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Research Paper:

Environmental Impact Assessment of Fish Breeding Center

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ABSTRACT

Background & Aims of the Study: Environmental impact assessment is the identification and systematic evaluation of the consequences of projects and programs on physical-chemical, biological, cultural, and socio-economic components of the environment. Changes caused by urban and rural effluents in the environment can directly affect the downstream part of the river. The goal of this study was to evaluate the environmental effects of the fish farming center of Miandoab and analyze the implementation and not implementation of the project at the two phases of construction and operation, which was conducted using the Saratoga Matrix. In addition to this goal, the physicochemical parameters of water and dissolved oxygen, Biochemical Oxygen Demand (BOD), nitrate, phosphate, alkalinity, ammonia, temperature, and Chemical Oxygen Demand (COD) were measured every 30 days in summer 2020.

Materials and Methods: Miandoab Fish Breeding Center on a land area of 2000 hectares is designed for breeding hydrothermal fish. The Saratoga matrix was used to evaluate the environmental effects and analyze the two options of implementation and non-implementation of the project in the two phases of construction and operation. In the present study, four stations were determined to investigate the effect of the Miandoab Fish Breeding Center on physicochemical parameters of water in different parts of the Siminehrood river in Miandoab city. Based on the results of physicochemical parameters, the Water Quality Index (WQI_{NSF}) was calculated.

Results: The result of the effects at the construction phase (-83) and operation phase (+137) indicated that implementation and operation of the fish farming center of Miandoab have positive effects. The results of the water evaluation showed that there was no significant difference in temperature between study stations ($P>0.05$). The parameters of nitrate, phosphate, alkalinity, ammonia, dissolved oxygen, pH, and BOD_5 were significantly affected by different stations ($P<0.05$). The highest and lowest levels of BOD_5 in stations three and one were 12±0.001 and 5.5±0.707 mg/L, respectively and also the highest and lowest ammonia levels were observed at 1.16±0.156 and 0.01±0.001 mg/l in stations one and four, respectively.

Conclusion: With the implementation of the project, some difficulties, such as lack of water caused by wasting it in soil channels, overall condition of fish farming activity in the region, immigration from villages to urban areas, lack of employment and lower-income and welfare of the people will be improved; accordingly, and a positive trend will be taken in the future. According to the Water Quality Index (WQI_{NSF}), the first and second stations showed good quality status and the third and fourth stations showed lower (average) status. Therefore, it is recommended that all units be equipped with wastewater treatment systems.

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1. Introduction

Environmental Impact Assessment (EIA) is a method, in which the effects of a project or its operation on the environment are assessed and predicted to minimize the impact during the project (depending on the current situation and the type of impact). EIA seeks to integrate management, planning, data analysis, and public participation in pre-decision assessments. In a shorter definition, it can be expressed as "an approach to development, through prior evaluation". At present, excessive human activities are a factor that harms nature and the environment [1]. It is not possible to limit these activities due to human need for food and energy; thus, different countries are trying to study the effects and consequences of these activities. This study and foresight are called EIA [2]. In Iran, there is a legal requirement to assess the environmental impact of some industrial and development projects. EIA is used to prevent the negative impact of the project on the environment and reduce costs. In this method, by conducting studies and cognition that experts gain from the current state of the environment and project processes in the construction and operation phase, the effects of operational factors on environmental factors at different stages are identified and solutions to reduce the above effects are suggested [3]. Development refers to the set of activities and work that human beings do to improve their lives and the environment. For sustainable development, in the long run, it is necessary to pay attention to the limitations of the environment and natural resources. Sustainable development is a development that improves human health and the environment in the long run. One of the ways to achieve sustainable development is to evaluate the environmental impact of projects [4]. Assessment of the environmental effects is a method, which predicts effects of implementation or operation of a project on the environment till in the time of project implementation, considering information about current status and effects type, the operation might be taken in a manner that the least effect to be imposed on the environment [5]. EIA process was designed to help appropriate planning of sustainable development and secondly expand the currently available development projects [6]. The physical and chemical properties of aquatic environments reflect the health status of an ecosystem [7]. Therefore, their quality reduction is severely affected by indiscriminate human intervention, and this is one of the current concerns. Changes caused by urban and rural effluents in the environment can directly affect the downstream of the river, including increasing water turbidity, increasing phosphorus concentration, and decreasing the amount of dissolved oxygen [8]. There are various ways to determine the pollution of rivers and to know the appropriate methods for detecting polluted and non-polluted water. One of these ways is to measure physical and chemical factors, such as DO, pH, nitrate, nitrite, and ammonia. Garnier et al. showed that municipal wastewater has a negative effect on the amount of ammonia, phosphorus, and silica in river water. With the treatment of effluent, ammonia is reduced and on the other hand, the amount of phosphorus and silica due to the consumption of algae will be in balance, but the amount of nitrate in water will increase [9]. Delshad et al. in a study examined the effect of fish breeding effluent (rainbow trout) on the water quality of Qarah Su river in Ardabil and concluded that the effluent output has the greatest effect on water quality [10]. Currently, all developmental and civil engineering activities in Iran are implemented based on environmental observations in line with reaching sustainable development in the country and preventing pollution and environmental destruction. In an environmental assessment of iron exploration conducted by Sundeep et al. in 2017 in India, aiming at sound control caused by the project implementation, it was identified that the project had a negative effect on the soil of the region and a positive effect on the land use. It is possible to decrease negative effects by employing an appropriate management strategy; however, developing a manual of the best methods of iron exploration along with environmental standards seems necessary in this field [11]. Heydari et al. in 2017 assessed the environmental effects of the Zaveh cement factory in Torbat Heidariyeh city using the Iranian Leopold matrix. Their study revealed that the project is acceptable if improvement plans are implemented and negative environmental effects are decreased considerably [12]. Yousefi et al. evaluated the proposed decree concerning how to conduct EIA in Iran. A description of the assessment procedures was provided. Also, recommendations were presented to improve process performance and reliability. Institutional capacity and limitations for effective environmental management were addressed as well [13].

Aims of the study

The present study proceeds on the main objective: Evaluating the environmental effects of establishing a fish breeding center in the Miandoab County and investigating of possible pollution of the Siminehrood river due to effluent from the fish breeding center using water quality indicators. Miandoab city with its abundant water resources is a suitable substrate for the habitat of many aquatic species and so far about 25 species of fish have been identified in the water resources of this city.

Miandoab fish breeding center on a land area of 2000 hectares in the form of 53 units of 25 hectares with 33 units of 10 hectares and six units of 25 hectares has been designed for the breeding of hydrothermal fish, of which 36 units of 25 hectares and 11 units of 10 hectares and in the form of twenty-eight cooperatives and eight real operators have been transferred.

2. Materials and Methods

Geographical location of the study area

Miandoab County (Figure 1) is located at 164 km of the capital city of West Azerbaijan province (Uremia) in Iran. The county is located at geographical longitude of eastern 640 6' of Greenwich meridian and geographical latitude of Northern 360 58' of the equator, at the south part of Uremia Lake, southeast of West Azerbaijan, and in East and West Azerbaijan provinces' intersection. The county with an area of 164 square km covers 4.18% of the province and it is located at the height of 1314 m from sea level. The average rainfall of the area has been recorded as 289 mm. Also, 33.11% of its area is covered with hills, and the remaining 67.88% is composed of plain and flowages. The area's weather is variable with relatively hot summers and relatively cold winters. The appropriate geographical condition of the area has resulted in relatively good growth of agriculture and its industrial development, consequently. The county's economy mostly relies on agriculture and animals husbandry and important crops, such as wheat, sugar beet, apple, and grape are produced in this area in abundance. Livestock and livestock products are among the export products of the area. The agricultural system of the county is traditional and it is possible to increase the products output several times through modernizing and mechanizing it. According to the latest census, the city has a population of about 240000 people [14].

In this study, the effects of not implementing along with implementing fish farming center of Miandoab were evaluated and at the implementation level, the effects of all operations were studied on the environment. The main attention paid to the effects in environmental evaluations is considered as certain. The Saratoga matrix method, which was first developed in Boston, USA, was used to evaluate the environmental effects of the fish farming center project and to analyze two options of implementing and not implementing the project. This method enjoys features, such as the possibility of quantification of effects quality and providing appropriate conditions for easier comparison of them in relation to each other. Saratoga matrix includes a horizontal column and a vertical row. Activities are placed in the horizontal column of the matrix and environmental factors are placed in a vertical row. Each cell of the matrix is divided into four parts of duration, intensity, range, and importance, which show different effects of activities regardless of the nature of the effect (positive or negative) and the effect happening manner (certain or probable) [15]. Affecting manner of the project effects on environmental factors based on the effect nature shows desirability or non-desirability of the effect being determined as negative (-) or positive (+). The effect duration is an index to determine the impact duration of the project activity on the environmental parameters [16]. Scoring the effect duration is based on the impact time of micro-activities related to the project (short-term or long-term). The impact intensity is an index to show the strength or weakness of the project micro-activities impacts on environmental factors, so that the effects with low, mid, and high impacts are scored as 1, 2, and 3, respectively [17]. The impact importance might be low, mid, and high based on change amount, which a specific effect bears on an environmental factor leading it toward environmental tolerance threshold, taking scores of 1, 2, and 3, respectively. "No implementation item" of the project is investigated as "no item". This shows that if the proposed project is not implemented, how will be the future condition of the environment in that case. The project implementation item is examined as an "implementation item" and the environmental changes are predicted and compared to other items in case of implementation of the project [18]. Each of the physical, biological, and socio-economic items is given in Tables 3 and 5, which are weighted according to Navaei et al. [19]. The entry of fish pond effluent in Miandoab city by changing the physical and chemical factors of water can affect the ecology of the Siminehrood river. According to the conditions of the region, including human gathering centers, pollutants, and communication routes to access the stations, four stations were considered. Station number one was chosen as the upstream station that was outside the city limits. Stations two and three were selected before and after the city, respectively, to investigate the effect of effluent inflow. Station four was selected at a greater distance to investigate the extent of river self-purification. For the present study, water parameters during the water shortage season (summer) in 2020 were studied so that in each sampling (monthly), three water samples were taken from a depth of 30 cm from the surface of the studied stations and transferred to the laboratory in polyethylene containers. Table 1 discusses the data collection methods and tools used.

Table 1. Method of measuring the desired parameters [20]

Parameter	Methods and Devices Used
Dissolved oxygen (mg/L)	Portable Multimeter (WTW)
Water temperature (degrees Celsius)	Portable Multimeter (WTW)
pH	Portable Multimeter (WTW)
Ammonia (mg/L)	By colorimetric method using a special measuring kit for Hach spectrophotometer
Phosphate (mg/L)	By colorimetric method using a special measuring kit for Hach spectrophotometer
Nitrate (mg/L)	By colorimetric method using a special measuring kit for Hach spectrophotometer
Alkalinity (mg/L)	By titration method
BOD_5(mg/L)	BOD meter and incubator for Hach device

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The WQI_{NSF} (National Sanitation Foundation Water Quality Index) Quality Index was developed by the National Institutes of Health in the early 1970s to monitor water quality. Increating the general WQI_{NSF} index, a weight or numerical value is assigned to each of the parameters. The interpretation of contamination in the WQI_{NSF} method is shown in Table 2 [21]. SPSS software v. 21 and one-way Analysis of Variance (ANOVA) were used for data analysis.

3. Results

The first step in the assessment of environmental effects is the identification and recognition of the current status of the area. Hence, in the present descriptive study, firstly a complete study was conducted about parameters of physical, biological, economic, social, and cultural environment. The physical environment was studied and investigated in terms of climatic conditions, topography, soil condition, surface and groundwater resource, air pollution quality, and sound pollution quality of the study area. The social, economic, and cultural condition was studied based on the population, its growth and density, literacy, income, employment, diseases condition along with resources and archeological and religious monuments. Columns of the matrix involve various activities related to the project and its rows have a list of parameters of biological, physical, economic, social, and cultural environment, which are influenced by the project implementation process. Table 3 shows the matrix of interactions of environmental parameter-activity in the construction phase of the fish farming pond.

In each construction and operation phase, two individual matrices were considered for environments influenced by physical, biological, social, economic, and cultural factors. Investigation of the current condition of the study area's environment was conducted relying on previous studies, collection of the reports, regional studies related to the project, and doing field inspections. There are 250 salmon fish farming centers and farms active in West Azerbaijan, which involve cold water complexes, personal farms, dual-purpose agricultural pools, and soil pools of private sectors. More than 7000 tons of salmon fish is produced in these farms and supplied to the province market. In addition to meeting the province farms' needs, surplus production is exported to East Azerbaijan, Ardebil, Kurdistan, Kermanshah, and Khorasan provinces. The lakes behind the dams are apt for cage aquaculture and it is a good opportunity for the development of fisheries activities and job creation at a wide level. At the physical level, the effect of each construction phase activity was studied on the parameters, such as air quality, sound quality, weather and climate, erosion, soil resources quality, river morphology, etc. Moreover, the effect of each construction phase activity was studied on the biological environment at the plant sub-section, such as plant coverage, animal coverage, and ecological relations. Next, the effects caused by the construction phase at social, economic, and cultural environments were studied and valued on each factor of such environment. In this environment, the effect was investigated on the population and immigration, employment, profession and education, income, archeological and religious monuments, etc. Table 4 shows the summary of construction results of the implementation of the Midandab fish center in the EIA stage.

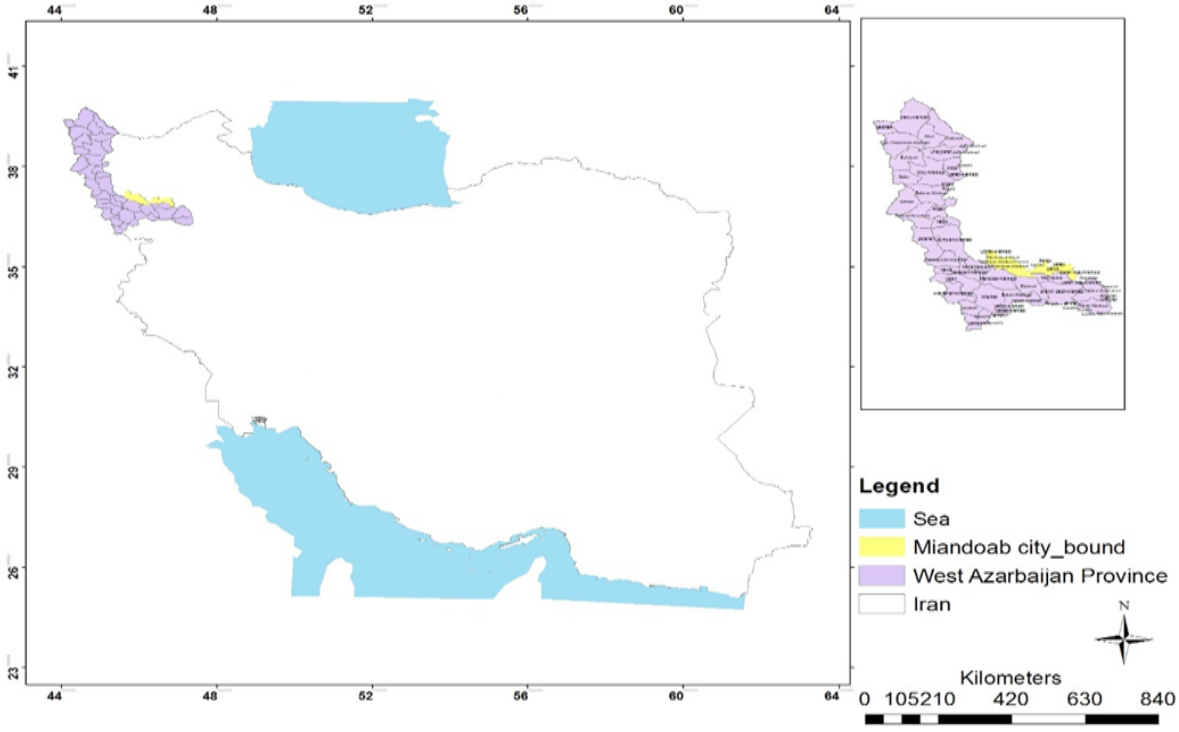

Figure 1. Geographical location of Miandoab County in West Azerbaijan in Iran

During the operation process of the study project, no special polluted sewage will be produced. The only sewage during the executive operation phase is produced by the concrete batching process. The sewage type has a higher amount of suspended materials, resulting in the temporal increase of turbidity and water resources salinity in the project operation area. Other pollutant factors are human sewages and solid waste materials, produced in the temporal camps built for personnel's residence, which can be considered as a potential pollution resource. Hence, the effects of the project implementation at the construction phase will be negative on the qualitative status of water resources with low to the middle range at short time. In the operation phase and with the establishment of concrete channels, sedimentation and erosion level will be decreased considerably. Table 5 shows the matrix of interactions of environmental parameter-activity in the operation phase of the fish farming pond.

Considering that the project has limited construction operations and there is no exclusive flora and fauna in it; thus, it is predicted that the plant coverage of the area to be influenced in a short time and the wildlife of the area has the least undesirable changes. Moreover, during the operation period, no considerable effect is predicted for the flora and fauna of the area. The most important potential plant flora effects are the plant coverage removal of the related channel and road path and the probability of an increase of weeds, especially aquatic weeds in the agricultural lands of the project zone. Generally, the effects of the project implementation on plant coverage during the construction phase (in terms of plant coverage destruction) are predicted as negative, short-term, with low intensity, and finally less important. In this phase, it is predicted that with channels and road establishment operations, nests of birds and mammals living in shrubs and plains will be destroyed and, consequently, they will be forced to find a new place for nesting. Generally, the effects of the project implementation during the construction phase on the migration of animal species are

Table 2. Interpretation of water quality by method WQI_{NSF}

Numerical Value of the Index	0-25	26-50	51-70	71-90	91-100
Definition	So bad	Bad	Medium	Good	Excellent

Table 3. Matrix of interactions of environmental parameter-activity in the construction phase of fish farming pond

Environmental Activity / Parameter		Road Construction	Cleaning	Excavation	Leveling	Transportation	Hiring Employees	Supply of Raw Materials	Landscaping
Physical	Air pollution	-4	-2	-4	-3	-3	0	-3	+1
	Sound level	-3	-2	-3	-3	-2	0	-4	0
	Surface water quality	-2	-2	-2	0	0	0	-1	-2
	Groundwater quality	0	-2	-3	0	0	-2	-1	-2
	Soil pollution and erosion	-4	-3	-2	-3	-3	0	-3	+3
Biologically	Habitat quality	-4	-4	-4	-3	-2	0	-2	+1
	Plant density	-4	-3	+1	-3	-2	0	-2	+1
Socio-economic	Income	+3	+1	-2	+1	+1	+5	+1	+1
	Vision	-3	-1	+2	-2	0	0	-2	+1
	Employment	+3	+2	-2	+2	+1	+5	+2	+1
	Change User	-3	-2	-1	-1	0	0	-1	0
	Migration	+3	+1	+1	0	+1	+4	+1	0
	Welfare	+3	-1	-1	0	+1	+4	0	0

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predicted as negative, but with lower intensity and range and low importance. Table 6 shows the summary of operating results of the implementation of the Midandab fish center in the EIA stage.

One of the main effects of the project at the construction and operation phase will be on income and employment, which is related to executive operations, such as the construction of main and side channels, drainage channels, inlet, and outlet vents of pools. Job creation and income are the most important effects of the project implementation, which employs higher intensity and importance. These effects are considered as direct certain and temporal indirect effects. The start of executive operations and employment of the necessary workforce, especially at the construction and operation phase will, to some extent, decrease the immigration rate to other areas, at least in the surrounding villages of the project site.

Table 4. Summary of construction results of the implementation of Midandab fish center

Project Implementation Option in the Construction Phase		
Effects	**Positive**	**Negative**
Physical environment	0	185
Natural and biological environment	0	145
Socio-economic and cultural environment	402	155
Total	402	485
Difference between positive and negative effects	83-	

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Table 5. Matrix of interactions of environmental parameter-activity in the operation phase of fish farming pond

	Environmental Activity / Parameter	Transportation	Oxygen Supply	Weed Control	Regular Fertilization	Feeding	Harvesting Fish
Physical	Air pollution	-4	+2	+2	-2	-2	-1
	Sound level	-3	0	-1	0	-1	0
	Surface water quality	-1	+2	+2	-2	-1	-1
	Groundwater quality	-1	+3	+2	-1	-1	0
	Soil pollution and erosion	-2	0	-1	+2	+1	0
Biologically	Habitat quality	-3	+3	+2	+2	+1	0
	Plant density	-2	+2	+2	+2	+1	0
Socio-economic	Income	+3	0	0	+2	0	+3
	Vision	-2	+1	+3	+3	0	+1
	Employment	+2	0	+1	+2	0	+4
	Change User	0	-1	-1	-2	0	-2
	Migration	0	-1	0	0	0	-1
	Welfare	+1	+2	+1	0	0	+2

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The results of statistical analysis of various physical and chemical factors in the designated stations are presented in Table 7. The highest and lowest amounts of nitrate and ammonium were significantly (P>0.05) in stations four and one, respectively, and the other stations showed the intermediate level. In terms of the station, the amount of ammonia was significantly different between stations one and two and stations three and four (P<0.05). In terms of the station, the mean nitrate was significantly different between study stations one and two and stations three and four (P<0.05). In terms of the monthly average, the highest amount of phosphate was recorded in station three with 0.736 mg/L and the lowest amount was recorded in station one with 0.014 mg/L. The highest BOD_5 was recorded in station three with 12 mg/L and the lowest in station one with 5 mg/L. There was a statistically significant difference in the amount of BOD_5 between all study stations (P<0.05). The lowest alkalinity was measured in station one and there was a significant difference between study stations one and stations two, three, and four. There was no statistically significant difference between the study stations in terms of

Table 6. Summary of operation results of implementation in Midandab fish center

Project Implementation Option in Operation Phase		
Effects	**Positive**	**Negative**
Physical environment	0	203
Natural and biological environment	0	155
Socio-economic and cultural environment	590	95
Total	590	453
Difference between positive and negative effects	137+	

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Table 7. Physicochemical parameters of water (mg/L) in different stations

Parameters	Mean±SD			
	1	2	3	4
Nitrate	0.1±0.04	0.97±0.058	3.00±0.346	3.07±1.159
Phosphate	0.36±0.05	0.07±0.044	0.63±0.104	0.49±0.108
Alkalinity	250±0.0001	343.33±23.094	360±26.458	340±10
Ammonia	0.01±0.001	0.02±0.003	1.09±0.121	1.16±0.156
Dissolved oxygen	6.90±0.361	6.43±0.705	5.52±0.502	5.44±0.485
pH	7.53±0.115	7.97±0.058	7.83±0.176	7.78±0.282
BOD_5	5.50±0.707	7.50±0.707	12±0.001	10±0.001
Temperature	20.27±1.617	25.33±2.631	24.20±3.985	24.50±4.244

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water temperature and pH ($P>0.05$). There was a statistically significant difference between stations one and two and stations three and four in terms of oxygen content.

Table 8 shows the results of the WQI_{NSF} index and its status review. Based on this index, sampling stations one and two showed good quality status, which indicates that the water is clean, but stations three and four had moderate water status. According to this BOD_5 assessment, phosphate and temperature had the most negative effect on water quality in stations three and four. The condition of the river in terms of oxygen was well.

4. Discussion

Land-use change around the river, including agriculture, arboriculture, and urban planning, has negative effects on downstream river water quality. Physical and chemical factors of water affect the fauna and flora of the river. The amount of dissolved oxygen in water is one of the most important and critical factors in the presence of fish. Low oxygen concentrations have decisive effects on fish and aquatic plant communities. Factors that affect water oxygen in rivers include temperature and nutrient uptake.

According to the results of the study, the amount of oxygen in stations one and two was higher than in stations three and four. There is a relationship between station oxygen and station phosphorus and nitrogen levels. High levels of nutrients, such as phosphorus and nitrogen lead to a decrease in oxygen at the same station. In this study, the amount of phosphate in station four decreased compared to station three; however, this decrease was not significant. The optimum amount of water-soluble oxygen for hydrothermal fish is higher than 5 mg/L. The decrease in oxygen occurred due to the presence of fish farms in our study area, but the oxygen balance due to aeration by the gravitational force of the area compensates for this decrease. Nitrate levels at stations three and four were higher than recommended in the surface

Table 8. WQI_{NSF} index results for each parameter

Sampling stations	Dissolved oxygen	Temperature	Phosphate	Nitrate	BOD	pH	WQI_{NSF} (Mean±SD)	Status by Average WQI_{NSF}
1	92.7	21.7	97.7	97.0	53.5	92.3	77.3±3.0	Good
2	90.0	15.3	97.0	96.0	44.0	85.0	73.0±3.1	Good
3	85.0	17.0	54.0	88.0	28.0	88.3	62.2±3.2	Medium
4	83.7	16.3	63.0	85.0	34.0	88.3	63.5±3.2	Medium

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normal, but nitrate levels were lower than recommended for fish farms (below 9.16 mg/L). Alkalinity plays an important role in stabilizing the pH of fish pond water. This factor prevents the pH of the pool water from decreasing and increasing too much during the day and night. For fish ponds, water with a total alkalinity of more than 50 mg/L in terms of calcium carbonate is suitable, so for the growth of hydrothermal fish, the total alkalinity should be more than 25 mg/L in terms of calcium carbonate. According to the results, the amount of alkalinity in different stations of the river is suitable for the growth and development of hydrothermal fish and is within the standard range. The changes in biochemical oxygen demand along the river are irregular. Temperatures above 30°C are lethal for hydrothermal fish. Due to the amount of water temperature in different stations, this amount is suitable for the development of hydrothermal fish and is within the standard range.

Different species of fish do not have the same resistance to pH changes. Slow and daily fluctuations in the range of 7 to 8.5 are tolerable for fish and are the best conditions for their growth. According to the results, although the pH was significantly different between different stations, this difference between the stations was within the standard of fish farming (6.5-9.5). The aquaculture industry is developing due to increasing demand as well as declining fishery resources. The development process includes policies, programs, and plans. Naturally, there is a kind of structural link between policy-making and the next levels of the development planning process. However, environmental assessment can be used as a reforming and controlling process at any level of the development process up to the level of micro-executive measures. Because the development of any activity is accompanied by a set of changes, accurate assessment of change is one of the most acceptable ways to achieve the goals of sustainable development. Therefore, the process of evaluating the effects of development can be considered as a planning tool to minimize the adverse effects of planned activities. Tavakoli and Mohammad Yari in 2018 evaluated the environmental effects of the construction of a recreational and tourist complex in the Dehloran region, separating the two phases of construction and operation. The results showed a positive preference for the negative and finally, the implementation of the project [22].

Miandoab Fish Breeding Center on a land area of 2000 hectares in the form of 53 units of 25 hectares with 33 units of 10 hectares and six units of 25 hectares is designed for breeding hydrothermal fish, of which 36 units of 25 hectares and 11 units of 10 hectares in the form of twenty-eight cooperatives and eight real operators have been transferred. Paying attention to the issue of fisheries and increasing aquaculture production, in addition to creating jobs, also indirectly plays a role in the health of families. Hashemi et al. in 2013 assessed the environmental impact of the Hasht Behesht tourism model area. In this article, the Iranian matrix method was used to study the process of activities resulting from the creation of a tourist area in Hasht Behesht, which lead to soil erosion and sedimentation in waterways, creating dust, and noise pollution in the environment. Other effects of the project will be the traffic of trucks transporting construction materials and creating traffic on the roads at the beginning of the construction operation, disturbing the comfort of the people in the surrounding settlements, as well as the insecurity of animal habitats due to these crowds. In addition to these effects and negative consequences, the project in the implementation phase has many effects on creating employment and income, especially for the young and job-seeking population in neighboring villages, and increasing the price and value of the real estate [23].

The proximity of Iraq and the proximity to the consumer market in this country can increase the grounds for more fish exports and thus, the incentive to produce more aquaculture in Miandoab. Negative consequences and effects of establishing a fish farming center in the area are preventable through employing some engineering operations and corrective actions and also through taking management plans and environmental monitoring. Most of the predicted negative effects of the project are short-term, related to the construction phase, which has inconsiderable intensity and importance. While most of the positive effects of the project are long-term, enjoying considerable importance and intensity. However, implementing and noting a decrease in negative effects and promotion of positive effects of the project have been predicted and developed in various studies. In the construction phase of the project, some of the most important corrective measures are as follows:

Controlling the type and quality of the employed instruments and updating them

Using fuels with low percent sulfur as much as possible

Using an appropriate cover on the materials at the time of transportation and collection

The most important corrective measures at the operation phase to decrease negative effects and consequences are as follows:

Observing national and international regulations and standards of transportation

Changing vehicles' fuel and using gas as one of the clean energy carriers

Supervising maintenance method of the dangerous wastes and preventing mix of such swages with ordinary sewages

With the implementation of the project, some difficulties, such as lack of water caused by wasting it in soil channels, overall condition of fish farming activity in the region, immigration from villages to urban areas, lack of employment, and lower-income and welfare of the people will be improved. Accordingly, a positive trend will be observed in the future. Thus, implementation of the project with regard to environmental issues is advised and emphasized.

5. Conclusion

In today's world, the aquaculture industry has had the fastest growth in the food production industry. Globally, this industry is expanding in terms of species diversity. In addition to high socio-economic and environmental benefits, aquaculture has important benefits, such as increasing food security, reducing poverty, increasing job opportunities in coastal rural communities, providing seafood, reducing primary production costs, and improving human nutrition. It must now be argued that the development of production methods has led to an increase in environmental impact. All-out efforts should be made to reduce these effects and move towards sustainable development using proper resource management methods. The water quality index in stations affected by fish pond effluent showed moderate water quality. Despite the improvement of water quality in the fourth station compared to the third station, still, the water quality was lower than in the upstream stations, which could be due to the effluent entering the river. It is recommended that the effluents be thoroughly treated before entering the river to minimize the concern of destroying the natural landscapes of the river ecosystem by first removing organic matter.

Ethical Considerations

Compliance with ethical guidelines

This study was approved by the Ethics Committee of the Malayer University (Code: IR.AJUMS.REC.1399.52).

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Authors' contributions

Both authors equally contributed to preparing this article.

Conflict of interest

The authors declare that there are no conflicts of interests regarding the publication of this manuscript.

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