



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



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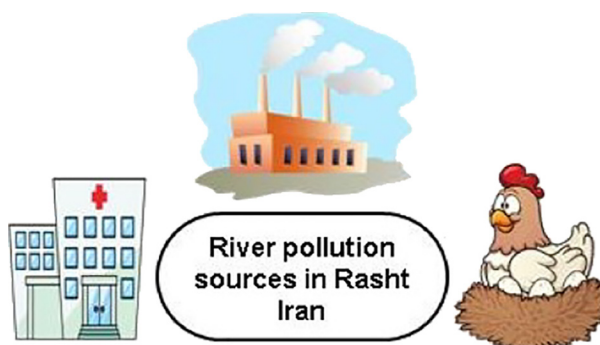
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### HIGHLIGHTS

- 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



### ARTICLE INFO

#### Article history:

Received 18 April 2017

Received in revised form 14 May 2017

Accepted 14 May 2017

Available online xxx

Editor: D. Barcelo

#### Keywords:

Environmental policy

Industrial areas

River pollution

Urban sewage

### 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 m<sup>3</sup>. 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

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