Evaluation of pH Changes in Trout Farms: A Case Study of Niğde Region, Turkey

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Abstract

In this study, it was aimed to periodically examine the pH changes in the water resources used for some trout farms in the Niğde region. For this purpose, the pH values of pool entrances and pool exits were determined in the trout farms. In this context, four (A, B, C, D) trout farms were defined and water samples were taken periodically (Spring, Summer, Autumn and Winter period). The pH values in the water samples were interpreted within the scope of the "Water Pollution Control Regulation" standards. According to the results, the average pH values were determined as 7.25, 7.26, 7.19 and 7.18, in the A, B, C and D trout farms, respectively. In general, the pH values of the pool's entrances were lower than the pH values of the pool's exits. According to the ''Water Pollution Control Regulation'' and the classes of inland water resources, it has been seen that the water resources are suitable for fish farming in terms of pH value in the examined stations.

Keywords: Trout farms, pH value, Water quality, Niğde region, Turkey

Research article
Received Date: 23 June 2021
Accepted Date: 28 June 2021

INTRODUCTION

The aquaculture sector is a growing and developing sector all over the world. According to the data reports of FAO, Turkey is the 3rd fastest growing country in aquaculture in the world (Coşkun et al., 2011). World aquaculture production is 170 million tons in total, 80 million tons of which is obtained through aquaculture (TUIK, 2018). In Turkey, aquaculture, which started especially in the 1970s, is around 630 thousand tons in total, 354 thousand tons of which is hunting and 276 thousand tons of aquaculture.

With a production of approximately 110 thousand tons, trout ranks first among the species that are farmed in Turkey. The reason of this is the ease of production of trout compared to other fish, the better marketing network, the availability of fresh water resources with suitable characteristics for aquaculture in Turkey, the number of facilities and the amount of production (Emre and Kürüm, 1998).

The increase in the need for animal protein with the increasing population in recent years causes a continuous increase in production capacity and pollution of water resources due to intensive production (Verep et al., 2017). In addition, the fact that natural stocks are affected by global warming and environmental pollution has led to an increased interest in aquaculture (Anonymous, 1993; Çelikkale et al., 1994). Seafood is a valuable food source because its protein content is uniform and of high quality and contains omega-3 fatty acids. Its contribution to nutrition, consumption of natural resources and meeting animal protein needs make aquaculture important. However, with the increasing interest in aquaculture, the deterioration of water quality has become inevitable. Various factors, especially feed residues and metabolic wastes, cause pollution of freshwater resources used in trout farming. All these cause fish farming to have some undesirable effects on the aquatic environment and the environment. For this reason, studies on the effects of aquaculture on fresh water resources have been increasing recently.

Tsutsumi et al. (1991) stated that 85% of phosphorus, 80-88% of carbon and 52-95% of nitrogen entering the aquaculture system as feed are given to the environment as metabolic wastes (feces, respiration, secretions) and feed waste. Kucukyilmaz et al. (2016) reported that in Şanlıurfa Balıklıgöl region, which generally has I. class water quality, is in II. class in terms of total phosphorus and nitrite, III. class in terms of nitrate. Bulut et al. (2012) evaluated the water quality of the Akpınar Stream (Denizli), where trout is produced, in the study where the parameters measured at station I did not pose a risk for Salmonids according to the EC directive, but in the II. They stated that the biochemical oxygen demand (BOD) and nitrite values in the station were high enough to affect fish health from time to time. In a study conducted in five different trout farms established on Karasu Stream (Bozüyük-Bilecik), water samples were taken monthly for a year and as a result, it was determined that the quality of the effluent differs from farm to farm and season to season.

In addition, it has been determined that the dissolved oxygen, pH, suspended solids, ammonium nitrogen, nitrite nitrogen and nitrate nitrogen levels in the effluent of the enterprises are within the prescribed standard and mandatory values (Palatsü et al., 2004). Yurtman (2006) periodically examined the pollution load created by different trout farms operating on Yene Stream (Kırklareli). They determined that the resulting pollution factors were primarily caused by the fish feeds used. They observed that the unconsumed feed left and the wastes resulting from the metabolic activities of the fish do not accumulate due to the high flow rate and do not create any visible periodic pollution.

Selong and Helfrich (1998) examined the effluent quality of five different trout farms in order to determine the environmental effects of trout farms. In line with the data they obtained, they reported that the effluent of the enterprises caused an increase in the total ammonia nitrogen, free ammonia and nitrite nitrogen in the receiving environment, but this load was below the limits that would endanger the life of aquatic organisms. They also stated that the settling pools in some enterprises significantly reduced the load of the effluent.

In this study, the pH values of the water resources of some trout production areas in the Niğde region were monitored and the results were periodically determined whether they were appropriate in terms of pH value according to the Water Pollution Control Regulation.

MATERIALS and METHODS

In the study, pH analyzes were carried out in the pool entrance and pool exit in seasonal periods (spring, summer, autumn, winter) in order to determine the water quality of the wastewater of some trout farms in the Niğde region. The location of the trout farms, which are the subject of the research, are shown on the map given in Figure 1.

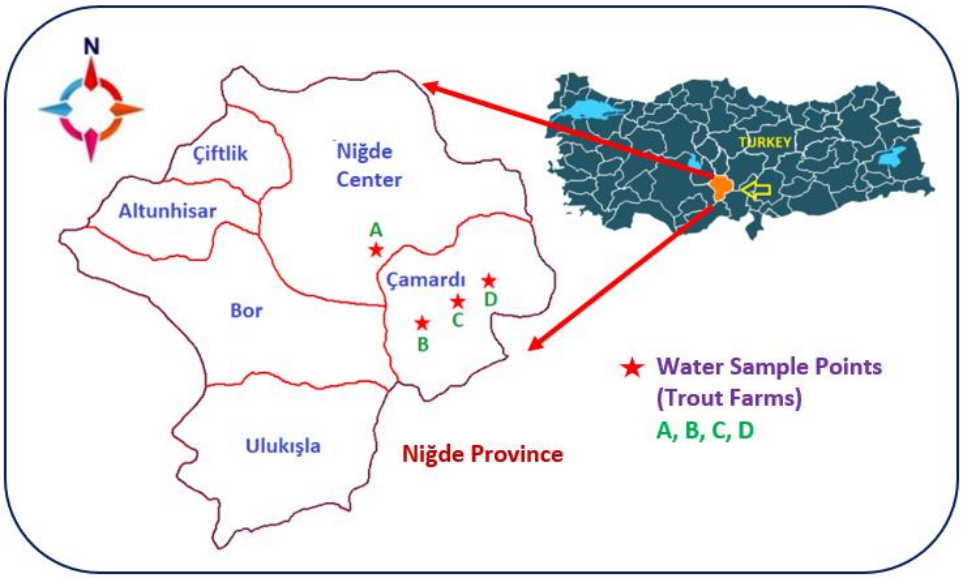

Figure 1. The location of research area

Water samples were taken from four farms during four seasons, from pool inlet water and pool outlet water at each trout farm. Water samples were collected and stored at +4^{o}C in a refrigerator. The pH values of the water samples were determined in the laboratory with digital display pH meters. The application regarding pH measurements made in the laboratory is given in Picture 1. The pH values of the research were evaluated according to the Water Pollution Control Regulation (Anonymous, 2004). Water samples were taken from the pool inlet and outlet waters during four periods from the determined areas. The periods during which water samples were taken are listed in Table 1.

Picture 1. pH measurements in the laboratory

Table 1. Pool locations and periods of water samples

Periods	Months	Sample Locations
Spring	April	Entrance
Spring	April	Exit
Summer	July	Entrance
Summer	July	Exit
Autumn	October	Entrance
Autumn	October	Exit
Winter	January	Entrance
Winter	January	Exit

RESEARCH FINDINGS

The pH changes in the pool inlet and the pool outlet of the "A" station trout farm is presented in the in Figure 2.

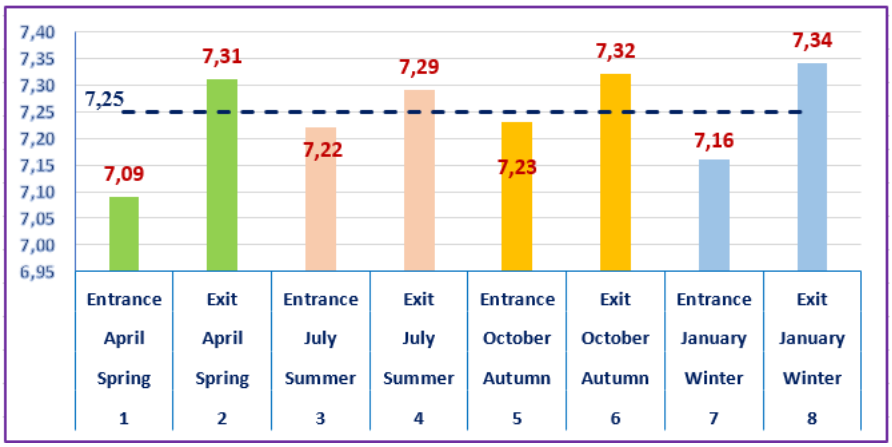

Figure 2. pH Changes of "A" Station During the Seasons

While the pH value of the entrance of the A station pool was 7.09 in April season, the pH value at the pool exit was determined as 7.31. In the same station the pH value of the pool entrance was 7.22 and the pH value of the pool exit was measured as 7.29 in July. In October, the pH of the pool entrance was 7.23, while it was determined as 7.32 in the pool exit. The pH value in January was determined as 7.16 in the entrance of the pool and 7.34 in the exit of the pool. The average pH value of A station was determined as 7.25. The pH changes in the pool inlet and the pool outlet of the "B" station trout farm is presented in the in Figure 3.

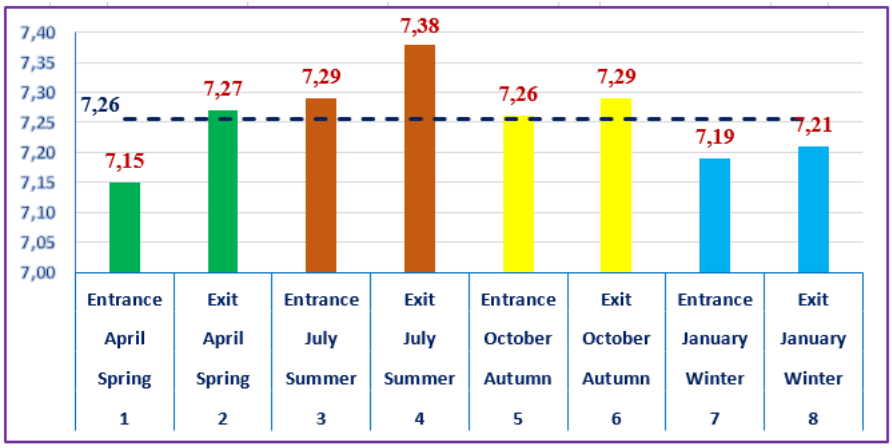

Figure 3. pH Changes of "B" Station During the Seasons

The pH value of the pool entrance of B station was determined as 7.15 in April, while the pH value of the pool exit was 7.27. In July, the pH value was determined as 7.29 in the entrance of the pool and 7.38 in the exit of the pool. In October, the pH value of the pool entrance was 7.26 and the pH value of the pool exit was 7.29. In January, while the pH value of the pool entrance was 7.19, the pH value of the pool exit increased to 7.21. The average pH value of B station was determined as 7.26. The pH changes in the pool inlet and the pool outlet of the "C" station trout farm is presented in the in Figure 4.

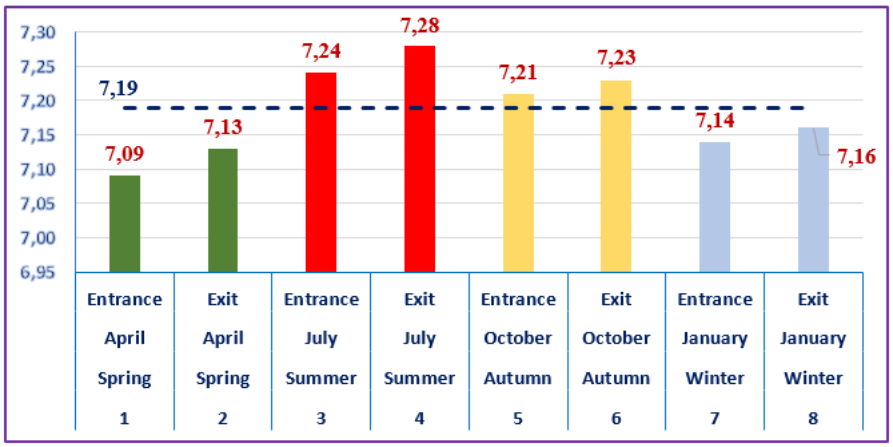

Figure 4. pH Changes of "C" Station During the Seasons

Significant changes were detected among the pH values in the water samples taken from the C station pool entrance and pool exits in April, July, October and January. While the pH value of the pool entrance was 7.09 in April, the pH value of the pool exit was 7.13. The pH value of the entrance of the C station was 7.24 in July season and the pH value at the pool exit was determined as 7.28. In the same station the pH value of the pool entrance was 7.21 and the pH value of the pool exit was measured as 7.23 in October. In January, the pH of the pool entrance was 7.14, while it was determined as 7.16 in the pool exit. The pH changes in the pool inlet and the pool outlet of the "D" station trout farm is presented in the in Figure 5.

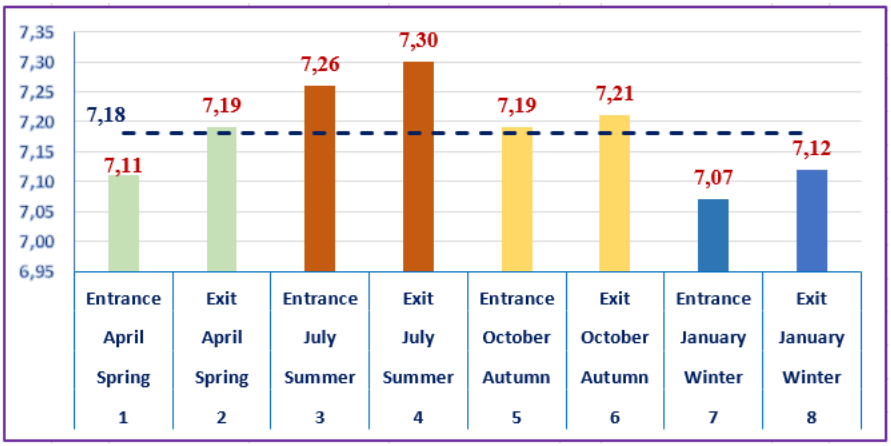

Figure 5. pH Changes of "D" Station During the Seasons

It was observed that there is a significant change between periods. pH values in April, July, October and January were measured as 7.11, 7.26, 7.19, and 7.07, respectively, in the pool entrances of D station. The pH values of the pool exit were determined as 7.19, 7.30, 7.21 and 7.12, respectively. The average pH value of the D station, measured during all periods, was determined as 7.18.

CONCLUSION

pH changes in some trout farms in Niğde region were determined during four seasons. Water samples were collected from the pool enterance and pool exit. In general, average pH values in water samples were determined as 7.25, 7.26, 7.19 and 7.18 in A, B, C and D farms, respectively. In terms of trout farming, pH characteristic close to neutral. Continuous monitoring of water quality in trout farms is extremely important for fish farming. Negative changes in water quality will adversely affect fish farming. In this context, studies to evaluate water resources in trout facilities in terms of water quality will also make positive contributions to fish production.

ACKNOWLEDGMENT

This study was supported by the Scientific Research Projects Administration of Niğde Ömer Halisdemir University with the project number of ''TGT 2019/12-HIDEP''.

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