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Change Trend of Electrical Conductivity (EC) Values of Water Resources in Trout Farms Operating in Niğde Province, Turkey

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Abstract

In this research, the Electrical Conductivity (EC) values of the water resources in the trout farms in the Niğde Region (Turkey), which is located in the Central Anatolia Region, were periodically examined. Within the scope of the study, water samples were taken from four randomly selected trout farms in different periods (spring, summer, autumn and winter). Water samples were collected from the pond enterance and the pond exit. EC measurements were carried out in three replications using an EC meter in the laboratory conditions. The EC values of the water samples were interpreted within the scope of the "Water Pollution Control Regulation" standards published by the Ministry of Environment and Forestry in 2004. As a result of the study, the average EC values of the water saamples for four different trout farms (No1, No2, No3 and No4) were determined as 480, 320, 689 and 540 µS/cm, respectively. Considering the data obtained in the study, it can be concluded that the EC values in the region examined according to the Water Pollution Control Regulation do not pose any problem in terms of fish farming.

Keywords: Electrical Conductivity (EC), Trout Farms, Water Resources, Water Quality, Niğde Province, Turkey

Research article
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INTRODUCTION

Water pollution is the pollution of clean water in nature directly by human hands or by organizations that produce for human life. Even though the fact that ¾ of the earth is covered with water gives the appearance of abundance of water in the world, the rate of drinkable water is only around 0.74%.

The world population, which was 1 billion at the beginning of the Industrial Revolution in the last quarter of the 18th century, reached 2.5 billion in 1950 and approximately 7 billion at the end of 2010. Reasons such as the rapid increase in the world population, the excessive development of industry and technology, and the inability to sufficiently establish or spread environmental awareness cause the amount of potable water in the world to decrease gradually. Studies show that water use worldwide has doubled in the last 40 years. In addition, the irresponsible pollution of potable water resources paves the way for problems that cannot be recycled. Estimates show that increasing water demand and decreasing clean water supply curves will intersect in 2030. This naturally means that there will be a universal crisis (Akın and Akın, 2007; Sağlam and Bellitürk, 2003).

The aquaculture sector has been a growing area in the world and in Turkey. In particular, the decrease in natural stocks due to global warming and environmental pollution has increased interest in aquaculture and has an increasing trend against products obtained from natural hunting (Anonymous, 1993; Çelikkale et al., 1994). World aquaculture production is 170 million tons in total, 80 million tons of which is obtained through aquaculture (Anonymous, 2018). The aquaculture sector is a growing and developing sector all over the world. According to the statistics of the Food and Agriculture Organization (FAO), Turkey is the third fastest growing country in aquaculture in the world (Coşkun et al., 2011). In Turkey, aquaculture, which started especially in the 1970s, is around 630 thousand tons in total, including 354 thousand tons of hunting and 276 thousand tons of aquaculture (Anonymous, 2018). With a production of approximately 110 thousand tons, trout ranks first among the species that are farmed in Turkey. The reason for this is the ease of production of trout farming 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).

There is a wide historical background for the natural life and cultural conditions of the trout. Trout are affected by various environmental factors (temperature, salinity (EC), pH, dissolved oxygen and ammonia), especially growth and reproduction activities, both in the natural environment and in the culture environment, and these have extreme and normal limits, and these environmental factors alone are effective. as well as it can make a folded effect together. These environmental conditions should be well known before aquaculture (Molony, 2001).The electrical conductivity (EC) of a water is the sum of the amounts of salts or soluble substances present in the water. The electrical conductivity of water depends on both geological factors and external influences. The conductivity increases in parallel with the increase in temperature and salinity (Özdemir et al., 2007; Dirican and Musul, 2008).

In this research, some of the trout farms operating in the Niğde region were investigated.This study was carried out to determine the seasonal change trend of Electrical Conductivity (EC) values in water resources. In this study, water samples were taken in four different periods (April, July, October, January) at the entrance and exit of the ponds from four trout farms selected by random sampling method. In the study, the EC values of the water samples collected from the trout farms were evaluated periodically and their suitability for trout farming was examined.

MATERIALS and METHODS

In this research, EC values of water resources of randomly selected trout farms in Niğde province were examined during four seasons (spring, summer, autumn and winter). Water samples were collected from the water sources in the pond enterance and from the pond exit. All samples were collected and transported to the laboratory. EC values were determined in laboratory conditions with digital display EC meters. The application regarding the EC measurements made in the laboratory environment is given in Picture 1.

Picture 1. EC measurements of water samples

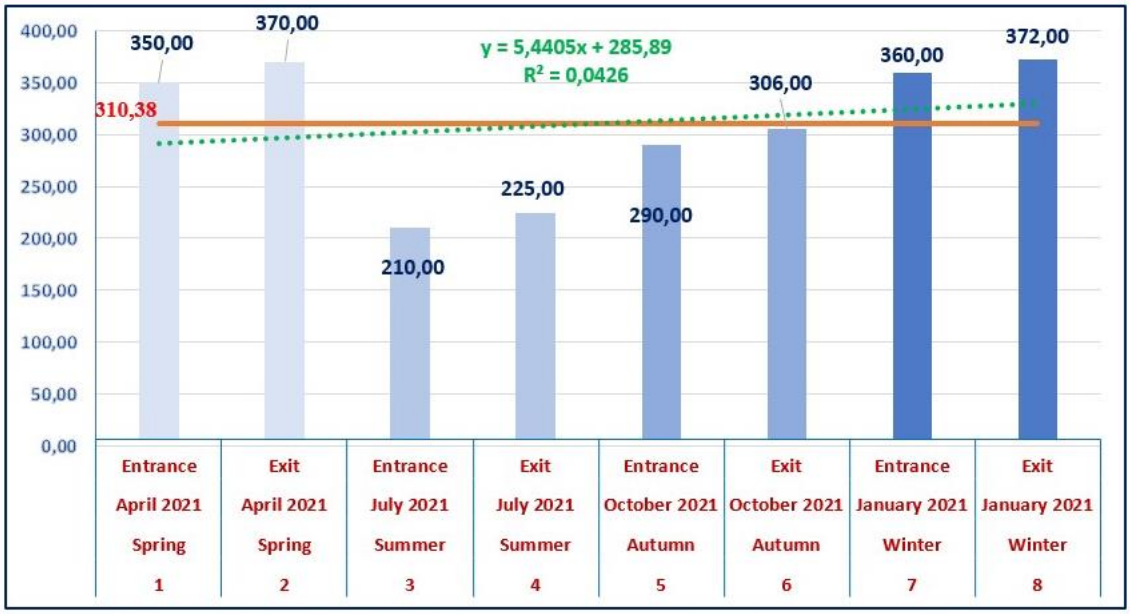
The EC values were evaluated according to the Water Pollution Control Regulation (Anonymous, 2004). Water samples were taken from the pool inlet and outlet waters from the designated areas for 4 periods. The periods during which water samples were taken are presented in Table 1.

Table 1. Dates and locations of water samples

Seasons	Dates	Locations
Spring	April 2021	Entrance of Pond
	April 2021	Exit of Pond
Summer	July 2021	Entrance of Pond
	July 2021	Exit of Pond
Autumn	October 2021	Entrance of Pond
	October 2021	Exit of Pond
Winter	January 2021	Entrance of Pond
	January 2021	Exit of Pond

RESEARCH FINDINGS

The EC changes of the pond entrance and pond exit in the No1 trout farm were periodically evaluated. As a result of the analysis, the periodic trend of the EC changes in the No1 trout farm is given in Figure 1.

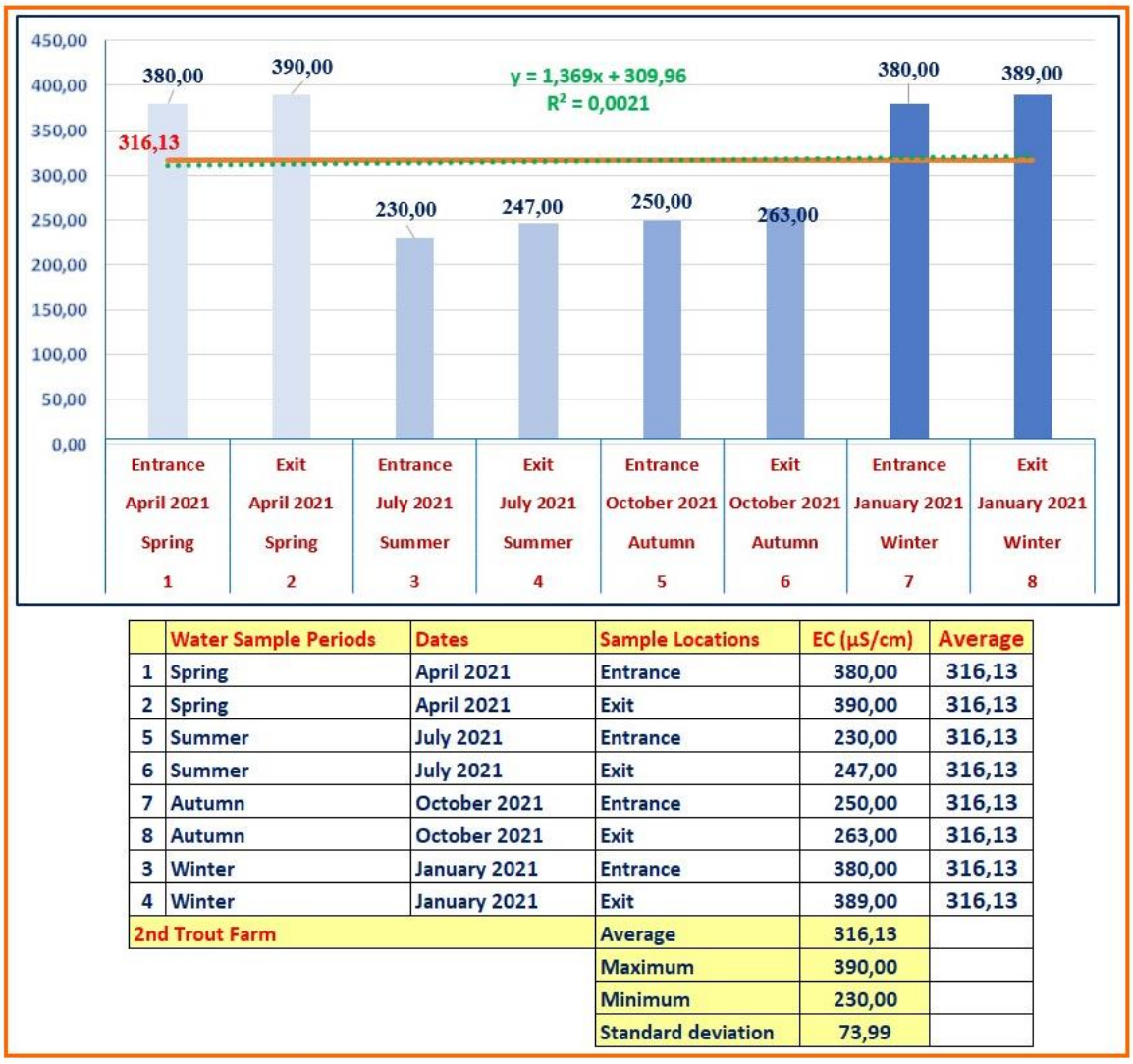


	Water Sample Periods	Dates	Sample Locations	EC (µS/cm)	Average
1	Spring	April 2021	Entrance	350,00	310,38
2	Spring	April 2021	Exit	370,00	310,38
3	Summer	July 2021	Entrance	210,00	310,38
4	Summer	July 2021	Exit	225,00	310,38
5	Autumn	October 2021	Entrance	290,00	310,38
6	Autumn	October 2021	Exit	306,00	310,38
7	Winter	January 2021	Entrance	360,00	310,38
8	Winter	January 2021	Exit	372,00	310,38
1st Trout Farm			Average	310,38	
			Maximum	372,00	
			Minimum	210,00	
			Standard deviation	64,57	

Figure 1. Periodic trend of EC changes in "No.1" trout farm

While the EC value measured from the water source at the entrance of the pond in April in the trout farm No. 1 was 350.0 µS/cm, the EC value at the pond outlet was determined as 370.0 µS/cm. In July, the EC value at the pond entrance was 210.0 µS/cm, while the EC value at the pond exit was measured as 225.0 µS/cm in the same month. In October, the EC of the pond entrance was 290.0 µS/cm, while it was determined as 306.0 µS/cm at the pond exit.

The EC value in January was determined as 360.0 µS/cm at the pond entrance and 372.0 µS/cm at the pond exit. The average EC value determined in the water samples collected during all periods in the No1 trout farm was determined as 310.38 µS/cm. The seasonal EC distribution of the water used in the No2 trout farm is presented graphically in Figure 2.

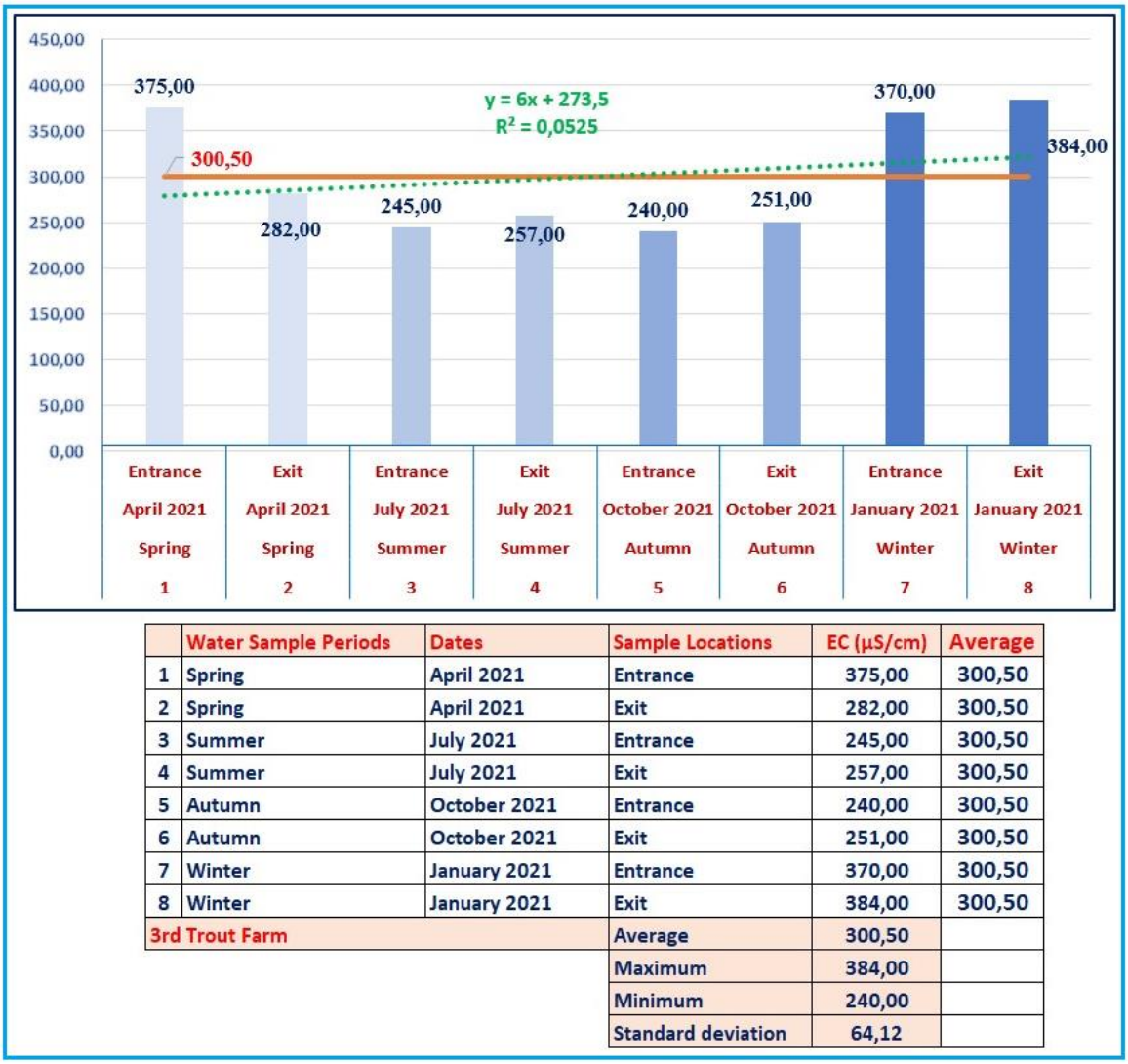


	Water Sample Periods	Dates	Sample Locations	EC (µS/cm)	Average
1	Spring	April 2021	Entrance	380,00	316,13
2	Spring	April 2021	Exit	390,00	316,13
5	Summer	July 2021	Entrance	230,00	316,13
6	Summer	July 2021	Exit	247,00	316,13
7	Autumn	October 2021	Entrance	250,00	316,13
8	Autumn	October 2021	Exit	263,00	316,13
3	Winter	January 2021	Entrance	380,00	316,13
4	Winter	January 2021	Exit	389,00	316,13
2nd Trout Farm			Average	316,13	
			Maximum	390,00	
			Minimum	230,00	
			Standard deviation	73,99	

Figure 2. Periodic trend of EC changes in "No.2" trout farm

Considering the periodic distribution of the EC value of the water in the No. 2 trout farm; the EC value at the pond entrance was 380.0 µS/cm in April, while the EC value at the pond exit was 390.0 µS/cm. In July, the EC value was determined as 230 µS/cm at the pond entrance and 247.0 µS/cm at the pond exit. In October, the EC value at the pond entrance was measured as 250.0 µS/cm and the EC value at the pond exit was measured as 263.0 µS/cm. In January, while the EC value at the pond entrance was 380.0 µS/cm, the EC value at the pond exit increased by 0.09 to 389.0 µS/cm. The mean EC value was determined as 316.13 µS/cm.

During the whole periods, the highest EC value was 390.0 µS/cm and the lowest EC value varied in the range of 230.0 µS/cm in the No. 2 trout farm. The standard deviation of all values was calculated as 73.99. The periodic distribution graph of the EC change in the trout farm No. 3 is presented in Figure 3.



	Water Sample Periods	Dates	Sample Locations	EC (µS/cm)	Average
1	Spring	April 2021	Entrance	375,00	300,50
2	Spring	April 2021	Exit	282,00	300,50
3	Summer	July 2021	Entrance	245,00	300,50
4	Summer	July 2021	Exit	257,00	300,50
5	Autumn	October 2021	Entrance	240,00	300,50
6	Autumn	October 2021	Exit	251,00	300,50
7	Winter	January 2021	Entrance	370,00	300,50
8	Winter	January 2021	Exit	384,00	300,50
3rd Trout Farm			Average	300,50	
			Maximum	384,00	
			Minimum	240,00	
			Standard deviation	64,12	

Figure 3. Periodic trend of EC changes in "No.3" trout farm

Significant changes were detected between the EC values measured in the water samples taken from the pond entrance and pond exits in April, July, October and January in the No 3 trout farm. While the EC value of the water sample taken from the pond entrance was 375.0 µS/cm in April, the EC value measured from the same pond entrance was 245.0 µS/cm with a decrease of 130.0 µS/cm in January.

In general, the average EC values of the water samples taken from the pond entrance and exit during all periods were found to be 300.50 µS/cm. The seasonal distribution trend of EC changes in water samples taken in four different periods in trout farm No. 4 is summarized with the graph given in Figure 4.

	Water Sample Periods	Dates	Sample Locations	EC (µS/cm)	Average
1	Spring	April 2021	Entrance	360,00	312,13
2	Spring	April 2021	Exit	342,00	312,13
3	Summer	July 2021	Entrance	255,00	312,13
4	Summer	July 2021	Exit	320,00	312,13
5	Autumn	October 2021	Entrance	255,00	312,13
6	Autumn	October 2021	Exit	321,00	312,13
7	Winter	January 2021	Entrance	335,00	312,13
8	Winter	January 2021	Exit	309,00	312,13
4th Trout Farm			Average	312,13	
			Maximum	360,00	
			Minimum	255,00	
			Standard deviation	38,52	

Figure 4. Periodic trend of EC changes in "No.4" trout farm

Considering the periodic distribution of the EC change in the surface spring water used in the No 4 trout farm; It can be seen that there is a significant change between periods. EC values in April, July, October and January vary between 255.0-360.0 µS/cm. The average of the EC values measured in the water samples was 312.13 µS/cm.

CONCLUSION and RECOMMENDATIONS

EC values were determined in water samples of four different trout farms selected by random sampling method in Niğde region. Water samples were collected from pond inlets and pond outlets in trout farms. In general, the average EC values in the water samples were 310.38, 316.13, 300.50 and 312.13 µS/cm in trout farms 1, 2, 3 and 4 respectively;

However, when the EC distributions in the water samples of different periods are examined, the EC values in all the enterprises were higher in April and January compared to other months. The EC values in July were measured at a higher level compared to other months.

The electrical conductivity (EC) of water depends on both geological factors and external influences. As pollution increases in water, the electrical conductivity value exceeds 1000 µS/cm (Dirican and Mosul, 2008). Since the EC values of the water samples taken from the trout farms are below 1000 µS/cm, there is no risk in terms of salinity.

Cleanliness of water resources and keeping its chemical content below permissible limits are extremely important factors in trout farming. Sudden adverse changes in water quality will also significantly affect fish production. In particular, it is extremely important to constantly monitor the water source and to take measures against possible negativities. The increasing trend of fish farming in the Central Anatolian Region also increases the interest in this sector. It is among the preferred sectors especially in terms of incentives provided by the state and economic gain.

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