an issue of major importance because it is considered an antecedent for pro-environmental behaviour (Latif et al., 2013). Thus, assessing environmental knowledge among residents is a significant first step for promoting participation in environmental conservation behaviors as long as residents recognize that the protection of the local environment will benefit their lives. Most residents on the banks of Zarjub and Goharrud rivers showed high interest in the conservation of the environment. Overall, 62.7% of the residents had moderate, 20% had high, and 4% had very high environmental awareness. Currently, there are few studies in the literature on residents' environmental awareness in urban areas. Therefore, in an international level the results of the study can be a useful gauge for future comparisons in the area or other areas facing a similar situation. In a national level, the information provides useful policy options for the development of environmental conservation in northern Iran by shedding some light on residents' perceptions. In a regional level, understanding what residents think about urban river pollution offers important information that can point out appropriate mitigation strategies. Especially, findings can have valuable implications for policy formulation by local decision makers, promoting environmental conservation action by respecting local culture and economic realities. Moreover, findings can be useful for other regions, where local stakeholders can initiate their own efforts by considering their own realities.

Data of this study denoted a moderate to high level of environmental awareness among residents on the river banks in the study area. This could be attributed to the young age and the high levels of education of the respondents. Two out of three respondents (66%) of this study were up to 40 years old and almost 80% had a high-school education and above (Table 1). However, no significant differences were detected in the levels of environmental awareness in terms of sex, age, level of education, and income of the respondents. Improved environmental performance is motivated and supported by environmental awareness

Table 6
Extension methods affecting awareness of environmental conservation.

Method	Mean	VR	WS	Mean rank
Visit of environment-related scientific centers	3.65	0.67	548	2.88a
Practical training on environmental conservation	3.44	0.67	516	2.60a
Documentaries about environmental issues	3.37	0.64	506	2.51a
Environment-related magazine and journals	2.95	0.62	443	2.01b

VR: variation ratio; WS: weight score; Friedman $\chi^2 = 44.54$, $df = 3$, $P < 0.01$. Different letters indicate significant differences.

Critical value for Bonferroni correction: $0.05/3 = 0.0167$.

Table 7
Municipal strategies for alleviating the pollution of Zarjub and Goharrud rivers.

Strategy	Mean	VR	WS	Mean rank
Developing green spaces	4.39	0.45	659	5.39a
Dredging the rivers	4.21	0.54	632	4.91ab
Establishing a water purifying system	4.17	0.55	626	4.84b
Establishing a garbage incinerator system	4.06	0.61	609	4.57bc
Establishing garbage separation system	4.01	0.62	601	4.47c
Constructing channels inside the city to collect rainfall	3.97	0.58	596	4.26c
Establishing voluntary associations for garbage collection	3.93	0.64	589	4.26c
Increasing the number of sweepers	3.51	0.66	527	3.28d

VR: variation ratio; WS: weight score; Friedman $\chi^2 = 90.93$, $df = 7$, $P < 0.01$; Different letters indicate significant differences.

Critical value for Bonferroni correction: $0.05/10 = 0.005$.

of the citizens, which is also affected by local economic development. When human needs are met, the focus goes to environmental protection and the local government that has the economic capacity to support strategies for a sustainable society. Therefore, it is necessary to know more about public environmental awareness. Information about the situation will help local government to frame proper environmental education policies, adopt the best practical educational methods to improve the environmental awareness, as well as to effectively guide environmentally friendly consumption patterns. However, environmental awareness alone is not strong enough to predict the behaviour performance towards the preservation of the environment (Hungerford and Volk, 1990; Klöckner, 2013). It is said that not all people who are aware and sensitive about the environmental issues are also motivated to practice and behave in an environmentally friendly way (Krajhanzl, 2010). People may be aware of what to do for the best of the environment, but that does not imply that they have the intention to conduct the action.

Industrial areas, hospitals, and poultry farms were perceived to be the most important factors deteriorating the pollution of Zarjub and Goharrud rivers in Guilan Province. The next rank was devoted to the discharge of urban sewage into the rivers. The residents on the banks of Zarjub and Goharrud rivers had high awareness of environmental conservation and exhibited high intention for establishing environmental associations. However, both rivers are highly polluted, a fact that needs attention by relevant officials in Guilan Province. As expected, population growth entails a lot of environmental, social, and economical issues. The pollution sources can be listed as urban and domestic sewage, industrial sewage, urban and rural solid wastes (garbage), farm sewage, and waste from abattoirs. A general look at environmental issues in Guilan Province reflects people's effective role in the deterioration of natural resources and water pollution. However, improvement of people's knowledge will not reverse the environment degradation, unless the authorities take appropriate actions to find the solution and pay the costs.

Families and the mass media (i.e., TV and radio) were found to play the most useful role in meeting the information requirements of residents about environmental issues. The next rank was for the internet. Though regarded important, environment experts, environmental organizations, and magazines and journals were rated in lower ranks of usefulness for environmental conservation. These preferences can be explained by the fact that family is the smallest component of the society showing deep intimacy and apparently it can convey knowledge more comfortably. Moreover, experience of the early education and the home learning environment are important influences on later educational outcomes (Melhuish et al., 2008). Previous research highlighted that the high level of environmental awareness among Turkish students was attributed to education at school and mass media (Altin et al., 2014). Media play an important role in forming positive attitudes of the public towards the environment. Media's role in increasing environmental awareness of the population is enormous as

it reaches a vast proportion of the society. Exposure to the news media was found to have a positive correlation with the level of concern over environmental issues (Mikami et al., 1999). At the same time, the overall level of exposure to the television showed a correlation with anti-environmental attitudes, suggesting a negative cultivation effect of television programs on public awareness of environmental issues in Japan (Mikami et al., 1999).

With respect to the best extension methods for promoting environmental conservation, visit of environment-related scientific centers and practical training on environmental conservation were selected as the most important ones. Thus, these methods should be made readily available to the residents of the river banks as they can be more influential on mitigating pollution. Scientific centers refer to learning situations, contrasted with the formal school classroom or the workplace, in which the learners are encouraged to move freely around the learning environment, which is generally full of stimuli or many kinds, and frequently work together in peer groups to develop their experience, knowledge, and understanding (Bell et al., 2009). Documenting learning in a scientific center environment is challenging because the evidence for learning outcomes is not often seen at the same time as the experience provided by the center. Practical training may include programs that are instructed by accredited in-house auditors and lectures comprising global environmental issues, environment-related technologies, environmental laws followed by practical on-site training.

The most popular approaches for reducing the pollution of these rivers were found to be constructing green spaces, dredging the rivers, establishing a water purifying system, and establishing a garbage incineration system along with a solid waste separation system. Green spaces, such as parklands, gardens, and squares, are the least polluted places in a city and contribute to improving the microclimate and reducing the rate of pollution in the city (Makhelouf, 2009). However, dredging has an impact on its environment that should be considered before its use as a measure for pollution reduction, with main factors associated with the environmental impact the contamination level of the sediment and the contamination level of the neighboring area (Manap and Voulvoulis, 2016). Furthermore, the above efforts need to be complemented by other measures, including significant changes in lifestyle and human behaviour, as well as consumption patterns. Emphasizing an environmentally friendly lifestyle in general is important to promote pro-environmental actions (Bound et al., 2006). Since problems caused by human activities for meeting human essential needs, making a change in this trend may turn out to be difficult. Also, the consequences of such a change cannot be precisely predicted until their emergence. Pollution of rivers strongly depends on population density. Rasht city has the highest population growth rate and urbanization rate which obviously entail plenty of environmental, social, and economical issues. So, the authorities should design and implement a multi-facet plan.

While this study provides new information concerning residents' awareness of river water pollution due to urban growth, also it has certain limitations that should be kept in mind. First, the study provides only a snapshot of public environmental awareness in time; thus, the results are of descriptive nature, they do not provide definite information about cause-and-effect relationships, and perhaps they could have been affected to some extent, if another time-frame had been chosen. Second, conclusions about whether the results and suggestions provided by this study will serve a universal need require more cases for validation, particularly in countries with different cultural and economic conditions. For example, residents in other communities who do not depend highly on local resources and the environment might hold differing opinions regarding environmental conservation. To overcome the above limitations, further research is necessary to investigate data pertaining to residents over the course of multiple years to better understand patterns and trends of environmental awareness among residents. Also, similar surveys across a wide spectrum of community types, such as urban communities, those that lack natural resources, and low environmental quality communities should be conducted.

5. Conclusions

This study provides an examination of the circumstances under which river water pollution is identified as a community problem in Rasht and offers a general view of residents' awareness level of river water pollution. Data denoted a moderate to high level of environmental awareness among residents on the river banks in the study area. Currently, there are few studies in the literature on residents' environmental awareness in urban areas. It is aspired that this study can trigger the importance of manifesting environmental awareness to the authorities from governmental and non-governmental institutions. Understanding residents' concerns is expected to improve policy making considerations by blending environmental awareness and behaviour performance to Iranian culture. Increasing public attention has been brought to bear on the environmental impacts of urban growth in Rasht due to the continually increasing impact of urban growth and the limited capacity of waste treatment facilities. Residents' perceptions depicted in this study provided some basic information for the future confrontation of urban growth impact on river water pollution in the area. The positive attitudes of residents towards environmental conservation, the use of proper information sources, and practical training in the context of extension services can be effective in conserving water resources in urban areas. Future research over the course of multiple years would be useful to better understand trends of environmental awareness in the population and adjust interventions accordingly.

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