Data article

Survey and mapping of heavy metals in groundwater resources around the region of the Anzali International Wetland; a dataset

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ARTICLE INFO

ABSTRACT

The purpose of this study is zoning and determining the concentration of heavy metals including Arsenic (As), Mercury (Hg), Lead (Pb), and Cadmium (Cd) in the groundwater resources of villages located around the Anzali International Wetland. The amount of heavy metals (As, Hg, Pb, and Cd) in the collected samples were determined by the Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES) technique. The maximum concentrations of As, Hg, Pb and Cd were 0.216, 0.059, 0.090 and 0.006 mg/L, respectively.

Specifications table

Subject area	Environmental Sciences
More specific subject area	Drinking water monitoring
Type of data	Table and figure
How data was acquired	Measurements of all parameters was done according to standard methods [1];

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	pH was analyzed by digital pH meter (Metrohm).
	Digital thermometer was applied for temperature determination.
	Heavy metals were measured using Inductively Coupled Plasma (ICP-OES) technique.
	Scaling method was used for Total Dissolved Solids (TDS) analyzing.
	EC of water was measured by electrical conductivity meter.
Data format	Raw, analyzed
Experimental factors	The data were obtained in both dry and wet season, summer and winter, and the Electrical Conductivity (EC), pH and temperature were measured in the place, and the other samples were transferred to the laboratory for TDS and heavy metals measurements.
Experimental features	All studied parameters were determined and compared with standards [2,3]. A spatial distribution map of heavy metals and weighted interpolation was made using the Arc GIS.
Data source location	Guilan Province, Iran (Fig. 1).
Data accessibility	All data are available.

Value of the data

- The data will be useful for health risk assessment of heavy metals related drinking water consumption.
- The data shown here can be helpful for Ministry of Power, water and wastewater companies for managing of groundwater resources.
- The zoning of the heavy metals was done to make a clear picture of the heavy metals concentrations in the groundwater resources of studied area.

1. Data

The contamination of groundwater is one of the most important environmental issues in the world [4–9]. Among the various pollutants that affect water resources, pollutants containing heavy metals are particularly important due to their high toxicity, even at low concentrations [10–13]. The parameters in the experiments of this research are including pH, TDS, EC, temperature and heavy metals (As, Hg, Pb, and Cd), in both season of winter and summer. The mean and standard deviation of the heavy metals concentrations and the physico-chemical parameters including pH, temperature, TDS and EC for both wet and dry seasons were given in Table 1. The statistical description of the concentration of heavy metals of water samples in the two seasons was given in Table 2. The average concentration of heavy metals in two seasons, for all studied parts and regions were given in Table 3. The Comparison of the average concentration of heavy metals in the dry and wet seasons was shown in Fig. 2, and the results of zoning the average concentrations of heavy metals evaluated in the groundwater of the study area in both the dry and wet seasons were shown in Figs. 3 and 4. The data of statistical comparison of the average concentration of heavy metals in the dry and wet seasons were given in Table 4. The results of statistical tests (one-way Analysis of variance, ANOVA) to compare the average concentration of heavy metals in two seasons in the eastern, central, and western parts of the study area were given in Table 5.
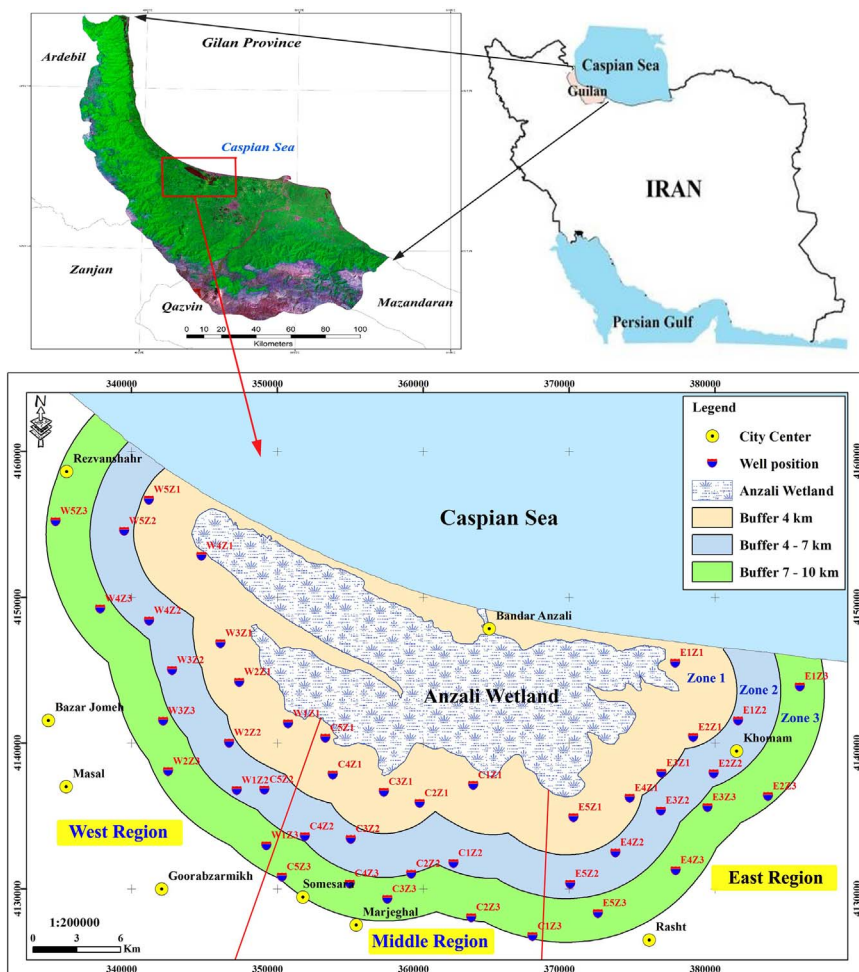
Fig. 1. Geographical position of the triple studied area and sampling point.

Table 1
The standards, mean and standard deviation values of parameters in both of wet and dry seasons.

Parameter	Unit	Dry season		Wet season		Maximum permissible	
		Mean	Std. D	Mean	Std. D	National standard	WHO guideline
As	mg/l	0.179	0.062	0.051	0.040	0.01	0.01
Hg	mg/l	0.022	0.011	0.020	0.007	0.006	0.006
Pb	mg/l	0.012	0.022	0.011	0.023	0.01	0.01
Cd	mg/l	0.002	0.002	0.001	0.001	0.003	0.003
EC	µS/cm	741.156	256.530	718.780	254.940	–	–
TDS	mg/l	370.578	128.260	359.390	127.470	1500	–
pH	–	7.781	0.221	7.652	0.310	6.5-9	–
T	°C	20.698	1.775	19.271	1.944	–	–

Table 2.
The statistical description of the concentration of heavy metals.

Heavy metals	Unit	Min	Max	Mean	Std. D
As	mg/l	0.039	0.216	0.115	0.036
Hg	mg/l	0.014	0.059	0.021	0.008
Pb	mg/l	0.000	0.090	0.012	0.022
Cd	mg/l	0.000	0.006	0.002	0.001

Table 3
The average concentration of heavy metals in two seasons, for all studied parts and regions.

Heavy metals	Unit	Parts			Regions		
		East	Center	West	1	2	3
As	mg/l	0.137	0.107	0.100	0.107	0.119	0.118
Hg	mg/l	0.021	0.016	0.025	0.027	0.019	0.017
Pb	mg/l	0.009	0.023	0.002	0.020	0.003	0.012
Cd	mg/l	0.002	0.002	0.001	0.002	0.001	0.001
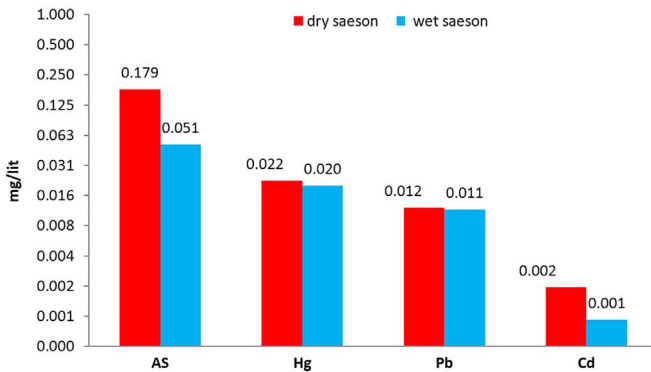
Fig. 2. Average values of heavy metals in the study area in wet and dry season.

2. Experimental design, materials and methods

2.1. Study area description

The study area is a part of the lowland plains of Foumanat (northern section) in Guilan province and is located in north of Iran (Fig. 1). Foumanat lowland is a part of the Anzali wetland watershed and the Caspian Sea, with area of 3,828.8 square kilometers. Sampling point include public and private wells that are the main sources of drinking water for local people. The locations of wells were recorded using geological positioning system (GPS).

2.2. Sample collection and analytical procedures

The study area was partitioned into three radial areas and three geographical sections of east, center, and west areas (Fig. 1). Forty five active deep wells in these nine sections were selected by systematic random sampling and for each sheet, five wells were taken for sampling. The 90 samples were collected in summer of 2016 and in winter of 2017. The sample containers were washed three
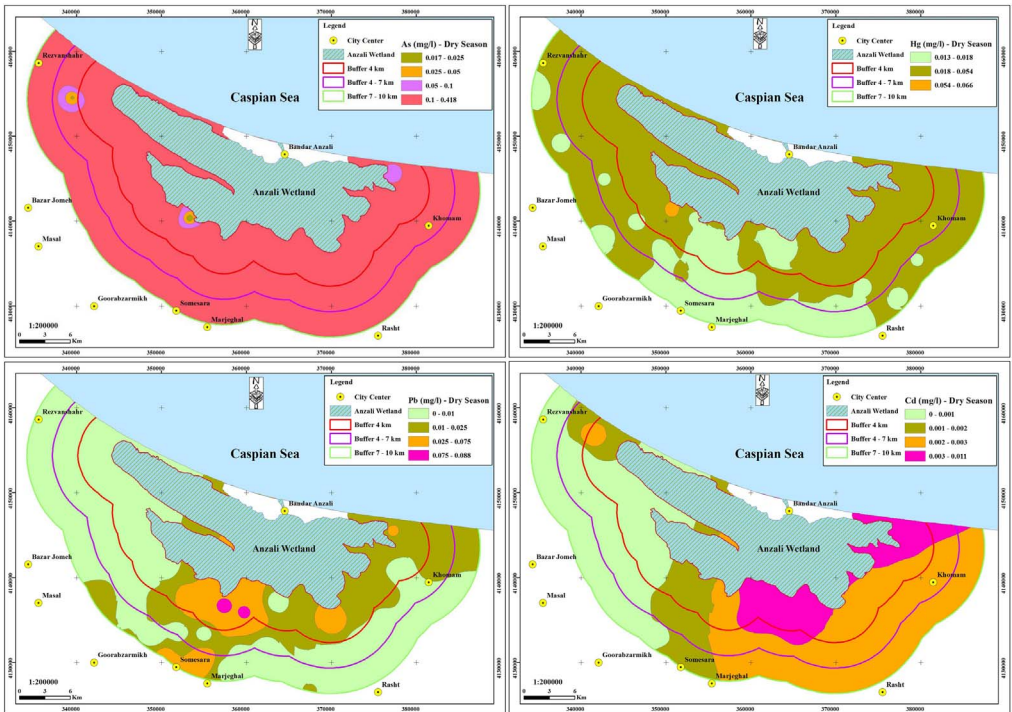
Fig. 3. Zoning map of Arsenic, mercury, lead and cadmium concentrations in studied area in the dry season.
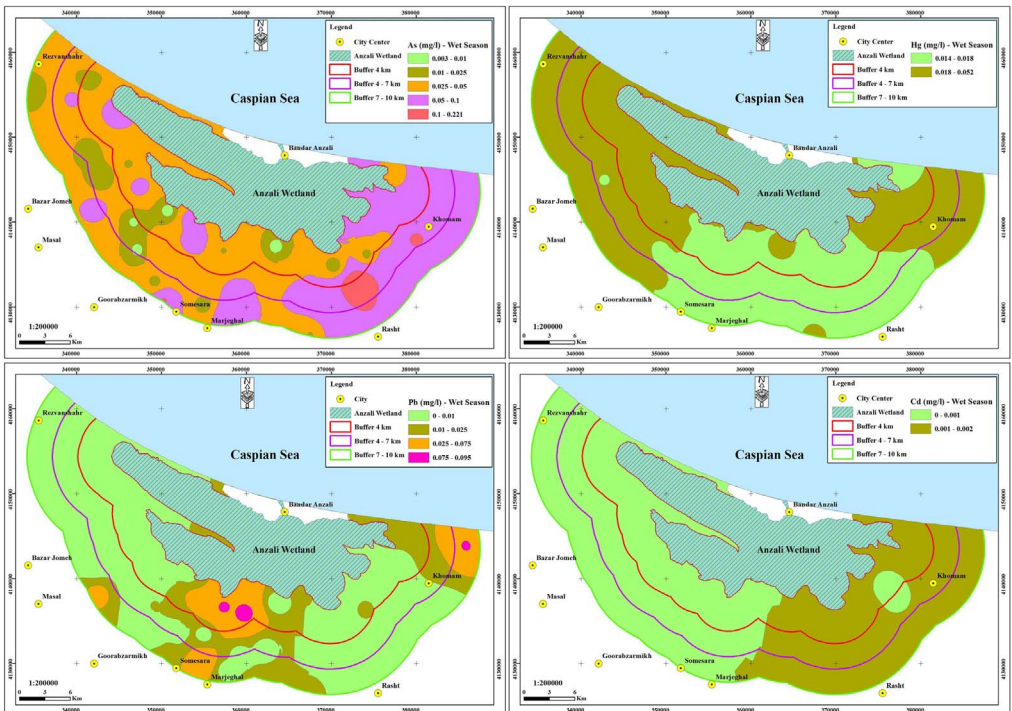

Fig. 4. Zoning map of Arsenic, mercury, lead and cadmium concentrations in studied area in the wet season.

Table 4
Comparison of mean concentration of heavy metals in wet and dry seasons.

Season	Heavy metals	One-sample t- Test		
		t	df	p-value
Wet season	As	6.846	44	0.000
	Hg	13.682	44	0.000
	Pb	0.395	44	0.690
	Cd	−23.500	44	0.000
Dry season	As	18.341	44	0.000
	Hg	10.041	44	0.000
	Pb	0.559	44	0.580
	Cd	−3.511	44	0.000

Table 5
Comparison of the mean concentration of heavy metals in the eastern, middle and western parts and in the three regions of the study area.

Parameter	(I) parts	(J) parts	Std. D (I - J)	P-value	(I) region	(J) region	Std. D (I-J)	P-value
As	East	Center	0.030	0.327	1	2	−0.012	0.854
		West	0.038	0.179		3	−0.011	0.870
	Center	East	−0.031	0.327	2	1	0.012	0.854
		West	0.008	0.933		3	0.001	0.999
	West	East	−0.038	0.179	3	1	0.011	0.870
		Center	−0.008	0.933		2	−0.001	0.999
Hg	East	Center	0.006*	0.040	1	2	0.008*	0.000
		West	−0.004	0.181		3	0.009*	0.000
	Center	East	−0.006*	0.040	2	1	−0.008*	0.000
		West	−0.009*	0.000		3	0.002	0.665
	West	East	0.004	0.181	3	1	−0.009*	0.000
		Center	0.009*	0.000		2	−0.002	0.665
Pb	East	Center	−0.014*	0.029	1	2	0.017*	0.007
		West	0.007	0.402		3	0.008	0.355
	Center	East	0.014*	0.029	2	1	−0.017*	0.007
		West	0.021*	0.001		3	−0.009	0.196
	West	East	−0.007	0.402	3	1	−0.007	0.355
		Center	−0.021*	0.001		2	0.009	0.196
Cd	East	Center	0.001	0.808	1	2	0.001	0.081
		West	0.002*	0.000		3	0.001	0.081
	Center	East	−0.001	0.808	2	1	−0.001	0.081
		West	0.001*	0.003		3	0.000	1.000
	West	East	−0.002*	0.000	3	1	−0.001	0.081
		Center	−0.001*	0.003		2	0.000	1.000

times with distilled water and from each well 1.5 liter of water sample was obtained. The parameters of temperature, EC, TDS and pH were measured in place by portable devices. The other samples were fixed by nitric acid and stored in a dark cold box (4 °C) and transferred to laboratory for analyzing of heavy metals. Statistical analysis of data was done using SPSS 22 and the spatial variability and estimation of the concentration of heavy metals (preparation of zoning map) in the study area, was done by the Inverse Distance Weighting (IDW) method with Arc GIS software, version 10.1.

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Transparency document. Supporting information

Supplementary data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.dib.2018.03.058.

References

[1] W.E. Federation, A.P.H. Association, Standard Methods for the Examination Of Water and Wastewater, American Public Health Association (APHA), Washington, DC, USA, 2005.

[2] WHO, Guidelines for Drinking Water Quality, World Health Organization, Geneva (2017) 468–475.

[3] Industrial research and standard institute of Iran, Physical and Chemical Quality of Drinking Water, Fifth edn, No.1053, Tehran, 2010. Available from: ⟨http://www.isiri.org/std/1053.pdf/⟩.

[4] S.D. Ashrafi, H. Kamani, H. Soheil Arezomand, N. Yousefi, A.H. Mahvi, Optimization and modeling of process variables for adsorption of Basic Blue 41 on NaOH-modified rice husk using response surface methodology, Desalin. Water Treat. 57 (2016) 14051–14059.

[5] D. Naghipour, S.D. Ashrafi, A. Mojtahedi, M. Vatandoost, L. Hosseinzadeh, E. Roohbakhsh, Data on microbial and physiochemical characteristics of inlet and outlet water from household water treatment devices in Rasht, Iran, Data Brief 16 (2018) 1005–1009.

[6] S. Hosseinipour Dizgah, K. Taghavi, J. Jaafari, E. Roohbakhsh, S.D. Ashrafi, Data on pollutants content in the influent and effluent from wastewater treatment plant of Rasht in Guilan Province, Iran, Data Brief 16 (2018) 271–275.

[7] N. Yousefi, A. Fatehizedeh, K. Ghadiri, N. Mirzaei, S.D. Ashrafi, A.H. Mahvi, Application of nanofilter in removal of phosphate, fluoride and nitrite from groundwater, Desalin. Water Treat. 57 (2016) 11782–11788.

[8] S.D. Ashrafi, H. Kamani, A.H. Mahvi, The optimization study of direct red 81 and methylene blue adsorption on NaOH-modified rice husk, Desalin. Water Treat. 57 (2016) 738–746.

[9] S.D. Ashrafi, H. Kamani, J. Jaafari, A.H. Mahvi, Experimental design and response surface modeling for optimization of fluoroquinolone removal from aqueous solution by NaOH-modified rice husk, Desalin. Water Treat. 57 (2016) 16456–16465.

[10] A. Mohseni-Bandpei, S.D. Ashrafi, H. Kamani, A. Paseban, Contamination and ecological risk assessment of heavy metals in surface soils of Esfarayen City, Iran, Health Scope 6 (2) (2017) e39703. http://dx.doi.org/10.5812/jhealthscope.39703.

[11] H. Kamani, S.D. Ashrafi, S. Isazadeh, J. Jaafari, M. Hoseini, F. Kord Mostafapour, E. Bazrafshan, S. Nazmara, A.H. Mahvi, Heavy Metal Contamination in Street Dusts with Various Land Uses in Zahedan, Iran, Bulletin of Environmental Contamination and Toxicology 94 (3), pp. 382–386. https://doi.org/Doi:10.1007/s00128-014-1453-9.

[12] D. Naghipour, J. Jaafari, S.D. Ashrafi, A.H. Mahvi, Remediation of heavy metals contaminated silty clay loam soil by column extraction with ethylenediaminetetraacetic acid and nitrilo triacetic acid, J. Environ. Eng. 143 (8) (2017) 04017026. http://dx.doi.org/10.1061/(ASCE)EE.1943-7870.0001219.

[13] H. Kamani, A.H. Mahvi, M. Seyedsalehi, J. Jaafari, M. Hoseini, G.H. Safari, A. Dalvand, H. Aslani, N. Mirzaei, S.D. Ashrafi, Contamination and ecological risk assessment of heavy metals in street dust of Tehran, Iran, Int. J. Environ. Sci. Technol. 14 (12) (2017) 2675–2682. http://dx.doi.org/10.1007/s13762-017-1327-x.