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Research Article

# Qualitative Evaluation of Surface Water Resources Using Iran Water Quality Index (IRWQSC) and National Sanitation Foundation Water Quality Index (Case Study: Kardeh Dam, Mashhad, Iran)

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## Abstract

The quality of water resources is one of the main subjects in ensuring public health. Therefore, monitoring water resources, especially surface waters, is one of the leading water operational management systems' requirements. Since the quality of surface waters is affected by natural factors and pollutants from human activity, monitoring water resources' quality leads to collecting and extracting valuable data, which needs a suitable method for interpretation and analysis. Therefore, this research assessing the annual quality of Kardeh Dam (One of the surface water sources of Mashhad) based on $IRWQI_{SC}$ and NSFWQI qualitative index. The results showed that the Kardeh Dam quality index in spring, summer, autumn, and winter is 55.43, 49.25, 57.61, and 60.9, respectively, indicating relatively good, average, relatively good, and relatively good quality conditions, respectively. Also, according to NSFWQI analysis, the quality index was calculated for spring, summer, autumn, and winter, respectively equal to 86.4 (good), 81.28 (good), 84.48 (good), and 96.64 (excellent). Comparisons showed that $IRWQI_{SC}$ was more rigorous than NSFWQI in judging the water quality of the Kardeh Dam. Comparisons indicate that the dam's water quality judgment with the $IRWQI_{SC}$ model is far more stringent than the NSFWQI model.

## Introduction

Today, the water crisis is one of the major challenges in developed and especially developing countries [1]. Although water is one of the most abundant compounds in nature, only a small part of water resources, including surface and groundwater, can be exploited by humans [2-5]. FAO[1] forecasts show; by 2025, about 1.9 billion people worldwide will face severe water shortages, and two-thirds of the world>s population will be under water stress [6]. In recent decades, population growth, urbanization, and industrial development have polluted water resources [7,8]. Decreased urban water quality leads to epidemics of many diseases and has many acute (short-term) and chronic (long-term) effects. Therefore, due to the urgent need to use available water resources, it is necessary to pay attention to their protection against pollution [9,10]. Protection and optimal use of water resources are among the principles of sustainable development in any country [11]. Therefore, it is important to study surface and groundwater quality to provide water with appropriate quality for various



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uses [12]. One efficient method without complex mathematical and statistical equations to determine water quality is water quality indicators presented on a numerical scale. In this method, the calculated number is categorized with a relative scale that indicates water quality from very bad to excellent [13-15]. $IRWQI_{SC}$[2] quality index is one of the most widely used indigenous criteria for surface water quality zoning. Due to the simplicity and availability of the required quality characteristics, it is a very useful and efficient tool for researchers. This index is determined based on fecal coliform parameters, $BOD_5$, COD, turbidity, total hardness, electrical conductivity, dissolved oxygen, nitrate, ammonium, phosphate, and pH.

Extensive research has been conducted in Iran and different countries to determine the quality of surface and groundwater using various indicators. various quality indicators such as [3]NSFWQI [16], [4]BCWQI [17], BMWP[5] [18], [6]HFBI [19], ASPT[7] [20], EPT[8] [21], and Shannon-Vince [22] are used in the world. Sarvai, et al. (2014) evaluated the water quality of the Tajan River based on Hilsenhoff biological parameters, Shannon-Wiener diversity, and environmental indicators. Most of the benthic invertebrates identified in this study belonged to 31 families, 12 orders, and 5 categories. The lowest and highest frequencies in all studied stations belonged to the family Psychodidae and Chironomidae, respectively [23]. Kurdi, et al. (2014), in a study, evaluated the quality of groundwater in the northwestern part of Kaboudar Ahang to measure hydrogeochemical parameters. To evaluate groundwater resources' quality in this area, the parameters of electrical conductivity, calcium, chloride, magnesium, sodium, sulfate, bicarbonate, TDS, and SAR obtained from chemical analysis of groundwater were used. Analysis of 18 water samples' chemical quality data from the distribution network of selected villages in the study area in two periods (November 1987 and August 1988) was performed using Schuler, Piper, Will Cox, Douro diagrams, and hydrogeochemical maps [24]. In another study by Vadiati, et al. (2016) evaluated groundwater quality for agriculture using a fuzzy inference model. In this study, the values of irrigation indices, including sodium uptake ratio, permeability index, total ratio, magnesium uptake ratio, residual sodium bicarbonate, sodium dissolution, and electrical conductivity, were measured as representative of all water-soluble salts. Using the fuzzy quality model, groundwater quality was divided into three categories: desirable, acceptable, and unacceptable [25]. In another study by Hao, et al. (2016) heavy metal pollution in rivers in Bangladesh was examined. In this study, the concentrations of heavy metals chromium, nickel, lead, arsenic, and cadmium in the river and its sediments were measured and studied [26]. Smithy, et al. (2016) studied the quality of surface water resources using multivariate statistical analysis. In this study, samples were taken from Yliki Lake over five years and analyzed to measure 16 physical and chemical parameters [27].

The present study intends to investigate the water quality of Kardeh Dam using $IRWQI_{SC}$ and NSFWQI indices with the help of laboratory measurements and the calculation of quality parameters of Kardeh Dam. In addition to analyzing the quality conditions of Kardeh Dam in all four seasons of the year, the dam's water quality was compared in terms of Iranian standards ($IRWQI_{SC}$) and the United States (NSFWQI).

## Materials and methods

### Site description

This study was carried out on the water of Kardeh Dam, located 40 km northeast of Mashhad (36°38'N, 59°40'E). Mashhad water treatment plant number one feeds from this dam and, after performing the necessary treatment, water is injected into the water supply network and provides to the subscribers (Figure 1). It is worth noting that the Kardeh dam is not supplied by urban or industrial treated wastewater. The mentioned dam is nearby the mountain and it fed by pure precipitated water flow.

### $IRWQI_{SC}$ quality index

For determining surface water quality according to $IRWQI_{SC}$ and NSFWQI standards, fecal coliform parameters, $BOD_5$, nitrate, dissolved oxygen, electrical conductivity, COD, ammonium, phosphate, turbidity, temperature, total solids, total hardness, and pH were measured according to standard methods in time intervals which were on the 15th of May, August, November, and February (the middle day of each season) in 2015 from the diversion section of Kardeh Dam.


**Figure 1:** Map of the study area (Kardeh Dam).

[1]Food and Agriculture Organization of United Nation.

[2]Iran Water Quality Index for Surface Water Resources Conventional Parameters

[3]National Sanitation Foundation Water Quality Index

[4]British Columbia Water Quality Index

[5]Biological monitoring working party

[6]Hilsenhoff Biological Family Index

[7]The Average Score per Taxon

[8]Ephemeroptera, Plecoptera and Trichoptera



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However, each of these parameters has different weights in $IRWQI_{SC}$, shown in Table 1. [28].

Weighing and mathematical analysis of water quality status of Kardeh Dam was performed based on the scoring-weighting indicators in the $IRWQI_{SC}$ model according to Equation 1.

$$IRWQI_{SC} = [\prod_{i=1}^{n} I_i^{W_i}]^{\frac{1}{g}}$$

$$g = \sum_{i=1}^{n} W_i \qquad (1)$$

In the above relation, the parameters $W_i$, n, and $I_i$ express the i-th parameter>s weight, the number of parameters, and the index value for the i-th parameter of the ranking curve, respectively. It should be noted that finally, the guide in Table 2. is used to describe the quality of the weights determined using the $IRWQI_{SC}$ model.

## NSFWQI quality index

The NSFWQI Index was introduced in 1970 by the American Institutes of Health to monitor water resources quality. This index has nine main parameters, including fecal coliforms, $BOD_5$, nitrate, dissolved oxygen, electrical conductivity, water temperature, phosphate, turbidity, total solids (TS), and pH. In this standard, each of the mentioned factors has a unique degree of importance, summarized in Table 3 [16].

Then, the value of NSFWQI for each chapter was calculated according to Equation 2, and the related quality was evaluated based on the classification in Table 4.

$$NSFWQI = \sum_{i=1}^{n} Q_i W_i \qquad (2)$$

In the above relation, the $Q_i$ and $W_i$ parameters represent the equivalence value of the i-th parameter in the NSFWQI standard and the weight ratio of the i-th parameter, respectively.

**Table 1:** The weight of each of the parameters measured in the IRWQISC surface water quality index.

| Water quality category | Parameter | Parameter | Water quality category |
|---|---|---|---|
| Physical Parameters | Electrical conductivity | Electrical conductivity | Physical Parameters |
| | Turbidity | Turbidity | |
| | pH | pH | |
| | Total hardness | Total hardness | |
| Chemical Parameters | $BOD_5$ | $BOD_5$ | Chemical Parameters |
| | COD | COD | |
| | Phosphate | Phosphate | |
| | Ammonium | Ammonium | |
| | Dissolved Oxygen | Dissolved Oxygen | |
| | Nitrate | Nitrate | |
| Biological Parameters | Fecal coliform | Fecal coliform | Biological Parameters |

* The values presented are the mean values of each parameter in all months

**Table 2:** Guide for describing weighted water quality indicators in the $IRWQI_{SC}$ standard..

| Descriptive equivalent | Index value |
|---|---|
| very bad | <15 |
| Bad | 29.9 - 15 |
| Relatively bad | 44.9 - 30 |
| Average | 55 - 45 |
| Relatively good | 70 – 55.1 |
| Good | 85 – 70.1 |
| Very good | 85< |

**Table 3:** The weight of each of the parameters measured in the NSFWQI surface water quality index.

| Water quality category | Parameter | Units | Weight in $IRWQI_{SC}$ |
|---|---|---|---|
| Physical Parameters | Turbidity | NTU | 0.08 |
| | Total solids | mg/L | 0.07 |
| | Temperature | C° | 0.1 |
| | pH | Standard unit | 0.11 |
| Chemical Parameters | $BOD_5$ | mg/L | 0.11 |
| | Phosphate | mg/L | 0.1 |
| | Dissolved Oxygen | Saturation percentage | 0.17 |
| | Nitrate | mg/L | 0.1 |
| Biological Parameters | Fecal coliform | MPN/100ml | 0.16 |

* The weight of each of the parameters measured in the NSFWQI water quality index

**Table 4:** Guide for describing weighted water quality indicators in the NSFWQI standard.

| Descriptive equivalent | Index value |
|---|---|
| Weak | 25- 0 |
| Suitable or relatively weak | 50- 26 |
| Average | 70-51 |
| Good | 90-71 |
| Excellent | 100-91 |

## Methods of measuring parameters

In this study, to determine $BOD_5$ of Kardeh Dam water, a water sample was aerated in 300 ml BOD glass bottles at 20 ° C. Immediately dissolved oxygen in one of the glass containers measured, and Other containers were incubated for five days. Finally, Equation 3 was used to calculate the $BOD_5$ value. In this regard, $D_1$ is the initial dissolved oxygen, $D_2$ is the final dissolved oxygen, and P is the ratio of sample volume to total combined volume [29].

$$BOD_5(mg.L^{-1}) = \frac{D_1 - D_2}{P} \qquad (3)$$

On the other hand, a potent oxidizing agent (potassium dichromate) and DR39000 spectrophotometer system were used to measure the COD parameter [30]. Also, fecal coliforms were determined by the Multiple-tube fermentation (possible MPN method) [31]. In this study, the spectrophotometric method was used to measure nitrate, phosphate, and ammonia [32]. UV-Visible DR39000 spectrophotometer was used to measure nitrate, and Agilent8453 was used to determine phosphate.



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The pH was determined using the pH Meter Metrohm 827. The HM Digital device calculated the total hardness. The electrical conductivity was measured using the Conductometer WTW 3110, and the turbidity was determined by the Hach 2100N. Moreover, a DO meter device along with polarographic probe MA840 was used to determine DO.

## Results and discussion

The experiments performed on Kardeh Dam's water for spring, summer, autumn, and winter seasons are shown in Figures 2 to 6. The severity of $BOD_5$, Nitrate, COD, and Ammonium contamination is highest in summer and lowest in winter (Table 5). The high levels of $BOD_5$ and COD in summer can be attributed to increased microbial activity and organic load from natural organic compounds in summer [33]. It is also worth mentioning about nitrate and ammonium; In summer, the temperature and consequently microbial activity increase, and this leads to successive processes of ammonification (production of ammonium nitrogen from the protein of organic compounds) and nitrification (production of nitrate from the protein of organic compounds and ammonium) [34]. However, the intensity of Phosphate contamination reached its maximum concentration in autumn and has the lowest value in spring. On the other hand, the total hardness reaches its maximum in spring, while autumn has the minimum total hardness. Similarly, Figure 3 shows the amount of electrical conductivity and turbidity in the spring, summer, autumn, and winter seasons. It should be noted that the total solids in spring, summer, autumn, and winter are 364, 395, 357, and 316 mg / l, respectively. The results of measuring total solids indicate that the Kardeh Dam is not suitable for the presence of solids in all seasons, and this parameter reaches its maximum in summer. Simultaneous evaluation of total solids, electrical conductivity, and turbidity show that these three factors, due to microbial activity and changes such as thermal stratification, achieve the highest value in summer [35]. As it turns out, electrical conductivity and turbidity have maximum values in

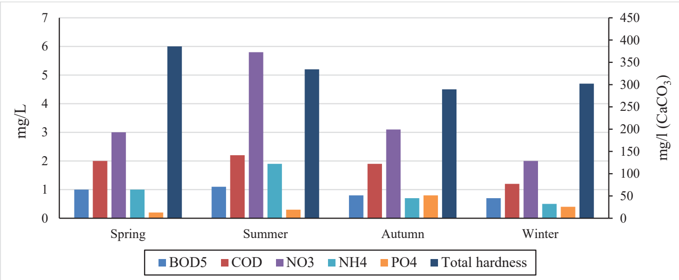


**Figure 2:** Changes in quality indices of total hardness, NO3, BOD5, COD, NH4, and PO4 in different seasons of 2015.

**Table 5:** The quality indices' values of $BOD_5$, $NO_3$, COD, and $NH_4$ in Summer and Winter.

| Quality indices | Summer | Winter |
|---|---|---|
| $BOD_5$ | 1.1 mg/L | 0.7 mg/L |
| $NO_3$ | 5.8 mg/L | 2 mg/L |
| COD | 2.2 mg/L | 1.2 mg/L |
| $NH_4$ | 1.9 mg/L | 0.5 mg/L |

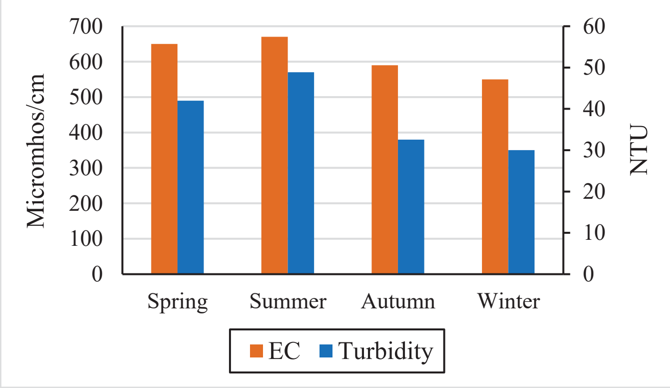


**Figure 3:** Changes in quality indices of turbidity and electrical conductivity in different seasons of 2015.

summer, and the minimum amount of electrical conductivity and turbidity occurs in winter.

Based on Figure 4, it can be seen that DO and pH indices have maximum laboratory values in summer and spring, respectively, and minimum values in autumn.

Figure 5 shows the number of fecal coliforms in spring, summer, autumn, and winter. Summer with 1400 fecal coliforms per 100 ml has the highest number of coliforms, significantly different from the values obtained for other seasons. Also, the minimum number of fecal coliforms occurs in autumn (730 per 100 ml).

Khara, et al. (2011), in a study evaluating the water quality of Ashmak river in Guilan province, measured the mean values of electrical conductivity, total hardness, and fecal coliforms as 1114.95 µmho/cm, 412.25 mg/L, and 5363 units per 100 milliliters, respectively Meanwhile, the average values of total hardness and fecal coliform in Kardeh Dam, according to Table 6, are equal to 327.75 mg/L and 976.25 per 100 ml [36]. Shresta and Kazama (2007) also assessed the Fuji River>s water quality in Japan in a similar study. In this study, qualitative parameters were measured from 13 different points along the river from 1995 to 2002. In this study, the mean parameters of DO, $BOD_5$, COD, $NO_3$, $NH_4$, and $PO_4$ in the mentioned period were equal to 9.77, 1.69, 3.04, 1.17, 0.84, and 0.06 mg/l, respectively [37]., Meanwhile, the average values mentioned for the water of Kardeh Dam, according to Table 6, are equal to 8.75, 0.87, 1.89, 8.1, 3.59, 1.01, and 0.41 mm, respectively. In other studies, Simonov, et al. (2003) assessed the surface water quality of northern Greece over three years. In this study, the values of DO, $BOD_5$, COD, $NO_3$ and $PO_4$ were 7.4, 11.4, 12.2, 0.38 and 0.22 mg /l, respectively [8].

Moreover, in the mentioned study, the average electrical conductivity was 421 µmho/cm, while it was 614.25 µmho/cm for Kardeh Dam water. In this part of the study, the water quality of Kardeh Dam is evaluated following the Iranian water quality standard for agricultural and recreational purposes. The values of the dam's average quality parameters and the required water standards for agricultural and recreational purposes are given in Table 6. According to Table 6, the geometric average of the number of fecal coliforms in the dam



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is 946 MPN/100ml, which meets the standard requirements of the Environmental Protection Agency (geometric average less – equal to 1000 fecal coliforms per 100 ml). The average nitrate concentration was 3.59 mg/L, which is much lower than the virtual limit set by the Environmental Protection Agency for water for agricultural use. The average electrical conductivity and pH of Kardeh Dam water are 614.25 μmho/cm and 8.1 per year, respectively, which satisfy the standard conditions. On the other hand, according to regional water reports in Khorasan Razavi province, the concentrations of Aluminum, Arsenic, Beryllium, Cadmium, Cobalt, Chromium, Copper, Iron, Lithium, Manganese, Molybdenum, Nickel, Palladium, Selenium, Vanadium, Zinc, Fluorine and Boron are very small in Kardeh Dam and are within the permitted limits set by the Environmental Protection Organization for agricultural purposes. Also, the arithmetic means the number of intestinal nematodes per liter does not exceed the range of water quality standards and provides the allowable bacteriological limits of water for agricultural use; hence the water of Kardeh Dam can be exploited for agricultural purposes without the need for treatment. Due to dams' tourism nature, these water resources are used for recreation by direct or indirect contact. Natural recreation is an activity in which the human body is in contact with water, and water is more likely to enter the body, primarily through swallowing. Indirect recreation is an activity in which part of the body is in contact with water, And the possibility of water entering the body is negligible. According to Table 6, the mean values of dissolved oxygen and pH are in the standard range for recreational use. On the other hand, the standard values of the geometric mean of fecal coliforms for direct and indirect recreation are 400 and 2000, respectively. Meanwhile, Kardeh Dam's water with a geometric average of 946 coliforms per 100 ml is only within the permissible range for indirect recreation.

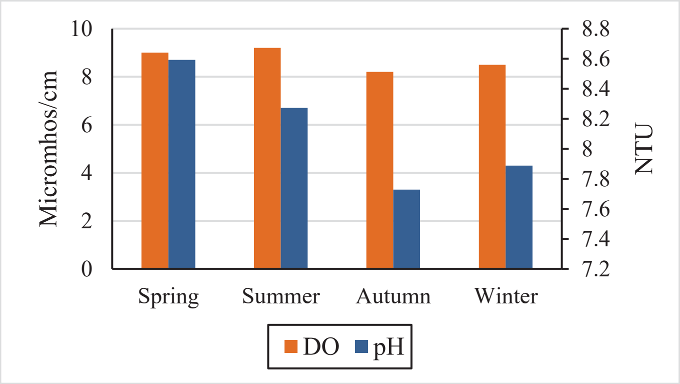


**Figure 4:** Changes in DO and pH quality indices in different seasons of 2015.

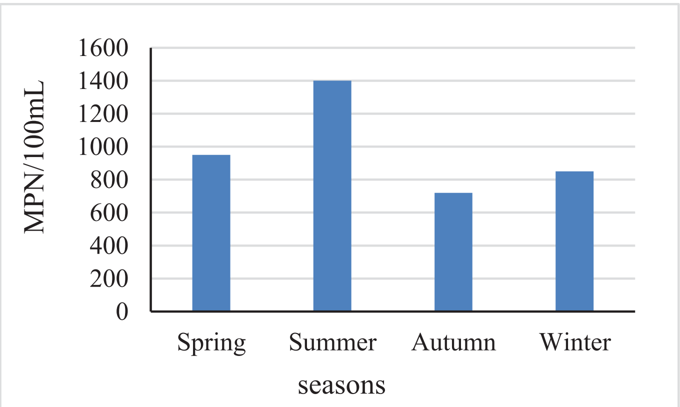


**Figure 5:** Changes in the qualitative indices of fecal coliforms in different seasons of 2015.

**Table 6:** Comparison of the average values of quality parameters of Kardeh Dam with standard values of water for agricultural and recreational uses (Iranian Water Quality Standard - Environmental Protection Organization).

| Parameter | Unit | Karde Dam* | Agriculture | Recreational | |
|---|---|---|---|---|---|
| | | | | Direct contact | Indirect contact |
| Fecal coliforms | > 1000 | MPN/100ml | 946 | 400 | 2000 |
| $BOD_5$ | mg/L | 0.87 | - | - | |
| Nitrate | mg/L | 3.59 | 30 | - | |
| DO | mg/L | 8.75 | - | >5 | |
| Electrical conductivity | μmho/cm | 614.25 | 3000 | - | |
| COD | mg/L | 1.89 | - | - | |
| Ammonium | mg/L | 1.01 | - | - | |
| Phosphate | mg/L | 0.41 | - | - | |
| Turbidity | NTU | 38.46 | - | - | |
| Total hardness | mg/L ($CaCO_3$) | 327.75 | - | - | |
| pH | Standard unit | 8.1 | 6.5 – 8.4 | 6.5 – 9 | |

* The values presented are the average of the parameters in spring, summer, autumn, and winter in 2015.

** The mean values provided for fecal coliforms are the geometric mean number of fecal coliforms per 100 ml.

The weighting result of Iranian surface water quality indicators (IRWQISC) for Kardeh Dam in different seasons of the year is shown in (Figure 6). It is clear that the desirability of surface water quality of Kardeh Dam is the highest in winter. Water conditions in winter, autumn, and spring according to $IRWQI_{SC}$ index with weight indices of 60.9, 57.61, and 55.43 (according to Table 2) has relatively good quality conditions. Meanwhile, the summer season with quality indicators of 49.25 evokes average quality conditions. Therefore, it can be considered that the level of desirability of surface water quality of Kardeh Dam has downward desirability in winter, autumn, spring, and summer, respectively.

The results of NSFWQI surface water quality analysis of Kardeh Dam are shown in (Figure 7) Considering the above figure, it seems that in the NSFWQI method, the weight of surface water quality in winter, autumn, spring, and summer is estimated to be 96.64, 84.48, 86.4, and 81.28, respectively and creates excellent, good, good, and good quality conditions.

Studies have shown that the best quality conditions are achieved in winter and the worst in summer. However, according to this assessment method (NSFWQI), spring has the best surface water quality after winter, and all seasons are in good condition. According to the calculations and tests performed in the $IRWQI_{SC}$ index, Kardeh dam was classified in



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relatively good conditions in all winters, autumns, and springs and moderate conditions in summer. But according to the NSFWQI index, winter was in excellent condition, and autumn, spring, and summer were in good condition. This comparison indicates that the $IRWQI_{SC}$ standard has a more stringent result than the NSFWQI for assessing the efficiency of the dam. In a review study, Alavi Moghadam (2006) examined the quality standards of water resources in Japan. In this study, the quality classification standards of lakes and reservoirs in Japan were presented according to Table 7. [37].

Examining Table 7 and comparing the data of this study, it is clear that water samples of Kardeh Dam in winter, spring, and summer are classified in category B. This means that Kardeh Dam's water can be used directly for raising grade 3 fish, grade 1 industrial water, and agricultural water. The analysis also showed that according to Japan>s quality standard, Kardeh Dam water is classified in category C in autumn due to the high amount of Suspended Solids (SS). This means that this water can be used as grade 2 industrial water. In this regard, Samadi (2015), during a study, measured physical and chemical parameters (pH, DO, TSI, TDS, $NO_3$, $PO_4^{-3}$) and IRWQI water quality index to assess pollution and investigate the Spatio-temporal impact of land use on the Water Quality of Choghakhor wetland. According to IRWQI index, the water of Choghakhor wetland, in the first half of spring and autumn, due to increased agricultural activities, floods, and seasonal rainfall

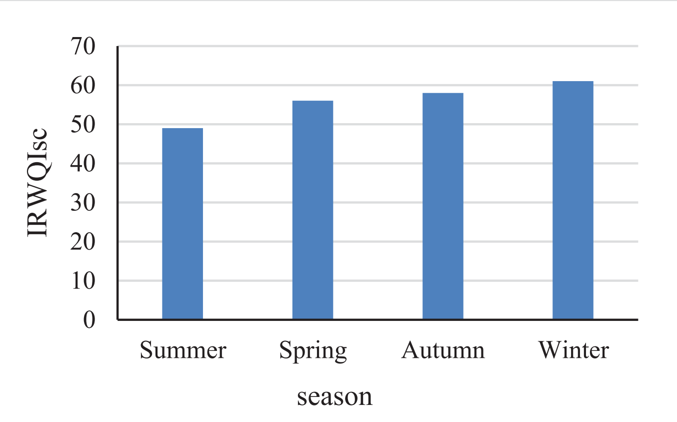


**Figure 6:** Weight indices of quality changes of Kardeh dam based on $IRWQI_{SC}$ system.

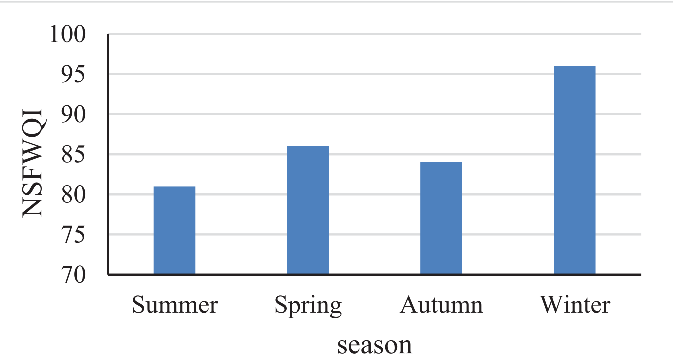


**Figure 7:** Weight indices of quality changes of the dam based on the NSFWQI system.

**Table 7:** Standards of lakes, reservoirs and their quality classification in Japan.

| Class | Water Usage | pH | COD (maximum) | SS (maximum) | DO (minimum) | Total Coliform (maximum) |
|---|---|---|---|---|---|---|
| AA | Grade 1 water supply and Grade 1 fish farming | 8.5 – 6.5 | 1 mg/L | 1 mg/L | 7.5 mg/L | 50 MPN/ml |
| A | Grade 2 and 3 water supply, grade 2 fish farming and swimming | 8.5 – 6.5 | 3 mg/L | 5 mg/L | 7.5 mg/L | 1000 MPN/ml |
| B | Grade 3 fish farming, grade 1 industrial water, and agricultural water | 8.5 – 6.5 | 5 mg/L | 15 mg/L | 5 mg/L | – |
| C | Industrial water grade 2 | 8.5 – 6 | 8 mg/L | Must be free of floating material. | 2 mg/L | – |

with moderate to relatively good conditions (60-51), had the worst water quality. The best water quality situation was related to the summer season and the first half of winter with a good condition (82-70) due to the reduction of agricultural activities, floods, and drainage due to seasonal rains [38]. In another study, Sadeghi, et al. (2015) determined the water quality status of the Zarrin Gol River in Golestan Province using the water quality index (NSFWQI) and surface water quality index of Iran (IRWQISC). In this study, the parameters of thermoplastic coliform, BOD, phosphate, turbidity, total hardness, pH, and total solids were measured. The results of this study were moderate (50-70) based on the NSFWQI index and in two categories of moderate (55-45) and relatively good (55.1-70) based on the IRWQISC index [39]. In another study, Javid, et al. (2015) investigated groundwater resources' toxicity in Semnan province (41 wells) using the IRWQIGT index. In this study, chemical parameters including Arsenic, Phenol, Mercury, detergents, Cadmium, Lead, Chromium, Cyanide, Iron, Manganese, and petroleum hydrocarbons were studied. The results of this study showed the value of IRWQIGT index for groundwater in Semnan province between 96.54 to 98.2, and the water of the region was in the excellent range [40]. Comparison of IRWQISC and NSFWQI shows that in physical parameters, Electrical conductivity and turbidity have the most weights, respectively. While, in IRWQISC the water hardness is considered as an important criteria and in NSFWQI it is not true. About chemical parameters in IRWQISC and NSFWQI systems, $BOD_5$ and Dissolved Oxygen are the most significant, correspondingly. Also, contrary to the NSFWQI method, ammonium values are considered in the IRWQISC computations. The biological section of IRWQISC and NSFWQI are similar with to gather. Finally, it is clear that the IRWQISC is stricter in comparison of NSFWQI, especially in chemical aspects.

## Conclusion

The quality of surface water depends on environmental factors such as temperature conditions, the region's climate, type of vegetation, soil type, etc. On the other hand, to treat



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water resources, it is necessary to carry out global monitoring at different time intervals to obtain coherent models of the qualitative behavior of different surface water resources. In this study, the water quality behavior of Kardeh Dam was investigated using $IRWQI_{SC}$ and NSFWQI evaluation models. A sampling of dam water was done on the 15th of May, August, November, and February 2015. The results of quality tests showed that water quality conditions, according to $IRWQI_{SC}$ standards in different seasons of winter, autumn, summer, and spring, have relatively good, relatively good, relatively good, and average quality conditions, respectively. $IRWQI_{SC}$ quality weight index in winter, which is equal to 60.9, was estimated to be 5.39, 8.97, and 19.13 % more than weight indices of autumn, spring, and summer seasons, respectively. Moreover, NSFWQI index analyzes evoked excellent, good, good, and good quality conditions in winter, autumn, summer, and spring, respectively. In this model, the winter quality index was calculated as 12.58, 10.59, and 15.89% higher than the weight index of the samples related to autumn, spring, and summer, respectively. This difference in water quality>s desirability can indicate a difference in many factors such as temperature and ecosystem conditions in different months and seasons of the year.

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